BREW HEMS | THE STRESS-TEST | ISSUE 03

THE DEEP COMPUTE

China put its data centres underwater. The question for India is not if —it is where.

The stress-test layer between hype and capital.

From the Editor | ManavK Mahajan

This issue began with a simple question: what is China doing with compute infrastructure that the rest of the world has not yet attempted at scale? The answer turned out to be literal — they put it underwater.

In June 2025, China launched the world's first fully commercial underwater data centre off Shanghai's coast. By May 2026, it was fully operational. The company behind it — HiCloud Technology, a subsidiary of Shenzhen-listed Highlander — has been stress-testing this technology in tropical Hainan waters since 2021. They chose the hardest conditions first. That is the kind of capital discipline worth understanding.

What follows is not a technology brief. It is a site-selection analysis, a cost anatomy, and an investment thesis question: if India were to attempt this, where would the numbers work, and where would the policy seams hold?

I. The Technology: What China Actually Built

The Underwater Data Centre (UDC) — How It Works

Conventional data centres consume 40% of their total energy on cooling alone. The core insight behind undersea deployment is deceptively simple: the ocean is already cold. Seawater at 35 metres depth provides passive thermal regulation that no engineered chiller system can match on cost.

HiCloud's design seals server racks inside pressure-resistant steel capsules coated with corrosion-resistant material. Seawater circulates through copper-pipe heat-exchange systems on the exterior — the heat transfers directly into the surrounding ocean. Inside the capsule, the environment is oxygen-free and dust-free, which itself drives hardware failure rates down dramatically. Microsoft's earlier Project Natick trials found undersea server failure rates running at one-eighth of equivalent land-based facilities.

> *"We put the entire data cabin in the deep sea because seawater can help cool down the temperature." — Pu Ding, Project Manager, HiCloud / Highlander*

The Shanghai Lingang Facility — Key Specifications

Parameter	Detail
Location	6.2 miles offshore, Shanghai Lingang Special Area
Depth	35 metres below sea surface
Total Investment	$226–232 million
Installed Capacity	24 MW (Phase 2 full build-out)
Phase 1 Capacity	2.3 MW (demonstration)
Servers	~2,000 sealed servers
Cabin Weight	1,300 tonnes per module
Racks per Cabin	24 server racks (400–500 servers)
Power Source	Offshore wind farm (50+ turbines); 95–97% renewable
PUE Achieved	1.15 (vs 1.73 China average; 1.25 national target)
Cooling Energy Reduction	90% vs conventional onshore facilities
Water Saved	~26,000 tonnes per year
Operational Date	Full commercial operations: May 2026
Development Partner	HiCloud Technology / Highlander + China Telecom

II. The Company: HiCloud Technology (Hailanyun)

HiCloud is not a hyperscale cloud operator. It is a marine engineering firm that happened to identify an infrastructure arbitrage. Founded in 2020 as a subsidiary of Shenzhen-listed Highlander — a marine navigation and communication equipment company — HiCloud brought shipbuilding and subsea engineering discipline to data centre architecture. That cross-domain capability is precisely why it succeeded where Microsoft eventually retreated.

The deployment timeline tells the stress-test story:

- 2021 — Experimental pod deployed off Hainan coast. Proof of concept.
- 2023 — First commercial deployment at Lingshui County, Hainan. 1,300-tonne cabin, 35m depth, South China Sea.
- Feb 2025 — Second module added to Hainan cluster. 400 high-performance / AI-optimised servers.
- June 2025 — Shanghai Lingang project formally launched. Partnership with China Telecom signed.
- Oct 2025 — Construction of Shanghai facility completed.
- May 2026 — Full commercial operations confirmed. World's first wind-powered undersea data centre.

The state partnership dimension is critical. China Telecom's involvement is not passive sponsorship. It is exploring 'land + subsea' hybrid cloud deployment solutions and plans to use HiCloud's infrastructure to enhance marine 5G network coverage — meaning the data centre doubles as telecom infrastructure. That dual-use logic is what justifies the capital.

Scale ambition: HiCloud has publicly stated plans for a 500 MW undersea data centre. At current 24 MW, that is a 20x scale-up — the difference between a pilot and a national infrastructure programme.

COMPARABLE: MICROSOFT PROJECT NATICK

Microsoft launched underwater experiments off the US Pacific coast in 2015 and in Orkney, Scotland in 2018. In 2024, Microsoft confirmed it had permanently abandoned its undersea data centre programme. China picked up where Microsoft stopped — and went commercial.

III. The Site Conditions: What Made It Work

HiCloud did not choose its locations randomly. Each site was selected against a five-factor framework. Understanding that framework is the prerequisite for evaluating where else in the world this model is replicable.

Factor 1 — Depth: The 30–50 Metre Zone

The operational sweet spot is 30–50 metres below surface. Shallow enough for pod deployment using standard marine crane operations; deep enough for stable thermal conditions and protection from surface weather. HiCloud operates at 35 metres — matching this range precisely. Going deeper (200m+) improves cooling temperatures but exponentially increases engineering complexity and servicing costs.

Factor 2 — Proximity to Shore and Demand Centres

The Shanghai facility sits 10 km offshore, directly adjacent to the Lingang Special Area — Shanghai's designated AI and advanced manufacturing hub. Short offshore distance keeps subsea cable costs manageable and latency at near-zero. The principle: the data centre needs to be far enough for stable seawater temperature, close enough for economical cable runs.

Factor 3 — Offshore Wind Co-location

This is the decisive variable. The Shanghai facility derives 95–97% of its power from the adjacent offshore wind farm via direct subsea photoelectric composite cables — bypassing the onshore grid entirely. Without a proximate offshore wind installation, the UDC's green energy credentials collapse, and the power delivery economics deteriorate. Co-location with offshore wind is not optional; it is load-bearing.

Factor 4 — Seabed Stability

The cylindrical vertical pod design was specifically engineered to withstand high sediment levels and extreme wave impacts at the Lingang seabed. Seabed geology matters — soft, unstable sediment requires anchoring solutions that add cost. Firm, well-mapped seabed reduces foundation engineering requirements.

Factor 5 — Sealed Internal Environment

By removing oxygen and dust from the server environment inside the sealed capsule, corrosion and contamination failure rates drop dramatically. The ocean becomes not just a coolant but a protective shell. This is the counterintuitive insight: the most hostile external environment (deep sea saltwater) enables the most stable internal environment for sensitive electronics.

Factor 6 — Regulatory Clarity

Hainan and Shanghai Lingang are both designated free trade and innovation zones with streamlined approvals. The UDC concept is embedded in the five-year economic plans of Hainan, Shandong, Xiamen, and Shenzhen. Without policy pre-alignment, maritime jurisdiction, environmental permits, and grid connection approvals become multi-year blockers.

IV. The Cost Anatomy

Shanghai Lingang — What $226 Million Bought

Cost Metric	HiCloud UDC	Land-Based Equivalent
Total Capex	$226–232 million	~$150–180 million
Capacity	24 MW	24 MW
Capex per MW	~$9.4 million/MW	~$6.5–7.5 million/MW
Capex per Server	~$113,000/server	~$70–80,000/server
Cooling % of Energy	~4%	~40%
PUE	1.15	1.73 (China avg)
Fresh Water Use	Near zero	High
Land Acquisition	Minimal (seabed lease)	Significant
10-Year TCO vs Land-Based	**Estimated 15–25% lower**	—

The capex premium is real — roughly 25–40% above equivalent land-based construction. The opex advantage is structural and compounding: a 90% reduction in cooling energy, near-zero freshwater consumption, dramatically lower hardware failure rates, and elimination of land acquisition costs in premium coastal zones.

> *The economics of undersea data centres do not compete on day-one capex. They compete on a 10-year total cost of ownership basis — and the opex advantage is structural, not cyclical.*

The Scale Economics Argument

HiCloud's stated ambition is 500 MW of undersea capacity. At that scale, pod manufacturing shifts from bespoke engineering to standardised shipyard production. If capex per MW compresses to $5–6 million — a reasonable manufacturing learning curve assumption — the total build cost for 500 MW falls to $2.5–3 billion, directly competitive with hyperscale land-based builds on a total cost of ownership basis over 10 years, once opex savings are factored in.

The strategic bet is that underwater data centres follow the container shipping model: standardised modular units, factory-built, deployable anywhere the ocean provides a uniform environment. The ocean, unlike land, requires no customisation.

V. India's Map: Five Candidate Sites

India has 7,517 km of coastline, the third-largest Exclusive Economic Zone in the Indian Ocean, and an estimated 432 GW of offshore wind potential between 30 and 200 metres depth. None of this is being used for subsea compute infrastructure — yet. The site-selection analysis below applies HiCloud's five-factor framework to India's coastal geography.

Site 1: Rameswaram–Dhanushkodi, Tamil Nadu — Top Candidate

The closest Indian equivalent to China's Lingang. Tamil Nadu's 1,076-km coastline holds over 35 GW of offshore wind potential with consistent 8–10 m/s wind speeds. The government's first offshore wind tender — 500 MW, issued by early 2026 — is anchored in the Dhanushkodi–Rameswaram corridor. The Gulf of Mannar side drops to 30–60 metres depth within a few kilometres of the tip at Dhanushkodi. India has four submarine cable landing stations in Chennai and one in Tuticorin, within 150–300 km.

- Wind: 35 GW offshore potential, 8–10 m/s consistent
- Depth: 30–60m within 5–10 km on the Gulf of Mannar side
- Cable: Chennai (4 landing stations) + Tuticorin (1 station)
- Policy: First government tender zone, NIWE + India-Denmark partnership active
- Limitation: Warm tropical waters (manageable, as HiCloud proved in Hainan)

Site 2: Gulf of Kutch–Kandla, Gujarat — Strong Contender

Gujarat's Gulf of Kutch has LiDAR surveys mapping 20 GW+ of offshore wind potential. The Centre is floating a 500 MW tender here alongside Tamil Nadu. The Gulf is well-mapped from decades of port and ONGC offshore oil operations — seabed data exists. Kandla port provides logistics access for pod deployment.

- Wind: 20 GW+ LiDAR-confirmed offshore potential
- Depth: Shallow Gulf waters (25–40m); seabed well-mapped from oil operations
- Logistics: Kandla port infrastructure for pod deployment
- Limitation: Semi-enclosed Gulf — slower seawater circulation means localised thermal discharge risk

Site 3: Mumbai Offshore (Ratnagiri Corridor)

The continental shelf off Mumbai is the widest in the Indian Ocean — extending 325 km offshore. Eight of India's 17 international submarine cable landing stations are in Mumbai, making it the country's most fibre-rich coastal node. For latency-sensitive AI workloads serving Mumbai's financial and tech ecosystem, this is the strongest demand case. The shelf width means you need to travel further to reach 35m depth — manageable with longer subsea cable runs, but it adds cost.

- Cable: 8 of India’s 17 international cable landing stations
- Demand: India’s largest data centre market (Mumbai + Pune corridor)
- Shelf: 325 km wide — largest in Indian Ocean; need to go further for depth
- Expertise: ONGC offshore oil infrastructure and marine engineering base

Site 4: Visakhapatnam, Andhra Pradesh

Vizag is one of the few deep natural harbours on India’s east coast. The Bay of Bengal shelf drops to 30–50m depth within 10–15 km of shore. AP is currently India’s most aggressive state on infrastructure investment. Hyderabad — India’s second-largest data centre market — is the inland demand anchor. No cable landing station currently exists at Vizag, but AP has announced ambitions to develop one. If that happens, this site moves to Tier 1 status.

- Harbour: One of few deep natural harbours on east coast
- Depth: 30–50m within 10–15 km offshore
- Demand: Hyderabad data centre market, AP infrastructure investment drive
- Constraint: No cable landing station yet; dependent on future AP infrastructure

Site 5: Kochi–Lakshadweep Corridor, Kerala

Kochi has an international cable landing station and sits on the Arabian Sea with a clean continental shelf. The Lakshadweep corridor offers deep, calm waters. The constraint is demand proximity — Bengaluru is 350 km inland, creating latency disadvantage vs a Mumbai or Chennai node. Best positioned as a subsea cable relay hub rather than a primary compute site.

India Site Scorecard

Site	Wind	Shelf Depth	Cable Access	Demand	Regulatory
Rameswaram / TN	★★★★★	★★★★	★★★★	★★★	★★★★★
Gulf of Kutch / GJ	★★★★★	★★★★	★★★	★★★	★★★★★
Mumbai Offshore / MH	★★★	★★★	★★★★★	★★★★★	★★★
Visakhapatnam / AP	★★★	★★★★	★★	★★★★	★★★★★
Kochi / KL	★★★	★★★	★★★★	★★	★★★

VI. The Critical Gap — And the Investment Thesis

India has the geography. It has the coastline, the offshore wind potential, the submarine cable infrastructure, and the data centre demand growth. What it does not yet have is the one thing China had at Lingang before HiCloud arrived: an operational offshore wind farm to co-locate with.

India’s offshore wind is still at the tender and feasibility stage. The seabed falls under Union government jurisdiction; states handle the electricity side once it reaches shore. That regulatory two-step — Centre for seabed, state for power purchase agreements — adds friction that China's single command structure simply does not face.

> **THE FIRST-MOVER THESIS**
> Whoever builds the first operational offshore wind farm off Tamil Nadu or Gujarat is simultaneously sitting on the ideal anchor tenant for an undersea data centre co-located alongside it. The offshore wind developer and the UDC operator need each other: the wind farm needs a captive, baseload-consuming offtaker to make the economics work; the UDC needs proximate, dedicated renewable power. This is not a sequential opportunity. It is a simultaneous structuring play.

What to Watch

- Tamil Nadu 500 MW offshore wind tender outcome (issued early 2026) — who wins and on what terms
- Gujarat Gulf of Kutch 500 MW tender: seabed conditions, developer shortlist
- AP cable landing station announcement: if Vizag gets connectivity, the east coast case changes materially
- HiCloud 500 MW scale-up: if it proceeds and costs compress as projected, expect inbound interest from Indian infrastructure funds within 18–24 months
- NIWE offshore surveys: LIDAR data from Tamil Nadu surveys (completed Jan 2026) will determine wind farm siting precision

The Structural Question for Indian Capital

India's data centre sector is currently receiving significant equity and debt capital — but entirely into conventional, above-ground, land-based facilities. The undersea thesis is not yet on any Indian fund manager's term sheet. That is precisely where the opportunity sits.

China went from experimental pod in 2021 to full commercial operation in 2026 — five years. India's earliest realistic timeline, starting today, with policy alignment, a willing offshore wind developer, and an Indian marine engineering partner, is 2029–2031 for a first commercial facility. The window to structure that opportunity — at seed-stage economics — is open now.

> *The ocean is the last frontier of data centre real estate. In India, it is also the most underwritten.*
