06 BOTTLING PLANTS · SIMULTANEOUS HEATING & COOLING

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

A Philippine beverage bottling plant, chilling the product for cold fill while heating the CIP loop and the tunnel pasteuriser from one Karnot platform — one electricity bill, no LPG boiler, financed by the bank, paid out of the saving. Modelled on a 50,000 L/day plant.

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, then the cooling zones drop it straight back down; CIP wants 65–85 °C and cold fill wants chilled water. The same kilowatt-hour, paid for twice — once to Meralco to throw it into the cooling tower, once to the LPG man to buy it back.

❄️

Cold fill and tunnel cooling are non-negotiable

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 an F-gas phasedown clock** on the asset register. The chiller is both your product-quality tool and your biggest electricity line.

🔥

The LPG boiler is optional — and nobody told you

CIP loops, tunnel pasteuriser heating, bottle warming: roughly **22,000 kg of LPG a year on a 50,000 L/day plant (~₱1.87M)**. But the heat your product and tunnel cooling zones give up is the same heat your hot side needs — captured at the CO_2 gas cooler, **it covers the CIP and pasteuriser load. The boiler is retired, not replaced.**

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THE ARCHITECTURE · ONE MACHINE, BOTH JOBS

Chill the product. *Bank the heat. Retire the boiler.*

KARNOT BOTTLING PLATFORM · MODELLED 50,000 L/DAY · 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 2–6 °C. All from iCOOL CO_2 at **COP 4.2 (Oak Ridge validated)** — 40% less electricity than the legacy chiller.

ICOOL CO_2 + 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 65–85 °C all shift. Tunnel pasteuriser heating zones 60–72 °C. Bottle warming to stop condensation. Fed from **recovered tunnel + product-chill heat** via the CO_2 gas cooler + iHEAT R290 top-up. **LPG: zero.**

ISTOR PCM · BOTH SIDES BUFFERED

Hot buffer banks tunnel heat for the CIP washout. **Cold buffer carries cold fill and the cold store through a brownout — the shift keeps running through the outage.**

THE LINE STAYS

Your filler, capper, labeller and tunnel pasteuriser don't change. **We replace the utilities around them, not the line.** Commissioning across two CIP windows.

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THE FOUR BOXES YOU ACTUALLY NEED

Four products. *One project. One commissioning team.*

iCOOL CO_2

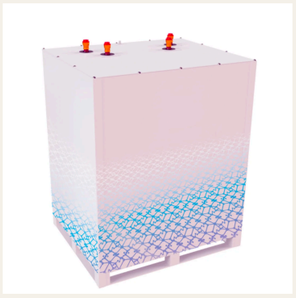
Transcritical R744 · GWP 1 · food-safe A1

Cold fill, tunnel cooling, process cooling. **COP 4.2 at –5 °C** (Oak Ridge validated). Gas cooler delivers **75–90 °C hot water from the same cycle**. The same CO_2 that carbonates the drink.

iHEAT R290

9.5–100 kW · COP 4.0+ · 60–85 °C

CIP and pasteuriser duty. **Drop-in replacement for the LPG boiler.** Outdoor install, sealed 1.4 kg charge, EN 378 compliant. No flame, no flue, no boiler-room schedule.



iSTOR PCM

38 kWh · 8–12 hr backup

Thermal battery on both sides. **Hot:** tunnel heat banked for the CIP washout. **Cold:** cold fill and the cold store ride through a PH brownout with zero compressor load. 1,500+ charge cycles.

iSAVE + iVOLT

IPMVP M&V + zero-export solar

iSAVE meters every duty — **monthly IPMVP Option B report to your accountant and your lender**. iVOLT zero-export solar cuts the remaining grid draw 30–50%. Plant roofs are flat and big.

THE BILL · MODELLED 50,000 L/DAY PLANT

₱2.85M utility bill today. *₱1.0M after. −64%.*

ANNUAL FIGURE	TODAY · BOILER + OLD CHILLER	KARNOT PLATFORM	YOU STOP PAYING
Process heat (CIP + tunnel pasteuriser)	~22,000 kg LPG/yr	0 kg · recovered heat	**₱1.87M/yr**
Product + tunnel cooling	COP 2.8 · R404A	COP 4.2 · CO_2	**₱980K/yr**
Scope 1 + refrigerant exposure	~52 t CO_2e + GWP 3,922	GWP 1 & 3 · natural	**~62 tCO_2e/yr**
Total investment (VAT-inc)	**(already paid)**	**~₱2.8M**	**1.5 yr 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 CO_2 chiller, iHEAT R290, hot + cold buffers, controls, commissioning, Permits-Managed Service LOW. ***Your plant might be 10,000 L/day or 200,000 L/day — the per-litre economics hold.*** *Excludes iVOLT solar (further 30–50% off the remainder).*

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THE CASH FLOW · BANK-FINANCED

From day one. *Net of the loan payment.*

MONTH 1

₱110K

~₱154K monthly saving **minus** the green-loan payment (~₱44K). Net cash in pocket. Every month. From day one.

YEAR 1

₱1.3M

In your pocket while the loan is being repaid. **The kit has paid for itself in cash terms by month 18.**

YEAR 5

₱6.6M

Banking ~₱1.3M a year after the loan payment. **The loan clears in year 7 — then you keep all of it.**

YEAR 15

₱24M

Total cash retained over the 15-year asset life vs keeping the boiler and the old chiller.

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

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

DBP

Sustainable Energy Finance Programme (SEFP)

Industrial energy-efficiency priority. Covers heat pump + refrigeration + solar. 70–80% LTV. 5–10 year terms.

~6.5–8% p.a.

LandBank

Sustainable Energy Investment Loan (SEILP)

Strong fit for regional and agri-linked bottlers already banking with LandBank. Friendly underwriting.

~7% p.a.

BPI

Sustainable Development Finance (SDF)

Fastest decisions for established producers with a BPI relationship. ESG-aligned loan book.

~1–1.5% below SME

These are **loans**, not grants. The monthly saving covers the payment **3.5× 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** as part of project scope.

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THE ENGINEERING BEHIND THE NUMBER · PINCH ANALYSIS

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

NUMBER 1 · MINIMUM HEATING

$Q_H min$

The **absolute least boiler energy** your plant needs after maximum heat recovery. If your boiler burns more than this — and in every plant we have surveyed, it does — **the difference is pure waste**.

NUMBER 2 · MINIMUM COOLING

$Q_c min$

The **absolute least chiller energy** required after recovery. Everything your chiller removes above this is tunnel heat you paid to make and then **paid again to throw away**.

NUMBER 3 · THE BOTTLENECK

~35 °C

The bottling-plant pinch point. Above it: heat deficit. Below it: heat surplus. **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%.

Hot streams are income. Cold streams are expenses. Pinch analysis is the accountant that finds the maximum internal transfer before you go to the bank (boiler) or throw money away (chiller). *Plain-English guide: karnot.com/blog/idiots-guide-utility-pinch-analysis*

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THE REFRIGERANT DECISION · FOOD-SAFETY ANGLE

Three ways to chill a bottling plant. *Two of them have a clock running.*

LEGACY HFC · THE PHASEDOWN

3,922

GWP of R404A · F-gas phasedown clock

R404A / R134a chillers face **quota-driven service price rises every year**. The EU PFAS restriction names the HFC family explicitly. PH typically follows 6–8 years behind. **Every peso spent maintaining one is a peso spent on a dying asset.**

INDUSTRIAL AMMONIA · THE EXCLUSION ZONE

B2L

Toxic safety class · specialist compliance

NH_3 is efficient but **toxic — exclusion zones, specialist technicians, emergency response plans**, and an insurance loading. Sized for macro-plant scale, not the 10,000–200,000 L/day producers that make up the growing PH beverage industry.

KARNOT NATURAL · NO CLOCK, NO ZONE

GWP 1

CO_2 (R744) + propane (R290 · GWP 3)

CO_2 is food-safe, A1 class — the same gas dissolved in your carbonated drinks. R290 sits outdoors in a sealed 1.4 kg charge under EN 378. No phasedown, no exclusion zone, no insurance loading, **nothing on the asset register with a death date.**

SEC PFRS S2 climate disclosure: ***~62 tCO_2e/yr avoided, audit-grade data from iSAVE, monthly.***

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WHAT HAPPENS NEXT

Four steps from this deck *to a retired boiler.*

1 Send us three things

Daily volume (L/day), 12 months of LPG + electricity bills, and your line + CIP schedule. That is all we need for the first model.

2 Level 1 Energy Survey + pinch study

₱90K, one week of portable metering on your actual line log — **refunded in full when you proceed to install**. Output: your $Q_H$min, $Q_C$min and a sized system quote.

3 Bank + BOI paperwork — we file it

DBP / LandBank / BPI green-loan application, BOI Pioneer ITH registration, building permits. You sign at the bank window, not before.

4 Install in 4–6 weeks · no lost shifts

The line stays. We swap the utilities around it — commissioning across two scheduled CIP windows. Boiler retired on handover day.

GET YOUR PLANT'S NUMBERS

Send us your *daily volume, 12 months of bills and your line schedule.*

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