

EPIC DEPLOY

Cooling Assessments

EXECUTIVE OVERVIEW | BRAZIL · ETHIOPIA · KENYA · MOROCCO · TUNISIA

A concise guide to the five country assessments

Each country page distils the report's main findings, principal screening estimates for healthcare, education and food cold chains, and the sections where readers can examine methods, assumptions, maps and sensitivities.

FIND THE RIGHT REPORT

COUNTRY	PRIMARY LENS	READ IT FOR
BRAZIL	Scale + low-carbon electricity	Institutional cooling, refrigerant emissions and industrial process refrigeration.
ETHIOPIA	Access + service resilience	Off-grid and hybrid systems, maintainability and service-based cold-chain development.
KENYA	Reliability + affordability	Passive-first design, resilient power supply and transparent demand ranges.
MOROCCO	Carbon intensity + water stress	Building efficiency, electricity savings and water-conscious technology selection.
TUNISIA	Summer peak + gas-based power	Seasonal efficiency, passive-first education and bounded adoption scenarios.

HOW TO USE THIS DOCUMENT

01 ONE PAGE PER COUNTRY A consistent page structure enables rapid cross-country comparison.	02 REGULATION KEPT LIGHT Regulatory and market-entry requirements are covered in separate country documents.	03 SCENARIOS, NOT INVENTORIES All quantitative results are screening estimates or scenarios and require project-level validation.
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COMMON REPORT STRUCTURE

01 COUNTRY CONTEXT Climate, demographics, the built environment and exposure to inadequate cooling.	02 ENERGY SYSTEM Electricity access, generation mix, reliability, tariffs and emission intensity.	03 SECTOR ASSESSMENTS Screening models for healthcare, education and food cold chains.	04 DECISION SUPPORT Technology pathways, implementation barriers, assumptions and sensitivity cases.
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Important: regulatory and market-entry content is intentionally limited because it is addressed in detail in the separate country documents. This overview is a navigation aid and does not replace the full assessments or site-specific due diligence.



BRAZIL

Scale and low-carbon electricity: institutional demand, refrigerant management and industrial process refrigeration.

POPULATION	COOLING DEGREE DAYS	RENEWABLE GENERATION	GRID EMISSION FACTOR
212.6 million	2,901 °C-day/yr	88.3%	0.0599 kg CO2e/kWh

KEY TAKEAWAYS

01 Brazil's low grid emission factor limits indirect emissions; in the healthcare and education screening models, refrigerant leakage is the larger climate component.	02 Cooling demand is large and spatially unequal. The North, North-East and continental interior combine high heat exposure with lower access to efficient equipment and thermally resilient buildings.	03 The strongest project levers are high-efficiency replacement, low-GWP refrigerants and leak control, passive-first school retrofits, natural-refrigerant process cooling and life-cycle procurement.
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SECTOR SNAPSHOTS

HEALTHCARE	EDUCATION	FOOD COLD CHAIN
Quantifies cooling in hospitals with more than 50 beds and covers clinical comfort, air treatment and medical cold-chain functions. 1.78 TWh/yr <i>screening estimate of annual cooling electricity demand</i> Estimated cooling emissions are 0.327 Mt CO2e/yr: 0.220 Mt direct and 0.107 Mt indirect.	Uses 2024 school-census microdata, regional heat exposure and a bottom-up classroom load model. 1,667 GWh/yr <i>estimated annual consumption of the recorded climatized stock</i> The higher outdoor-air treatment case reaches 2,328 GWh/yr; direct refrigerant emissions dominate the benchmark footprint.	Separates domestic and export storage, maritime reefers and industrial meat and poultry refrigeration. 4,491 GWh/yr <i>screening estimate of annual operational electricity demand</i> Industrial process refrigeration accounts for about 4,000 GWh/yr; electricity-related emissions are about 0.27 Mt CO2e/yr.

WHAT THE REPORT CONTAINS

REPORT COVERAGE Biome-specific heat exposure; cooling poverty and urban heat; building performance; electricity and hydrological risk; domestic RAC manufacturing; procurement conditions; and bottom-up sector models.	USE THE FULL REPORT FOR Facility and exposure maps; model equations and input data; classroom ventilation and adoption cases; industrial refrigeration boundaries; and project-level sensitivity analysis.
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PROJECT OPPORTUNITY AREAS

Institutional efficiency retrofits	Low-GWP refrigerants and leak control	Passive-first education	Natural-refrigerant process cooling
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All values are screening estimates or scenarios from the source assessment, not official national inventories. Project design must replace them with verified site- and operator-level data.



ETHIOPIA

An access and service-resilience challenge shaped by altitude, limited electrification and unreliable supply.

POPULATION	COOLING DEGREE DAYS	ELECTRICITY ACCESS	GRID EMISSION FACTOR
132 million	2,169 °C-day/yr	about 55%	0.016 kg CO2e/kWh

KEY TAKEAWAYS

01 Altitude, rather than latitude, determines cooling need: most people live in temperate highlands, while the hottest lowlands have the weakest electricity, health and education infrastructure.	02 Electricity generation is almost entirely renewable, but access and continuity are limited. Critical loads require off-grid or hybrid supply, backup or storage, and maintainable system design.	03 The very low grid factor makes refrigerant leakage the dominant operational emission in several models; low-GWP equipment, installation quality, servicing and end-of-life recovery are therefore central.
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SECTOR SNAPSHOTS

HEALTHCARE	EDUCATION	FOOD COLD CHAIN
Reconstructs the operational hospital and bed base and models clinical cooling, vaccine refrigeration and pharmaceutical and laboratory loads. 177 GWh/yr <i>reference service scenario for annual hospital cooling electricity</i> Grid-only cooling emissions are about 0.048 Mt CO2e/yr; the 6.5% diesel-supply sensitivity increases them to about 0.056 Mt CO2e/yr.	Separates the largely unserved primary and secondary estate from the more concentrated tertiary sector. 68.5 GWh/yr <i>school-census-weighted central scenario; 172 GWh/yr in the hotter spatial sensitivity</i> Central-case emissions are about 60 kt CO2e/yr, of which approximately 98% is direct refrigerant leakage.	Models potential serviced throughput across pre-cooling, storage, air cargo, reefers and the Djibouti export corridor. 279 GWh/yr <i>annual electricity demand in the serviced cold-chain scenario</i> Operational emissions are about 0.035 Mt CO2e/yr. The separate 5.36 Mt CO2e/yr food-loss proxy is strategic and not a national inventory.

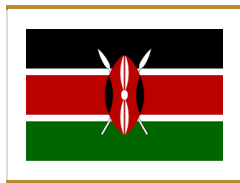
WHAT THE REPORT CONTAINS

REPORT COVERAGE Altitude-based climate zones; urban growth and thermal vulnerability; electricity access, outages and diesel backup; healthcare and education service expansion; domestic and export cold-chain development; the Djibouti corridor; post-harvest losses; and service-based delivery models.	USE THE FULL REPORT FOR Facility and exposure maps; registry-based capacity assumptions; off-grid and diesel sensitivities; corridor bottlenecks; and calculation parameters for leakage, throughput and storage duration.
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PROJECT OPPORTUNITY AREAS

Solar and hybrid health systems	Technical and O&M capacity	Passive-first school design	Cooling-as-a-service cold rooms
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KENYA

High renewable generation coexists with expensive, unreliable supply and major cooling-access deficits.

COUNTRY REPORT

03 / 05

POPULATION	COOLING DEGREE DAYS	ELECTRICITY ACCESS	RENEWABLE GENERATION
56.4 million	2,813 °C-day/yr	76.2%	91.2% incl. biofuels

KEY TAKEAWAYS

01 Renewable generation does not eliminate delivery risk: incomplete access, high tariffs and average interruptions of 3.57 per month affect operating cost, equipment life and continuity of service.	02 The ASALs, temperate highlands and humid coast require distinct technical responses, ranging from off-grid heat resilience to urban comfort cooling and humidity control.	03 National cold-chain data remain incomplete. The report therefore presents a bounded demand range and identifies the metered operator data required for investment-grade baselines.
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SECTOR SNAPSHOTS

HEALTHCARE	EDUCATION	FOOD COLD CHAIN
Maps hospital tiers and clinical cooling functions, including vaccine storage, and models the serviced stock above 50 beds. 121 GWh/yr <i>annual cooling electricity demand for the serviced current stock above 50 beds</i> The modelled footprint is about 65 kt CO ₂ e/yr; maintaining current facility ratios would still require substantial capacity expansion by 2050.	Uses passive measures as the baseline and models an indicative current-use case and a medium-term adoption case. 14.5-56.0 GWh/yr <i>indicative annual demand from current use to medium-term adoption</i> Estimated emissions increase from about 10.5 to 36.9 kt CO ₂ e/yr across the two scenarios.	Covers milk chilling, horticultural pre-cooling, warehouses, reefers and industrial food refrigeration. 155-250 GWh/yr <i>bounded annual operational electricity demand</i> Indirect emissions are about 43-69 kt CO ₂ e/yr. The separate 3-11 Mt CO ₂ e/yr food-loss sensitivity is not added to this footprint.

WHAT THE REPORT CONTAINS

REPORT COVERAGE	USE THE FULL REPORT FOR
Climate zones and informal-settlement heat; cooling-access risk and urbanisation; tariffs, outages and dry-season constraints; public-facility cooling and maintenance; milk chilling, horticulture, warehouses, industrial refrigeration and reefer logistics.	Facility maps; tariff, outage and diesel sensitivity cases; adoption assumptions; derivation of the cold-chain range; and the operator data needed to resolve industrial and reefer loads.

PROJECT OPPORTUNITY AREAS

Passive-first education	Solar, storage and backup	Efficient health facilities	Metered cold-chain pilots
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MOROCCO

Near-universal access combines with a carbon-intensive power system, severe water stress and rapidly increasing cooling demand.

POPULATION	COOLING DEGREE DAYS	ELECTRICITY ACCESS	GRID EMISSION FACTOR
36.83 million	about 1,470 °C-day/yr	about 100%	0.83 kg CO2e/kWh

KEY TAKEAWAYS

01 The six official climate zones span mild Atlantic conditions to extreme pre-Saharan heat; national averages are not suitable for project sizing.	02 Coal-dominated generation gives high value to avoided electricity use, strengthening the case for envelope retrofits, efficient equipment and demand-side management.	03 Water availability is a design constraint. Evaporative systems require site-specific water budgets, while reduced food loss also avoids wasting the water embodied in agricultural production.
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SECTOR SNAPSHOTS

HEALTHCARE	EDUCATION	FOOD COLD CHAIN
Reconstructs the public hospital estate and clearly distinguishes official facility records from modelled energy nodes. 70 GWh/yr <i>screening estimate of annual hospital cooling electricity demand</i> Estimated cooling emissions are about 70 kt CO2e/yr: approximately 58 kt indirect and 12 kt direct.	Uses enrolment, classroom and university data because no official inventory of installed cooling equipment is available. 24.3-33.2 GWh/yr <i>current low-penetration recirculating and outdoor-air treatment cases</i> Estimated emissions are about 25.8-38.4 kt CO2e/yr; school-calendar effects limit annual operation because much of the peak heat occurs during the summer break.	Assesses selected horticulture, fisheries, storage, processing and refrigerated-transport segments. 273.3 GWh/yr <i>selected-segment final-energy equivalent: 179.6 GWh electricity and 93.7 GWh diesel-equivalent</i> Operational emissions are about 0.193 Mt CO2e/yr; the separately reported central spoilage proxy is 1.707 Mt CO2e/yr.

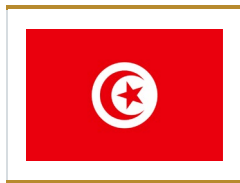
WHAT THE REPORT CONTAINS

REPORT COVERAGE The six climate zones; cooling-degree-day trends; urbanisation, building performance and water stress; electricity supply and generation mix; healthcare infrastructure; school thermal exposure and ventilation; and export and domestic cold-chain nodes, ports and processing.	USE THE FULL REPORT FOR Climate-zone and facility maps; hospital-inventory methodology; current and latent school-demand cases; outdoor-air and water-related assumptions; and selected cold-chain boundaries.
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PROJECT OPPORTUNITY AREAS

Building-envelope retrofits	High-efficiency cooling	Water-conscious technologies	Port and process upgrades
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TUNISIA

COUNTRY REPORT

05 / 05

A compact, highly urbanised market where air conditioning drives the summer peak and gas-based generation magnifies the value of efficiency.

POPULATION	COOLING DEGREE DAYS	ELECTRICITY ACCESS	GRID EMISSION FACTOR
12.35 million	1,739 °C-day/yr	99.8%	0.468 kg CO ₂ e/kWh

KEY TAKEAWAYS

01 Air conditioning accounted for about 44% of the cited 2021 summer peak, making seasonal efficiency, passive measures and peak-load management central.	02 Thermal stress is greatest in the interior and south. In schools, the hottest July-August period largely falls outside the teaching calendar, supporting a passive-first strategy.	03 Education and cold-chain results are bounded scenarios, not measured national consumption; equipment condition, adoption rates, throughput and food-loss baselines require project-level verification.
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SECTOR SNAPSHOTS

HEALTHCARE	EDUCATION	FOOD COLD CHAIN
Assesses hospital capacity, clinical comfort and air-treatment loads, vaccine refrigeration and equipment condition. 98 GWh/yr <i>screening estimate of annual hospital cooling demand, about 0.5% of national generation</i> Cooling-related emissions are about 0.064 Mt CO ₂ e/yr; both energy efficiency and refrigerant management are material.	Compares an illustrative 8% adoption case with a full classroom air-conditioning upper bound. 12-97.7 GWh/yr <i>central adoption scenario to full classroom air-conditioning</i> Estimated emissions increase from about 13 to 105 kt CO ₂ e/yr; school-calendar effects and passive measures reduce addressable demand.	Separates export logistics, fragmented domestic chains and industrial meat and fisheries refrigeration. up to 78.6 GWh/yr <i>addressable annual electricity under stated full-coverage assumptions</i> Electricity-related emissions are about 0.0368 Mt CO ₂ e/yr; the separate food-loss proxy is about 0.84 Mt CO ₂ e/yr.

WHAT THE REPORT CONTAINS

REPORT COVERAGE	USE THE FULL REPORT FOR
Northern, central and southern climate zones; urban heat and building performance; the gas-based power system and network losses; healthcare cooling and vaccine refrigeration; school adoption scenarios; and produce, fisheries, processing, storage and reefer chains.	Climate-zone evidence; summer-peak analysis; distinctions among central, full-coverage and addressable cases; and project inputs such as adoption, throughput and storage duration.

PROJECT OPPORTUNITY AREAS

Peak-aware efficiency retrofits	Passive-first education	Vaccine cold-chain renewal	Modular solar cold rooms
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