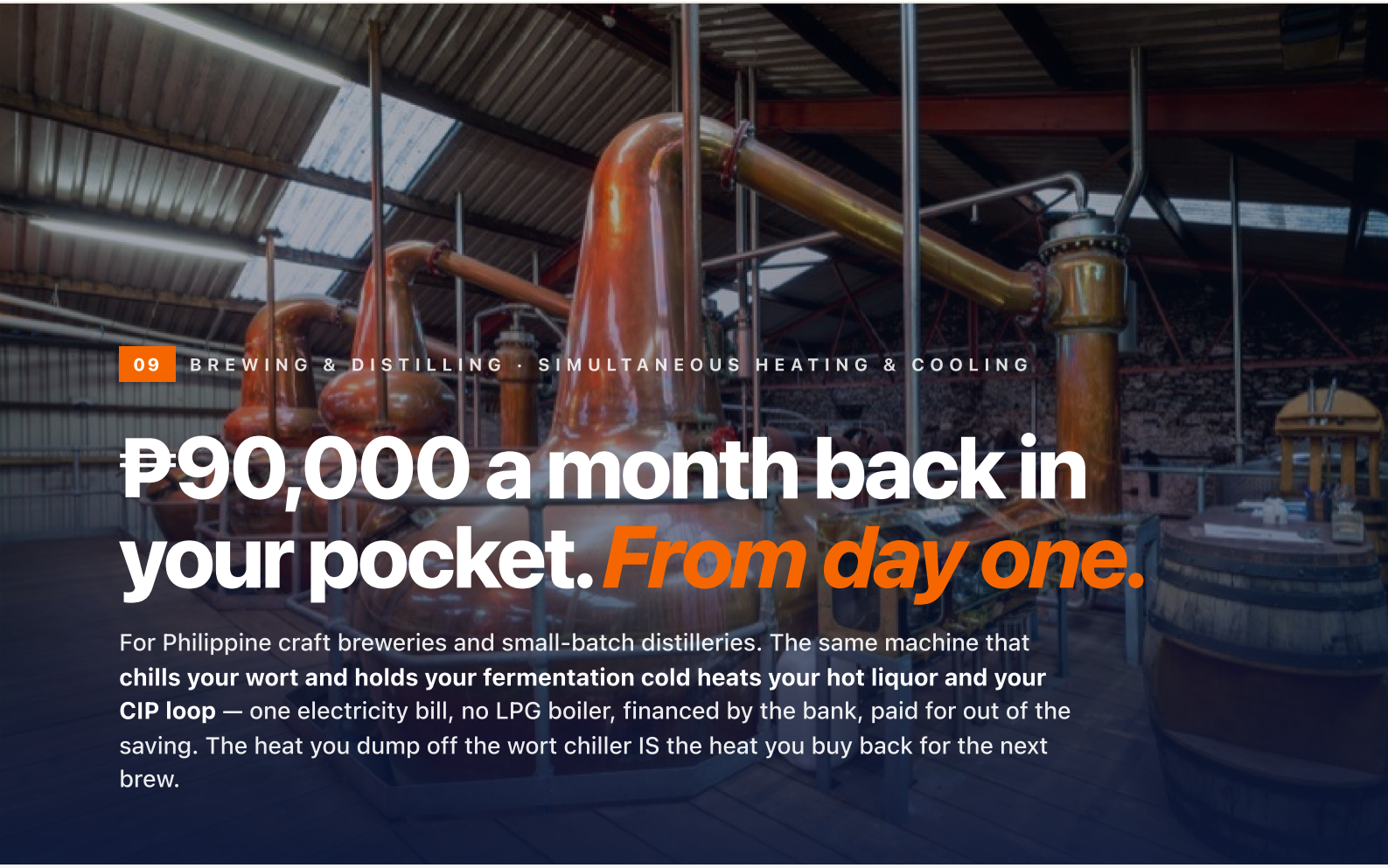

09 BREWING & DISTILLING · SIMULTANEOUS HEATING & COOLING

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

For Philippine craft breweries and small-batch distilleries. The same machine that **chills your wort and holds your fermentation cold heats your hot liquor and your CIP loop** — one electricity bill, no LPG boiler, financed by the bank, paid for out of the saving. The heat you dump off the wort chiller IS the heat you buy back for the next brew.

MODELLED 5,000 HL/YR PHILIPPINE CRAFT BREWERY · HOT LIQUOR + CIP + FERMENTATION

₱90K
In your pocket every month
Saving minus the green-loan payment · from day one

1.5 yr
Cash payback
~₱2.4M install vs ~₱1.55M/yr saving · –64% utility bill

0
LPG deliveries from day one
Boiler retired · ~55 tCO_2e/yr avoided · no flame on site

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 (~₱129K) is larger than the monthly loan payment (~₱39K). **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 BREWERY PAYS FOR EVERY KILOWATT TWICE

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

Every brewhouse runs **two opposing thermal jobs at once**: wort comes off the boil at 100 °C and must hit 18 °C pitching temperature within the hour, then ferment holds cold for days; meanwhile the next brew's hot liquor wants 76 °C and the CIP loop wants 85 °C all shift long. Today the plate chiller throws the wort's heat into a cooling tower (and wastes mains water) — then the LPG boiler buys that same heat back at ₱85/kg. **The same kilowatt-hour, paid for twice.** A heat pump moves it across instead.

Fermentation temperature IS your product — and your glycol chiller is the weak link

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 a phasedown clock on the asset register**. Karnot iCOOL CO_2 holds the same glycol duty at **COP 4.2 (Oak Ridge validated)** — 40% less electricity for the cold side, and the heat it removes is the heat your next brew needs.

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

Hot liquor (76 °C strike + sparge), CIP caustic and acid loops (65–85 °C) and keg / cask washing (60 °C) burn roughly **19,900 kg of LPG a year** on a 5,000 hL/yr brewery — ~₱1.69M/yr. The heat recovered from wort knockdown and fermentation, captured at the iCOOL gas cooler, **covers the hot-liquor and CIP load**. Convert the kettle to electric and the boiler is retired, not replaced.

ONE MACHINE · BOTH JOBS · ONE ELECTRICITY BILL

KARNOT BREWERY PLATFORM · 5,000 HL/YR MODELLED · 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 at 2–4 °C. All duties from iCOOL CO_2 at COP 4.2 — with iSTOR PCM carrying the cold store through brownouts.

← **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 at 76 °C for strike and sparge. CIP caustic, acid and sanitiser loops 65–85 °C. Keg and cask washing at 60 °C. Wort preheat into the kettle. All fed from **recovered wort + ferment heat** via the iCOOL gas cooler + iHEAT R290 top-up. LPG: zero.

THE FOUR BOXES · ONE PROJECT

iCOOL CO_2

Transcritical R744 · GWP 1 · TRL 9

Wort knockdown, glycol fermentation and cold store. **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 CO_2 that carbonates the beer.

iHEAT R290

9.5–100 kW · COP 4.0+

Hot-liquor and CIP 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 wort heat between brews for the next strike; cold buffer carries the fermentation cellar through a brownout** with zero compressor load. The batch survives 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 brewery roof cuts the remaining grid draw 30–50%.

WHAT YOU PAY TODAY · WHAT YOU PAY AFTER

5,000 hL/yr brewery. *A real number per hectolitre.*

ANNUAL FIGURE · 5,000 HL/YR BREWERY	TODAY · BOILER + OLD CHILLER	KARNOT INTEGRATED PLATFORM	YOU STOP PAYING
Process heat fuel (hot liquor + CIP + preheat)	~19,900 kg LPG/yr	0 kg · recovered wort heat	**₱1.69M/yr · no flame**
Fermentation + wort cooling	COP 2.8 · R404A clock	COP 4.2 · CO_2 GWP 1	**₱720K/yr elec + water**
Total utility bill (heat + cooling)	~₱2.4M/yr	~₱0.85M/yr	**–64% / ~₱1.55M/yr**
Scope 1 + refrigerant exposure	~50 t LPG CO_2e + R404A GWP 3,922	R744 GWP 1 · R290 GWP 3	**~55 tCO_2e/yr total**
Total investment (VAT-inc)	**(already paid)**	**~₱2.4M**	**1.5 yr cash payback**

Basis: 5,000 hL/yr (~500,000 L) · hot liquor heated 25→76 °C, CIP + keg wash 65–85 °C, kettle converted to electric for the rolling boil (we replace the utilities, not the brewhouse). Glycol fermentation + crash cooling + wort knockdown. LPG ₱85/kg at 82% boiler efficiency; Meralco GP ₱14/kWh. CAPEX includes iCOOL CO_2 glycol chiller, iHEAT R290 hot-side, hot + cold buffer tanks, controls, commissioning and Permits-Managed Service LOW tier. ***Your brewery might be 1,000 hL/yr (divide by 5) or 50,000 hL/yr (multiply by 10) — the per-hectolitre economics hold.*** *Excludes iVOLT solar, which cuts the remaining ₱0.85M a further 30–50%.*

THE CASH FLOW · PLAIN AND DULL

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

Loan paid off in year 7. Until then you bank ~₱1.1M a year **after** the loan payment.

YEAR 15

₱20M

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

THE ENGINEERING BEHIND THE NUMBER · PINCH ANALYSIS

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

Pinch analysis maps every hot stream (wort that must cool, fermentation heat that must leave) against every cold stream (hot liquor and CIP water that must heat) and computes **$Q_H$min and $Q_C$min — the absolute minimum heating and cooling your brewery needs** after maximum heat recovery. Everything above that minimum is waste. The pinch point in a brewery sits around 30–40 °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 brew 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 breweries** 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 3.3× 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 to see** as part of project scope.

WHY NATURAL REFRIGERANTS · THE FOOD-SAFETY ANGLE

CO_2 and propane. *No ammonia zone. No F-gas clock.*

Legacy brewery refrigeration is either **R404A / R134a glycol (GWP up to 3,922, F-gas phasedown, rising service prices)** or **industrial ammonia (toxic, exclusion zones, specialist compliance)**. Karnot iCOOL runs on CO_2 — **GWP 1, A1 safety class, food-safe**, the same gas already dissolved in your beer. 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: ~55 tCO_2e/yr avoided, audit-grade data from iSAVE.**

> **"A brewery is the textbook case for simultaneous heating and cooling — the pinch analysis writes itself. The wort must lose exactly the heat the hot liquor and the CIP loop must gain, on the same brew day. Today Philippine breweries 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 wort, bank the heat, retire the boiler. ₱2.4M installed, ₱1.55M back every year, and the bank finances it against the saving. The maths is not subtle."**
>
> **Stuart Cox · Founder & CEO · Karnot Energy Solutions Inc.**