



— HOTELS & RESORTS

You run the resort. *We run the energy.*

Building **CO₂** and **R290** natural refrigerant heat pumps — for the hotels, resorts and spas of Southeast Asia. Hot water, pools, kitchens, cold storage, air conditioning. **One platform. Four loads.**

APPLICATION
Hotels & Resorts
Brief · Edition 1 · 2026

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Karnot Energy Solutions
Pangasinan · Region 1 · Philippines

— WHO WE ARE

The people behind *cleaner energy.*

We're **engineers, installers and problem-solvers** building natural-refrigerant technology that **cuts energy costs** and **protects the planet.**

OUR MISSION

Replace combustion. *Replace synthetics.*

Natural refrigerant systems that deliver **75% energy savings** — just as global regulations make them essential.

CO₂ · R290 · THE NEW STANDARD



OUR FOUNDER

Stuart Cox — *Founder & CEO*

Stuart brings **decades of hands-on experience** designing and delivering natural-refrigerant systems for the world's most demanding industries. His thermal fluid temperature-control systems have become industry standards.

He previously founded **Likido Ltd** in Edinburgh, grew it to technical maturity, and successfully **exited via acquisition to Dalrada Corporation (OTCQB: DFCO) in 2020**. His systems were selected for technology assessment by the **U.S. Department of Energy** and **Oak Ridge National Laboratory**.

In 2023, Stuart moved to **Pangasinan, Philippines**, to build Karnot — bringing world-class heat-pump technology to Southeast Asia's fastest-growing thermal energy market.

— PART I — THE OPPORTUNITY

You already have heat pumps. *The gas inside is the problem.*

Most Philippine hotels installed **R410A or R134a heat pumps** in the last refurb cycle. Both are now mid-phasedown under **DENR DAO 2021-31** (Kigali codified into PH law). Every recharge costs more, every leak costs more, and every year the gas gets harder to source.

01 — THE GAS

GWP 2,088

R410A traps **2,088x** more heat than CO₂. R32 (the "bridge" replacement) is 675. **Karnot R290 is 3.**

02 — THE PRICE

3–5x since 2022

Virgin R410A wholesale price **up 3–5x in four years** as Kigali quotas tighten supply. Service-call recharge cost is now the largest line on most hotel HVAC contracts.

03 — THE DEADLINE

–80% by 2047

Under DAO 2021-31 the Philippines is committed to a **10% HFC cut by 2029, 30% by 2035, 50% by 2040, 80% by 2047**. Equipment installed today must outlive the gas inside it.

2024

FREEZE

PH hits HFC consumption ceiling

2029

–10%

Virgin HFC supply tightens

2035

–30%

R410A becomes a financial liability

2040

–50%

Synthetic refrigerants near-eliminated

2047

–80%

Final phase-down target

— PART I — THE OPPORTUNITY (CONTINUED)

Salt air. Cheap parts.

Aging COP.

The gas isn't the only problem. Most Philippine hotels are **within 5 km of salt water**, most existing heat pumps are **low-cost imports** from the 2014–2018 wave, and every unit silently **loses efficiency every year it runs**.

01 — COASTAL CORROSION

Salt air destroys the coil.

Boracay, Palawan, Cebu, Bohol, Pangasinan — most luxury PH properties sit in **aggressive marine atmospheres**. Aluminum fin pitting visible inside 18–24 months. Copper coil perforations follow. Refrigerant leak frequency triples. **Karnot iSPA uses marine-grade titanium** as standard.

KARNOT ANSWER: TITANIUM TUBE-IN-SHELL · LIFE-OF-ASSET

02 — CHEAP-OEM SPARES

Parts on 8-week back-order.

A wave of low-cost imported heat pumps shipped into PH hospitality in **2014–2018**. Many of those vendors have since consolidated, renamed, or left the export market. **Spare parts now require 8–12 week air-freight** — and your hot water can't wait three months.

KARNOT ANSWER: PANGASINAN-BUILT · PH PARTS DEPOT

03 — AGING COP

A unit specified at 4.0 now delivers 3.0.

Heat pumps lose **1–2% efficiency per year** from compressor wear and slow refrigerant loss. By year 10, a 2017 unit rated at COP 4.0 is silently running at **3.0 to 3.2** — a 25% increase in your kWh bill that nobody flagged.

KARNOT ANSWER: SCHEDULED SERVICE CONTRACT + COP AUDIT

04 — SERVICE SCARCITY

Fewer techs. Higher rates. Rising premiums.

As R410A phases down, the licensed-technician pool shrinks. Annual service contracts on F-gas equipment are **rising 12–18% per year**. Insurance premiums on properties with large refrigerant charges are climbing too — VRF systems hit hardest.

KARNOT ANSWER: MONOBLOC R290 · SINGLE 24/7 SLA

— THE WORKING FLUID

A natural fluid. *From -45 °C to +120 °C.*

The industry default was synthetic — HFCs and HFOs, chemicals invented for refrigeration and now being phased down worldwide. **Two natural fluids cover everything a hotel needs.**

FLUID 01 · INDUSTRIAL RANGE

CO₂ R744

Natural · Non-flammable · GWP = 1. Used for cryogenic freezing, blast cooling and high-temperature process heat. Drives Karnot iCOOL and iCRYO.

-45 °C → +90 °C · A1 SAFETY CLASS

FLUID 02 · WATER & LIGHT COMMERCIAL

R290 PROPANE

Natural · Low-cost · GWP = 3. Engineered into a sealed monobloc, kept entirely outside the building. Drives Karnot iHEAT, iSPA and AquaHERO.

0 °C → +120 °C · COP 4.5+



One platform. Two natural fluids. Every thermal load in the property.

 PART II — WHAT KARNOT DELIVERS

From energy audit to commissioning.

We run the project.

A single contractor across the entire mechanical scope — survey, design, install, commission, monitor. **One number to call. One throat to choke.**

01 — AUDIT

Free site walk-around & pinch study

Two hours on site with our engineers. We pull **12 months of utility data**, model your thermal load, and produce an indicative pinch report inside 14 days. No procurement triggered.

FREE · NO OBLIGATION · 14-DAY TURNAROUND

02 — DESIGN

Mechanical package & compliance

Full hydronic design, R290 plant sizing, BMS integration plan, electrical loads, structural review. **RA 11285 / DOE classification** support and **SEC PFRS S2 carbon model** included. BOI registration paperwork on request.

DOE · RA 11285 · SEC PFRS S2 · ASEAN GREEN HOTEL

03 — INSTALL

Phased rollout · zero guest disruption

Phased cutover by room block. iMESH first (immediate chiller savings), then iHEAT on the next planned hot-water plant outage. **Commissioned to ASHRAE / CIBSE standards.**

12-MONTH TYPICAL SCHEDULE · SINGLE CONTRACTOR

04 — SERVICE

Scheduled service & spare-parts depot

Quarterly service visits, refrigerant-leak inspection, performance audit. **PH-based parts depot** — no 8-week air-freight waits. **3-year warranty** on the heat-pump core.

ANNUAL SERVICE CONTRACT · PANGASINAN PARTS DEPOT

— PRODUCT 01 · IHEAT

iHEAT — R290 hot water, *rooms & laundry.*



The *centre of gravity* of every Karnot hotel project — heating *and* cooling from one R290 monobloc.

Reversible air-source R290 (propane) heat pump in a sealed monobloc — refrigerant stays **outside the building**, only safe water enters the plant room. Heats to 82 °C, cools to 7 °C from the same machine. Full DC inverter, smart controller, A+++ class. Replaces LPG and diesel boilers, electric resistance immersion, and aging R410A heat pumps reaching end-of-life under Kigali phasedown.

REFRIGERANT · CHARGE

R290 0.55 kg · GWP 3

HEATING COP / COOLING EER

4.14–5.59 / 3.51–4.16

AMBIENT OPERATING RANGE

–25 → +45 °C · all PH climates

CAPACITY LINE-UP

9.5 → 105 kW · 9 R290 + 4 CO₂ models

BUILT FOR

Full-service hotels · resorts · serviced apartments · spas · F&B central kitchens. **Modular** — start with one unit, add capacity through the rollout. **Heats and cools simultaneously** via one hydronic loop.

— PRODUCT 02 · AQUAHERO

AquaHERO — plug-and-play *R290 hot water.*



Tank-integrated *R290 heat pump water heater* for boutique scale — when iHEAT is too big.

Self-contained R290 heat pump + insulated storage tank in a single floor-standing unit. Single-phase 240 V, plugs into any standard outlet. **No external plant room required**, no plant-room electrician needed. The right answer for boutique villas, single-restaurant F&B operators, premium serviced apartments and the small hotels that don't justify a full iHEAT install.

REFRIGERANT · CHARGE

R290 150 g · GWP 3

COP · OUTPUT TEMP

3.48 35 → 70 °C DHW

TANK · LINER

200 / 300 L enamel · 1.7 MPa tested

POWER SUPPLY

220–240 V single phase · 8.4 A**BUILT FOR**

Boutique villas (< 30 keys) · single-outlet F&B · serviced apartments · resort staff housing · small spas. **Pairs with iVOLT** for off-grid resilience during brownouts.

— ISPA · POOL HEAT PUMPS

Perfect pool, year-round.

Eighty-five percent less to run.

Heat or cool any pool from **residential to water-park scale** at **COP 7.5+** — saltwater-immune titanium build, full DC inverter, 11 models from 6.5 to 39 kW.



01 — THE BILL

85% lower than gas.

5–7× more efficient than gas heaters or electric resistance.
Payback in two seasons on hotels and resorts.

02 — THE COMFORT

Heats *and* cools.

18–35 °C heating, 15–32 °C cooling. **The only sensible answer to a tropical pool that overheats.**

03 — THE BUILD

Marine titanium for life.

Tube-in-shell titanium exchanger. **Immune to chlorine, bromine and salt** — designed to outlive the pool itself.

04 — THE LINEUP

37 dB → 39 kW.

11 models on one platform — **boutique villas to commercial water parks.** –15 °C to +45 °C ambient.

BUILT FOR

Hotels

Resorts

Water parks

Spas

Premium villas

PANASONIC DC INVERTER · DANFOSS EEV

— PRODUCT 04 · iCOOL

iCOOL — CO₂ refrigeration *for kitchens & cold storage.*



Replace every R404A walk-in, blast freezer and F&B cold room — *with the gas that has no phasedown clock.*

CO₂ (R744) is a natural refrigerant — non-flammable, non-toxic, GWP of exactly 1. Where R290 hits its efficiency limit (cold storage operates below 0 °C), R744 thrives. Drives Karnot's full refrigeration line: **walk-in chillers, blast freezers, ice machines, F&B cold rooms** and ultra-low cryogenic units. Zero Kigali phasedown risk — a 30-year asset with a refrigerant supply that will outlive it.

REFRIGERANT

CO₂ R744 · GWP 1

SAFETY CLASS

A1 non-flammable · non-toxic

TEMPERATURE RANGE

-45 → +90 °C

REPLACES

R404A GWP 3,922 · phasedown 2026+

BUILT FOR

Hotel kitchens · banqueting · F&B walk-in cold rooms · blast chillers · resort logistics cold chain · ice plant. **Pairs with iCRYO** for ultra-low temperature applications.

— PRODUCT 05 · IMESH

iMESH — adiabatic upgrade for the chillers you already own.



The bridge investment — **+15–25% chiller efficiency** on day one, with the plant you've already paid for.

Adiabatic pre-cooling media that **bolts onto your existing air-cooled chiller** — any make, any model, any refrigerant, no plant change required. Drops condensing-side air temperature **6–10 °C** using evaporative cooling, lifting COP **15–25%** the moment it's switched on. The right move while iHEAT is being designed: **immediate ROI, funds the next step.**

COP UPLIFT

+15–25% day one

CONDENSER ΔT

–6 to –10 °C ambient drop

COMPATIBILITY

Any make R410A · R32 · R134a

TYPICAL PAYBACK

< 12 months

BUILT FOR

Hotels with **aging central chillers** still inside their service life. Phase-1 install while iHEAT roll-out is being planned. **Saves ~20% of cooling kWh from the day it's commissioned.**

— PRODUCT 06 · IZONE

iZONE — silent guest cooling.

Water in the rooms, not chemicals.



Hydronic fan coils for guest rooms — *the silent, safe alternative to PTAC and VRF.*

Variable-speed ECM fan coils served by **chilled and hot water from the central iHEAT plant**. Only safe water enters the guest space — never refrigerant. **Below 30 dBA** at low speed (vs PTAC at 46–61 dBA, VRF at <35 dBA but with flammable A2L refrigerant piped through occupied corridors). The architecture preferred by 5-star operators and required by **ASEAN Green Hotel Standard**.

SOUND LEVEL

< 30 dBA · luxury class

FLUID IN ROOM

Water no refrigerant · no PFAS

FORM FACTORS

Cassette · Ducted + wall-mount

BMS

ModBus RS485 · open protocol

BUILT FOR

5-star city hotels · destination resorts · serviced apartments · **ASEAN Green Hotel** certifications. Replaces PTAC, VTAC and refrigerant-loaded VRF without the safety liability.

— PRODUCT 07 · iVOLT

iVOLT — solar + battery + heat pump.

Brownout-proof, by design.



For the *"colorful season"* — March to June, when Luzon hits yellow and red grid alerts and your diesel generator runs flat out.

Pre-engineered bundles of Karnot solar panels + LiFePO4 battery + integrated heat pump. Solar runs the day, the battery runs the night — your hot water never goes cold during a brownout, and the iHEAT/AquaHERO load is decoupled from Meralco's tariff entirely. **Five bundles** sized from 3 kW Starter to the 10 kW Enterprise Kit (includes iHEAT 9.5 kW R290).

BUNDLES

5 3 kW → 10 kW

BATTERY

LiFePO4 millisecond cutover

PRICE RANGE

₱278K–₱650K fully installed

INCLUDES

AquaHERO / iHEAT F&B + Enterprise kits

BUILT FOR

Boutique resorts · island properties · F&B sites · backup-critical operations. **Eliminates yellow/red grid alert exposure** and removes the diesel-generator OPEX line entirely.

THE CASE FOR KARNOT · PHILIPPINE PESO

Less pesos. *Less diesel. Every kWh of heat.*

Two metrics decide every heating project — **CO₂ per kWh** and **cost per kWh** of delivered heat. The per-kWh figures below are independent of site size; the per-room saving below scales linearly.

FIG. 01 · CO₂ PER KWH OF HEAT DELIVERED (KG CO₂ / KWH)

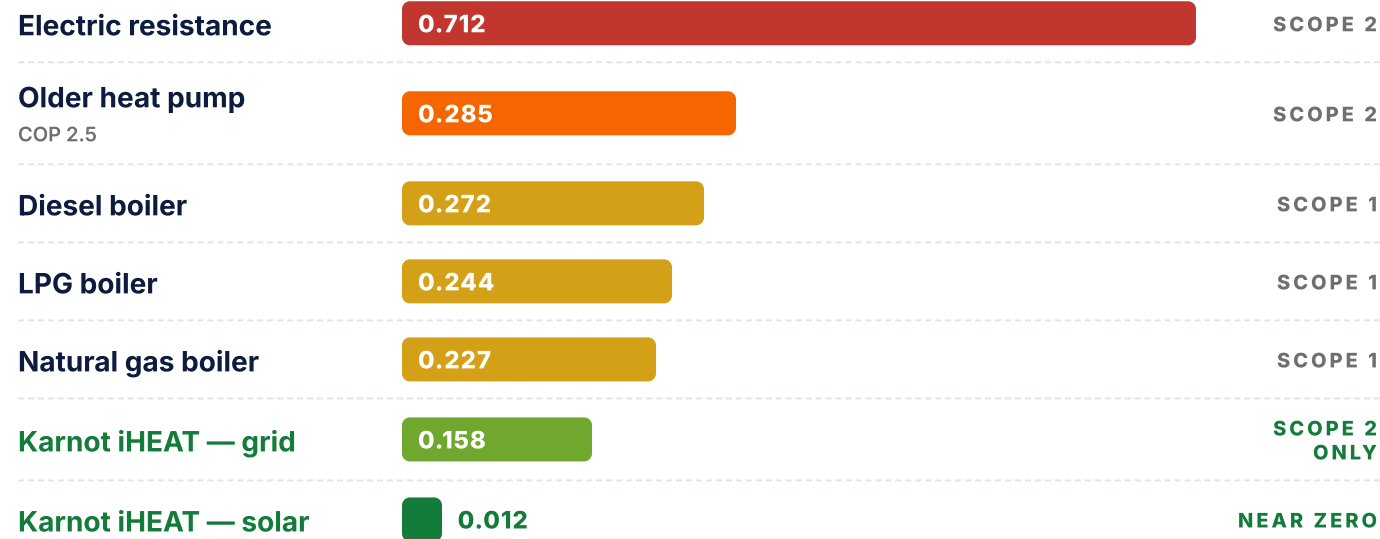
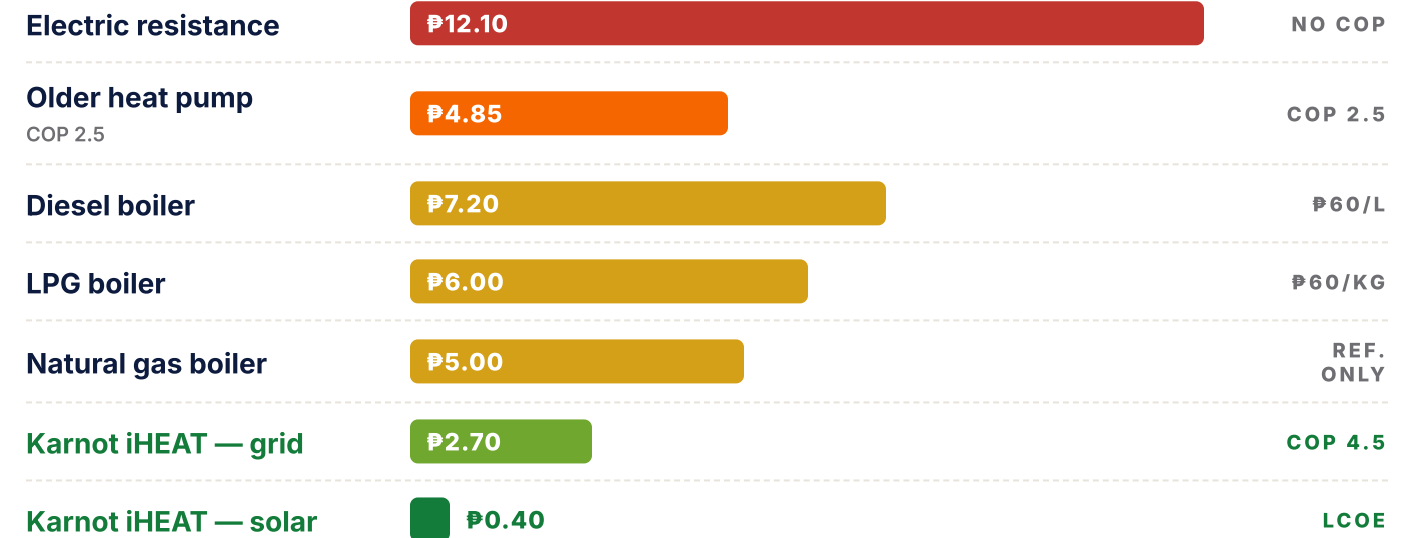


FIG. 02 · ENERGY COST PER KWH OF HEAT DELIVERED (₱ / KWH · MERALCO INDUSTRIAL RATES)



-65%

KWH SAVED · IHEAT VS LPG

₱25K

PER ROOM/YR · DHW RETROFIT

+₱33K

PER ROOM/YR · ADD FULL THERMAL

~24 mo

PAYBACK · DHW VS LPG

— THE FREE TOOLS WE GIVE YOU

Run your own numbers. *No sign-up. No email gate.*

Six **live calculators** on karnot.com — built for the engineer, the CFO and the sustainability officer to use in the same conversation. Indicative output in under three minutes.

01 — RECOMMENDED FOR HOTELS

Hotel Retrofit Calculator

Rooms in, savings out. Models DHW + pool + laundry, sizes the iHEAT system, projects payback period, capex requirement and CO₂ avoided per year.

karnot.com/applications/hotels-calculator

02 — COMPLIANCE

RA 11285 DOE Classification

Determines your facility's tier under the Energy Efficiency & Conservation Act. Triggers CECO/CEM appointment, mandatory audits and DEOS portal reporting.

karnot.com/compliance#doe

03 — CARBON

SEC PFRS S2 Carbon & F-Gas

Scope 1 + Scope 2 calculator including the F-gas refrigerant leak liability that most hotel groups under-report. Built for SEC climate disclosures.

karnot.com/compliance#sec-pfrs

04 — POOL ROI

Pool Retrofit ROI

Replace gas or electric pool heating with iSPA. Sizes the heat pump, models payback against current fuel cost, accounts for tropical heating + cooling demand.

karnot.com/engineering-hub/pool-retrofit

05 — F-GAS

Refrigerant Carbon Calculator

CO₂e impact of refrigerant leaks. R290 vs CO₂ vs R32 vs R410A vs R134a vs R404A vs R407C vs R22. PFAS classification & carbon-tax estimates.

karnot.com/engineering-hub/refrigerant-carbon

06 — HOT WATER

Hot Water OPEX Estimator

Rapid OPEX comparison: diesel boiler vs LPG vs electric vs Karnot iHEAT. Drops out a year-1 cost delta and a 10-year NPV — share-able single page.

karnot.com/engineering-hub/hot-water-opex

— THE COMMERCIAL MODEL

Capital purchase. *Two-year payback on hot water alone.*

Karnot equipment is sold outright with a **3-year warranty on the heat-pump core**. Energy-efficiency capex may qualify for **BOI incentives under RA 11285** — Karnot supports the registration paperwork.

01 · PAYBACK MATH

From day one, the bill drops.

DHW RETROFIT

~24 mo

vs LPG / diesel boiler

FULL RETROFIT

3–5 yr

DHW + iSPA + iCOOL + iMESH

IMESH RETROFIT

< 12 mo

Adiabatic chiller upgrade

ASSET LIFE

15–20 yr

No phasedown clock on R290

02 · RA 11285 · BOI SUPPORT

Energy-efficiency capex may qualify.

RA 11285 (the Energy Efficiency & Conservation Act) establishes the framework for **BOI fiscal incentives** on energy-efficiency investments — registered case-by-case.

- **RA 11285 framework** — codifies energy-efficiency as a public-policy priority
- **DOE designation** — supports Type 1 / Type 2 establishment compliance
- **BOI registration** — Karnot supports application paperwork as standard project scope
- **Final incentive package** — confirmed by BOI based on project profile and Strategic Investment Priority Plan

Specific incentives subject to BOI approval — verify with your tax adviser before commitment.

— NEXT STEP · A FREE PINCH STUDY

Thank you.

Now let's run your numbers.

Every Karnot project starts with a **pinch study** and a conversation. **Walk us through your plant room** — kitchens, laundry, pool plant, chillers — and we'll come back inside two weeks with an indicative system, payback under both commercial models, and the CO₂ you'd avoid. **No procurement triggered. No obligation.**

01 · FOUNDER & CEO

Stuart Cox

Direct line for site visits, pinch studies and bespoke quotes

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02 · THE COMPANY

Karnot Energy Solutions Inc.

SEC-registered · BOI-SIPP · Engineering · Compliance · Carbon · IP

karnot.com

03 · THE MARKETS

PH · UK · US · CA

Four jurisdictions · One stack · Built for the tropics · Shipping today

karnot.com/applications/hotels-resorts