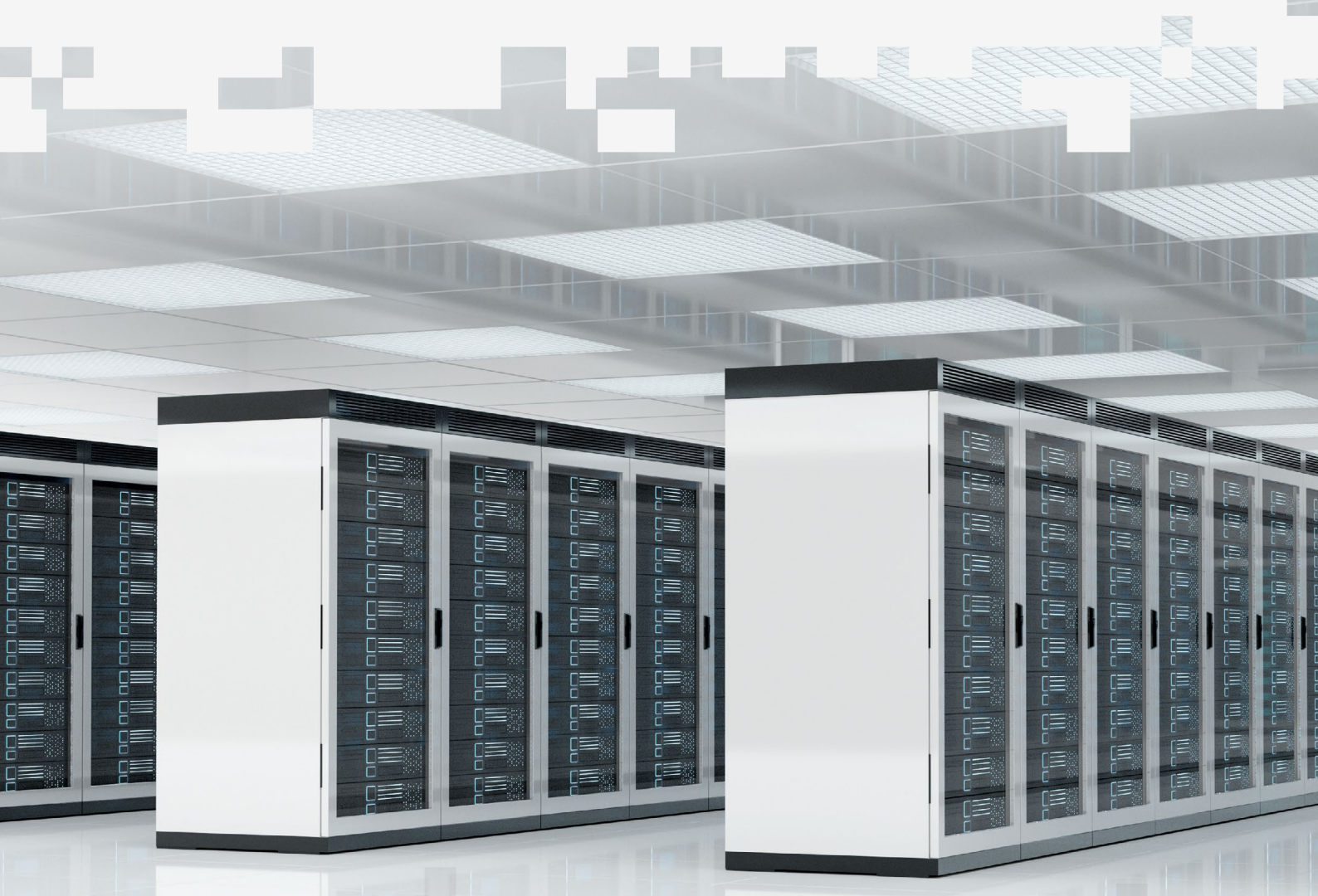
Alliance for an Energy Efficient Economy

Advancing Resource-Efficient Growth of India's Data Centre



Policy Brief

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Alliance for an Energy Efficient Economy (AEEE) supports policy implementation and enables the energy efficiency market with a not-for-profit motive. AEEE promotes energy efficiency as a resource and collaborates with industry and government to transform the market for energy-efficient products and services, thereby contributing toward meeting India's goals on energy security, clean energy, and climate change. AEEE collaborates with diverse stakeholders, including policymakers, government officials, business and industry, consumers, researchers, and civil society organisations. We believe that our work speaks for itself, and we hold Respect, Integrity, and Synergy as central to our efforts.

Summary

India's data centre (DC) sector is emerging as a critical pillar of the digital economy, underpinning cloud computing, artificial intelligence, financial services, telecom networks, e-governance, and public digital infrastructure. This expansion, however, is accompanied by significant sustainability challenges, including high and continuous electricity demand, increasing water consumption for cooling, and a high carbon footprint. Recognising the strategic importance of digital growth, DCs have recently been accorded infrastructure status, enabling access to long-term financing and improved regulatory clarity. In addition, both central and state governments have introduced a range of fiscal and non-fiscal incentives, including tax benefits and streamlined approvals to accelerate DC investments across the country.

In India, DC capacity has expanded rapidly over the past decade, with development concentrated in a limited number of metropolitan regions and states in predominantly warm, often water-stressed areas. Cooling systems account for a substantial share of operational energy and water consumption; thus, cooling performance is the primary determinant of both Power Usage Effectiveness (PUE) and Water Usage Effectiveness (WUE), the two most widely used indicators of DC sustainability. India's existing building energy codes address DCs through generic provisions applicable to large commercial buildings, with a primary focus on component-level, design-stage compliance rather than delivered, operational cooling performance. As a result, cooling efficiency across the operational DC fleet remains weakly governed and insufficiently integrated with power system planning, water availability, and climate objectives, leaving sustainability outcomes largely dependent on voluntary actions by operators, such as through green rating systems.

A cooling-centred, performance-based approach anchored in measurable metrics such as PUE and WUE offers a pragmatic pathway to improve sustainability while supporting continued sectoral growth. Starting with mandatory disclosure, climate-appropriate guidance, and performance benchmarking can create the evidence base needed for scalable and investment-aligned policy action. International experience shows that such approaches deliver substantial efficiency gains without constraining digital innovation and growth. At scale, improved cooling performance could reduce cooling power demand by up to 40–45%, delivering system-level benefits for energy security, water resilience, and climate goals. At this level, cooling power savings of approximately 440 MW by 2026 and 1,760 MW by 2030 are achievable. Through the adoption of water optimisation measures, a WUE of 1.5 litres/kWh or lower is achievable, which could translate into annual water savings of up to 9 billion gallons by 2026 and 36 billion gallons by 2030 while safeguarding energy security, water resilience, and long-term climate goals.

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Introduction

Data centres (DCs) are foundational components of modern digital infrastructure, enabling cloud computing, artificial intelligence, telecommunications, and the delivery of digital services. As India's digital economy expands, DC capacity is growing rapidly in scale and complexity. Rapid digitalisation, expanding cloud and hyperscale deployments, AI-driven workloads, 5G rollout, and data localisation requirements are driving sustained growth, positioning India among the fastest-growing DC markets globally. The Union Budget 2026–27 reinforces India's ambition to emerge as a global hub for AI and cloud infrastructure, recognising DCs, particularly AI DCs, as critical digital infrastructure. With investments exceeding USD 70 billion already underway and a further USD 90 billion announced, the budget introduces a tax holiday till 2047 for foreign cloud service providers operating from India, along with safe harbour provisions for related-party DC services. This long-term policy signal positions India among the leading global destinations for hyperscale and AI-driven DC development.

This rapid growth, while economically strategic, also introduces significant environmental challenges. DCs impose three closely interlinked environmental pressures, such as energy consumption, water use, and associated greenhouse gas (GHG) emissions, with cooling systems acting as the central nexus. Power Usage Effectiveness (PUE) captures the ratio of total facility energy consumption to IT energy consumption, and it reflects how efficiently electricity is used in productive computing rather than consumed by overhead systems such as cooling and other energy end uses. In parallel, Water Usage Effectiveness (WUE) has emerged as a critical sustainability metric, as cooling choices can drive high water consumption. This concern is particularly acute in water-stressed regions of India.

Industry projections suggest that India's DC installed power capacity, currently at 1.6 GW[1], is expected to exceed 2 GW by 2026, with total capacity projected to grow nearly fivefold to more than 8 GW by 2030 [1], which would translate into a total DC-connected electrical load of about 12 GW. This is equivalent to the electricity demand of 10–12 million Indian households and exceeds Delhi's current peak power demand of about 9 GW [2]. At this scale, DCs will operate as infrastructure comparable to India's largest metropolitan electricity loads, underscoring the need to integrate cooling efficiency and efficient resource planning into power and urban infrastructure governance.

1 In the data centre industry, installed capacity is typically expressed in terms of IT load, which refers to the power consumed by servers, storage, and networking equipment. The total electrical load of a data centre is higher, as it includes additional infrastructure such as cooling systems, power conditioning, lighting, and other auxiliary services. Consequently, an installed IT capacity of around 8 GW may correspond to a total facility load of roughly 12 GW, depending on the efficiency of the data centre.

Cooling accounts for approximately 30–40% of total DC electricity consumption, with an even higher share in older or sub-optimally designed facilities [3]. Cooling systems play a decisive role in shaping the environmental footprint of DCs, particularly in warm and humid climates such as India's, where thermal management requirements are inherently higher. Cooling technologies, especially evaporative and water-cooled systems, are also the primary source of direct water consumption in DC operations. While much of India's existing DC stock operates at moderate rack power densities of 4–8 kW per rack [4], new hyperscale and AI-ready facilities are being designed for substantially higher densities. Leading AI platforms already support rack power densities exceeding 120 kW [5], conventional air-based cooling systems are approaching their technical limits and can no longer provide reliable heat removal without significant energy penalties. At these densities, liquid cooling technologies, particularly direct-to-chip cooling, rear-door heat exchangers, and immersion cooling, become a functional requirement rather than an optional efficiency upgrade, due to their significantly higher heat transfer capacity and ability to maintain thermal stability at lower energy use. The gradual penetration of high-density and mixed-load configurations will materially increase both cooling energy demand and water requirements.

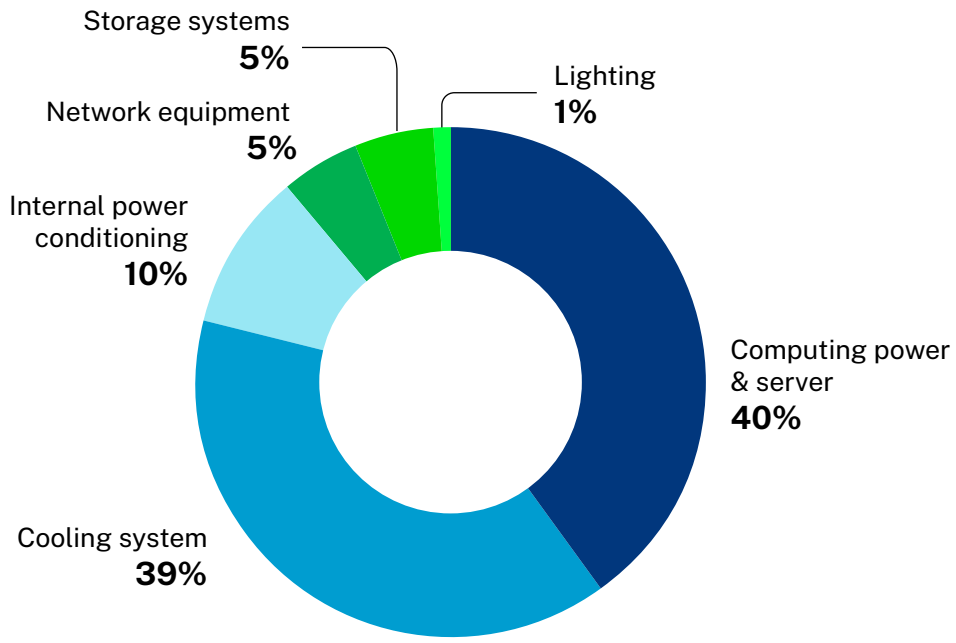

Fig. 1: Illustrative energy consumption by various components of a typical data centre

Publicly disclosed information indicates that the PUE values across Indian DCs vary significantly, ranging from around 1.3–1.4 in newer hyperscale facilities to 1.8 or higher in older and colocation-focused centres, reflecting wide differences in cooling efficiency, design, and operational maturity [6]. Hyperscale operators generally report lower PUEs due to advanced cooling architectures and tighter operational optimisation, while legacy and mixed-use facilities exhibit higher energy overheads. With an average PUE of around 1.52, total electricity consumption would be about 90 TWh annually. Given India's grid emission factor of about 0.71 kg CO_2e/kWh, this corresponds to around 64 million tonnes of CO_2e per year from DC operations alone.

Water use also varies widely, driven by cooling technology and climatic conditions, with WUE typically ranging from about 1.5 to 3.0 litres per kWh in water-cooled and evaporative systems [7], particularly higher in warm regions. A mid-sized DC of around 15 MW capacity can consume about

105 million gallons of water annually for cooling [8], comparable to the yearly water use by 20000 rural households. Scaled to India's projected 8 GW of IT capacity, cooling-related water demand could reach approximately 36–59 billion gallons per year, depending on cooling configuration and climate conditions.

At present, thermal energy storage (TES) in data centres is mainly used to meet Tier reliability requirements by providing short-duration backup cooling, typically 5–15 minutes, during power interruptions and transition to backup systems. However, its role can be expanded beyond resilience to support sustainability and grid flexibility. TES can enable load shifting by storing cooling capacity during off-peak hours or periods of high renewable energy availability and using it during peak demand periods, thereby reducing chiller operation during grid stress, lowering peak electricity demand, and improving PUE. In parallel, dedicated renewable power procurement through open access, captive solar and wind, group captive models, and long-term power purchase agreements (PPAs) can reduce grid carbon intensity and improve Carbon Usage Effectiveness (CUE). Integration of TES with battery storage, demand-response mechanisms, grid-aware load management, and waste heat recovery can further enhance operational reliability, renewable energy utilisation, and Energy Reuse Effectiveness (ERE).

Together, PUE and WUE highlight how cooling strategy choices, air-based, hybrid, or water-intensive, critically shape the energy, water, and carbon footprint of DCs, particularly in water-stressed regions and fossil-fuel-dependent power systems such as India's. However, PUE and WUE data in the public domain remain sparse, fragmented, and largely self-reported, limiting comparability and independent verification. This lack of consistent, standardised disclosure constrains sector-wide benchmarking and underscores the need for structured performance reporting to enable evidence-based policy and more sustainable DC growth.

India's climatic diversity, high ambient temperatures, seasonal humidity, and increasing frequency of heat waves further amplify the importance of cooling performance. Many major DC clusters are located in urban and peri-urban regions already experiencing power system congestion, peak demand stress, and growing water scarcity. In India, data centres are concentrated in Mumbai, Chennai, NCR, Bengaluru, Hyderabad, and Pune, but these hubs are also facing significant challenges. Mumbai and Chennai, the largest hyperscale hubs, face high temperatures, humidity, and growing freshwater scarcity, with Chennai's 2019 water crisis clearly exposing the risks of water-intensive cooling systems. NCR faces extreme summer heat, very high peak electricity demand, groundwater depletion, and severe cooling stress during prolonged heatwaves. Bengaluru and Hyderabad are witnessing rising pressure on urban water supply and grid reliability as large-scale data centre capacity expands. Pune offers relatively better climatic conditions, but it is also seeing increasing demand for power and water.

Cooling decisions made at the design and policy level therefore have long-term implications not only for facility-level efficiency, but also for grid resilience, urban water systems, and local environmental outcomes. From a policy perspective, cooling systems differ fundamentally from IT equipment. While server efficiency and IT hardware performance are largely driven by global technology cycles and vendor innovation, cooling system design, configuration, and operation are strongly shaped by local climatic conditions, water availability, electricity tariffs, land constraints, and regulatory signals. Cooling infrastructure is also long-lived, with typical asset lifetimes of 15–25 years, meaning inefficient design choices can lock in high energy and water intensity for decades.

Importantly, significant efficiency gains are achievable through cooling-side interventions without constraining digital innovation or computing growth. Measures such as improved airflow management, temperature and humidity optimisation, climate-appropriate cooling strategies, operational monitoring,

and responsible refrigerant use can deliver substantial reductions in both energy and water use, often at relatively low cost and with strong retrofit potential. From a governance standpoint, cooling efficiency therefore represents a low-regret entry point for policy action. Unlike IT hardware choices, which policymakers have limited leverage over, cooling performance can be effectively influenced through disclosure, guidance, incentive alignment, and integration with power and water planning, directly improving PUE and WUE outcomes while preserving technology neutrality for operators.

02

Data Centre Policies Review

2.1 India's Current Policy Landscape and Governance Gaps

Prior to their formal recognition as infrastructure, DCs in India were governed through a fragmented regulatory framework, commonly classified as IT–ITeS establishments or large commercial buildings, and treated as either commercial or industrial high-tension electricity consumers depending on state practice [9]. This resulted in inconsistent tariff treatment, limited integration with power system and transmission planning, and largely incidental sustainability oversight, despite their continuous and high-density demand for energy and water. The inclusion of DCs in the Harmonised Master List of Infrastructure Sub-sectors marks a structural shift, enabling access to long-term financing and more rational tariff treatment. However, infrastructure status does not establish a framework for managing operational energy, water, and cooling performance at scale.

India's regulatory framework for building energy performance is anchored under the Energy Conservation Building Code (ECBC/ECSBC). DCs fall within the Code's scope based on their connected load; however, they are addressed through generic provisions developed for large commercial buildings, rather than as a distinct, high-intensity building typology [10]. In addition to these codes, India also has voluntary green rating systems applicable to commercial buildings. However, these frameworks are largely oriented toward design-stage compliance and project-level certification and may not fully capture the operational and performance-intensive characteristics of DCs. Sector-specific considerations for DCs are instead outlined in a separate user guide, which is advisory in nature and not part of the ECBC's enforceable requirements [11]. In practice, energy performance requirements for key DC components are instead governed through equipment-level regulations, such as the Standard & Labelling (S&L) programme of the Bureau of Energy Efficiency (BEE), which covers major cooling equipment, including chillers. However, these measures operate at the component level and do not constitute a holistic, system-level efficiency framework tailored to DCs. As a result, cooling performance across operational DCs remains weakly governed and poorly linked to power system planning, water availability, and climate objectives, leading to uneven energy and water intensity outcomes that rely largely on voluntary action by operators. Given the exceptionally high heat densities and continuous cooling demands of DCs, adapting and extending

existing commercial building codes with dedicated, performance-based provisions would help ensure that cooling systems receive appropriate policy attention, commensurate with their importance to overall efficiency and sustainability.

At the national level, DCs intersect with multiple policy domains. Several states have introduced dedicated DC policies, offering incentives. While these policies have successfully attracted investment, sustainability requirements in the policies remain limited, inconsistent, or voluntary. The fundamental policy challenge, therefore, is not the absence of policy and regulatory instruments but rather the lack of integration, sector-specific benchmarks, and sustainability-linked conditionalities across governance levels. India's current approach to DC development is strongly anchored in investment promotion and accelerated digital growth, with policy emphasis on rapid DC capacity growth aided by reliable and low-cost power and streamlined approvals. As a result, PUE and WUE imperatives remain uneven, and there is no consistent national mechanism for performance benchmarking and disclosure.

In the absence of targeted cooling-focused policy guidance, short-term investment decisions likely prioritise speed, cost, or land availability over long-term efficiency and resource resilience. This creates the risk of locking in sub-optimal cooling designs that conflict with India's energy security, water stewardship, and climate objectives. Addressing this governance gap requires policy instruments that complement existing use guides or ratings by focusing on operational performance, regional context, and system-level outcomes.

2.2 Global Policy Signals

Global experience shows that DC policy interventions have increasingly emerged in response to local infrastructure constraints, particularly electricity capacity, cooling-related energy demand, and water stress, before scaling to national policy frameworks. Singapore offers a prominent example of a nationally led, cooling- and resource-conscious approach. Faced with land scarcity and power system limitations, the government deliberately slowed DC growth, introduced stricter efficiency targets for energy and water use, and used this pause to allow power infrastructure to adapt. Cooling efficiency and water intensity became explicit policy levers, reflecting the city-state's recognition that unconstrained expansion would exacerbate system-level risks. As a result, DC policy in Singapore has remained a national issue, tightly integrated with energy and water planning [12].

In the Netherlands, policy evolution illustrates how cooling and waste heat concerns can drive a transition from local to national governance. Initial restrictions in the Metropolitan Region of Amsterdam focused on limiting spatial expansion, mandating waste heat reuse, and increasing renewable electricity use in response to local grid congestion and cooling-related impacts. These regional measures culminated in a nationwide DC policy that introduced efficiency targets, land-use controls, and a temporary moratorium on large hyperscale facilities. Subsequent "no, unless" policies linked new approvals to demonstrable local value and enhanced sustainability performance, embedding cooling efficiency and waste heat considerations into both urban planning and national infrastructure policy [13].

Ireland demonstrates a grid-security-driven approach where cooling-related electricity demand became a national concern. Rapid growth of DCs around Dublin led regulators to impose constraints on new connections, introduce efficiency targets, and require on-site generation and storage to manage peak demand. Although triggered by regional grid stress, these measures were implemented nationally, explicitly recognising that cooling-driven electricity demand from DCs could undermine system reliability and broader decarbonisation efforts [14].

In Germany and the UK, cooling, waste heat, and water governance have followed a similar trajectory from regional planning to broader regulatory integration. Cities such as Frankfurt and London initially introduced local licensing controls, waste heat reuse expectations, and water-use restrictions to address cooling impacts in dense urban areas. In Germany, these concerns were later elevated to the national level through the Energy Efficiency Act, which mandates waste heat utilisation, renewable electricity use, and public disclosure of DC energy consumption.

Together, these cases demonstrate a consistent global pattern: cooling-related energy and water impacts act as early policy triggers, prompting governance that evolves from localised controls to integrated national frameworks [15,16]. Such approaches, particularly the use of performance disclosure, cooling system performance, waste heat utilisation mandates, and resource efficiency benchmarks, offer important lessons that can help inform India's approach to resource-efficient DC growth.

03

Technology Levers for Improving Cooling-Related PUE and WUE

Improving sustainability in DCs depends on a portfolio of proven and emerging technology levers, with the largest and most immediate gains concentrated on the cooling side. Key interventions include indoor temperature and humidity optimisation, improved airflow management and containment, and the use of climate-appropriate free and hybrid cooling systems, advanced cooling solutions for high-density AI workloads, and digital monitoring through DC infrastructure management (DCIM) systems. For high-density and AI-driven facilities, shifting to advanced cooling solutions such as Distributed Pumping System, typically described as terminal unit or primary and distributed secondary pumping systems, which enables the entire chilled water system to operate with temperature-based control instead of pressure-based control, along with the deployment of digital controls and smart equipment is increasingly critical for maintaining efficiency and reliability. The adoption of distributed pumping architectures, prefabricated system solutions, and smart equipment's allows precise flow and energy modulation at the point of demand, reduces overall losses, improves part-load efficiency, and lowers auxiliary power consumption, thereby contributing directly to improved cooling-related PUE.

In parallel, prefabricated systems enhance hydraulic optimisation, reduce installation and commissioning losses, and deliver predictable performance, while condition monitoring and advanced diagnostics enable continuous performance tracking, early fault detection, and sustained operational efficiency over the asset lifecycle. On the energy side, thermal and electrical energy storage, grid-interactive operation, and renewable energy integration procurement can complement cooling efficiency by reducing peak load impacts and improving system flexibility. On the water side, closed-loop cooling configurations, recirculation systems, optimised pumping, heat recovery and the use of non-potable water are essential for reducing freshwater consumption and improving WUE, particularly in water-stressed regions. Many of these measures are retrofit-friendly, making them highly relevant for improving the sustainability of India's existing DC stock.

The purpose of highlighting these levers is not to prescribe specific technologies, but to illustrate the range of options through which policy frameworks can enable improved cooling performance. Technology-neutral policies that reward delivered outcomes, rather than mandating solutions, allow

operators to select appropriate interventions based on scale, climate, and operational constraints, while ensuring measurable improvements in PUE and WUE.

Table 1: Technology Levers for Improving Cooling-Related PUE and WUE

Category	Sustainability Lever	Primary Resource Impact	Typical Applications	Indicative Impact Range	Policy Relevance
Cooling system architecture	Climate-appropriate cooling systems	Energy, Water	Free cooling, hybrid air/water systems	Cooling energy 4–34% reduction (site-specific) [17]	High policy leverage; avoids long-term inefficiency lock-in
	High-density cooling solutions	Energy	Liquid, rear-door, or direct-to-chip cooling	Cooling energy 10–30% reduction [18]	Essential for AI/ HPC growth without PUE degradation
	Water-efficient heat rejection	Water	Closed-loop, dry/hybrid cooling, non-potable water use	Freshwater use by 50–90% reduction [19]	Critical for siting and WUE regulation
	Energy efficient and appropriate liquid pumping system	Energy, Water, System Reliability	All type of liquid based closed looped cooling systems	Pumping power reduction by 15 –30% and water use reduction by 5-15%	High policy leverage; avoids long-term inefficiency lock-in and essential for achieving desired PUE and WUE
Operational optimisation	Indoor temperature and humidity setpoint optimisation	Energy	Higher server inlet temps (24–27 °C), wider RH envelopes	Cooling energy 5–15% reduction [20]	Immediate gains; suitable for codes of practice and advisory guidelines
	Airflow management and containment	Energy	Hot/cold aisle containment, sealing, and airflow balancing	Cooling energy 40% reduction [21]	Baseline requirement for PUE improvement
	Digital monitoring and control (DCIM / EMS)	Energy, Water (indirect)	Real-time performance tracking and optimisation	Whole-facility energy 5–10% reduction [22]	Enables performance reporting and compliance
	Fan speed modulation	Energy	Real-time performance tracking and optimisation	Energy 30–50% reduction [23]	Immediate gains; suitable for codes of practice and advisory guidelines

Category	Sustainability Lever	Primary Resource Impact	Typical Applications	Indicative Impact Range	Policy Relevance
Energy system interaction	Thermal and electrical energy storage	Energy, Diesel	Peak shaving, backup optimisation	Peak demand 10–20% reduction [24]	Supports grid resilience and RE integration
	Grid-interactive operation	Energy (system-level)	Demand response, flexible load shifting	Emissions (context-dependent)	Integrates DCs into power-sector planning
Cooling system configuration	Refrigerant transition	Energy and carbon environment	Adoption of low-GWP refrigerants	10–30% GHG emissions reduction and 10–15% improvement in energy efficiency [25,26]	Avoids long-term climate lock-in; aligns with Kigali Amendment trajectory
Circularity and externalities	Waste heat recovery and reuse	Energy (indirect)	District heating and cooling, industrial heat reuse	Improvement of system efficiency up to 5–15% [27]	Relevant for industrial clusters, not universal

Industry reports indicate that the current average PUE of DCs is approximately 1.52, with a feasible reduction to around 1.2 to 1.3 through targeted efficiency interventions. As mentioned in the Table above, adoption of measures such as climate-appropriate cooling systems, high-density cooling solutions, temperature and humidity setpoint optimisation, airflow management and containment, DCIM/EMS deployment, fan speed modulation, and refrigerant transition can collectively enable up to a 40-45% reduction in cooling power demand, sufficient to achieve an average PUE of 1.3 (as illustrated in the figure). At this performance level, cooling efficiency improvements could deliver demand-side power savings of approximately 440 MW by 2026 and 1,760 MW by 2030.

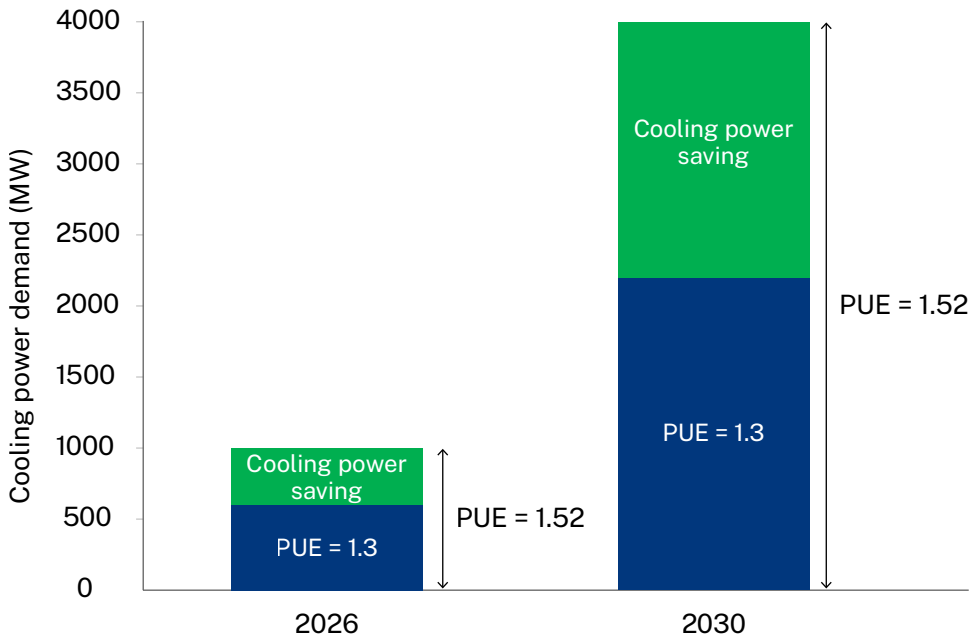

Fig. 2: Cooling power demand and saving potential through various methods

In existing DCs, energy performance improvements can be achieved through a phased retrofit strategy that prioritises measures with minimal structural disruption and high returns. Operational optimisation measures, such as indoor temperature and humidity setpoint optimisation, pumping system audit and optimisation through replacement with much efficient cooling water pumps and fully auto operation to ensure proper balancing of chilled water system airflow management and containment, fan speed modulation, and deployment of DCIM/EMS, are typically the most feasible first steps, as they can be implemented within existing layouts and deliver immediate energy savings. Cooling system retrofits, including partial free cooling, hybrid air/water solutions, and water-efficient heat rejection, might not be immediate and can be integrated during equipment replacement cycles, subject to site climate and infrastructure constraints. While high-density liquid cooling and comprehensive refrigerant transitions may be limited by legacy design architecture. Technologies such as rear-door heat exchangers, in-row cooling, or low-GWP refrigerants during chiller end-of-life replacement can lead to improved energy efficiency. However, their deployment in existing DCs is often limited by retrofit constraints. Although measures such as airflow containment, fan-speed modulation, setpoint optimisation, and DCIM-based controls are relatively retrofit-friendly, adoption in legacy facilities is often constrained by concerns about space constraints, capital cost, operational disruption, and downtime risk. These barriers can be reduced through phased implementation during planned maintenance windows, modular retrofits that avoid full system shutdowns.

The relationship between PUE and WUE is defined by a sensitive energy-water trade-off where optimising one often stresses the other. WUE is closely linked to cooling strategies and does not necessarily improve in tandem with PUE. While efficiency measures such as airflow optimisation, containment, and higher temperature setpoints can reduce both energy and water consumption, certain high-efficiency cooling approaches, such as evaporative systems, may lower PUE at the expense of increased water use. Conversely, air-cooled or dry cooling systems can significantly reduce water consumption, albeit with a marginal increase in energy demand. With the adoption of modern cooling technologies such as closed-loop liquid cooling and optimisation measures, WUE can be improved to an average level of around 1.5 litres/kWh. At this level of performance, the resulting efficiency gains could translate into annual water savings of approximately 9 billion gallons by 2026 and 36 billion gallons by 2030. These trade-offs highlight the need to assess WUE alongside PUE, and to adopt cooling strategies that are aligned with local resource constraints, particularly in water-stressed regions.

04

Conclusion and Policy Recommendations

India's DC sector is transitioning from a niche digital service to core national infrastructure, with rapid capacity additions already placing measurable pressure on electricity systems and local water resources. Evidence presented in this brief demonstrates that cooling systems are the primary driver of both energy and water intensity in DC operations, and that current regulatory frameworks do not systematically govern cooling performance across the operational fleet. As capacity scales and rack densities increase, the absence of performance-oriented cooling governance risks locking in avoidable inefficiencies for decades. Addressing cooling performance through disclosure, guidance, and incentive alignment, therefore, represents a pragmatic and low-regret pathway to improve sustainability outcomes while enabling continued digital and AI-driven growth. This brief presents a set of targeted recommendations to systematically embed sustainability into the planning, design, and operation of DCs in India:

a. **Introduce mandatory performance disclosure and benchmarking:** India should mandate DCs to disclose their PUE and WUE annually, with phased implementation thresholds. The initial focus should be on data collection and comparability, creating a robust evidence base for policy calibration and future regulation. Public or regulator-level reporting would improve sector visibility, enable benchmarking across facility types and climates, and align India with emerging global best practice.

b. **Dedicated star rating framework for DCs:** Bureau of Energy Efficiency (BEE) launched building star rating system in 2009 to rate buildings with connected loads of 100 kW or above on a 1–5-star scale based on energy usage per unit area (kWh/sqm/year), with 5-star buildings being the most energy efficient. While DC operations are currently subsumed under the BPO building category, this classification fails to capture their distinct energy profile. Unlike conventional buildings, DCs are characterised by continuous 24×7 loads, high rack power densities, and critical cooling requirements, none of which are adequately reflected in the existing Energy Performance Index (kWh/sqm/year) metric. BEE is in the process of revising the scheme and should introduce a dedicated DC typology within the scheme, anchored to internationally recognised metrics such as PUE and DC Infrastructure Efficiency (DCiE). Given the significant variation in rack power densities across colocation, hyperscale, and edge DCs, a tiered rating approach by DC type should be adopted to ensure meaningful and comparable benchmarking.

c. **Issue national guidance on climate-appropriate cooling:** National and state guidance should connect India's climatic zones and local water stress conditions with appropriate cooling strategies, with a focus on airflow management, temperature optimisation, and reducing freshwater use in water-stressed areas. This would help operators make better design and operational decisions while retaining flexibility in how cooling systems are implemented.

d. **Enable retrofit-focused efficiency improvements in existing facilities:** Cooling governance should apply not only to new DCs but also to existing facilities, where substantial near-term efficiency improvements are possible and can be adopted readily. Incentives, concessional financing, and technical support should focus first on retrofit-ready measures, such as setpoint optimisation, airflow containment, fan speed modulation, and DCIM/EMS deployment, and then support cooling system upgrades with advanced cooling approaches wherein pumping system configuration is of primary and distributed secondary or distributed pumping set up as part of normal equipment replacement cycles.

e. **Integrate DC performance into power and water planning**: Large DC cooling loads should be explicitly considered in electricity transmission planning, peak demand management, and urban water availability, particularly in clustered developments. In high density DC clusters such as IT hubs, special economic zones, planning authorities should also evaluate the feasibility of district cooling systems to aggregate cooling demands and improve overall system efficiency. Such approaches can reduce peak electricity loads, optimise water use, and enable the use of alternative cooling sources and waste heat recovery. Linking fiscal incentives, tariff concessions, and fast-track approvals to demonstrated improvements in PUE and WUE would shift support mechanisms from entitlement-based to performance-based models.

f. **Strengthen institutional capacity and implementation readiness**: Regulatory agencies will require enhanced technical capacity to assess cooling performance data, interpret operational metrics, and support enforcement. Coordinated capacity building across central and state institutions is essential to sustain performance-based governance.

Adoption of climate-appropriate cooling systems, high-density cooling solutions, operational optimisation, digital monitoring, fan speed modulation, and refrigerant transition can collectively enable a 40–45% reduction in cooling energy consumption, sufficient to achieve a PUE of 1.3 or lower. At this level, cooling energy savings of approximately 440 MW by 2026 and 1,760 MW by 2030 are achievable. Through the adoption of water optimisation measures, a WUE of 1.5 litres/kWh or lower is achievable, which could translate into annual water savings of up to 9 billion gallons by 2026 and 36 billion gallons by 2030 while safeguarding energy security, water resilience, and long-term climate goals. Overall, improving DC sustainability does not require heavy-handed regulation. A phased approach, progressively aligning incentives with delivered performance, can steer the sector toward globally competitive sustainability outcomes.

Implementation of these recommendations will require coordinated action across multiple institutions. BEE and the Ministry of Power (MoP) are well-positioned to lead efforts on performance benchmarking, star rating, disclosure frameworks, and cooling efficiency guidelines. The Ministry of Electronics and Information Technology (MeitY) can play a central role in integrating sustainability into DC policies and digital infrastructure planning. At the state level, State Electricity Regulatory Commissions (SERCs) and DISCOMs can support tariff design, demand-side management, and performance-linked incentives, while urban local bodies and state industrial development agencies can enable integration with water planning and district cooling infrastructure, particularly in DC clusters.

05

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