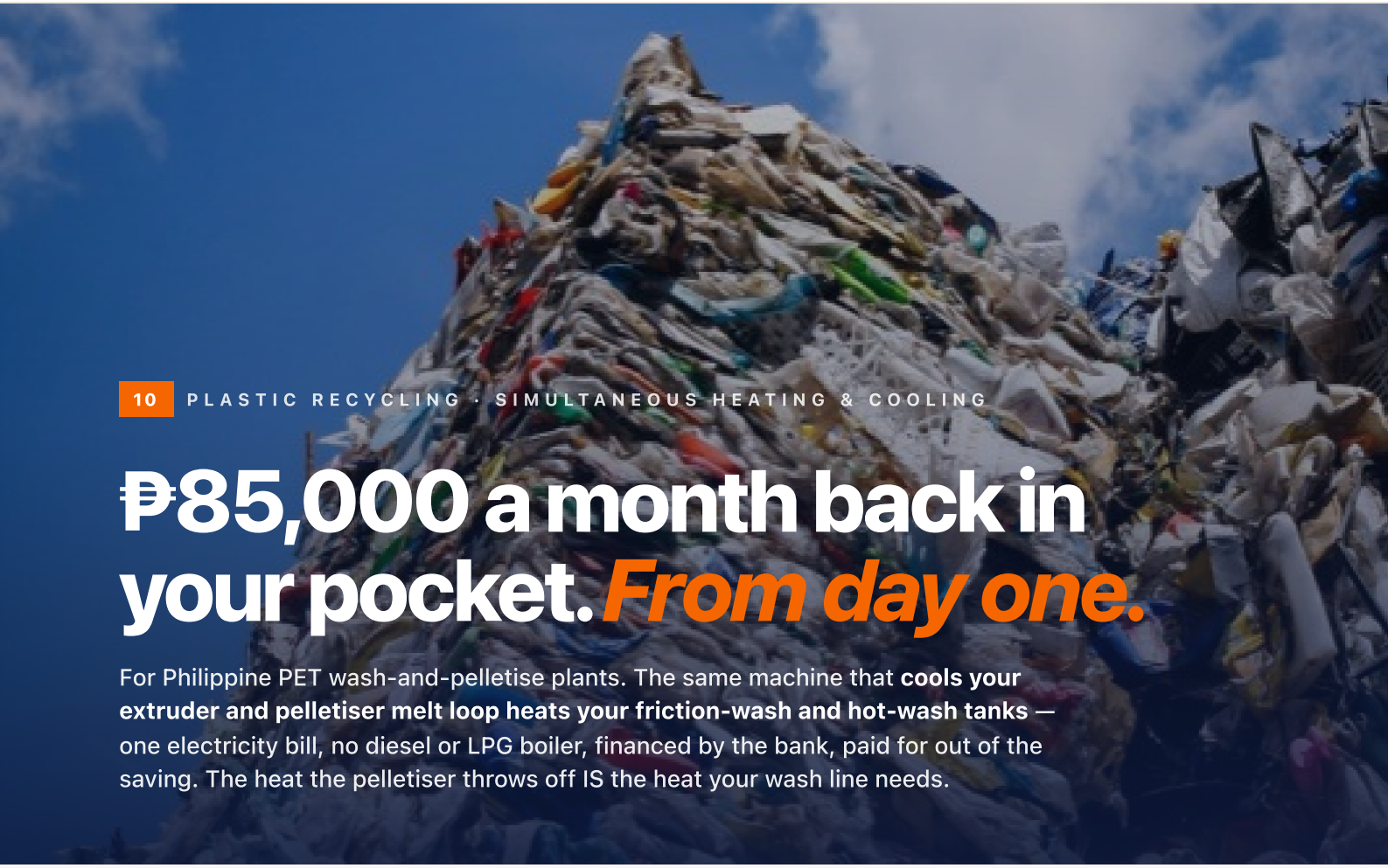

10 PLASTIC RECYCLING · SIMULTANEOUS HEATING & COOLING

₱85,000 a month back in your pocket. *From day one.*

For Philippine PET wash-and-pelletise plants. The same machine that **cools your extruder and pelletiser melt loop heats your friction-wash and hot-wash tanks** — one electricity bill, no diesel or LPG boiler, financed by the bank, paid for out of the saving. The heat the pelletiser throws off IS the heat your wash line needs.

MODELLED PHILIPPINE PLASTIC RECYCLING PLANT · FRICTION WASH + HOT WASH + PELLETISER COOLING

₱85K

In your pocket every month

Saving minus the green-loan payment · from day one

1.6 yr

Cash payback

~₱2.4M install vs ~₱1.5M/yr saving · −63% energy bill

0

Diesel/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 (~₱125K) is larger than the monthly loan payment (~₱38K). **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 recycling-manufacturing installs qualify for **BOI Pioneer status and Income Tax Holiday under RA 11285**.

WHY YOUR RECYCLING LINE PAYS FOR EVERY KILOWATT TWICE

The pelletiser throws off heat. The wash tanks buy it back. *At the same moment.*

Every wash-and-pelletise line runs **two opposing thermal jobs at once**: the extruder and pelletiser melt the flake at 230 °C and the melt-cooling loop must reject that heat continuously to keep the die and water ring stable; meanwhile the friction-wash and hot-wash tanks want 60–90 °C water and the flake dryer wants warm air all shift long. Today the pelletiser cooling loop dumps its heat into a cooling tower (and wastes mains water) — then the diesel or LPG boiler buys that same heat back at ₱85/kg-equiv. **The same kilowatt-hour, paid for twice.** A heat pump moves it across instead.

Wash-water temperature IS your flake quality — and your old chiller is the weak link

Friction wash and hot-wash caustic loops must hold **60–90 °C** to lift glue, labels and oils off the PET, while the pelletiser melt-cooling loop must hold the die-face and water ring steady. Most PH recyclers run an ageing **R404A chiller at COP ~2.8 with a phasedown clock on the asset register**. Karnot iCOOL CO_2 holds the same melt-cooling duty at **COP 4.2 (Oak Ridge validated)** — 40% less electricity for the cold side, and the heat it removes is the heat your wash tanks need.

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

Friction wash, hot-wash caustic loops (60–90 °C) and flake drying burn roughly **₱1.5M of diesel/LPG a year** on a typical PET line. The heat recovered from the extruder and pelletiser melt-cooling, captured at the iCOOL gas cooler, **covers the friction-wash and hot-wash load**. Top it up with iHEAT R290 and the boiler is retired, not replaced.

ONE MACHINE · BOTH JOBS · ONE ELECTRICITY BILL

KARNOT PLASTIC-RECYCLING PLATFORM · PET WASH-AND-PELLETISE MODELLED · SCALES WITH THROUGHPUT

COLD SIDE · WHAT THE LINE NEEDS

Extruder · pelletiser melt cooling · die-face & water ring

Melt rejected from the extruder and pelletiser at 230 °C. **Chilled water at 8–15 °C holds the die-face and water-ring cooling steady.** Process cooling for the pellet water bath. All duties from iCOOL CO_2 at COP 4.2 — with iSTOR PCM carrying the cooling through brownouts.

← iCOOL CO_2 + iHEAT R290 →

The heat pulled out of the melt is delivered to the wash side. Nothing goes to the cooling tower.

HOT SIDE · WHAT THE WASH NEEDS

Friction wash · hot wash · flake drying

Hot-wash caustic tanks at 60–90 °C to lift glue, labels and oils off the PET. Friction-wash water and pre-wash. Warm air for flake drying. All fed from **recovered pelletiser + extruder heat** via the iCOOL gas cooler + iHEAT R290 top-up. Diesel/LPG: zero.

THE FOUR BOXES · ONE PROJECT

iCOOL CO_2

Transcritical R744 · GWP 1 · TRL 9

Extruder and pelletiser melt cooling, die-face and water-ring. **COP 4.2** (Oak Ridge validated). Gas cooler delivers **75–90 °C hot water** from the same cycle. A1 food-safe — recovered heat drives the wash.

iHEAT R290

9.5–100 kW · COP 4.0+

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

iSTOR PCM

38 kWh · 8–12 hr backup

Thermal battery on both sides: **hot buffer banks pelletiser heat for the wash tanks; cold buffer carries the melt cooling through a brownout** with zero compressor load. The line 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

A PET wash-and-pelletise line. *A real number per tonne.*

ANNUAL FIGURE · PET WASH-AND-PELLETISE LINE	TODAY · BOILER + OLD CHILLER	KARNOT INTEGRATED PLATFORM	YOU STOP PAYING
Process heat (friction wash + hot wash + drying)	diesel/LPG hot water	0 · recovered pelletiser heat	**₱1.5M/yr · no flame**
Pelletiser / extruder cooling	COP 2.8 · R404A clock	COP 4.2 · CO_2 GWP 1	**₱900K/yr elec + water**
Total energy bill (heat + cooling)	~₱2.4M/yr	~₱0.9M/yr	**−63% / ~₱1.5M/yr**
Scope 1 + refrigerant exposure	~45 tCO_2e + R404A GWP 3,922	R744 GWP 1 · R290 GWP 3	**~55 tCO_2e/yr total**
Total investment (VAT-inc)	**(already paid)**	**~₱2.4M**	**1.6 yr cash payback**

Basis: PET bottle-to-flake/pellet wash-and-pelletise line · friction wash + hot-wash caustic loops 60–90 °C, flake drying, continuous extruder and pelletiser melt cooling. We replace the utilities, not the wash-and-pelletise line. Diesel/LPG ₱85/kg-equiv at 82% boiler efficiency; Meralco GP ₱14/kWh. CAPEX includes iCOOL CO_2 melt-cooling chiller, iHEAT R290 hot-side, hot + cold buffer tanks, controls, commissioning and Permits-Managed Service. ***Your line might run at half this throughput (divide) or double it (multiply) — the per-tonne economics hold.*** *Excludes iVOLT solar, which cuts the remaining ₱0.9M a further 30–50%.*

THE CASH FLOW · PLAIN AND DULL

MONTH 1
₱85K
~₱125K monthly saving **minus** the green-loan payment (~₱38K). Net cash in pocket. Every month. From day one.

YEAR 1
₱1.0M
In your pocket while the loan is being repaid. **The kit has paid for itself in cash terms by month 19.**

YEAR 5
₱5.1M
Loan paid off in year 7. Until then you bank ~₱1.0M a year **after** the loan payment.

YEAR 15
₱18M
Total cash retained over the 15-year asset life vs keeping the boiler and the old melt-cooling 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 (melt that must cool, pelletiser heat that must leave) against every cold stream (friction-wash and hot-wash 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 recycling line 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 63%, 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 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 recycling 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 circular-economy recyclers** already banking 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 3.3× 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 RECYCLER'S TRILEMMA

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

Legacy recycling-plant cooling is either **R404A melt-cooling chillers (GWP up to 3,922, F-gas phasedown, rising service prices)** or **industrial ammonia (toxic B2L, exclusion zones, specialist compliance)**. Karnot iCOOL runs on CO_2 — **GWP 1, A1 safety class, food-safe**, fitting for a plant turning bottles back into food-grade flake. 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 plastic recycling line is the textbook case for simultaneous heating and cooling — the pinch analysis writes itself. The pelletiser must lose exactly the heat the friction wash and the hot-wash tanks must gain, at the same moment. Today Philippine recyclers pay Meralco to throw that heat into a cooling tower and pay the diesel man to buy it back. One Karnot platform does both jobs from one electricity bill: cool the melt, bank the heat, heat the wash. ₱2.4M installed, ₱1.5M back every year, and the bank finances it against the saving. The maths is not subtle."**
>
> **Stuart Cox · Founder & CEO · Karnot Energy Solutions Inc.**

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