

destacto

DESIGN THINKING LED TACTICAL AUTOMATISM

Utilizing Data Center Waste Heat for a Sustainable Future

DEC 2025

Executive Summary

India's exponential data center capacity boom, projected to reach approximately **9.34 GW by 2030**, is creating a critical collision with the country's severe water scarcity and heat wave crisis, as the facilities are concentrated in densely populated water-stressed urban hubs like Mumbai, Chennai, and Bengaluru. This rapid expansion will escalate the projected annual water consumption for cooling to **358 billion liters by 2030**, depleting municipal and agricultural supplies, while simultaneously wasting vast amounts of low-grade heat, as up to **99% of consumed electricity is converted into heat** and exhausted into the atmosphere, creating heat stress nearby.

To ensure sustainable digital growth, the whitepaper mandates a dual priority shift focusing on **Responsible Water Usage**—by requiring the use of **100% reclaimed/non-potable water** and adopting water-efficient technologies like liquid cooling—and **Responsible Waste Heat Utilization**, which involves capturing thermal energy for valuable external applications such as **seawater desalination**, industrial pre-heating, and food dehydration, etc., thereby minimizing environmental impact and turning an economic and environmental inefficiency into a monetizable resource.

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Disclaimer

The Challenge & Opportunity

Data centres consume vast amounts of electricity, up to 99% of which is eventually converted into heat. Currently, most of this heat is exhausted into the atmosphere, representing a monumental waste of energy, water and a contribution to local thermal and water pollution.

Waste heat represents a significant opportunity: low-grade heat, which can be effectively utilized for applications such as seawater desalination, agriculture & food processing, other industrial processes, space and water heating, etc., thereby reducing overall national energy demand and carbon emissions.

The Indian Context: Growth, Water Scarcity, and Economic Loss

India is experiencing exponential growth in data centre capacity, especially across key states such as Andhra Pradesh, Tamil Nadu, Maharashtra, Gujarat, and Karnataka. This rapid expansion, while powering the digital economy, significantly exacerbates the looming crisis of potable and pure water scarcity. Data centres, traditionally relying on fresh water for cooling, are set to dramatically increase the demand for freshwater in regions already facing severe water stress.

Furthermore, the economic value of the heat lost is substantial. Conservatively estimated, the thermal energy wasted by the nation's data centres would be worth tens of thousands of crores annually if properly monetized through utilization in industrial or heating applications. This is not just an environmental oversight but a colossal economic inefficiency that a national framework must address.

The Combined Capacity Shift

Total Current Capacity (Est. 2025)
~1.33 GW

Total Projected Capacity (Target 2030)
~9.34 GW

The blue bar represents the current capacity (~1.33 GW) compared to the 2030 target (~9.34 GW).

**Capacity figures are based on industry reports, state policy target CAGR estimates for 2025 and 2030, and are subject to change based on project timelines and investment realization (1 GW = 1,000 MW).*

The exponential growth of India's digital infrastructure, anchored by massive data centre construction in cities like Vizag, Chennai, and Mumbai, is rapidly escalating the national water crisis. Data centers are principally located in urban centres that already face chronic water scarcity and groundwater depletion.

This geographical mismatch—placing water-guzzling facilities in water-stressed zones—creates direct competition with local municipal water needs, demanding an immediate policy shift toward mandated water reuse and advanced, dry-cooling technologies to safeguard both digital continuity and public welfare.

Andhra Pradesh (Vizag)
Emerging Western India Gateway
Current Capacity (2025)
~50 MW
State Target (2030)
~6000 MW
~120X
Growth Multiplier (Hyperscale goal)

Tamil Nadu (Chennai)
Strong subsea cable advantage
Current Capacity (2025)
~550 MW
Projected Target (2030)
~1700 MW
3.1X
Growth Multiplier

Maharashtra (Mumbai)
India's leading data hub
Current Capacity (2025)
~550 MW
Projected Target (2030)
~1000 MW
1.8X
Growth Multiplier

Gujarat (Ahmedabad)
Emerging Western India Gateway
Current Capacity (2025)
~100 MW
Projected Target (2030)
~400 MW
4.0X
Growth Multiplier

Karnataka (Bengaluru)
India's Tech Ecosystem Hub
Current Capacity (2025)
~80 MW
Projected Target (2030)
~240 MW
3.0X
Growth Multiplier

**Source: Industry reports (JLL, Macquarie, S&P Global) and environmental studies. Capacity and consumption figures are estimates and vary by cooling technology.*

The Cost of Cooling: Data Centers & Climate Conflict

1. The Digital Footprint: Three Core Threats

Rapid data centre expansion in hot climates requires massive resources, directly contributing to local climate stress and resource scarcity.

Water Consumption

A single large DC can consume water equivalent to 1,000 to 50,000 households annually for evaporative cooling.

Waste Heat Discharge

Massive waste heat is generated by servers and released into the local environment.

Energy Demand

DCs consume immense electricity and rely on diesel gensets during grid instability.

9.34 GW
Projected (2030) - Mostly from fossil-based plants

99%
Electricity converted to Waste Heat

358 B Ltr
Projected Water Consumption (2030)

2. The Critical Nexus: Climate & Community Conflict

The development of data centres in high-risk zones (like Mumbai, Chennai, Bengaluru) creates an acute resource conflict, significantly magnifying the burden of climate change on vulnerable populations.

💧 Water Crisis Intensified

DCs rely on massive freshwater cooling (evaporative) while climate change drives droughts and erratic monsoons.

Result: Water withdrawal further depletes stressed aquifers, leading to Intensified Scarcity for local residents, drinking, and agriculture.

🔥 Heat Risk & Infrastructure Failure

DCs release vast amounts of waste heat, compounding the Urban Heat Island effect and rising ambient temperatures.

Result: Higher risk of Heatwave Mortality, while coastal DCs face climate hazards (cyclones, flooding) that threaten essential community infrastructure.

🌡️ Impact on Pollution

DC hotspots cause air pollution through massive emissions from energy use related to fossil fuel combustion (incl. diesel gensets for power backup). Further, cooling water discharge carries various chemicals which leach into groundwater and acquatic ecosystems

Result: An exacerbation of global climate change and severe localized environmental and public health burdens on nearby communities.

The discharge of waste heat and water is not just an operational issue, but a direct multiplier of community suffering—intensifying drought-driven scarcity and magnifying urban heatwave mortality risks. To forge a path to resilience, regulatory focus must now shift to include Responsible Waste Heat Utilization.

3. The Path to Resilience: Essential Solutions

To ensure the digital boom doesn't deepen climate vulnerability, regulation and technological innovation are critical.

Responsible Use of Water

- Use of 100% reclaimed/non-potable water for cooling in water-stressed regions.
- Deployment of Zero Liquid Discharge (ZLD) plants for wastewater treatment.

Responsible Waste Heat Utilization

- Implement heat recovery systems to capture thermal energy from servers via water or air cooling loops.
- Utilize captured waste heat for external purposes, such as district heating, desalination plants, food dehydration or industrial heating/drying nearby.

**Source: Based on analysis from CEEW, The Hindu, Down to Earth, The Wire Science, XDI Climate Risk Reports, and Destacto Internal Analysis*

This involves implementing heat recovery systems to capture the thermal energy generated by servers. This captured heat is used for external applications such as powering desalination plants (one of the top priorities) and industrial heating, instead of being dumped into the local environment. Further, focus must extend beyond using only non-potable water to establishing Responsible Water Utilization and becoming water positive. This implies large-scale water desalination, Zero Liquid Discharge (ZLD) plants and implementing closed-loop systems to capture and reuse cooling tower 'blowdown' water. This dual-benefit approach significantly minimizes the local Urban Heat Island effect, being water-surplus instead of conflict for water-generating economic value from what was previously considered waste, advancing the goal of making digital growth environmentally neutral and supportive of the community.

4. Strategic Learnings (The "How")

1. Optimize Output

Prioritize Higher-Grade Heat Recovery

Shift to Liquid Cooling (Direct-to-Chip) to produce heat at 60°C+ (vs. 30°C from air). Utilize heat pumps to upgrade the recovered waste heat into usable heat. Deploy mega-scale evaporative seawater desalination, utilize and value-add desalination by-products.

2. Drive Policy

Implement Regulatory Mandates

Implement regulations that require operators to explore heat reuse, turning it from voluntary CSR to a mandatory obligation, as is being done in Germany and the Netherlands.

3. Locate Strategically

Co-locate Demand & Supply

Locate DCs immediately next to major heat consumers (industrial parks, dehydration or desalination plants) to minimize pipe costs and heat loss during transport.

A combination of technology, policy, as well as physical co-location can bring about the best results of heat and water resource management, which in isolation would not be able to achieve their best results. These three pillars are mutually reinforcing, as policy can incentivize technological adoption and strategic location - maximizing economic viability.

1

Mandate Heat Capture & Reuse

- **Mandate:** Embrace heat reuse as a core strategic imperative.
- **Infrastructure:** Establish Data Heat Utilization Zones.
- **Applications:** Reuse heat for Desalination (Priority), Agriculture, and Industry.

2

Adopt Water-Neutral Cooling

- **Source:** Mandate 100% reclaimed/non-potable water for cooling.
- **Technology:** Adopt Liquid Cooling (up to 90% water savings).
- **Wastewater:** Mandate Zero Liquid Discharge to reuse blowdown water.

3

Utilize Surplus By-products of Desalination

- **Production:** Produce and distribute common salt (East coast- Logistics advantage).
- **Value-addition:** Utilize surplus salt to produce chlor-alkali products.
- **Preservation:** Use surplus salt for preservation of seafoods/pickled foods.

4

Incentivize Synergies

- **Incentives:** Schemes for co-location, re-utilization & reduced discharges.
- **Innovation:** Encourage innovative applications of by-products.
- **Penalties:** Disincentivize environmentally detrimental discharges.

Nohejuco

nohejuco is an initiative to help utilize the power of established technologies but with innovative process/business models to enhance the utilization as well as value generation/cost efficiency.

However, the nohejuco approach goes far beyond it, including:

1. Exploring collaboration across the same value chain as well as across other value chains

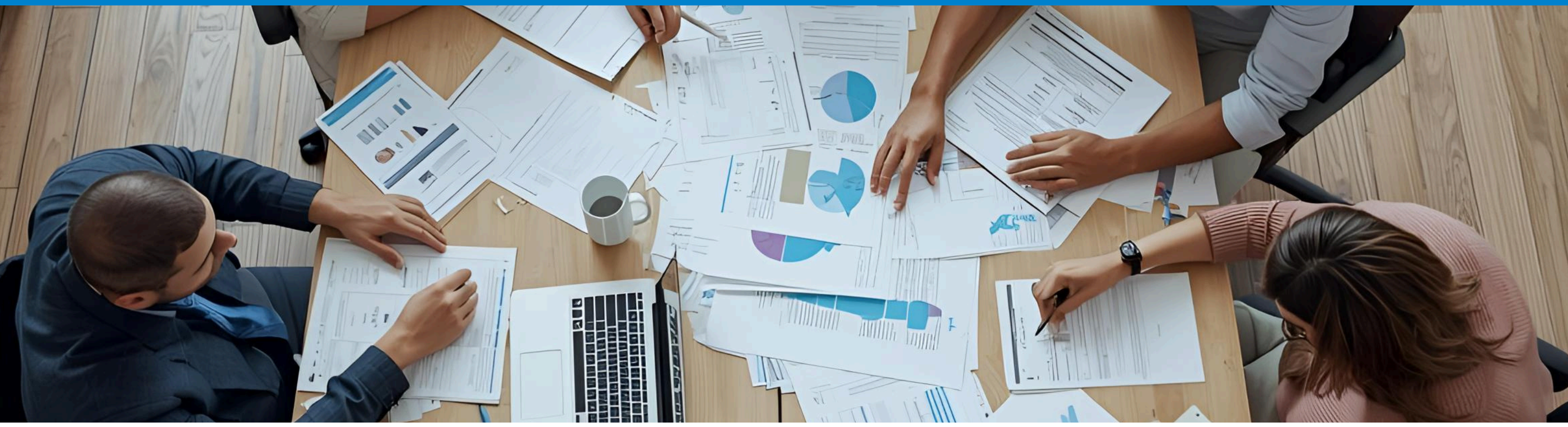
2. Leveraging policy & advocacy to enable cross-utilisation of resources across organizations

3. Enhancing total socio-economic welfare of various stakeholders

4. Increasing revenue generation with the additional uses of the key resources.- This is one of the hallmark benefits of the nohejuco approach

5. Developing roadmaps and implementing them in phases to bring about the larger changes

6. Above all, doing everything with greater empathy for people and the environment



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