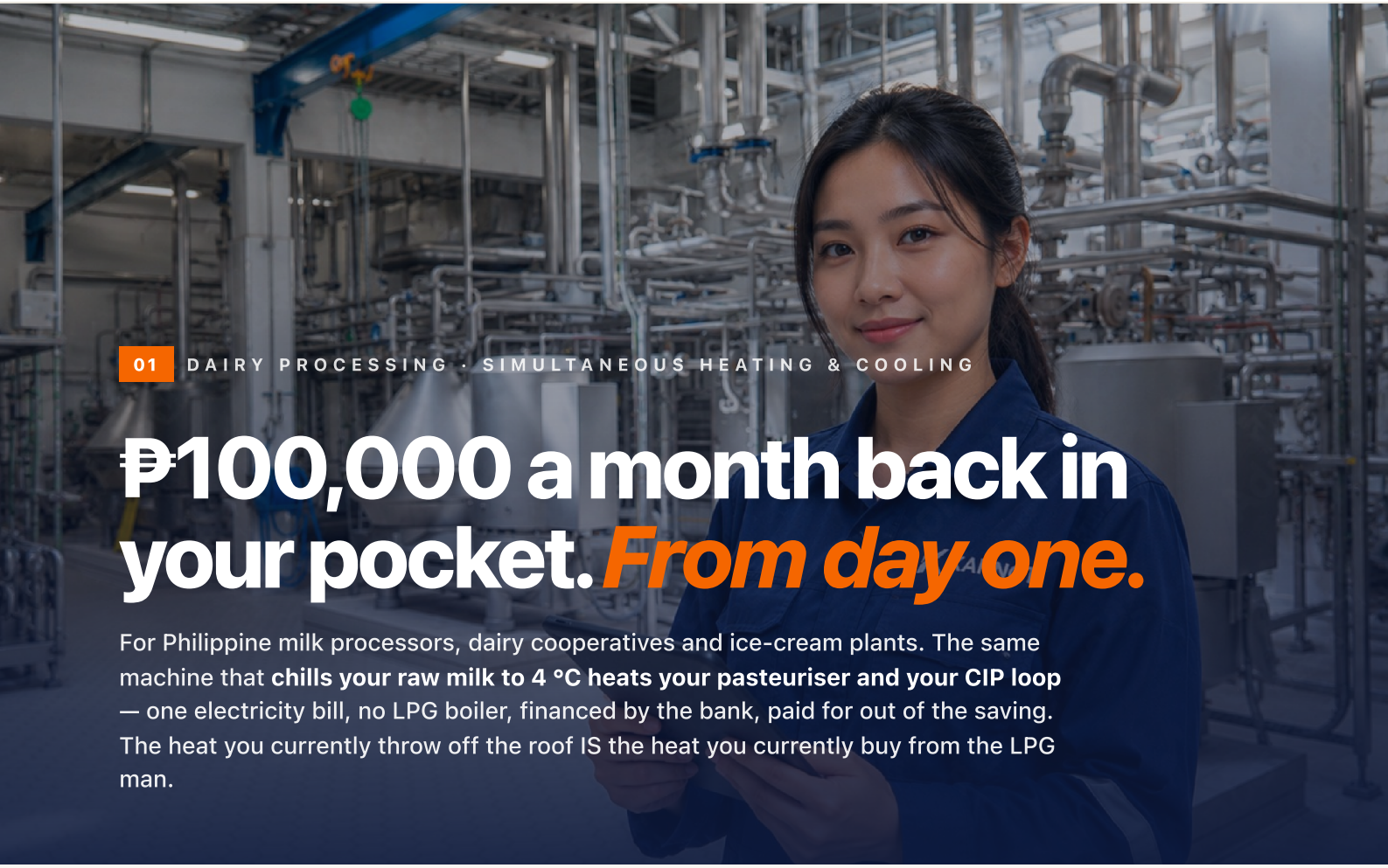

01 DAIRY PROCESSING · SIMULTANEOUS HEATING & COOLING

₱100,000 a month back in your pocket. *From day one.*

For Philippine milk processors, dairy cooperatives and ice-cream plants. The same machine that **chills your raw milk to 4 °C heats your pasteuriser and your CIP loop** — one electricity bill, no LPG boiler, financed by the bank, paid for out of the saving. The heat you currently throw off the roof IS the heat you currently buy from the LPG man.

MODELLED 20,000 L/DAY PHILIPPINE MILK PROCESSOR · HTST + CIP + COLD STORE

₱100K
In your pocket every month
Saving minus the green-loan payment · from day one

1.2 yr
Cash payback
~₱2.0M install vs ~₱1.7M/yr saving · −61% thermal bill

0
LPG deliveries from day one
Boiler retired · ~70 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 (~₱141K) is larger than the monthly loan payment (~₱40K). **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 dairy installs qualify for **BOI Pioneer status and Income Tax Holiday under RA 11285**.

WHY YOUR DAIRY PAYS FOR EVERY KILOWATT TWICE

The chiller dumps heat. The boiler buys it back. *Within metres of each other.*

Every milk plant runs **two opposing thermal jobs at the same time**: raw milk arrives at up to 35 °C and must reach 4 °C within hours; the pasteuriser and the CIP loop want 65–85 °C all shift long. Today the chiller takes the milk's heat and throws it off the roof — 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.

🥛

Milk quality lives or dies at 4 °C — and your chiller is the bottleneck

Grade-A milk must drop from body temperature to **4 °C within 2 hours** of reception, or bacterial count and spoilage losses climb. Most PH plants run ageing R22 / R404A chillers at **COP ~2.5 with a phasedown clock on the asset register**. Karnot iCOOL CO_2 delivers the same ice-water duty at **COP 4.2 (Oak Ridge validated)** — 40% less electricity for the cold side alone.

🔥

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

HTST pasteurisation (72 °C), CIP caustic and rinse loops (65–85 °C) and crate washing (60 °C) burn roughly **11,400 kg of LPG a year** on a 20,000 L/day plant — ~₱968K/yr. The heat your milk gives up during chilling, captured at the iCOOL gas cooler, **covers the entire heating load**. The boiler is retired, not replaced.

ONE MACHINE · BOTH JOBS · ONE ELECTRICITY BILL

KARNOT DAIRY PLATFORM · 20,000 L/DAY MODELLED · SCALES 2,000 – 200,000 L/DAY

COLD SIDE · WHAT THE MILK NEEDS

Reception chilling · ice water · cold store

Raw milk 35→4 °C within 2 hours of reception. **Ice-water loop feeds the pasteuriser cooling section.** Finished-product 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 removed from the milk is delivered to the hot side. Nothing goes off the roof.

HOT SIDE · WHAT THE PLANT NEEDS

Pasteuriser · CIP · crate wash

HTST final-heater loop at 75–80 °C (72 °C hold). CIP caustic, acid and sanitiser loops 65–85 °C. Crate and churn washing at 60 °C. All fed from **recovered milk 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

Milk chilling, ice water and cold store. **COP 4.2 at –5 °C** (Oak Ridge validated). Gas cooler delivers **75–90 °C hot water** from the same compression cycle. A1 food-safe refrigerant — no ammonia toxicity zone.

iHEAT R290

9.5–100 kW · COP 4.0+

Hot-side top-up and standalone 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 decouples CIP demand from heat-pump runtime; cold buffer carries the cold store through a brownout** with zero compressor load. The milk survives the outage.

iSAVE + iVOLT

M&V + zero-export solar

iSAVE meters every duty — **IPMVP Option B M&V report monthly** to your CFO 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

20,000 L/day plant. *A real number per litre of milk.*

ANNUAL FIGURE · 20,000 L/DAY PROCESSOR	TODAY · BOILER + OLD CHILLER	KARNOT INTEGRATED PLATFORM	YOU STOP PAYING
Process heat fuel (HTST + CIP + wash)	~11,400 kg LPG/yr	0 kg · recovered milk heat	**₱968K/yr · no flame**
Chilling + ice water + cold store	COP 2.5 · R404A clock	COP 4.2 · CO_2 GWP 1	**₱726K/yr electricity**
Total thermal energy bill	~₱2.76M/yr	~₱1.07M/yr	**–61% / ~₱1.69M/yr**
Scope 1 + refrigerant exposure	~34 t LPG CO_2e + R404A GWP 3,922	R744 GWP 1 · R290 GWP 3	**~70 tCO_2e/yr total**
Total investment (VAT-inc)	**(already paid)**	**~₱2.0M**	**1.2 yr cash payback**

Basis: 20,000 L/day · 360 day/yr milk reception. Milk cp 3.93 kJ/kg·K, reception 30→4 °C, HTST 72 °C with 90% regenerative plate HX (the regenerator stays — we replace the utilities, not the pasteuriser). CIP + crate wash ~3,000 L/day at 65–85 °C. LPG ₱85/kg at 82% boiler efficiency; Meralco GP ₱14/kWh. CAPEX includes iCOOL CO_2 unit, iHEAT R290 top-up, 2× buffer tanks, controls, commissioning and Permits-Managed Service LOW tier. ***Your plant might be 5,000 L/day (divide by 4) or 100,000 L/day (multiply by 5) — the per-litre economics hold.*** *Excludes iVOLT solar, which cuts the remaining ₱1.07M a further 30–50%.*

THE CASH FLOW · PLAIN AND DULL

MONTH 1

₱100K

~₱141K monthly saving **minus** the green-loan payment (~₱40K). Net cash in pocket. Every month. From day one.

YEAR 1

₱1.2M

In your pocket while the loan is being repaid. **The kit has paid for itself in cash terms by month 15.**

YEAR 5

₱6.1M

Loan paid off. From now on you keep **every peso** of the ₱1.69M annual saving.

YEAR 15

₱23M

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

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 (pasteurised milk that must cool) against every cold stream (raw milk and CIP water that must heat) and computes **$Q_H$min and $Q_C$min — the absolute minimum heating and cooling your plant needs** after maximum heat recovery. Everything above that minimum is waste. The pinch point in a dairy 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 61%, 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 production data.

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 dairy CAPEX*

DBP · SEFP

Sustainable Energy Finance Programme

Agri-industrial priority · dairy qualifies. 70–80% LTV · 5–10 yr · **~6.5–8% p.a.**

LANDBANK · SEILP

Sustainable Energy Investment Loan

Path of least resistance for **dairy cooperatives** that already bank with LandBank · **~7% p.a.**

BPI · SDF

Sustainable Development Finance

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

These are **loans**, not grants. The monthly saving covers the payment 3.5× over. Plus **BOI Pioneer Income Tax Holiday under RA 11285** — food-security infrastructure 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 dairy refrigeration is either **R404A / R22 (GWP up to 3,922, Montreal Protocol 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 inside your carbonated products. 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: ~70 tCO_2e/yr avoided, audit-grade data from iSAVE.**

> **"A milk plant is the textbook case for simultaneous heating and cooling — the pinch analysis writes itself. The milk must lose exactly the heat the pasteuriser and the CIP loop must gain, every single shift. Today Philippine dairies pay Meralco to throw that heat off the roof and pay the LPG man to buy it back. One Karnot platform does both jobs from one electricity bill: chill the milk, bank the heat, retire the boiler. ₱2M installed, ₱1.7M back every year, and the bank finances it against the saving. The maths is not subtle."**
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> **Stuart Cox · Founder & CEO · Karnot Energy Solutions Inc.**