15 ADVANCED MANUFACTURING · PRECISION PROCESS COOLING

₱50,000 a month back in your pocket. *From day one.*

A Philippine precision metal-fabrication shop, cooling its fibre lasers, CNC spindles and weld stations to ±1 °C while heating the parts-wash and facility hot water from one Karnot platform — one electricity bill, no flame on site, financed by the bank, paid out of the saving. iSAVE shaves the laser's peak off your demand charge.

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WHY YOUR SHOP PAYS FOR EVERY KILOWATT TWICE

The chiller dumps the heat the wash bay buys back. *And the laser's spike sets your demand charge.*

A precision shop is a **cooling-led plant**. Lasers, CNC spindles and weld stations must hold ±1 °C, so the process chillers run all shift — throwing reject heat over the roof while the parts-wash pays to make that same heat back. The same kilowatt-hour, paid for twice. And the laser + weld load switches hard enough to set your Meralco demand charge for the whole month.

🔧

Process cooling IS your tolerance

Laser resonators, CNC spindle oil and weld cooling must hold within **±1 °C** or kerf, focus and bead quality drift. Most PH shops run an ageing **R404A chiller at COP ~2.8 with an F-gas phasedown clock** on the asset register. The chiller is both your tolerance tool and your biggest electricity line.

⚡

The laser + weld spike is shaveable — and nobody told you

Fibre lasers and weld sets switch in hard bursts. On a Meralco tariff your bill is **energy plus a demand charge set by your worst 15-minute peak (~₱380K/yr)**. But the chiller's reject heat is the same heat your wash bay needs — captured at the CO_2 gas cooler, **it covers most of the hot-water load. And iSAVE shaves the peak with stored cooling, so you stop paying for the spike all month.**

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THE ARCHITECTURE · COOL, RECOVER, SHAVE

Cool the cut. *Bank the heat. Shave the peak.*

KARNOT MANUFACTURING PLATFORM · MODELLED MID-SIZE SHOP · SCALES WITH INSTALLED COOLING LOAD

COLD SIDE · WHAT THE MACHINES NEED

Laser resonators · CNC spindles · weld cooling

Fibre-laser resonators, CNC spindle oil and weld stations held to ±1 °C all shift on a closed process-water loop. All from iCOOL CO_2 at **COP 4.2 (Oak Ridge validated)** — 40% less electricity than the legacy process chiller.

ICOOL CO_2 + IHEAT R290

The heat pulled off the lasers and spindles is delivered to the wash bay. Nothing goes over the roof.

HOT SIDE · WHAT THE SHOP NEEDS

Parts-wash · facility hot water

Parts-washing hot water 60–70 °C for degrease and post-weld cleaning. Facility DHW for crew amenities. Fed from **recovered chiller reject heat** via the CO_2 gas cooler + iHEAT R290 top-up. **Flame on site: zero.**

ISAVE + ISTOR PCM · THE PEAK-SHAVER

iSAVE meters the laser + weld load and **shaves the demand peak with stored cooling — so a 15-minute spike never sets your whole-month demand charge. The cut survives a brownout too.**

THE SHOP FLOOR STAYS

Your lasers, CNCs and weld cells don't change. **We replace the utilities around them, not the machines.** Commissioning across two planned downtime windows.

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THE FOUR BOXES YOU ACTUALLY NEED

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

iCOOL CO_2

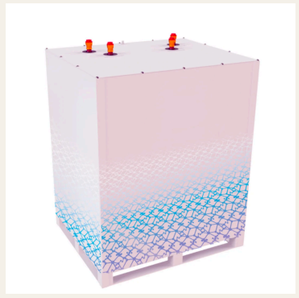
Transcritical R744 · GWP 1 · A1 non-flammable

Precision cooling for lasers, CNC spindles and weld stations to **±1 °C**. **COP 4.2 at –5 °C** (Oak Ridge validated). Gas cooler delivers **60–90 °C hot water from the same cycle**.

iHEAT R290

9.5–100 kW · COP 4.0+ · 60–85 °C

Parts-wash and facility hot-water duty. **Tops up the recovered chiller heat.** Outdoor install, sealed 1.4 kg charge, EN 378 compliant. No flame, no flue, no plant-room schedule.



iSTOR PCM

38 kWh · 8–12 hr backup

Thermal battery on both sides. **Cold:** the process loop rides through a PH brownout so the cut survives. **Hot:** recovered heat banked for the wash bay. Stores the cooling iSAVE draws on to flatten the peak.

iSAVE + iVOLT

IPMVP M&V + peak-demand shaving

iSAVE meters every duty and **shaves the laser + weld spike off your demand charge — monthly IPMVP Option B report**. iVOLT zero-export solar cuts the remaining grid draw 30–50%. Shop roofs are flat and big.

THE BILL · MODELLED PRECISION METAL-FAB SHOP

₱1.8M energy bill today. *₱0.8M after. −56%.*

ANNUAL FIGURE	TODAY	KARNOT PLATFORM	YOU STOP PAYING
Process cooling (laser + CNC + weld)	COP 2.8 · R404A	COP 4.2 · CO_2	**₱620K/yr**
Parts-wash + facility hot water	electric / direct	recovered chiller heat	**₱280K/yr**
Peak demand charge (laser/weld spike)	un-managed	iSAVE peak-shaving	**₱380K/yr**
Refrigerant exposure	R404A GWP 3,922	GWP 1 & 3 · natural	**~40 tCO_2e/yr**
Total investment (VAT-inc)	**(already paid)**	**~₱2.0M**	**2.0 yr payback**

Basis: Philippine precision metal-fab shop — fibre lasers + CNC + welding. Process chillers held to ±1 °C; recovered chiller reject heat into parts-wash + DHW; iSAVE peak-demand shaving on the spiky laser/weld load. Meralco GP ₱14/kWh plus a demand charge set by the worst 15-minute peak. CAPEX includes iCOOL CO_2 precision chiller, iHEAT R290, iSAVE controller, hot + cold buffers, controls, commissioning, Permits-Managed Service. ***Your shop scales with installed cooling load — bigger laser fleet multiplies up, a single cell divides down — the per-machine-hour 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

₱50K

~₱83K monthly saving **minus** the green-loan payment (~₱32K). Net cash in pocket. Every month. From day one.

YEAR 1

₱0.6M

In your pocket while the loan is being repaid. **The kit has paid for itself in cash terms by year 2.**

YEAR 5

₱3.0M

Banking ~₱0.6M a year after the loan payment. **The loan clears in year 7 — then you keep all of it.**

YEAR 15

₱11M

Total cash retained over the 15-year asset life vs keeping the old process chiller and the un-managed peak.

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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 export-zone fabricators 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 **2.6× 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 + DEMAND SHAVING

We don't guess the saving. *We calculate your minimum — and your peak.*

NUMBER 1 · MINIMUM HEATING

$Q_H min$

The **absolute least heating energy** your shop needs after maximum recovery. The parts-wash and DHW load is modest — and the chiller's reject heat covers most of it, so **you buy almost no heating in at all**.

NUMBER 2 · MINIMUM COOLING

$Q_c min$

The **absolute least chiller energy** required after recovery. The cold side dominates a precision shop — **so the COP 2.8 → 4.2 jump is where most of the saving lives**, every machine-hour, every shift.

NUMBER 3 · THE DEMAND PEAK

Peak

The laser + weld spike sets your whole-month demand charge. **iSAVE meters it and shaves it with stored cooling — Measure → Shave → Prove.** That is the second lever the heat pump alone can't pull, and it's ~₱380K/yr.

Cold streams are expenses. The demand peak is a fine you pay for a single bad quarter-hour. Pinch analysis finds the maximum heat transfer; iSAVE flattens the spike. *Plain-English guide: karnot.com/blog/idiots-guide-utility-pinch-analysis*

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THE REFRIGERANT DECISION · THE PROCESS CHILLER

Three ways to cool a precision shop. *Two of them have a clock running.*

LEGACY HFC · THE PHASEDOWN

3,922

GWP of R404A · F-gas phasedown clock

R404A / R134a process 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 heavy-industry plant rooms, not the precision process loops a fabrication shop actually runs.

KARNOT NATURAL · NO CLOCK, NO ZONE

GWP 1

CO_2 (R744) + propane (R290 · GWP 3)

CO_2 is A1 class — non-toxic, non-flammable — holding the resonators and spindles to ±1 °C. 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: ***~40 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 process chiller.*

1 Send us three things

Your installed laser / CNC / weld cooling load, 12 months of electricity bills (with the demand-charge line) and your shift pattern. 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 machine log — **refunded in full when you proceed to install**. Output: your $Q_H$min, $Q_C$min, your demand-peak profile 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 machine-hours

The shop floor stays. We swap the utilities around it — commissioning across two scheduled downtime windows. Old chiller retired on handover day.

GET YOUR SHOP'S NUMBERS

Send us your *cooling load, 12 months of bills and your shift pattern.*

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