09 BREWING & DISTILLING · SIMULTANEOUS HEATING & COOLING

# ₱90,000 a month back in your pocket. *From day one.*

A Philippine craft brewery, chilling the wort and holding the ferment while heating the hot liquor and CIP from one Karnot platform — one electricity bill, no LPG boiler, financed by the bank, paid out of the saving. Modelled on a 5,000 hL/yr brewery.

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WHY YOUR BREWERY PAYS FOR EVERY KILOWATT TWICE

# The wort chiller dumps the heat. The hot-liquor tank buys it back. *On the same brew day.*

Every brewhouse runs **two opposing thermal jobs at once**: wort off the boil at 100 °C must hit 18 °C within the hour, then ferment holds cold for days; the next brew's hot liquor wants 76 °C and CIP wants 85 °C. 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.

## Fermentation temperature IS your product

Ferment must hold within **±0.5 °C** and crash-cool to 2 °C to drop yeast and condition. Most PH craft breweries run an ageing **R404A glycol chiller at COP ~2.8 with an F-gas phasedown clock** on the asset register. The chiller is both your flavour-stability tool and your biggest electricity line.

## The LPG boiler is optional — and nobody told you

Hot liquor, CIP loops, keg washing: roughly **19,900 kg of LPG a year on a 5,000 hL/yr brewery (~₱1.69M)**. But the heat your wort and ferment give up is the same heat your hot side needs — captured at the $CO_2$ gas cooler, **it covers the hot-liquor and CIP load. Convert the kettle to electric and the boiler is retired, not replaced.**

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THE ARCHITECTURE · ONE MACHINE, BOTH JOBS

# Chill the wort. *Bank the heat. Retire the boiler.*

KARNOT BREWERY PLATFORM · MODELLED 5,000 HL/YR · SCALES 1,000 – 50,000 HL/YR

COLD SIDE · WHAT THE BEER NEEDS

## Wort knockdown · fermentation · cold store

Wort 100→18 °C through the heat exchanger. **Glycol at 0–4 °C holds fermentation and crash-cools the tanks.** Bright-tank and cold store 2–4 °C. All from iCOOL $CO_2$ at **COP 4.2 (Oak Ridge validated)** — 40% less electricity than the legacy glycol chiller.

**ICOOL $CO_2$ + IHEAT R290**

*The heat pulled out of the wort and the ferment is delivered to the hot side. Nothing goes to the cooling tower.*

HOT SIDE · WHAT THE BREWHOUSE NEEDS

## Hot liquor · CIP · kettle preheat

**Hot-liquor tank 76 °C** for strike and sparge. CIP caustic, acid, sanitiser 65–85 °C. Keg and cask washing 60 °C. Fed from **recovered wort + ferment heat** via the $CO_2$ gas cooler + iHEAT R290 top-up. **LPG: zero.**

ISTOR PCM · BOTH SIDES BUFFERED

Hot buffer banks wort heat between brews for the next strike. **Cold buffer carries the fermentation cellar through a brownout — the batch survives the outage.**

THE BREWHOUSE STAYS

Your mash tun, kettle and fermenters don't change. **We replace the utilities around them, not the brewhouse.** Commissioning across two CIP windows.

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THE FOUR BOXES YOU ACTUALLY NEED

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


## iCOOL $CO_2$

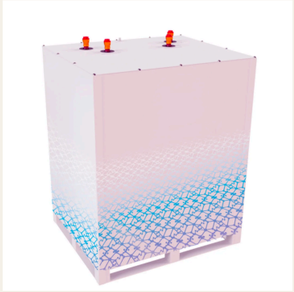
Transcritical R744 · GWP 1 · food-safe A1

Wort knockdown, glycol fermentation, cold store. **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 beer.


## iHEAT R290

9.5–100 kW · COP 4.0+ · 60–85 °C

Hot-liquor and CIP 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:** wort heat banked for the next strike. **Cold:** the fermentation cellar rides 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%. Brewery roofs are flat and big.

THE BILL · MODELLED 5,000 HL/YR BREWERY

# ₱2.4M utility bill today. *₱0.85M after. −64%.*

| ANNUAL FIGURE | TODAY · BOILER + OLD CHILLER | KARNOT PLATFORM | YOU STOP PAYING |
|---|---|---|---|
| **Process heat (hot liquor + CIP + preheat)** | ~19,900 kg LPG/yr | 0 kg · recovered wort heat | **₱1.69M/yr** |
| **Fermentation + wort cooling** | COP 2.8 · R404A | COP 4.2 · $CO_2$ | **₱720K/yr** |
| **Scope 1 + refrigerant exposure** | ~50 t $CO_2e$ + GWP 3,922 | GWP 1 & 3 · natural | **~55 t$CO_2e$/yr** |
| **Total investment (VAT-inc)** | **(already paid)** | **~₱2.4M** | **1.5 yr payback** |

*Basis: 5,000 hL/yr (~500,000 L). Hot liquor 25→76 °C, CIP + keg wash 65–85 °C, kettle converted to electric for the rolling boil. Glycol fermentation + crash + wort knockdown. LPG ₱85/kg at 82% boiler efficiency; Meralco GP ₱14/kWh. CAPEX includes iCOOL $CO_2$ glycol chiller, iHEAT R290, hot + cold buffers, controls, commissioning, Permits-Managed Service LOW.* ***Your brewery might be 1,000 hL/yr (÷5) or 50,000 hL/yr (×10) — the per-hectolitre 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**

## ₱90K

~₱129K monthly saving **minus** the green-loan payment (~₱39K). Net cash in pocket. Every month. From day one.

**YEAR 1**

## ₱1.1M

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

**YEAR 5**

## ₱5.5M

Banking ~₱1.1M a year after the loan payment. **The loan clears in year 7 — then you keep all of it.**

**YEAR 15**

## ₱20M

Total cash retained over the 15-year asset life vs keeping the boiler and the old glycol 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 breweries** 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 **3.3× 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 brewery needs after maximum heat recovery. If your boiler burns more than this — and in every brewery 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 glycol chiller removes above this is wort heat you paid to make and then **paid again to throw away**.

NUMBER 3 · THE BOTTLENECK

## ~35 °C

The brewery 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 brewery. *Two of them have a clock running.*

### LEGACY HFC · THE PHASEDOWN

**3,922**

GWP of R404A · F-gas phasedown clock

R404A / R134a glycol 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-brewery scale, not the 1,000–50,000 hL/yr craft producers that make up the growing PH 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 beer.** 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: *~55 $tCO_2e$/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

Annual volume (hL), 12 months of LPG + electricity bills, and your brew + 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 brew 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 brews

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

GET YOUR BREWERY'S NUMBERS

## Send us your *annual volume, 12 months of bills and your brew schedule.*

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