



06 BOTTLING PLANTS · SIMULTANEOUS HEATING & COOLING

₱110,000 a month back in your pocket. *From day one.*

For Philippine beverage bottlers — juice, RTD tea, bottled water. Your line runs **hot and cold at once: the tunnel pasteuriser heats the product then chills it within metres** — one electricity bill, no LPG boiler, financed by the bank, paid for out of the saving. The heat you dump off the cooling zones IS the heat you buy back for CIP.

MODELLED 50,000 L/DAY PHILIPPINE BEVERAGE BOTTLING PLANT · CIP + TUNNEL PASTEURISER + COLD FILL

<p>₱110K</p> <p>In your pocket every month</p> <p>Saving minus the green-loan payment · from day one</p>	<p>1.5 yr</p> <p>Cash payback</p> <p>~₱2.8M install vs ~₱1.85M/yr saving · -64% utility bill</p>	<p>0</p> <p>LPG deliveries from day one</p> <p>Boiler retired · ~62 tCO₂e/yr avoided · no flame on site</p>
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You pay nothing up front. *The bank does.*

DBP, LandBank and BPI all run **green-loan programmes** built for exactly this CAPEX — **~6.5–8% p.a., 5–10 year terms, 70–80% LTV**. The monthly saving (~₱154K) is larger than the monthly loan payment (~₱44K). **Cash flow goes UP from day one**. Karnot files the loan application, the BOI paperwork and the building permits as part of project scope. Most beverage-manufacturing installs qualify for **BOI Pioneer status and Income Tax Holiday under RA 11285**.

— WHY YOUR BOTTLING PLANT PAYS FOR EVERY KILOWATT TWICE

The tunnel pasteuriser heats the product, then chills it. *Within metres.*

A bottling line runs **two opposing thermal jobs at once**: the tunnel pasteuriser raises the filled bottle to 60–72 °C to kill spoilage organisms, then the cooling zones drop it straight back down — meanwhile CIP wants 65–85 °C all shift and cold-fill product wants chilled water. Today an LPG boiler makes the heat, and a separate chiller throws the same heat away into a cooling tower (and wastes mains water). **The same kilowatt-hour, paid for twice.** A heat pump moves it across instead.



Cold fill and tunnel cooling are non-negotiable — and your chiller is the weak link

Cold-fill product and the tunnel cooling zones need chilled water on demand, and process / room cooling runs all shift. Most PH bottlers run an ageing **R404A chiller at COP ~2.8 with a phasedown clock on the asset register**. Karnot iCOOL CO₂ holds the same duty at **COP 4.2 (Oak Ridge validated)** — 40% less electricity for the cold side, and the heat it removes is the heat your CIP loop needs.



The LPG boiler is your biggest controllable cost — and it's optional

CIP caustic and acid loops (65–85 °C), the tunnel pasteuriser heating zones (60–72 °C) and bottle warming burn roughly **22,000 kg of LPG a year** on a 50,000 L/day plant — ~P1.87M/yr. The heat recovered from the tunnel cooling zones and the product-chill condenser, captured at the iCOOL gas cooler, **covers the CIP and pasteuriser load**. The boiler is retired, not replaced.

— ONE MACHINE · BOTH JOBS · ONE ELECTRICITY BILL

KARNOT BOTTLING PLATFORM · 50,000 L/DAY MODELLED · SCALES 10,000 – 200,000 L/DAY

COLD SIDE · WHAT THE LINE NEEDS

Cold fill · tunnel cooling · process cooling

Product chilled for cold fill; the tunnel pasteuriser cooling zones **drop the bottle back down**. Process and room cooling at 2–6 °C. All duties from iCOOL CO₂ at COP 4.2 — with iSTOR PCM carrying the cold store through brownouts.



iCOOL CO₂ + iHEAT R290

The heat pulled out of the product and the tunnel cooling zones is delivered to the hot side. Nothing goes to the cooling tower.



HOT SIDE · WHAT THE PLANT NEEDS

CIP · tunnel pasteuriser · bottle warming

CIP wash water at 65–85 °C all shift. Tunnel pasteuriser heating zones 60–72 °C. Bottle warming to prevent condensation. All fed from **recovered tunnel + product-chill heat** via the iCOOL gas cooler + iHEAT R290 top-up. LPG: zero.

— THE FOUR BOXES · ONE PROJECT

iCOOL CO₂

Transcritical R744 · GWP 1 · TRL 9

Cold fill, tunnel cooling and process cooling. **COP 4.2 at –5 °C** (Oak Ridge validated). Gas cooler delivers **75–90 °C hot water** from the same cycle. A1 food-safe — the same CO₂ that carbonates the drink.

iHEAT R290

9.5–100 kW · COP 4.0+

CIP and pasteuriser duty. **60–85 °C delivery** at PH ambient. Outdoor install, 1.4 kg sealed charge, EN 378 compliant. **Drop-in replacement for the LPG boiler.**

iSTOR PCM

38 kWh · 8–12 hr backup

Thermal battery on both sides: **hot buffer banks tunnel heat for the CIP washout; cold buffer carries cold fill and the cold store through a brownout** with zero compressor load. The shift keeps running through the outage.

iSAVE + iVOLT

M&V + zero-export solar

iSAVE meters every duty — **IPMVP Option B M&V report monthly** to your accountant and your lender. iVOLT zero-export solar on the plant roof cuts the remaining grid draw 30–50%.

— WHAT YOU PAY TODAY · WHAT YOU PAY AFTER

50,000 L/day plant. *A real number per litre.*

ANNUAL FIGURE · 50,000 L/DAY PLANT	TODAY · BOILER + OLD CHILLER	KARNOT INTEGRATED PLATFORM	YOU STOP PAYING
Process heat (CIP + tunnel pasteuriser)	~22,000 kg LPG/yr	0 kg · recovered heat	₱1.87M/yr · no flame
Product + tunnel cooling	COP 2.8 · R404A clock	COP 4.2 · CO ₂ GWP 1	₱980K/yr elec + water
Total utility bill (heat + cooling)	~₱2.85M/yr	~₱1.0M/yr	-64% / ~₱1.85M/yr
Scope 1 + refrigerant exposure	~52 t LPG CO ₂ e + R404A GWP 3,922	R744 GWP 1 · R290 GWP 3	~62 tCO₂e/yr total
Total investment (VAT-inc)	(already paid)	~₱2.8M	1.5 yr cash payback

*Basis: 50,000 L/day, 300 day/yr · CIP wash water 65–85 °C, tunnel pasteurise-and-cool (heat to 60–72 °C then chill the bottle back down), product cold fill. LPG ₱85/kg at 82% boiler efficiency; Meralco GP ₱14/kWh. CAPEX includes iCOOL CO₂ chiller, iHEAT R290 hot-side, hot + cold buffer tanks, controls, commissioning and Permits-Managed Service LOW tier. **Your plant might be 10,000 L/day or 200,000 L/day — the per-litre economics hold.** Excludes iVOLT solar, which cuts the remaining ₱1.0M a further 30–50%.*

— THE CASH FLOW · PLAIN AND DULL

<p>MONTH 1</p> <p>₱110K</p> <p>~₱154K monthly saving minus the green-loan payment (~₱44K). Net cash in pocket. Every month. From day one.</p>	<p>YEAR 1</p> <p>₱1.3M</p> <p>In your pocket while the loan is being repaid. The kit has paid for itself in cash terms by month 18.</p>	<p>YEAR 5</p> <p>₱6.6M</p> <p>Loan paid off in year 7. Until then you bank ~₱1.3M a year after the loan payment.</p>	<p>YEAR 15</p> <p>₱24M</p> <p>Total cash retained over the 15-year asset life vs keeping the boiler and the old chiller.</p>
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THE ENGINEERING BEHIND THE NUMBER · PINCH ANALYSIS

We don't guess the saving. *We calculate your plant's thermodynamic minimum.*

Pinch analysis maps every hot stream (product that must cool, tunnel cooling-zone heat that must leave) against every cold stream (CIP and pasteuriser water that must heat) and computes **Q_Hmin** and **Q_Cmin** — **the absolute minimum heating and cooling your plant needs** after maximum heat recovery. Everything above that minimum is waste. The pinch point in a bottling plant sits around 35 °C — and **a heat pump is the only utility that moves surplus heat from below the pinch to the deficit above it.** That is why the saving is 64%, not 15%. Read the plain-English guide: karnot.com/blog/idiots-guide-utility-pinch-analysis — or commission a Level 1 Energy Survey (₱90K, refunded on install) and we run the pinch study on your actual line log.

— HOW YOU PAY FOR IT · YOU DON'T, THE BANK DOES

Three banks. One BOI Income Tax Holiday. *Karnot files everything.*

Philippine green-loan programmes *built for beverage CAPEX*

DBP · SEFP

Sustainable Energy Finance Programme

Industrial energy-efficiency priority.
70–80% LTV · 5–10 yr · ~6.5–8% p.a.

LANDBANK · SEILP

Sustainable Energy Investment Loan

Strong fit for regional and agri-linked bottlers already banking with LandBank · ~7% p.a.

BPI · SDF

Sustainable Development Finance

Fastest decisions for established producers · ~1–1.5% below standard SME rate

These are **loans**, not grants. The monthly saving covers the payment 3.5x over. Plus **BOI Pioneer Income Tax Holiday under RA 11285** — energy-efficient manufacturing qualifies. Karnot files **the loan, the BOI registration, the building permits and the monthly IPMVP M&V report your lender wants to see** as part of project scope.

WHY NATURAL REFRIGERANTS · THE FOOD-SAFETY ANGLE

CO₂ and propane. *No ammonia zone. No F-gas clock.*

Legacy bottling-plant refrigeration is either R404A / R134a (GWP up to 3,922, F-gas phasedown, rising service prices) or industrial ammonia (toxic, exclusion zones, specialist compliance). Karnot iCOOL runs on CO₂ — GWP 1, A1 safety class, food-safe, the same gas already dissolved in your carbonated drinks. iHEAT runs on R290 outdoors with a sealed 1.4 kg charge under EN 378. Nothing on the asset register has a phasedown date, an exclusion zone, or an insurance loading. SEC PFRS S2 climate disclosure: ~62 tCO₂e/yr avoided, audit-grade data from iSAVE.

“ A bottling plant is the textbook case for simultaneous heating and cooling — the pinch analysis writes itself. The tunnel pasteuriser heats the product then chills it within metres, while the CIP loop must gain exactly the heat the cooling zones must lose, on the same shift. Today Philippine bottlers pay Meralco to throw that heat into a cooling tower and pay the LPG man to buy it back. One Karnot platform does both jobs from one electricity bill: chill the product, bank the heat, retire the boiler. ₱2.8M installed, ₱1.85M back every year, and the bank finances it against the saving. The maths is not subtle. ”

Stuart Cox · Founder & CEO · Karnot Energy Solutions Inc.