On behalf of:

Federal Ministry
for the Environment, Climate Action,
Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

IKI INTERNATIONAL CLIMATE INITIATIVE

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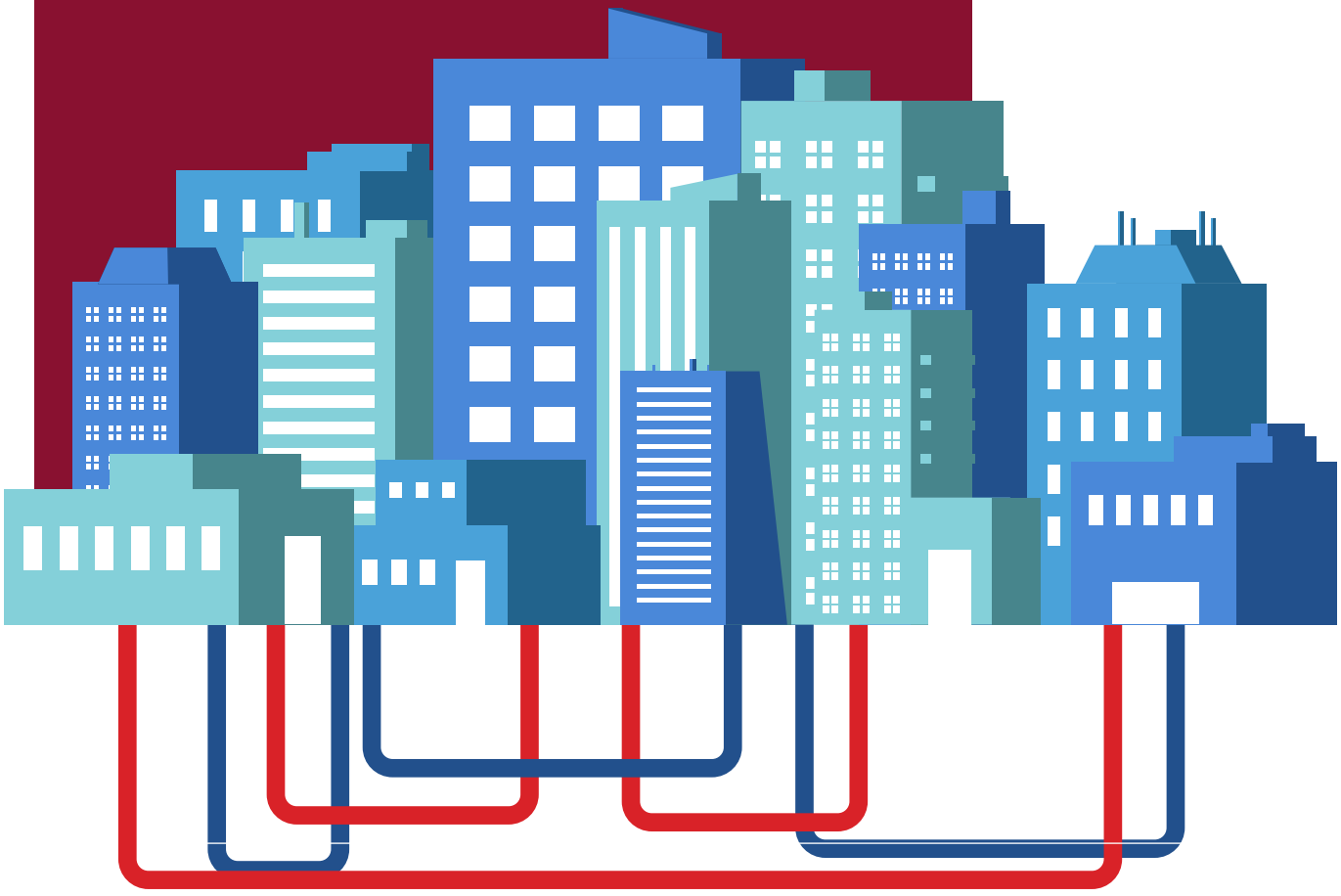
DISTRICT COOLING Roadmap for India

Outlining Strategies for Scaling Shared Cooling Infrastructure



2025

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Outlining Strategies for Scaling Shared Cooling Infrastructure

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

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FOREWORD

As India continues its rapid urbanization and economic growth, the demand for cooling is expanding at an unprecedented pace. Cooling is no longer a luxury – it is a necessity for comfort, productivity, and public health. Yet, meeting this growing demand sustainably is one of the defining energy challenges of our time. Efficient cooling solutions are essential not only to ensure reliable thermal comfort but also to safeguard our energy security, reduce emissions, and contribute to the nation's long-term climate goals.

The Bureau of Energy Efficiency (BEE), a statutory body of the Ministry of Power, Government of India formed to support the formulation and implementation of policies and strategies aimed at enhancing energy efficiency across sectors. The vitality of cooling in the building sector is required to be scaled up innovative solutions such as District Cooling System (DCS) to meet cooling demand. DCS provide an efficient, low-emission,and cost-effective alternative to conventional cooling methods.

To accelerate the adoption of such systems, this District Cooling Roadmap has been developed as a strategic framework for action. Building on earlier efforts jointly developed with GIZ such as the District Cooling Guidelines for India, the roadmap identifies opportunities to scale up DCS deployment across diverse city types and climatic zones. It provides direction on enabling policy and regulatory measures, business models, financing mechanisms, and technological options – all aimed at creating a robust ecosystem for district cooling in India.

I urge city planners, developers, and all stakeholders to actively engage with the strategies and recommendations outlined in this document. By integrating district cooling into India's urban planning and infrastructure development, we can collectively advance toward a greener, more energy-efficient future – one that supports our national goals under the ICAP and contributes to achieving Net Zero by 2070, as envisioned by our Hon'ble Prime Minister.

Shri. Dhiraj Kumar Shrivastava
Director General
Bureau of Energy Efficiency

FOREWORD

As temperatures rise and cities grow denser, the need for cooling has become a defining challenge of India's urban future. Over the coming decade, this demand is set to surge – placing increasing pressure on the country's energy systems, affordability, and climate goals. India's own Cooling Action Plan and several national studies make it clear: traditional, buildingby- building cooling alone will not be enough. To meet the scale of this challenge, we must look beyond individual solutions toward shared, efficient, and resilient systems. District Cooling offers precisely such an opportunity – an approach that can make India's cooling transition smarter, cleaner, and more sustainable.

Germany has been playing a very active role in not only addressing these issues pertaining to its own land but also supporting the other countries to move towards sustainable living with lesser carbon footprints. Germany has been supporting India in various fields since last 60 years, with an aim of promoting cooperation and involving public-private sectors of both sidesin the areas of energy, environment and sustainable economic development. Under the leadership of the Government of India and supported by the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) as part of the International Climate Initiative (IKI), the Bureau of Energy Efficiency (BEE), with support from GIZ India, is advancing sustainable, energy-efficient cooling solutions that support India's energy transition. GIZ, in collaboration with partners including the Alliance for an Energy Efficient Economy (AEEE) and the United Nations Environment Programme (UNEP), has worked to build stakeholder consensus and develop the District Cooling Guidelines for India, launched in 2023. This District Cooling Roadmap builds on that foundation, outlining actionable strategies to scale DCS nationwide by identifying city and load typologies, proposing regulatory and tariff frameworks for viable business models, and providing guidance on technology selection, financing, and stakeholder engagement.

On behalf of the GIZ India team and the EE-Cool Project PMU, I extend our sincere gratitude to the Ministry of Power, Bureau of Energy Efficiency and all the stakeholders for their continued guidance and support. We hope this Roadmap serves as a catalyst for informed dialogue and coordinated action to overcome implementation challenges, unlock the potential of DCS, and accelerate India's transition to efficient, equitable, and climate-aligned cooling. Implemented at scale, district cooling can help keep India cool – without overheating its energy system.

Mr. Nitin Jain
Programme Head – EE Projects
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FOREWORD

India's vision towards becoming a developed nation by 2047, calls for holistic transformation across economic, infrastructural, social, and environmental dimensions. Rapid urbanisation, increasing population, combined with changing lifestyle and rising thermal-comfort needs, are driving an unprecedented surge in cooling demand. The India Cooling Action Plan (ICAP) estimates an eightfold rise in cooling demand by 2037–38, with conventional air-conditioning alone likely adding 150–180 GW to peak electricity demand and significant greenhouse gas emissions. As cities expand and modernise, sustainable and efficient cooling becomes central to achieving India's vision of livable, competitive, and climate-resilient urban centres.

In this context, **District Cooling System (DCS),** as a model of shared cooling solution, presents a transformational opportunity to reshape India's urban cooling landscape. By shifting from individual units to shared, utility-scale infrastructure, district cooling reimagines cooling as an essential public service that is clean, reliable, affordable, and accessible to all.

While the sector has witnessed sporadic progress and isolated signs of development till now, the District Cooling Roadmap for India is designed to provide the sustained impetus needed to move from opportunity to scale. This roadmap is aimed to serve as a strategic blueprint to accelerate the adoption and scale-up of DCS across the country. It provides clear strategies, drawing from international best practices, and domestic lessons from sectors such as renewables, city gas distribution, and telecom, and insights from extensive stakeholder consultations. Its five-strategy approach lays out a clear recommendations to build a mature and self-sustaining district cooling ecosystem. This roadmap underscores that meaningful transformation requires a whole-of-government and whole-of-society approach. From establishing a institutional foundation , integrating DCS into national and state urban planning mandates, and creating fiscal and financial incentives, to piloting flagship projects and designing innovative business models, India has the unique opportunity to leapfrog conventional cooling pathways.

I commend the dedicated contributors to this work and sincerely acknowledge the Bureau of Energy Efficiency (BEE) and GIZ, under the Indo-German Energy Programme, for their sustained leadership and technical guidance through the EE-Cool programme. I encourage policymakers, urban planners, utilities, developers, and industry stakeholders to study this roadmap and act on its insights.

Together, let us build a cooler, greener and resilient urban future, aligned with the vision of an *Atmanirbhar, Viksit Bharat*.

Dr. Satish Kumar
President & Executive Director,
Alliance for an Energy Efficient Economy (AEEE)

ACKNOWLEDGEMENTS

This report, the "DCS Roadmap for India," represents a collaborative effort, synthesising the knowledge and insights gathered from numerous organisations and individuals committed to India's sustainable future. The development of this strategy would not have been possible without the foundational knowledge and expertise provided by a wide array of stakeholders.

We extend our deepest gratitude to the **Ministry of Power** and the **Bureau of Energy Efficiency (BEE), Government of India**, for their visionary leadership and for championing the cause of energy efficiency and sustainable cooling in the nation. The pioneering work in developing the *District Cooling Guidelines* provided an essential technical bedrock for this roadmap.

This roadmap report has been developed as a part of the **Energy Efficient Cooling (EE-Cool) programme**, which operates under the aegis of the **Indo-German Energy Programme**. The EE-Cool programme is implemented by the **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH** on behalf of the International Climate Initiative (IKI) of the Federal Government of Germany. Within the Federal Government, the IKI is anchored in the Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN). The EE-Cool programme has been instrumental in advancing the dialogue on creating an ecosystem for DCS development in India, sensitising stakeholders, and building institutional capacity on DCS in India, culminating in the creation of this strategic document.

Finally, this document serves as a testament to the power of collaboration and provides a clear, actionable path for all stakeholders to work together in building a cooler, more sustainable, and climate-resilient India.

CONTENTS

01

INTRODUCTION

India stands at a critical juncture in its development trajectory. As one of the world's fastest-growing economies, the nation is witnessing unprecedented urbanization, rising disposable incomes, and a concurrent surge in the necessity for thermal comfort. The India Cooling Action Plan (ICAP) projects an eightfold increase in cooling demand by 2038, a surge that poses significant challenges to our energy infrastructure, environmental sustainability, and climate commitments. The expected proliferation of standalone air conditioning units, at an average of 15 million per year threatens to exacerbate peak electricity demand, strain the grid, and accelerate greenhouse gas emissions. Room air conditioners have been estimated to account for 40-60% of peak electricity load during the hottest hours, highlighting the critical need for innovative solutions to manage this demand.[1]

In this context, District Cooling Systems (DCS) emerge not merely as an alternative, but as a strategic imperative. By centralising the production of cooling and distributing it through a network of insulated pipes, DCS has the potential to reduce electricity consumption for cooling by up to 50%, mitigate urban heat island effects, and facilitate a transition to climate-friendly refrigerants. This technology represents a paradigm shift from a product-based approach to a service-based, utility-scale solution that aligns perfectly with India's goals of energy efficiency, smart urban development, and climate resilience.

This "District Cooling Roadmap for India: Outlining Strategies for Scaling Shared Cooling Infrastructure" lays out a strategic, five-pillared approach to create a thriving DCS ecosystem, addressing everything from policy and regulation to demand creation, business models, and

financing. It draws valuable lessons from the successful scaling of other infrastructure sectors in India, such as power, telecom, and city gas distribution, to propose a pragmatic and actionable path forward.

This roadmap is structured to guide policymakers, investors, urban planners, and non-government actors in building a national DCS ecosystem. It begins by establishing the "why" and "what," then moves to diagnose the challenges, and finally presents a set of actionable plans for "how" to move forward.

The roadmap is structured as follows:

Sections 2 and 3, *Need for* and *Potential of DCS*, outline the pressing challenges of India's rising cooling demand and quantify the significant energy, environmental, and economic opportunities that DCS presents.

Section 4, *Barriers in DCS*, provides a diagnosis of the hurdles impeding the growth of the sector in India. This section details the complex web of policy, financial, market, and technical barriers that must be overcome.

Section 5, *Enabling Environment*, introduces the "Four-Quadrant Approach" as a conceptual framework for market creation. It explains how coordinated interventions in policy, standards, finance, and capacity building are necessary to create a DCS market.

Section 6, *Lessons from Good Practices*, draws on proven successes to inform India's strategy. It analyses relevant parallels from India's own infrastructure triumphs, such as the scaling of renewable energy and city gas, and synthesises key lessons from mature international DCS markets, with a special focus on Dubai.

Section 7, *Roadmap: A Five-Strategy Approach*, forms the core of this report, presenting an actionable five-pillar strategy to build the DCS ecosystem by focusing on demand creation and enabling the environment for DCS suppliers. The strategies are supplemented with case studies and examples for substantiation wherever possible.

Sections 8 and 9, *Role of Ministries* and *Time Schedule*, translate the strategy into a roadmap. These sections assign specific responsibilities to key governmental bodies and lay out a phased decade-long timeline for action.

***Way Forward*,** concludes the report with a summary of the most critical, immediate actions required to set India firmly on the path to a sustainable cooling future.

The journey to mainstreaming District Cooling will require coordinated action and unwavering commitment. This roadmap provides the foundational blueprint for that journey. By embracing the strategies outlined herein, India can transform the challenge of rising cooling demand into an opportunity for sustainable growth, establishing itself as a global leader in climate-resilient urban development.

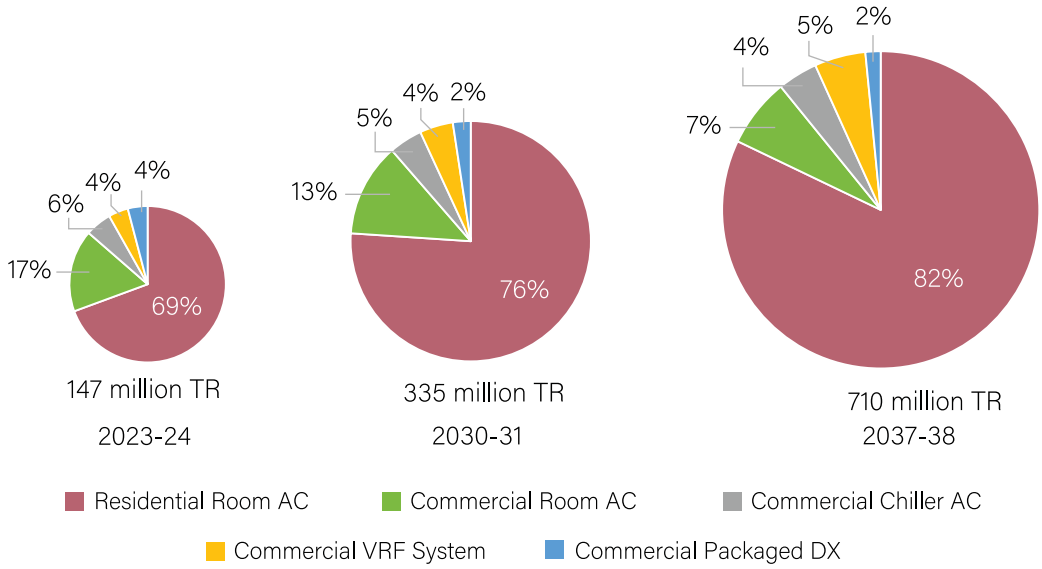
02

NEED FOR DISTRICT COOLING SYSTEMS

India is entering an era where sustainable cooling has become critical—not only for human comfort and productivity, but also for energy security, climate resilience, and urban sustainability. The nation's urban population is projected to swell to over 630 million by 2030 and 700 million by 2037, placing immense pressure on urban infrastructure and essential services[2]. This growth, coupled with rising ambient temperatures due to climate change and increased purchasing power, is fueling an exponential rise in the demand for space cooling. In this context, District Cooling Systems offer a scalable and energy-efficient solution to meet growing cooling needs while reducing electricity consumption, peak loads, and greenhouse gas emissions.

The India Cooling Action Plan (ICAP) forecasts that the country's cooling energy demand will grow by eight times between 2018 and 2038. ICAP estimates that 80% of the expected demand is expected to be met by conventional standalone units[3].

This presents a multifaceted crisis. Firstly, it will place an unsustainable burden on India's electricity grid. Cooling already accounts for a significant portion of peak electricity demand in major cities, and unmanaged growth could necessitate massive investments in new power generation capacity, undermining the nation's energy security and climate goals.



**For chiller systems, standby capacity constitutes 20% of its total cooling capacity*

Figure 1: Refrigerant based cooling equipment stock projection (ICAP[3])

Space cooling is already "nearly 10-12%" of India's electricity use today, and by 2030 cooling could account for nearly half of India's peak-demand growth, contributing to a ~60% rise in peak load versus today, if unmanaged[4]. Cooling demand in India is growing at an unprecedented pace. Already, in 2024, room air-conditioners alone contributed around 50–60 GW to India's evening peak load, which is more than the entire peak demand of countries like Spain or South Africa[5]. It is estimated that by 2050, cooling could represent nearly 45% of India's peak electricity demand if business as usual continues[4].

Secondly, the environmental consequences are severe. The proliferation of individual AC units, each rejecting heat directly into the ambient environment, significantly contributes to the **Urban Heat Island (UHI)** effect, a phenomenon where cities become several degrees warmer than surrounding rural areas. This creates a vicious cycle, where hotter cities drive even greater demand for cooling. Furthermore, conventional cooling systems rely on hydrofluorocarbon (HFC) refrigerants, potent greenhouse gases whose escalating use poses a direct threat to India's commitments under the Kigali Amendment to the Montreal Protocol.

DCS offer a systemic solution to this complex challenge. By treating cooling as a public utility, analogous to water or electricity, DCS aggregates demand from multiple buildings and serves it from a centralized, highly efficient plant. This approach fundamentally changes the energy equation. It decouples cooling from individual buildings, allowing for economies of scale, professional operation and maintenance, and the integration of sustainable technologies that are unfeasible at a building level. DCS can utilize treated wastewater for cooling, integrate waste heat through absorption chillers, and deploy large-scale thermal energy storage to shift electricity demand to off-peak hours. In doing so, it addresses the interconnected challenges of growing cooling demand, rising energy consumption, the urban heat island effect, and the need for resource circularity, paving the way for a more sustainable and resilient urban future.

03

POTENTIAL OF DISTRICT COOLING SYSTEMS

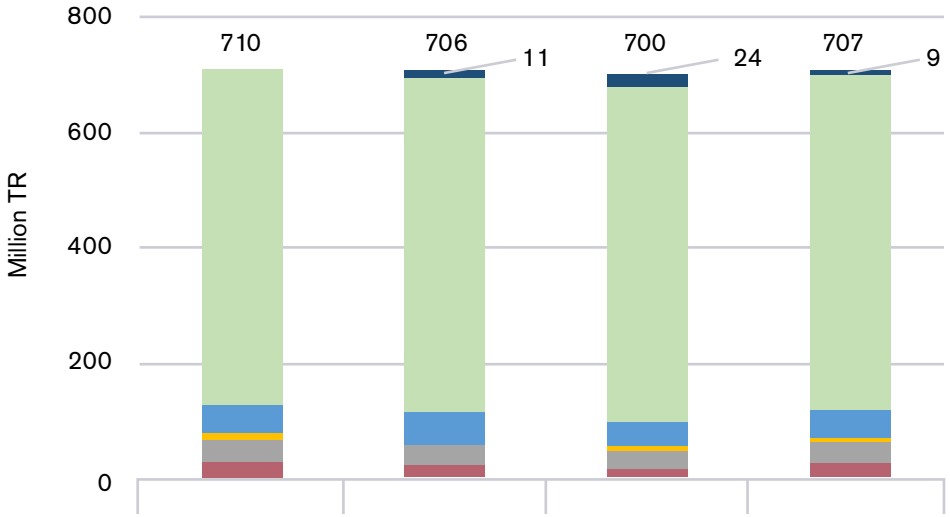
Having established the urgent need for a new approach to cooling, this section quantifies the scale of the opportunity that District Cooling presents for India. It synthesizes findings from key national studies to project the potential market size, energy savings, and emissions reduction potential through DCS adoption. Policymakers would find this analysis and the high potential sites presented in this section useful to set a realistic national capacity target for DCS.

The potential for District Cooling Systems in India is vast, driven by the sheer scale of projected urban development and the clear techno-economic advantages of the technology. Independent analyses from governmental and international bodies converge on a significant opportunity for DCS to meet a substantial portion of India's future cooling load, delivering immense energy, economic, and environmental benefits.

A 2021 study by the United Nations Environment Programme (UNEP) and the Energy Efficiency Services Limited (EESL) conducted a bottom-up assessment based on the master plans of 21 Tier

1 and Tier 2 cities. It concluded that DCS has the technical potential to serve 78 million Tonnes of Refrigeration (TR) of cooling load. Even capturing a fraction of this, the study estimated a national DCS potential of 12.57 million TR from 300+ sites by 2037-38 under an optimistic scenario, which would yield annual energy savings of ~7,850 GWh and mitigate ~6.6 million tonnes of CO_2 emissions annually[6].

The India Cooling Action Plan (ICAP) further reinforces this potential. A modelling analysis carried out under the EE Cool programme shows that even a conservative 2% DCS integration into the national cooling capacity could reduce the cooling capacity requirement by 4 million TR, save nearly **3,000 GWh of electricity consumption** annually, and reduce approximately **4 GW of peak electricity demand** by 2037-38[7].



	ICAP-BAU	Low DCS integration (2%)	High DCS integration (5%)	DCS potential estimated in UNEP-EESL study
Either Comm./Resi. DCS	0	11	24	9
Residential Room AC	583	580	578	579
Commercial Room AC	50	48	43	48
Commercial Packaged DX	11	10	9	9
Commercial VRF System	37	35	32	35
Commercial Chiller System	29	22	15	27

Commercial Chiller System · Commercial VRF System · Commercial Packaged DX · Commercial Room AC · Residential Room AC · Either Comm./Resi. DCS

Figure 2: Scenarios of DCS integration and its impact on cooling capacity requirements in 2037-38

Please refer to the separately published report on "Future-Proofing India's Cooling: An Assessment of District Cooling System Integration within the ICAP Framework" for a detailed explanation of the scenarios, underlying assumptions, and results.

3.1 High Potential Sites

The economic and technical viability of DCS is highest in areas characterised by high cooling load density and diversity. Such environments allow for optimised plant sizing and efficient operation, maximising returns on the initial capital investment. The *District Cooling Guidelines* published by the Bureau of Energy Efficiency (BEE) outline specific criteria for site selection, emphasising aggregated cooling loads (typically >10,000 TR), proximity of buildings, and mixed-use profiles[8]. Based on these criteria, several infrastructure typologies across India present prime opportunities for DCS deployment:

- **Airports and Transit-Oriented Developments (TODs):** These are 24/7 hubs with a high and diverse mix of cooling loads from terminals, hotels, retail centers, and offices. The high land value makes the space-saving benefits of DCS particularly attractive. Major airports in Delhi, Mumbai, and Chennai already utilise large centralised cooling plants, and several railway stations are being redeveloped into multimodal hubs.

- **IT Parks, FinTech Hubs, and Special Economic Zones (SEZs):** These zones feature high-density clusters of office buildings with consistent and critical cooling needs. The successful implementation of DCS in GIFT City, Gandhinagar, which has a planned capacity of 180,000 TR, serves as a powerful proof-of-concept for this segment[9]. An analysis of just 220 notified IT/ITeS SEZs reveals a DCS-eligible potential of approximately 2.3 million TR by 2037-38[7]. This single sub-segment alone represents a significant market.

- **Industrial Parks and Manufacturing Clusters:** Areas like the Hyderabad Pharma City and other planned industrial corridors require reliable process and comfort cooling. DCS offers an opportunity to improve energy efficiency and integrate waste heat from industrial processes for trigeneration (power, heating, and cooling).

- **Integrated Townships and Large-Scale Mixed-Use Developments:** Greenfield projects and large urban redevelopment schemes offer a clean slate to integrate DCS from the planning stage, ensuring optimal layout of the distribution network and mandatory connections for all buildings.

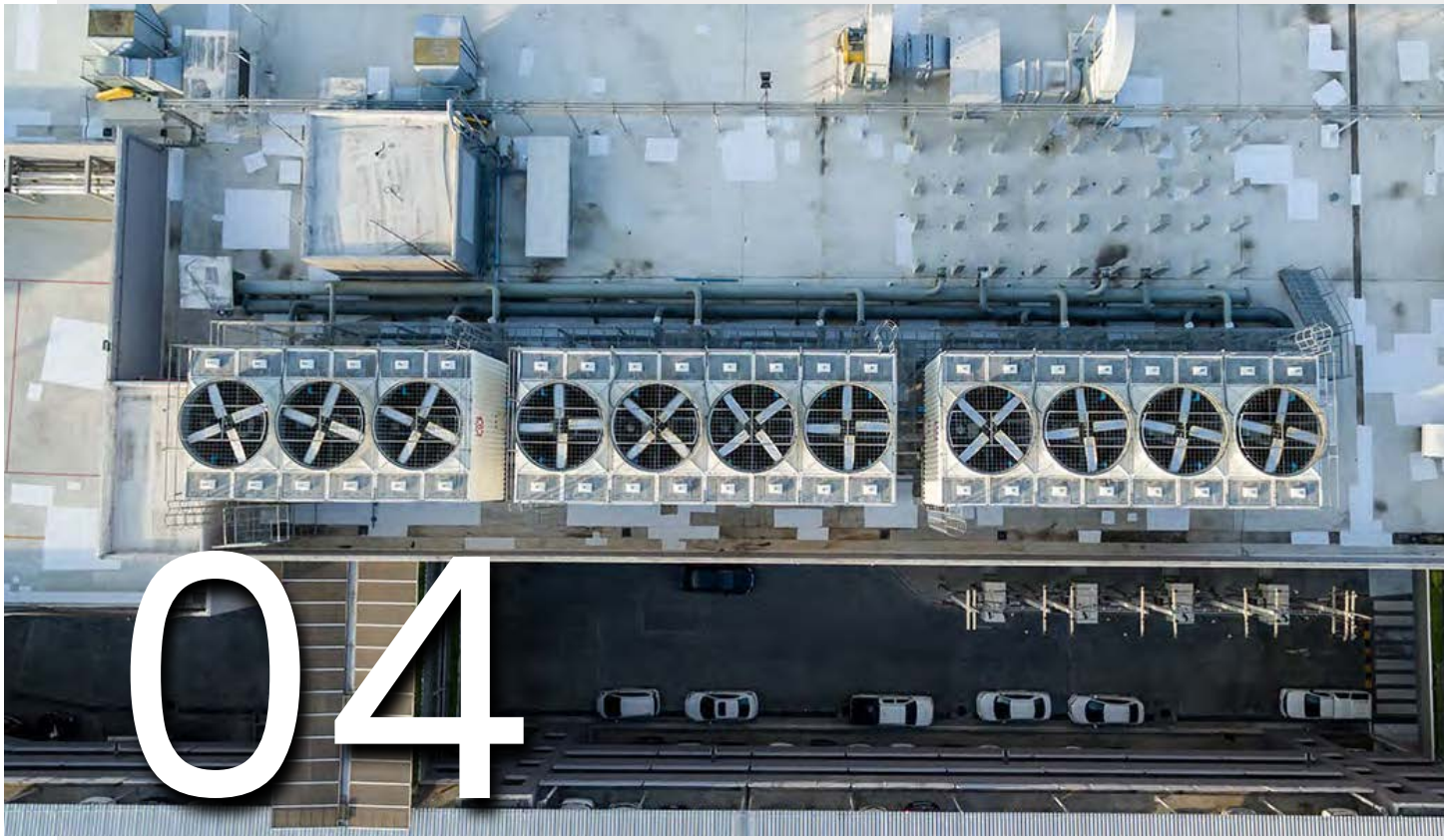
- **Medi-Cities and Institutional Campuses:** Hospitals and large university campuses have steady, year-round cooling loads and are often managed by a single entity, simplifying contractual arrangements and demand aggregation.

3.2 DCS Potential Capacity

It can be observed from Figure 2 that the DCS installations potential estimated under the UNEP-EESL study and ICAP-BAU are ballpark same.

While the theoretical potential is enormous, market readiness, policy support, and financing realities require a conservative yet practical growth trajectory. This roadmap proposes a realistic national target of achieving a cumulative DCS capacity of 6 million TR by 2037-38. This target, equivalent to roughly 300 plants of 20,000 TR each, represents approximately 60% of the ICAP's Low-DCS integration scenario. Achieving this target would firmly establish DCS as a mainstream infrastructure solution and lay the groundwork for exponential growth in the decades to follow.

Please refer to the **Appendix-A** on "Infrastructure Projects and Schemes in India relevant for DCS" for details about government infrastructure projects relevant to DCS



04

BARRIERS IN DISTRICT COOLING SYSTEMS

While the potential of DCS is immense, its journey to mainstream adoption is impeded by significant, systemic barriers. This section provides a critical diagnosis of these challenges, categorizing them into four key areas: policy, finance, market awareness, and technical integration. Understanding these interconnected hurdles is essential for designing the targeted, strategic interventions that form the core of this roadmap.

Despite the compelling benefits and significant potential, the adoption of District Cooling in India has been slow and sporadic. An analysis carried out under the EE Cool programme found several sites in India where centralized cooling system serves multiple buildings. However, these sites mainly operate under a captive model where the owner and beneficiary of the cooling systems are the same entities. Barring a few sites, where the shared cooling infrastructure is operated under a service model (cooling as a service), the examples are limited. The sector's growth is constrained by a complex web of interconnected barriers that span policy, finance, technical, and market domains. Overcoming these hurdles is the central challenge that this roadmap seeks to address. A clear

understanding of these barriers, as identified in consultations with stakeholders and analysis of early projects, is the first step toward designing effective interventions.

4.1 Fragmented Policies and Lack of Regulatory Clarity

This is arguably the most significant barrier. DCS currently exists in a regulatory vacuum in India. It is not officially recognized as a public utility, unlike electricity, water, or natural gas. This creates a host of problems:

No Nodal Agency: No single ministry or agency has a clear mandate to promote, regulate, or oversee DCS. Projects fall between the jurisdictions of Urban Development, Power, Environment, leading to policy fragmentation and a lack of coordinated action.

Absence of Licensing Framework: There is no established process for licensing DCS providers, defining service areas, or ensuring quality of service and consumer protection. This creates uncertainty for investors and can lead to the emergence of unregulated local monopolies.

Right-of-Way (RoW) Challenges: Without utility status, laying the essential underground chilled water pipe network becomes a logistical and legal hassle, requiring numerous permits from various municipal agencies with no streamlined process.

4.2 Financial Barriers and High Upfront Capital Costs

DCS is a capital-intensive infrastructure. The initial investment in the central plant, thermal storage, and extensive distribution network is substantial.

High Perceived Risk: For private investors and financial institutions, the lack of a proven, large-scale market, coupled with revenue uncertainty and long payback periods (often exceeding 10-15 years), makes DCS projects appear high-risk.

Lack of Access to Infrastructure Finance: Because DCS is at a nascent stage, projects struggle to access long-term, low-cost financing options as available to other infrastructure sectors, such as dedicated debt funds, green bonds, or viability gap funding.

Uncertain Revenue Streams: The revenue model depends on securing long-term offtake agreements with multiple customers, whose creditworthiness may vary. The risk of customer default or delayed payments is a major deterrent for private developers.

4.3 Market and Awareness Barriers

There is a significant knowledge gap regarding DCS among key decision-makers.

Low Awareness: Many real estate developers, urban planners, and municipal officials are unfamiliar with the techno-economic benefits of DCS. They often default to conventional, building-level cooling solutions, which are better understood and have a lower initial cost from the developer's perspective.

Demand Aggregation Challenge: The success of a DCS project hinges on aggregating sufficient cooling demand in a dense area to achieve economies of scale. This requires coordinating with multiple building owners, who may have different construction timelines and preferences, making it a complex and time-consuming process.

Split Incentive Problem: Developers, who make the initial decision on cooling systems, are often focused on minimizing upfront CAPEX, while the long-term operational savings (OPEX) benefit the future building owners or tenants. This "split incentive" discourages the adoption of higher-CAPEX, higher-efficiency solutions like DCS.

4.4 Technical and Urban Planning Integration Barriers

Lack of Infrastructure Recognition: DCS is not yet considered core urban infrastructure in city master plans or zoning regulations. This results in a failure to allocate space for cooling plants or access to an electrical substation and dedicated utility corridors for pipelines during the urban planning phase, making installation difficult and expensive.

Absence of Standardized Codes: While BEE has released initial guidelines, India lacks a formal, legally binding "District Cooling Code" that specifies technical standards for design, installation, performance, and metering. Recently, the BIS has published a draft NBC where DCS is included as part of "Part 8 Building Services - Section 3 Air Conditioning, Heating and Mechanical Ventilation". The ECSBC 2024[13] also mentions DCS. However, nothing till date is mandatory.

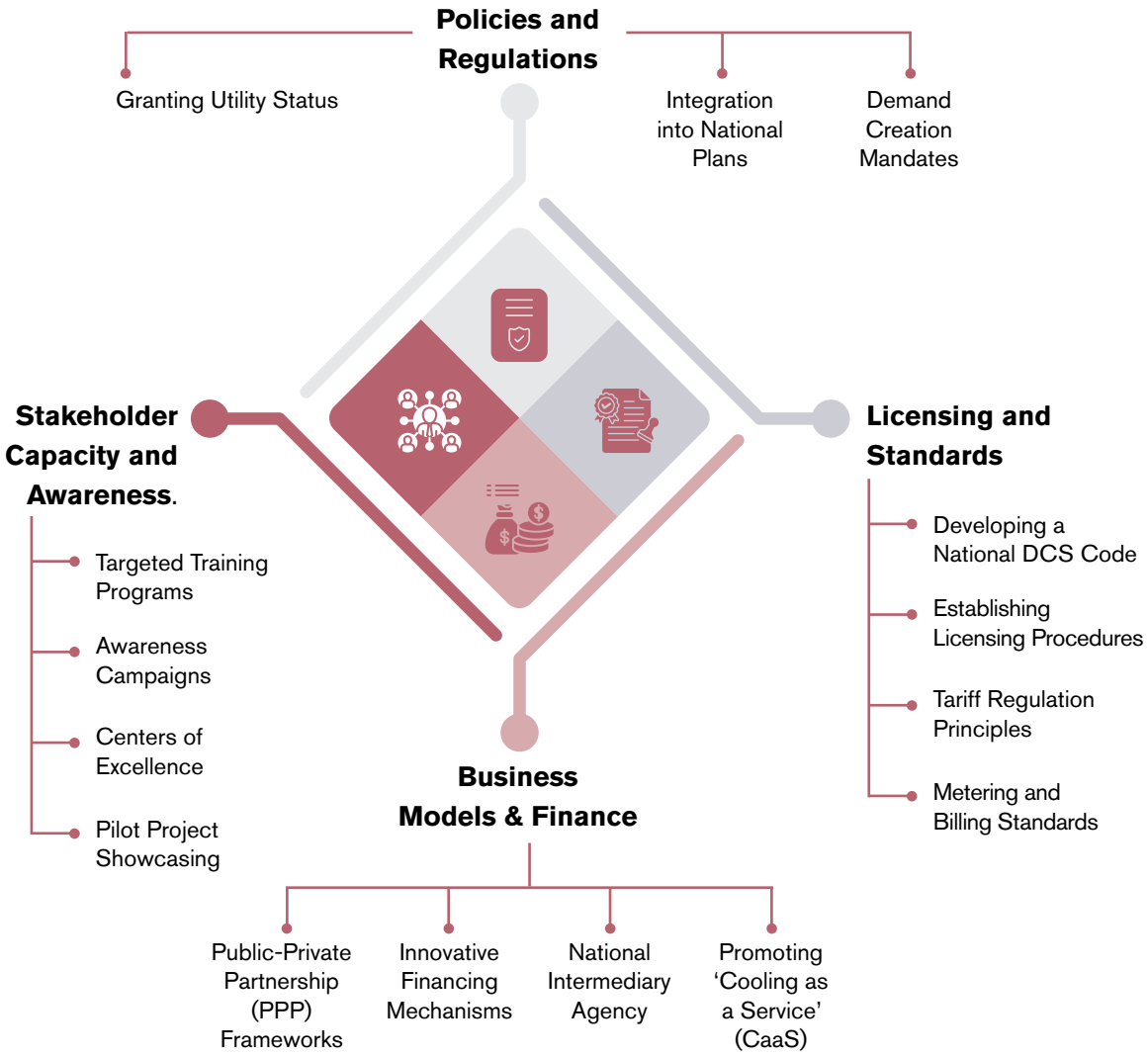
Addressing these barriers requires a concerted, multi-pronged effort that simultaneously builds market confidence, establishes clear rules of engagement, and provides the financial and policy support needed to de-risk investments and unlock the sector's potential.

05

ENABLING ENVIRONMENT: THE FOUR-QUADRANT APPROACH TO MARKET CREATION

To overcome the barriers identified in the previous section, a structured and holistic approach is required to build a functional market for DCS. This section introduces the “Four-Quadrant Approach,” a strategic framework that organizes the necessary interventions into four interconnected pillars:

(1) Policies and Regulations, **(2) Licensing and Standards**, **(3) Business Models and Finance**, and **(4) Stakeholder Capacity and Awareness**. These four pillars work in concert to stimulate the core components of a functioning market: creating predictable demand, fostering a competitive supply side, and attracting ready financiers.



5.1 Policies and Regulations

This is the foundational quadrant, focused on establishing the high-level mandates and legal frameworks that signal DCS as a national priority.

- **Objective:** To provide long-term policy certainty and institutionalize DCS within India's governance structure.
- **Key Levers:**
  - **Granting Utility Status:** Formally recognizing DCS as a public utility, on par with electricity and water, to streamline approvals and right-of-way.
  - **Integration into National Plans:** Embedding DCS into key national policies and guidelines, including the Urban and Regional Development Plans Formulation and

Implementation (URDPFI) Guidelines, the National Infrastructure Pipeline (NIP), Building Codes, and Environmental Impact Assessment (EIA) norms.

- **Demand Creation Mandates:** Introducing policies that require mandatory DCS feasibility studies or mandate its use in specific high-density zones like new townships, SEZs, and smart cities.

5.2 Licensing and Standards

This quadrant focuses on the technical and operational governance of the sector, ensuring quality, reliability, and fair competition.

- **Objective:** To standardize technical performance, ensure consumer protection, and create a transparent process for market entry.
- **Key Levers:**
  - **Developing a National DCS Code:** Formalizing the BEE's *District Cooling Guidelines* into a mandatory code that specifies standards for design, equipment efficiency, installation, and maintenance.
  - **Establishing Licensing Procedures:** Creating a clear, transparent process for granting licenses to DCS operators for specific geographical areas, defining their rights and service obligations.
  - **Tariff Regulation Principles:** Formulating guidelines for tariff setting that balance investor returns, operational costs, and consumer affordability.
  - **Metering and Billing Standards:** Mandating accurate and smart metering protocols to ensure transparent billing and build consumer trust.

5.3 Business Models and Finance

This quadrant is about creating the financial architecture and commercial structures that make DCS projects bankable and attractive to investors.

- **Objective:** To de-risk investments, lower the cost of capital, and enable a diverse range of public and private participation.
- **Key Levers:**
  - **Public-Private Partnership (PPP) Frameworks:** Developing standardized concession agreements and risk-sharing models for DCS projects.
  - **Innovative Financing Mechanisms:** Utilizing instruments like green bonds, infrastructure debt funds, viability gap funding (VGF), and sustainability-linked loans.
  - **A Central Intermediary Agency:** Establishing a government-backed entity like SECI to aggregate demand, provide payment security, and issue large-scale tenders, thereby mitigating risk for private developers.
  - **Promoting 'Cooling as a Service' (CaaS):** Encouraging business models that shift the focus from selling equipment to selling cooling as a measurable service, reducing the upfront cost barrier for consumers.

5.4 Stakeholder Capacity and Awareness

This quadrant addresses the knowledge and skills gap, ensuring that all actors in the ecosystem are equipped to plan, build, operate, and regulate DCS effectively.

- **Objective:** To build a pool of skilled professionals and create widespread understanding and acceptance of DCS.
- **Key Levers:**
  - **Targeted Training Programs:** Developing and delivering training modules for urban planners, municipal officials, engineers, architects, and financial analysts.
  - **Awareness Campaigns:** Launching campaigns to educate real estate developers, building owners, and the public about the long-term economic and environmental benefits of DCS.
  - **Centers of Excellence:** Establishing knowledge hubs for research, best-practice dissemination, and technical support.
  - **Pilot Project Showcasing:** Leveraging successful demonstration projects like GIFT City to provide tangible proof of concept and experiential learning opportunities.

The five strategic pillars of this roadmap presented in Section 7 are designed to directly activate these four quadrants, creating a virtuous cycle where clear policies attract investment, standardized practices ensure quality, and informed stakeholders drive demand, ultimately leading to a mature and thriving DCS market in India.

06

LESSONS FROM DOMESTIC AND INTERNATIONAL GOOD PRACTICES

The path to scaling District Cooling in India does not need to be forged in isolation. A wealth of experience exists, both within India's own successful infrastructure sectors and in mature DCS markets abroad. By strategically adapting these proven models of regulation, market creation, and public-private partnership, India can accelerate its journey and avoid common pitfalls.

6.1 Learning from India's Infrastructure Sectors

India has a strong track record of transforming nascent infrastructure sectors into mature, regulated markets. The journeys of **City Gas Distribution (CGD)**, **Telecom**, and the **Power Sector** offer powerful analogues for DCS[10].

6.1.1 City Gas Distribution (CGD): The CGD sector's growth trajectory is perhaps the most relevant parallel for DCS. Both involve a piped utility network delivering a service to end-users within a defined geographical area.

- **Key Lesson:** The Role of a Strong Regulator and Geographical Exclusivity. The establishment of the Petroleum and Natural Gas Regulatory Board (PNGRB) in 2006 was a game-changer. PNGRB's mandate to grant long-term exclusive licenses for specific "Geographical Areas" (GAs) through competitive bidding created a predictable and de-risked environment for private investment. This model of granting time-bound monopolies for infrastructure rollout, coupled with enforceable service obligations, is directly transferable to DCS. A DCS regulator could similarly auction "Cooling Zones" to private operators.

6.2.2 Telecom Sector: The telecom revolution in India demonstrates how market liberalisation, coupled with a clear regulatory framework, can drive massive private investment and consumer adoption.

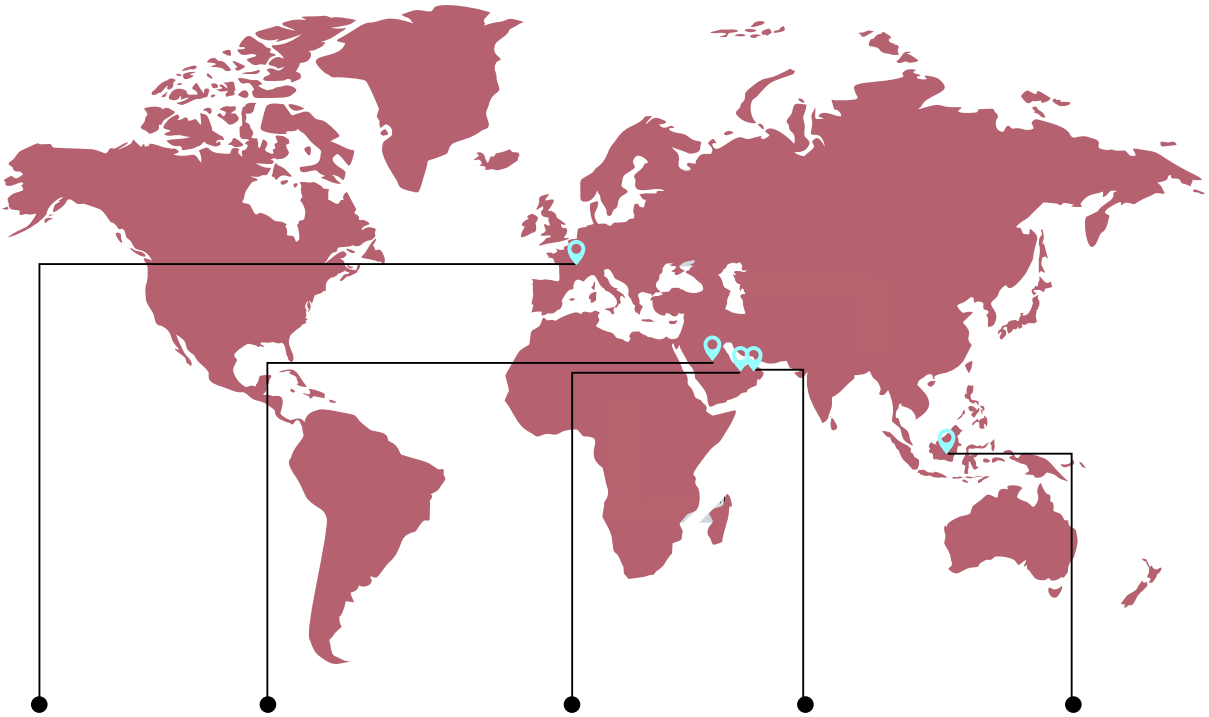
- **Key Lesson: Enabling Infrastructure Sharing.** To optimize capital expenditure, the telecom sector developed a robust model for sharing passive infrastructure like mobile towers. A similar principle can be applied to DCS, where regulations could allow for open access to the primary chilled water distribution network, enabling multiple cooling generation companies to serve a large geographical area. dont use the word district as it will create confusion.

6.3.3 Power Sector (Renewable Energy): The phenomenal success of India's solar energy program offers a blueprint for overcoming high initial capital costs and payment risks.

- **Key Lesson: The Power of an Intermediary Aggregator.** The **Solar Energy Corporation of India (SECI)** played a pivotal role by acting as an intermediary between renewable power producers and state-level distribution companies (DISCOMs). SECI aggregates demand from various DISCOMs, issues large-scale tenders for competitive bidding, and signs Power Purchase Agreements (PPAs) with developers. It then signs back-to-back Power Sale Agreements (PSAs) with the DISCOMs. Crucially, SECI's central government backing provides a payment security mechanism that mitigates the counterparty risk of financially weak DISCOMs. This model is directly replicable for DCS, as detailed in Strategy 3 of this roadmap.

6.2 Learning from International Examples

Mature DCS markets around the world provide tested models for regulation and urban integration. The following table provides a snapshot of policy measures across key countries, highlighting the common threads of dedicated regulators, mandatory requirements, and financial incentives.



France
French Energy Regulatory Commission (CRE).

Saudi Arabia
Electricity & Co-generation Regulatory Authority (ECRA) under Ministry of Water and Electricity (MoWE).

UAE
Dubai Regulatory & Supervisory Bureau (RSB) under Dubai Supreme Council of Energy.

Qatar
Qatar General Electricity & Water Corporation (KAHRAMAA) - District Cooling Department.

Singapore
Energy Market Authority (EMA) - Common regulator for electricity, gas, and DCS.

Table 1: Global Scenario Mapping of DCS - Policy Measures and Penetration

Country	Regulator & Policy Makers	Mandatory Measures	Voluntary Measures & Scaling Factors
Singapore	Energy Market Authority (EMA) - Common regulator for electricity, gas, and DCS.	▶ District Cooling Act 2001 ▶ District Cooling Services Supply Code, 2009 (sets MEPS, defines rights).	▶ Cooling Singapore Project (research initiative). ▶ Tariff incentives for energy efficiency. ▶ Green Mark certification benefits for adoption.
Qatar	Qatar General Electricity & Water Corporation (KAHRAMAA) - District Cooling Department.	▶ DC Regulation (KPIs). ▶ District Cooling Design and Water Management Standards.	▶ Government subsidies for DCS infrastructure. ▶ Long-term concession agreements for private investment.
Saudi Arabia	Electricity & Co-generation Regulatory Authority (ECRA) under Ministry of Water and Electricity (MoWE).	▶ DC Regulation: DCS is a mandate for government projects needing 15,000+ tons of cooling.	▶ Vision 2030 drives DC expansion. ▶ Public-Private Partnerships (PPP). ▶ Incentives for integrating solar energy.
France	French Energy Regulatory Commission (CRE).	None specified, market is driven by incentives.	▶ Carbon tax incentives (VAT reduced from 20% to 5.5% on bills if >50% energy is from renewables/waste heat). ▶ Financial grants for green cooling projects.
UAE	Dubai Regulatory & Supervisory Bureau (RSB) under Dubai Supreme Council of Energy.	▶ DC Regulation. ▶ DCS mandatory for new developments in specified zones (e.g., Business Bay, Palm Jumeirah).	▶ ESCO (Energy Service Company) models. ▶ Subsidized cooling tariffs for early adopters.

6.2.2 **Singapore:** Singapore's approach highlights the power of mandatory integration and strong regulatory oversight.

- **Key Lesson: Mandated Connections and a Dedicated Act.** The **District Cooling Act (2001)** empowers the Energy Market Authority (EMA) to license all DCS providers and regulate prices. Crucially, in designated service areas like Marina Bay, all new developments are *required* to connect to the DCS network[11]. This "mandated hook-up" guarantees the anchor load, making projects financially viable from day one and preventing the installation of redundant, inefficient cooling systems. This is a powerful policy tool for Indian cities to consider in new, high-density development zones.

6.2.3 **France:** The French model, particularly in Paris, showcases how long-term concession agreements and leveraging of unique cooling sources can create a world-class system.

- **Key Lesson: Long-Term Concessions and Innovative Sources.** The Paris district cooling network, one of the largest in Europe, is operated under a long-term concession model by Fraîcheur de Paris (a joint venture)[12]. This provides the stability needed for continuous investment and expansion. The system also innovatively uses cold water from the River Seine for free cooling, significantly boosting its efficiency. This underscores the importance of long-term PPP structures and integrating local environmental assets.

6.3 Dubai Case Study showing DCS evolution

Dubai represents one of the world's most advanced and rapidly scaled DCS markets, offering a comprehensive case study in creating a sector from the ground up.

- **The Genesis:** Dubai's DCS journey began in the late 1990s and early 2000s, driven by the vision to support its rapid, high-density real estate development with efficient and reliable infrastructure. The government established key players like **Empower** and supported the growth of private entities like **Tabreed**.
- **Regulatory Evolution:** Initially, the market was largely self-regulated. However, to ensure sustainable growth, consumer protection, and standardized performance, Dubai established a formal regulatory framework. The **Dubai Supreme Council of Energy (DSCE)** sets the overarching strategy, while the **Regulatory and Supervisory Bureau (RSB)** is responsible for licensing operators, setting technical codes, and regulating tariffs. This evolution from an unregulated to a regulated market provides a key insight for India: proactive regulation is essential to prevent market failures.
- **Key Success Factors:**
  - **Government Vision and Mandates:** DCS was integrated into Dubai's urban master plan. For certain new developments, connecting to the DCS network was made mandatory, creating instant, large-scale demand.
  - **Strong Public-Private Synergy:** The government's role in master planning and regulation, combined with the operational expertise and investment from companies like Empower and Tabreed, created a powerful growth engine.
  - **Focus on Efficiency and Innovation:** The regulatory framework includes performance standards and encourages the use of advanced technologies like Treated Sewage Effluent (TSE) for cooling towers, enhancing sustainability.

- **Clear Commercial Framework:** A transparent and regulated tariff structure provides revenue certainty for operators while protecting consumers from monopolistic pricing.

- **Scaling and Financial Model:** Dubai's success is also a story of a well-structured financial model that evolved over time. The charts below illustrate the symbiotic relationship between policy, investment, and market growth.

The scaling of DCS capacity in Dubai shows a direct correlation with investment. As enabling policies like mandatory CaaS and efficiency targets were introduced, private investment flowed in, accelerating capacity addition from under 1 million RT in 2009 to a projected 25 million RT by 2030.

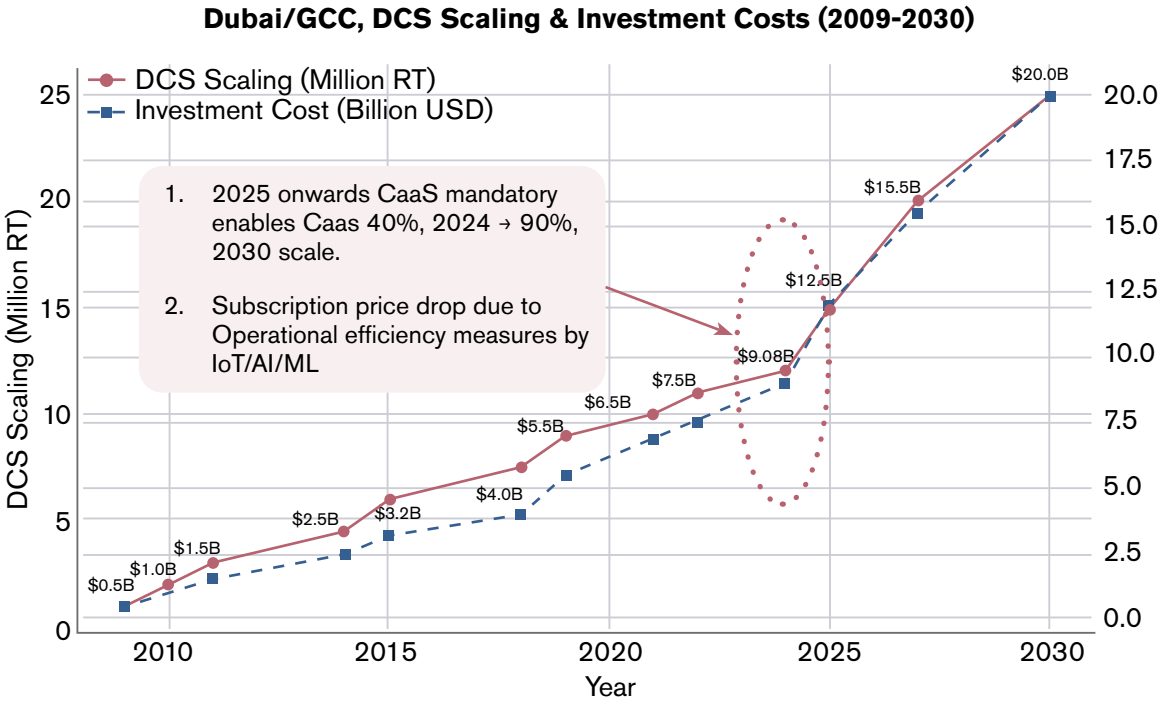


Figure 3: Evolution Trajectory of DCS Scaling in Dubai

The funding sources for this expansion have also matured. Initially reliant on a mix of government support and private capital, the market has increasingly been dominated by Public-Private Partnership (PPP) models. Over time, government subsidies have declined, replaced by structured financing instruments like Green Bonds and carbon credits, demonstrating a clear path towards a self-sustaining, commercially viable market.

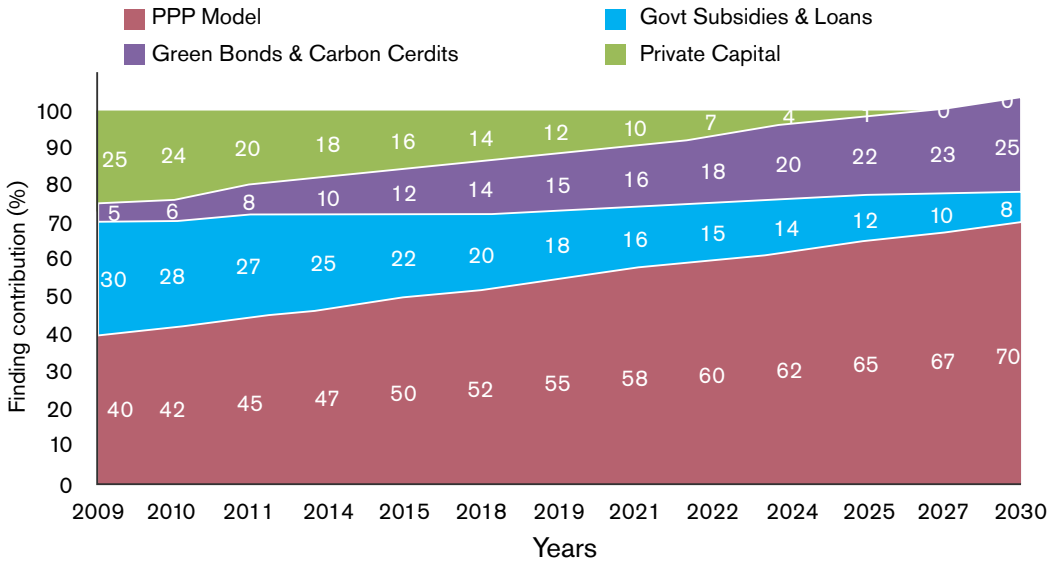


Figure 4: Evolution of DCS project financing models in Dubai

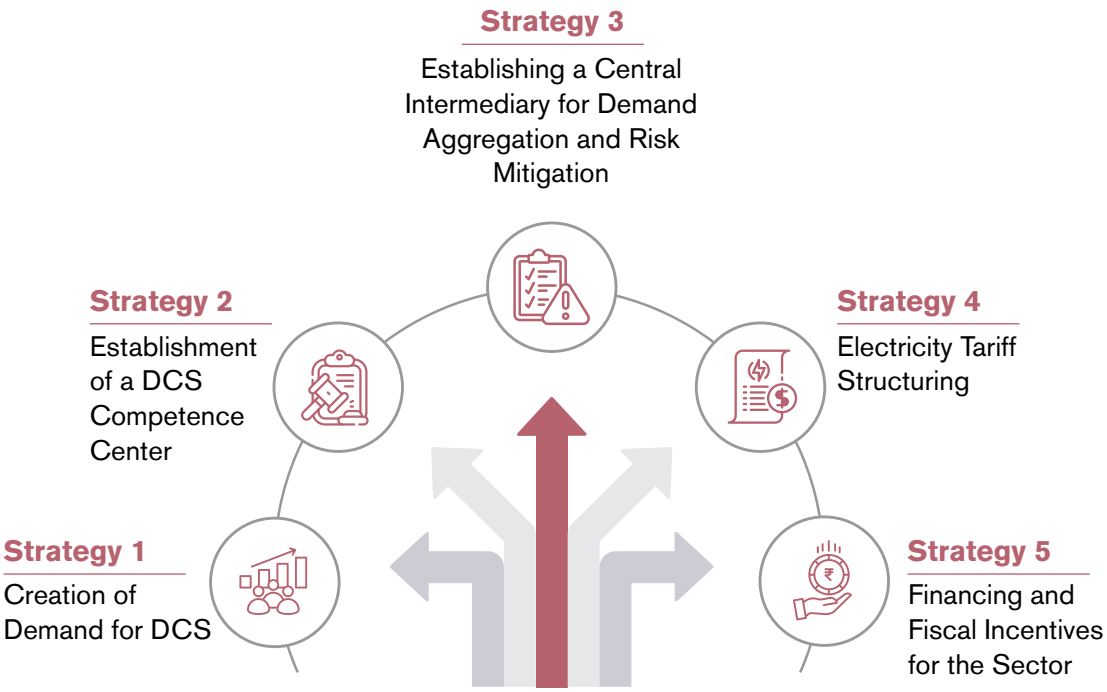
The collective lesson from these domestic and international examples is clear: scaling DCS requires a deliberate and strategic state-led effort. It is not a market that will emerge organically. It necessitates the creation of a robust regulatory framework, the establishment of credible institutions, the use of public-private partnerships, and the integration of cooling into the very fabric of urban planning. Please refer to the **Appendix-B** on “Global Policy Landscape for District Cooling and Learnings for India” for a comprehensive coverage of leading countries policy and regulatory landscape.

07

DCS ROADMAP: A FIVE-STRATEGY APPROACH

This section presents the strategic core of the roadmap: a five-point strategy designed to construct a vibrant District Cooling ecosystem in India systematically. Drawing from the preceding analysis of barriers and best practices, these five pillars—Demand Creation, Regulation, Risk Mitigation, Electricity Tariff Structuring, and Financing—are interconnected and designed for parallel implementation. Together, they provide a comprehensive and actionable blueprint for transforming DCS from a nascent concept into a mainstream urban utility.

The strategies are intentionally focused on national-level interventions, which are deliberate and strategic, as the history of infrastructure market creation in India—from telecom to renewable energy—demonstrates that clear central government policy is the primary catalyst for unlocking private investment and achieving scale. Furthermore, global lessons on DCS deployment corroborate this view, showing that successful markets are built on a foundation of national-level regulation and standardisation. While state and city-level actions are critical for implementation, the initial market-making impetus must originate from the centre to build investor confidence across the country.



7.1 Strategy 1: Creation of Demand for DCS

A sustainable DCS market cannot be built without a predictable pipeline of customers. This strategy focuses on using policy and regulatory levers to create and aggregate demand, shifting the market from a "push" model (where suppliers try to find buyers) to a "pull" model (where projects are developed in response to clear demand signals).

7.1.1 Integrate DCS into Urban Planning via URDPFI Guidelines

The most impactful top-down measure is to amend the **Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines**. By formally recognising DCS as a core physical infrastructure utility alongside water, power, and sanitation, the central government can mandate its consideration in all city master plans and development plans. This would require State Town and Country Planning Departments to identify high-density zones suitable for DCS and create provisions for utility corridors, ensuring that cooling infrastructure is planned from the outset, not as an afterthought.

Special Policy Highlight: URDPFI Guidelines and the Case for DCS Integration

National-level planning guidelines 'Urban Development Plans Formulation and Implementation' (URDPFI) were framed in 1996 by the Institute of Town Planners, India. The URDPFI Guidelines, 1996, provided a plan preparation and implementation framework. They were recently revised in 2014. The guidelines include chapters on different aspects as well as the infrastructure of a city. The guideline discusses physical infrastructure under its subheadings in the infrastructure planning chapter. The sub-chapter details the utilities required/voluntary to be deployed in the cities like electricity, water supply, sewage network, domestic gas supply pipeline, rain water harvesting, drainage, and telecom. For DCS to be formally recognised as a utility for cities, its inclusion in this section is necessary.

Including DCS directly in the guidelines shall not be possible, as the technology itself is at a very nascent stage in India. Thus, based on the defined need for alternate cooling infrastructure, a section could be introduced in the guidelines document. These Alternate/Sustainable Cooling systems could delve into the technology, posing it as one of the solutions. In a broader picture, this would be a part of the already existing physical infrastructure section, which provides details about the existing utilities in the country like water, electricity, sewerage, domestic gas, telecom, drainage, like what is mentioned under the telecom services, DCS could be integrated with the utility corridor, and Right of Way (RoW) permission should be made available for its services (Ministry of Urban Development, 2015).

The Figure 5 is a snip from the URDPFI Guidelines Volume 1. In the latest available document, Chapter 8 focuses on Infrastructure Planning, with sub-section 8.3. being dedicated to Physical Infrastructure

Figure 5: A snip from the URDPFI Guidelines Volume 1.

Source: Urban and Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, 2014. Ministry of Urb\an Development, Government of India, 2014

The above figure shows the section, as discussed above, that details the existing physical infrastructure in Indian cities. District cooling, being a utility, if included in URDPFI guidelines, shall be a sub-section under this heading.

Apart from this, multiple other sections in the current version of the document support the adoption of energy-efficient technologies like DCS.

- Section 5.4.1., 5.4.2. and 5.4.3. (Green City, Compact City & Smart City respectively) under 5.4. Urban Planning Approach: The section details three city types, listing their elements and undertaken initiatives. Cooling as an element along with DCS as an initiative could be included for them considering the future demand as well as from cases like Rajkot, etc., which are working towards adopting DCS city-wide (smart city area)

- Section 6.1.4. Urban Infrastructure under 6.1. Sustainable Development: The section emphasizes sustainable urban infra in a city, and DCS could be a necessary addition to it

- Section 6.4. Environment Policies and Statutory Obligations: Adoption of ICAP can be promoted by adding another sub-section under this, where critical recommendations from ICAP could be discussed, highlighting DCS

Inclusion of DCS in the URDPFI Guidelines would give it the required **infrastructure recognition** alongside other utilities in a city, which shall lead to its inclusion as a physical infrastructure in upcoming planning documents like master/development plans nation-wide.

7.1.2 Mandate DCS Feasibility Studies through EIA Norms

The Ministry of Environment, Forest and Climate Change (MoEF&CC) should revise the Environmental Impact Assessment (EIA) notification. For large-scale development projects (e.g., those exceeding a specified built-up area or cooling load, such as 50,000 sq.m.), the EIA process should mandate a **"DCS Feasibility Assessment."** The GIFT City's EIA report, which demonstrated the designed power demand reduction and CO_2 savings from DCS compared to conventional cooling, provides a useful template. If DCS is found to be feasible and superior, its adoption could be made a condition for environmental clearance, creating a powerful regulatory driver.

7.1.3 Strengthen and Mandate DCS in Building Codes (NBC and ECBC)

The Bureau of Energy Efficiency (BEE) should move to convert its *District Cooling Guidelines* into a mandatory **"DCS Code,"** which would be integrated into the National Building Code (NBC) and the Energy Conservation Sustainability Building Code (ECSBC). The ECSBC could be strengthened to require large commercial buildings and campuses in designated "DCS Zones" to connect to the district network. This ensures that buildings are not only designed to be efficient but are also part of a more efficient system-level solution.

7.1.4 Recognize DCS in the National Infrastructure Pipeline (NIP) and Harmonized List

The Ministry of Finance must officially include "District Cooling Systems" in the **Harmonized Master List of Infrastructure Sub-sectors**. This single action would unlock access to critical long-term financing, including infrastructure debt funds, lower-cost foreign borrowing (ECB), and financing from institutions like the India Infrastructure Finance Company Limited (IIFCL) and National Investment and Infrastructure Fund (NIIF). Furthermore, including a clear pipeline of DCS projects in the next iteration of the National Infrastructure Pipeline would provide visibility and confidence to domestic and international investors.

Please refer to the AEEE website for a dedicated blog on "Cooling the Future: Making District Cooling a Core Infrastructure in India's Urban Strategy", where the authors have made a strong case for DCS to be considered as a public infrastructure and bring alignment with the National Infrastructure Pipeline.

7.2 Strategy 2: Establishment of a National DCS Competence Center

To address the systemic hurdles identified in Chapter 4, a national DCS Competence Center is essential. This initiative is a primary lever under the "Stakeholder Capacity and Awareness" quadrant of the "Four-Quadrant Approach". While regulatory frameworks provide the market rules, the center will focus on building and strengthening the institutional and human capacity to implement them. The center will provide policy advisory, project support, technology transfer, training, and capacity building for the long-term support of the diffusion of energy-efficient District Cooling Systems in India. The center can be incubated in a virtual mode initially to kick start the process as it will enable the immediate dissemination of training modules, design guidelines, and best practices without the delays of a physical infrastructure setup. As the market matures and right set of partners are identified, the centre could transition into a physical competence center.

7.2.1 Potential Core Functions

The Competence Center could act as a central node for:

- **Policy Advisory:** Supporting governments in drafting DCS-conducive policies and integrating cooling into urban master plans.
- **Technical Support:** Assisting developers with feasibility studies and standardisation, connecting Indian stakeholders with global bodies like ISO and ASHRAE.
- **Capacity Building:** Developing certification programs to create a skilled workforce of engineers and technicians.

The centre should operate under a Steering Committee chaired by entities like the Bureau of Energy Efficiency (BEE). The selection of a physical centre would depend on several factors. Ideally, it can be planned to be strategically co-located with an existing successful DCS project (e.g., GIFT City) fostering knowledge sharing and collaboration, or within a state with strong policy support and government backing on DCS adoption to ensure practical relevance (e.g., Tamil Nadu or Gujarat). Implementing partners could include academic institutions or industry associations to ensure neutrality and technical depth.

7.3 Strategy 3: Establishing a Central Intermediary for Demand Aggregation and Risk Mitigation

The early years of the solar power boom in India were plagued by fragmented demand and high counterparty risk from state DISCOMs. The creation of the Solar Energy Corporation of India (SECI) was the solution. A similar entity for DCS through a **District Cooling Corporation of India (DCCI)** could catalyze the market in the same way.

7.3.1 Case Study: The SECI Model for Renewable Energy

The challenges facing the nascent DCS sector—fragmented demand, high capital costs, and weak buyer creditworthiness—are remarkably similar to those that confronted India's renewable energy sector a decade ago. SECI was established as a Central Public Sector Enterprise (CPSE) specifically to overcome these barriers. By acting as a credible intermediary, SECI successfully de-risked the sector and unlocked massive private investment (see the Table below on the lessons for DCS).

Table 2: How SECI Addressed Barriers in Renewable Energy – Lessons for DCS

Barrier	Challenge in Renewable Energy	SECI's Intervention	Result
Fragmented demand	Individual DISCOMs procured small volumes, leading to unviable projects	Aggregated demand from multiple DISCOMs and issued large tenders	Achieved economies of scale, reduced tariffs, made projects bankable
High upfront capital cost	Developers faced high risk premiums due to uncertainty and small project sizes	Introduced competitive bidding and bundled projects at scale	Brought down cost of capital, attracted global investors
Revenue / offtake risk	DISCOMs often delayed or defaulted on payments to developers	Tri-partite arrangement: Developer ↔ SECI (PPA) SECI ↔ DISCOM (PSA)	Revenue certainty for developers, stronger investor confidence
Weak buyer creditworthiness	Many DISCOMs had poor financial health, increasing the risk of default	Created Payment Security Mechanism with RBI/sov. guarantee	Developers assured of timely payment, sector de-risked
Lack of standardized contracts	Early PPAs were inconsistent, creating legal/financing hurdles	Developed model PPAs adopted nationally	Legal clarity, faster financial closure, sector-wide trust

The Figure 6 below illustrates the Tripartite Agreement (TPA), a key mechanism in the Indian renewable energy sector that guarantees payment security.

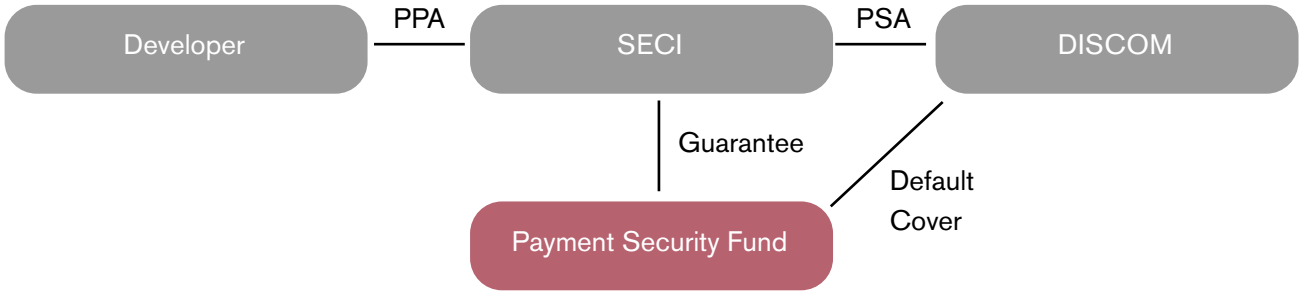


Figure 6: Schematic of Tripartite Agreement (TPA) mechanism in the Indian renewable energy sector

This arrangement involves three primary parties: the Renewable Energy Developer, the Solar Energy Corporation of India (SECI), and the State Distribution Company (DISCOM), with the Central Government and the Reserve Bank of India (RBI) providing the ultimate risk guarantee. If a State DISCOM defaults on its payment to SECI, the Central Government can instruct the RBI to directly debit the overdue amount from the defaulting State Government's account. This debited amount is then credited to SECI. This sovereign guarantee ensures that SECI always receives its payment, allowing it to fulfil its payment obligations to the renewable energy developers. This removes counterparty credit risk for the developers, making projects more attractive to investors and lenders and significantly lowering the cost of capital.

7.3.2 Replicate the SECI Model's Benefits

A district cooling corporation would replicate the core functions of SECI to create a bankable and scalable market for District Cooling:

- **Demand Aggregation:** The DCCI would act as a central aggregator, identifying potential DCS zones (e.g., an IT park with 20 buildings) and signing preliminary Cooling Service Agreements (CSAs) with all potential customers. It would then bundle this aggregated demand into a single, large-scale, bankable project.

- **Risk Mitigation:** The DCCI would issue a competitive tender for this project and sign a master **Chilled Water Purchase Agreement (CWPA)** with the winning private developer. The developer's counterparty would be the creditworthy, sovereign-backed DCCI, not the individual building owners. This eliminates the primary commercial risk for the developer.
- **Payment Security:** The DCCI would then manage the back-end CSAs with the end-users. A tripartite agreement between the central government, state governments, and the RBI—similar to the one backing SECI—could provide the ultimate payment security, ensuring the DCCI can always meet its obligations to the developer.

7.3.3 Identify Potential Entities to House this Function

This intermediary role could be incubated within an existing Public Sector Undertaking (PSU) with a strong balance sheet and experience in infrastructure or energy services. SECI, NTPC, or EESL, which already has experience with demand aggregation and innovative business models, is a prime candidate to pilot this function. Over time, as the project pipeline grows, this function could be spun out into a dedicated DCCI.

Please refer to the separately published Policy Brief on "Accelerating District Cooling in India – Lessons from SECI's Model for Demand Aggregation and Risk Mitigation" for details on the rationale of a SECI-like approach to create a DCS industry in India and the way forward.

7.4 Strategy 4: Electricity Tariff Structuring

A transparent, predictable, and fair electricity tariff structure is essential for both consumer adoption and investor confidence. The tariff must allow operators to recover their capital and operational costs while providing a reasonable return, and it must offer a compelling value proposition to customers compared to the lifecycle cost of standalone cooling systems. The graph below shows the life cycle benefits of DCS. Please note that this is for a specific case and for a defined set of assumptions. The key takeaway insight is that the life cycle economics are highly dependent on the electricity price and therefore is an important lever to drive DCS adoption.

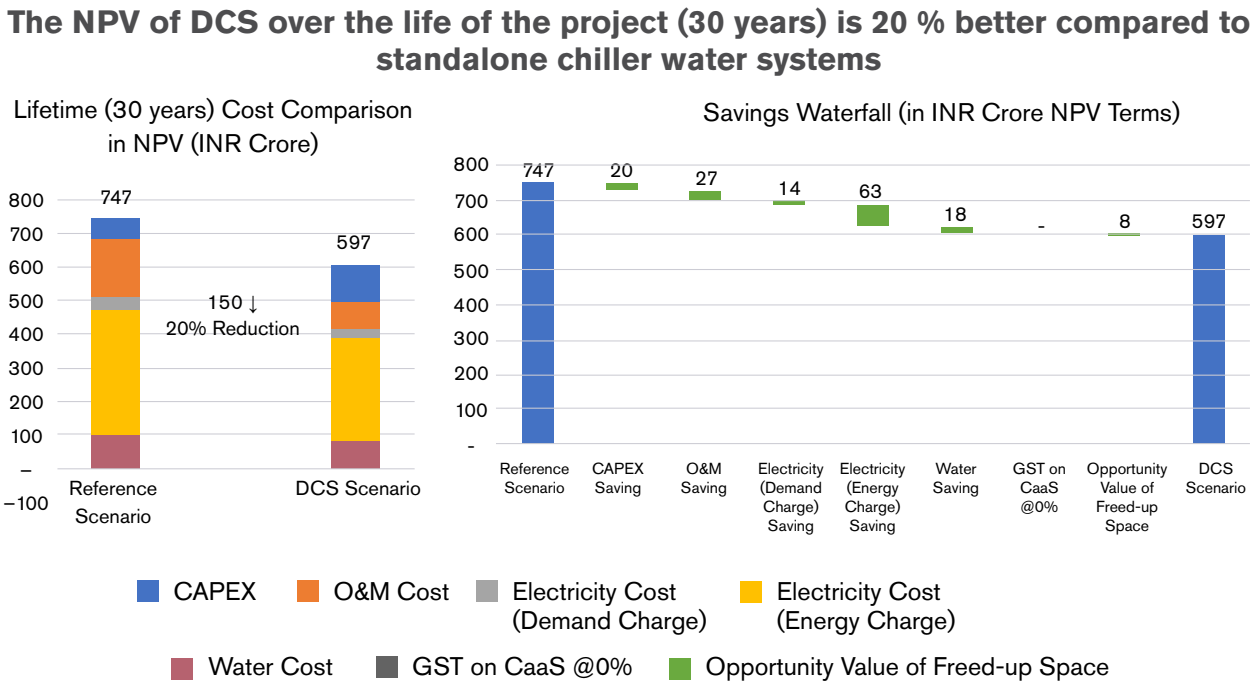


Figure 7: Life cycle cost analysis of DCS compared to standalone chilled water system

7.4.1 Address the Problem of Distorted Electrical Tariffs

DCS plants are large, energy-intensive industrial facilities. However, they often serve commercial or residential buildings and hence often treated as a commercial activity. This can lead to tariff anomalies where the DCS plant ends up paying a higher tariff (e.g., commerical category) depending on its location, thereby eroding the benefits to its potential customers.

7.4.2 Create a Special Electricity Tariff Category for DCS

The regulator (or SERCs in the interim) should create a new, dedicated electricity tariff category for District Cooling plants. This tariff should reflect the grid-supportive nature of DCS (e.g., peak load reduction) and be competitive. The state of **Maharashtra**, for example, has created special tariffs for certain infrastructure projects, providing a precedent that can be followed. The following placeholder table illustrates the typical tariff disparity across key states with high cooling demand, underscoring the financial challenge for a DCS plant often classified under a high-cost industrial or commercial tariff while its customers may fall under lower-cost categories.

Table 3: Indicative Electricity Tariff Comparison in Key States (2025)

State	Residential Tariff (Avg. ₹/kWh)	Commercial Tariff (Avg. ₹/kWh)	Industrial (HT) Tariff (Avg. ₹/kWh)
Maharashtra	~7.50	~11.50	~9.50
Tamil Nadu	~5.50	~9.00	~8.50
Gujarat	~6.50	~8.50	~7.50
Andhra Pradesh	~6.00	~9.50	~8.00
Telangana	~7.00	~10.50	~9.00

Note: *Tariffs are indicative and represent average costs for high-consumption slabs as of 2025. Actual rates vary based on DISCOM, consumption level, and other charges.*

7.4.3 Leveraging Thermal Energy Storage and Time-of-Day Tariffs for Grid Flexibility

DCS, when integrated with Thermal Energy Storage (TES), transforms from a mere energy efficiency measure into a powerful tool for grid management. TES allows a DCS plant to store cooling energy (as chilled water or ice) during off-peak hours when electricity is cheap and abundant—such as overnight or during midday solar generation peaks. This stored cooling is then dispatched during peak demand hours, reducing the need to run chillers at full capacity when electricity is most expensive and the grid is most stressed.

The key enabler for this is a **Time-of-Day (ToD) tariff** structure for DCS plants. By creating a significant price differential between peak and off-peak electricity, ToD tariffs provide a direct economic incentive for operators to maximize TES utilization. This provides critical **demand flexibility** to the grid operator (DISCOMs). In a grid emergency or a sudden supply deficit, a DISCOM could signal a DCS plant to curtail its electricity consumption, with the plant seamlessly switching to its stored cooling reserves to serve its customers without any interruption. This capability is invaluable for supply-demand management, helping to flatten the grid's load curve and reducing the reliance on costly and polluting peaker power plants.

7.5 Strategy 5: Financing and Fiscal Incentives for the Sector

Given the high upfront capital expenditure, targeted financial and fiscal support is crucial in the early stages to improve project viability and attract private capital.

7.5.1 Provide Viability Gap Funding (VGF)

For initial flagship projects that have high strategic value but may not be fully commercially viable on their own, the government should provide Viability Gap Funding to cover a portion of the CAPEX. This would reduce the risk for the private developer and help establish a track record for the sector.

7.5.2 Offer Fiscal Incentives

- **GST Exemption and Rate Rationalization:** Cooling is an essential service for economic productivity, and "Cooling as a Service" provided by DCS utilities could benefit from a lower GST rate or exemption. The current 18% GST on most district cooling goods and services increases project costs and extends payback periods, limiting the financial feasibility of new projects. Reducing or exempting GST would improve the use of input tax credits, lower financial barriers for private developers, and align tax policy with energy efficiency goals, thereby supporting sector growth and accelerating private investment in sustainable cooling infrastructure.
    - Proposed Rate Structure: Considering the unique role of district cooling services and their potential benefits, the following GST rate structure could be considered:
        - » Reduced rate of 12% for standard district cooling services to lower overall project costs and encourage adoption.
        - » Further reduced rate of 5% for district cooling plants that meet specified energy efficiency benchmarks or utilize renewable energy sources, incentivizing sustainable practices.
        - » Zero-rating for district cooling services overall, or zero-rating for specific sectors where cooling is critical, to maximize economic and environmental impact

Please refer to the separately published Policy Brief "Applicability of Goods and Services Tax (GST) to District Cooling Plants in India" for the details and the way forward

7.5.3 Implement Targeted Risk Mitigation Instruments

Beyond direct financial support, the government must address the significant revenue risks that deter private developers. The long-term nature of DCS projects makes them vulnerable to uncertainties such as **lower-than-forecast load growth, customers exiting their contracts, or cooling sales falling below projected estimates**. The table below illustrates the revenue shortfall in the case of a sluggish demand. These revenue shortfall risks can jeopardize a project's ability to recover its fixed costs and service its debt.

Table 4: Illustrative estimation of revenue shortfall in a district cooling project under scenarios of lower-than-expected cooling demand

	Unit	Yr 0	Yr 1	Yr 2	Yr 3
Total capacity	TR	10,000			
Total maximum demand	TR	9,000			
Investment	INR	₹ 1,50,00,00,000			
Annual demand projected at full capacity	TR		9,000	9,000	9,000
Annual demand actual	TR		6,000	7,000	8,000
Fixed cost recovery projected	INR/Year	₹ 15,91,20,000	₹ 15,91,20,000	₹ 15,91,20,000	₹ 15,91,20,000
Fixed cost recovery actual	INR/Year		₹ 10,60,80,000	₹ 12,37,60,000	₹ 14,14,40,000
Shortfall in fixed cost recovery	INR/Year		₹ 5,30,40,000	₹ 3,53,60,000	₹ 1,76,80,000

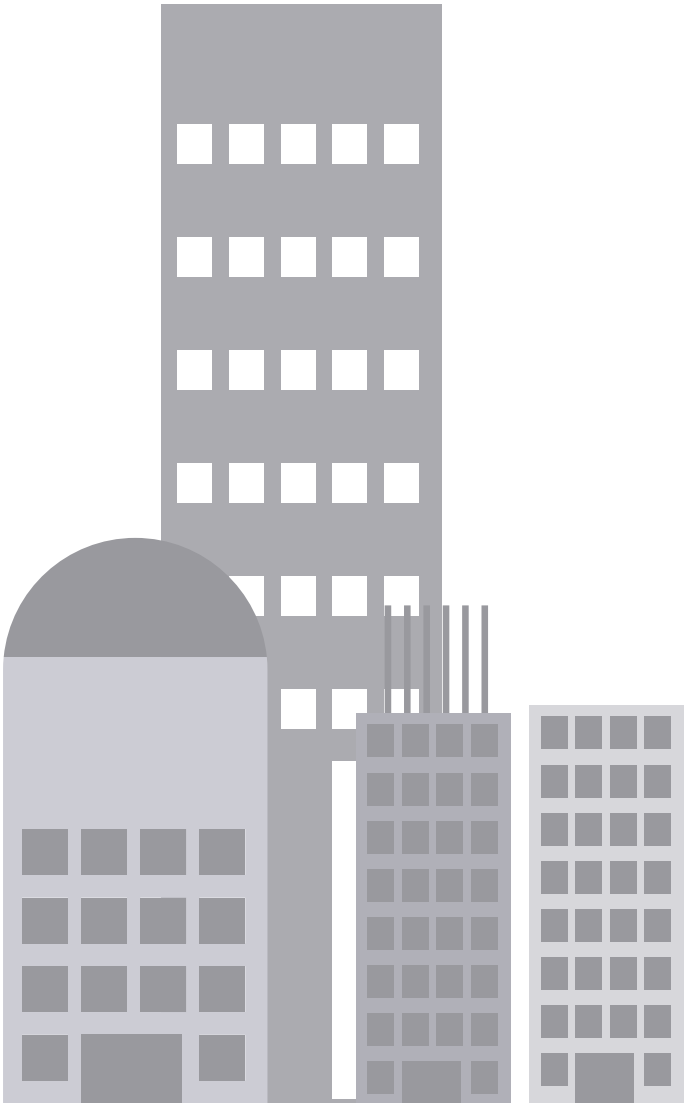
To counter this, an upward revision of the fixed tariff will be needed which will be detrimental for customer adoption. Aan approach to protect both developers will be through a risk guarantee fund or risk-sharing facility which will shield investors and lenders by offering compensation for a pre-defined portion of revenue loss if, for instance, sales fall more than 10% below contracted estimates due to unforeseen market conditions. These guarantees would not cover commercial mismanagement but would act as a crucial backstop against systemic market risks (financial impact of major anchor customers exiting prematurely or a slower-than-expected build-out of a new development area), making projects significantly more bankable.

7.5.5 De-risking Projects through Balanced Contractual Agreements

Beyond fiscal incentives and direct funding, the structure of the legal agreements underpinning a DCS project is essential for attracting finance. Financiers, from commercial banks to infrastructure funds, scrutinize Concession Agreements and Service Agreements to assess the project risks, that impacts the risk profile of a project, thereby enabling access to capital at a lower cost. By developing standardized, bankable Concession and Service Agreement model documents that incorporate these principles of balanced risk, the government can significantly ease the challenge of perceived risks for new DCS projects, making them more attractive to both developers and the financial community. While this roadmap doesn't provide any model document, key provisions that need to be included in the Concession Agreement and Service Agreement have been identified. This includes:

- **Flexible and Adequate Timelines** for complex processes like achieving Financial Closure, without punitive penalties for minor delays, acknowledges the practical realities of infrastructure development and improves project feasibility.
- **Fair Termination Clauses** provides crucial stability to the developer during the high-risk initial phases. Furthermore, clauses that compensate the developer for delays or disruptions caused by the authority (e.g., in providing utility connections) ensure that the developer is not unfairly penalized for factors outside its control.
- **Measurable Performance Standards** incorporating clear Key Performance Indicators (KPIs) such as for system availability, energy efficiency (kW/TR), and service response times provides a transparent framework for performance management and enforcement of damages.

Appendix-C presents a set of proposed revision and additional contractual clauses tailored to the development and operation of a district cooling plant. The approach draws on the Hyderabad Pharma City model as a reference point, with relevant provisions adapted to better suit the specific needs. Several of the proposed revisions and their rationale are also informed by comparable clauses found in other PPP agreements reviewed during the course of research. This illustrative document is intended to serve as a starting point for future model documents



08

ROLE OF DIFFERENT MINISTRIES AND INSTITUTIONS

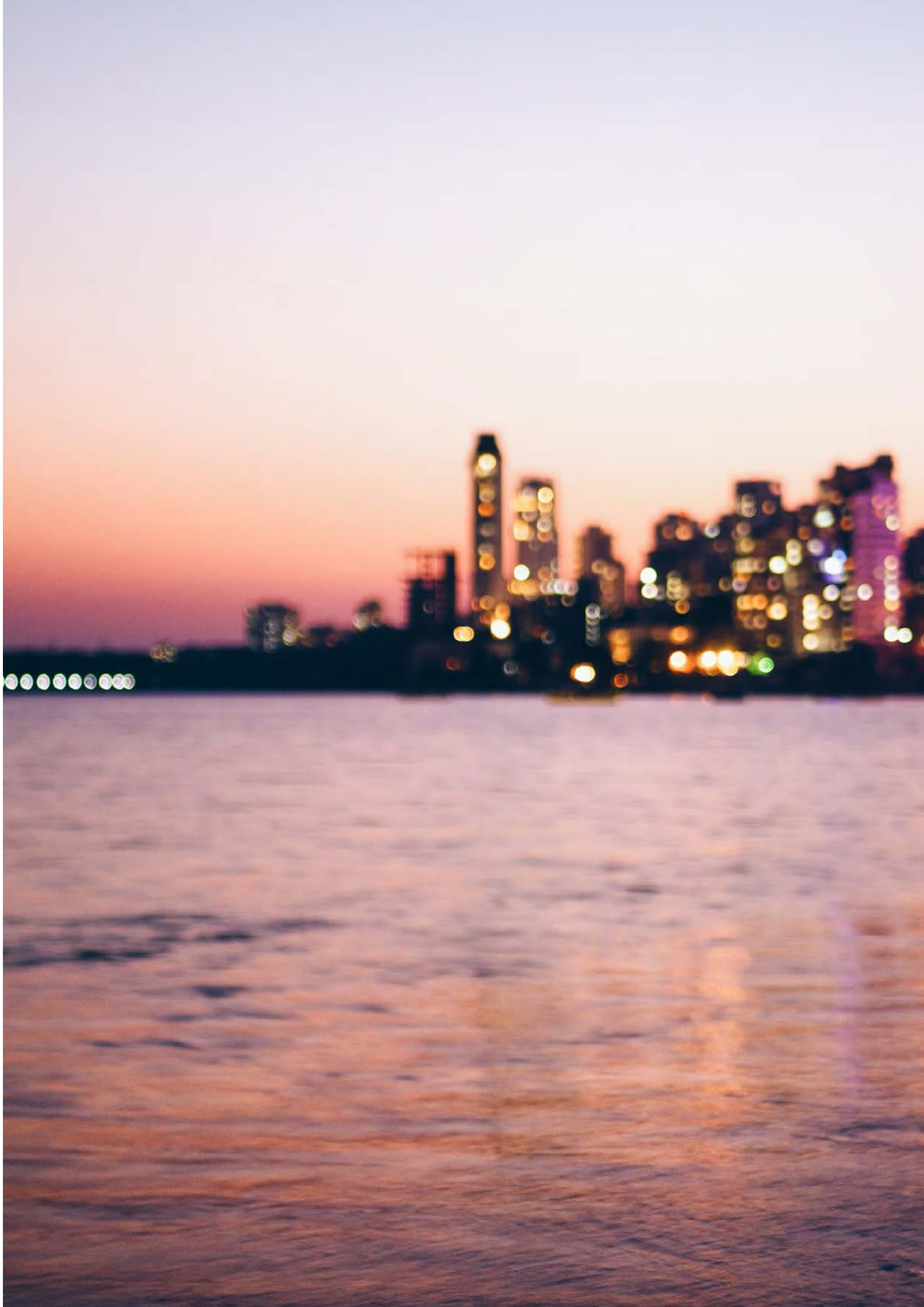
This section translates the strategic framework into a concrete governance model, assigning clear roles and responsibilities to the key governmental bodies that will drive the DCS roadmap. A successful, nationwide scale-up depends on a “whole-of-government” approach where ministries and agencies work in concert. The following table outlines this collaborative structure, ensuring accountability and coordinated action across the central, state, and city levels.

The successful implementation of the five-pillar strategy requires a “whole-of-government” approach, with clearly defined roles and responsibilities for various ministries and institutions at the central, state, and city levels. A coordinated governance structure is essential to break down silos and ensure that policies are aligned and mutually reinforcing.

Table 5 Role of Different Ministries and Institutions in DCS Roadmap

Level	Institution / Ministry	Primary Role and Key Responsibilities in DCS Roadmap
Central	Ministry of Environment, Forest & Climate Change (MoEF&CC)	**Policy Anchor and Climate Alignment:** As the nodal ministry for the ICAP, lead inter-ministerial coordination. Integrate DCS into national climate targets (NDCs). Revise EIA norms to mandate DCS feasibility studies and fast-track clearances for DCS-integrated projects.
	Ministry of Power (MoP) / Bureau of Energy Efficiency (BEE)	**Energy Efficiency and Standards:** Drive the transition of BEE's DCS Guidelines into a mandatory National DCS Code. Integrate DCS into demand-side management (DSM) policies. Guide SERCs in creating a special electricity tariff category for DCS.
	Ministry of Housing and Urban Affairs (MoHUA)	**Urban Integration and Planning:** Amend the URDPFI Guidelines to recognize DCS as essential urban infrastructure. Drive DCS adoption through national urban missions like the Smart Cities Mission and AMRUT. Guide State Town Planning Departments to incorporate DCS in city master plans.
	Ministry of Finance (MoF)	**Financial Enablement:** Officially include DCS in the Harmonized Master List of Infrastructure Sub-sectors. Earmark funds for Viability Gap Funding (VGF) for pilot projects. Create fiscal incentives (tax breaks, accelerated depreciation). Promote green financing instruments like Sovereign Green Bonds for DCS. Develop standard bidding document and service agreement.
	Intermediary Agency (e.g., EESL or new DCCI)	**Market Creation and Risk Mitigation:** Act as the central demand aggregator. Issue large-scale tenders for DCS projects. Provide payment security to developers through back-to-back Cooling Purchase and Sale Agreements.
	NITI Aayog	**Strategic Oversight and Coordination:** Provide high-level strategic guidance and facilitate inter-ministerial dialogue to ensure policy coherence and track progress against roadmap targets.

Level	Institution / Ministry	Primary Role and Key Responsibilities in DCS Roadmap
State	State Urban Development Department (UDD)	**State-Level Implementation:** Designate a State Nodal Agency for DCS. Adapt central guidelines to the state context. Mandate DCS adoption in large-scale state-level housing and infrastructure projects.
	State Electricity Regulatory Commission (SERC)	**Tariff Implementation:** Notify and implement the special electricity tariff category for DCS plants within the state, as guided by the MoP.
	State Industrial Development Corporations (SIDCs)	**Industrial Adoption:** Promote and facilitate the development of DCS in greenfield and brownfield industrial parks, SEZs, and manufacturing clusters.
City	Urban Local Bodies (ULBs) / Municipal Corporations	**Ground-Level Execution:** Amend local building by-laws and development control regulations (DCRs) to align with the DCS-integrated URDPFI guidelines. Grant Right-of-Way (RoW) permits for pipeline networks in a streamlined manner. Identify and zone areas for mandatory DCS implementation.
	Smart City SPVs / Development Authorities	**Pilot Project Champions:** Act as the primary clients or partners for implementing flagship DCS demonstration projects. Aggregate demand from public and private buildings within their jurisdiction.
	Electricity Distribution Companies (DISCOMs)	**Grid Integration Partner:** Collaborate with DCS operators on load management. Could potentially act as a DCS utility provider themselves, offering 'cooling as a service' as a new business vertical.

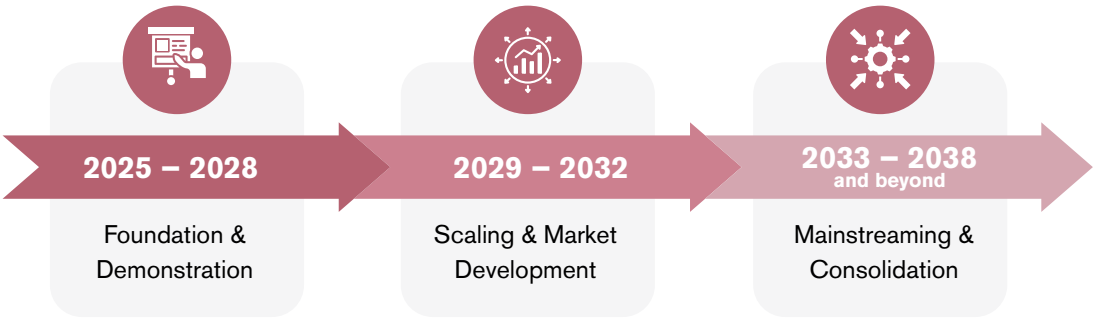


09

TIME SCHEDULE FOR THE FIVE-PILLAR STRATEGY

A long-term vision requires a structured, time-bound implementation plan. This section breaks down the five-pillar strategy into a phased timeline spanning from 2025 to 2038 and beyond. By defining clear actions and milestones for each phase—Foundation and Demonstration, Scaling and Market Development, and Mainstreaming and Consolidation—this schedule provides a practical guide for policymakers to track progress and ensure momentum is maintained.

The implementation of this roadmap is envisioned as a dynamic, phased process spanning the next decade and beyond. The timeline is structured to build momentum, starting with foundational policy actions and pilot projects, and moving towards market maturation and large-scale deployment.



9.1 Phase 1: Foundation and Demonstration (2025 – 2028)

Objective: Establish the core policy framework, establish the knowledge centre, launch high-visibility pilot projects, and build market confidence. Target: 1.5 million TR cumulative capacity.

Demand Creation

Key Actions (2026-2028)

- MoF: Include DCS in Harmonised List of Infrastructure.
- MoHUA: Formulate draft amendments for URDPFI Guidelines.
- MoEF&CC: Issue notification mandating DCS feasibility in EIA for large projects.

DCS Competence Center

Key Actions (2026-2028)

- Establishing a virtual knowledge centre in India
- Repository of knowledge products and training materials
- Identification of a suitable supporting institution for the physical competence centre

SECI-like Body

Key Actions (2026-2028)

- DCCI: Establish a dedicated vertical to pilot the demand aggregation model for 2-3 flagship projects. Develop standardized contract documents (CWPA/CSA).

Tariff Structuring

Key Actions (2026-2028)

- MoP: Issue advisory to SERCs to create a special electricity tariff category for DCS.
- CERC/FOR: Publish model electricity tariff guidelines for consumer billing.

Finance & Incentives

Key Actions (2026-2028)

- MoF:
  - Announce VGF scheme and initial fiscal incentives for the first 1 million TR.
  - Launch first Sovereign Green Bond with an earmarked portion for DCS.
  - Develop standard bidding document and service agreement

Figure 8: Time Schedule for Phase 1

9.2 Phase 2: Scaling and Market Development (2029 – 2032)

Objective: Intensify demand creation, empower the knowledge centre, replicate successful business models, and achieve significant private sector-led growth. Target: 3.5 million TR cumulative capacity.

Figure 9: Time Schedule for Phase 2

9.3 Phase 3: Mainstreaming and Consolidation (2033 – 2038 and beyond)

Objective: Establish DCS as a standard urban utility, fully integrated into city planning and driven by a mature market. Target: 6 million TR cumulative capacity and beyond.

Figure 10: Time Schedule for Phase 3

WAY FORWARD

This roadmap has laid out a clear and actionable strategy for elevating District Cooling Systems from a concept to a cornerstone of India's urban infrastructure. The journey ahead requires decisive action, unwavering political will, and collaborative innovation.

The immediate priorities are unequivocal.

First, the Government of India must provide the foundational policy signals by **formally recognizing DCS as a utility** and including it within the **Harmonized Master List of Infrastructure**. This single step will unlock critical financing and streamline development.

Second, to address the capacity barriers, the Government should establish a **national DCS Competence Center** to bridge the critical technical skills gap, drive standardization, and provide expert advisory support to key stakeholders.

Third, the powerful **SECI model must be replicated** to de-risk early projects, with an entity like NTPC or EESL taking the lead in aggregating demand and guaranteeing offtake.

This is not merely a technological transition; it is an economic opportunity. By embracing DCS, India can unlock billions of dollars in investment, create a new industry for green jobs, and enhance the competitiveness of its cities. It is a chance to build smarter, more resilient urban centers that offer a higher quality of life for citizens while responsibly stewarding our planet's resources.

The time for incremental steps has passed. The challenges of a rapidly warming world and a rapidly urbanising nation demand bold, systemic solutions. This roadmap provides the blueprint. It is now up to the collective will of our policymakers, industry leaders, and urban planners to build the future of cooling—a future that is efficient, sustainable, and distinctly Indian.

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APPENDICES

Appendix-A

Infrastructure Projects and Schemes in India relevant for District Cooling Systems

DCS offer a transformative approach to urban cooling needs, leveraging centralized cooling infrastructure to deliver substantial energy savings, environmental benefits, and cost efficiencies. As India progresses toward sustainable development, integrating DCS into various government projects, missions, schemes, and plans is crucial for achieving broader climate goals and enhancing urban resilience. This document critically examines the potential for integrating DCS within existing and upcoming infrastructure initiatives in India.

While DCS might not seem directly relevant to many of these programs or schemes at first glance, its alignment with the overarching aims and objectives of the Government of India is undeniable. Whether the goals involve fostering a circular economy, making current infrastructure robust and sustainable, increasing efficiency, providing world-class facilities to all citizens, ensuring affordability, or promoting equity in resource and infrastructure access, DCS aligns seamlessly with these aspirations. Notably, DCS serves as a multifaceted solution that can address these diverse goals through a single intervention. While other measures are certainly necessary, DCS stands out as a comprehensive solution that addresses multiple targets simultaneously.

Furthermore, DCS addresses a critical issue that necessitated its development: the need for thermal comfort for all without compromising the sustainability of cooling infrastructure. Given the projected surge in cooling demand as outlined in the India Cooling Action Plan (ICAP), exploring and implementing alternatives like DCS becomes imperative. DCS not only provides efficient cooling but also ensures that this is done sustainably, meeting the rising demand without exacerbating environmental impacts.

The analysis spans several key national programs, identifying the relevance and strategic alignment of DCS with each initiative. The objective is to highlight where DCS can be directly integrated to maximize energy efficiency and sustainability, and where indirect integration can still offer significant benefits. By mapping out the landscape of government schemes and their compatibility with DCS, this document aims to provide a comprehensive roadmap for policymakers and stakeholders to embed this innovative technology into India's urban infrastructure framework.

Government Initiatives	Nodal Ministry/ Department	Relevance to DCS (Highly relevant-HR; Relevant-R; Slightly Relevant-SR)	Investments and Funding	Remarks
National Infrastructure Pipeline	Department of Economic Affairs, Ministry of Finance	**HR-** DCS aligns seamlessly with the program objectives and goals of the national infrastructure pipeline. NIP already has a dedicated opportunity sector of 'Utilities and Resource pipeline' which aligns perfectly with the 'cooling as a service' model of DCS. The program also supports infrastructure on 'energy storage' which further makes DC Systems more efficient and sustainable.	Till date, the 'Utilities and Resource pipeline' sector has attracted USD 2.44 Billion* investments. Overall NIP has attracted an investment of 1826.63 Billion USD*. **(figures quoted are till 27 May 2024)*	NIP aims to draw investment for infrastructure development in India and a utility like DCS has high potential to draw it as it will also get support from climate finance instruments
Smart City Mission and initiatives under it	Ministry of Housing and Urban Affairs and NIUA	**HR-** District cooling aligns with Smart Cities Mission's goals for sustainable urban spaces. It offers centralized cooling, reducing energy consumption and emissions compared to individual building units. This benefits the environment and eases strain on power grids. Already, smart cities like Rajkot have planned to adopt DCS in their Smart City Plan but it is voluntary and there is no mandate under the mission to do feasibility for the technology.	A total investment of Rs.2,01,981 cr had been proposed. Projects focusing on revamping an identified area are estimated to cost Rs. 1,63,138 cr. Smart initiatives across the city account for the remaining Rs. 38,841 cr of investments.	Dedicated sub-schemes like the CITIIS with an objective to optimise the cooling sector shall be required.
State Technology Parks of India	Ministry of Electronics and Information Technology	**HR-** with a requirement for high, constant, diverse and uninterrupted cooling demand, for multiple users, DCS becomes a very attractive air conditioning solution with its CaaS model.		The STPI initiative can have programs aimed at making them sustainable and efficient with cooling being one of the parameters.
Micro & Small Enterprises Cluster Development Programme (MSE-CDP)	Ministry of Micro Small and Medium Enterprise	**SR-** The initiative has objectives like: 1. Support sustainability and growth of MSEs 2. Create/upgrade infrastructure for MSEs DCS has the potential to support the above objectives and also provide a better working environment for the workers in the industries.	https://msme.gov.in/infrastructure-development-program -Setting up of CFCs with maximum eligible project cost of Rs 15.00 cr with GoI contribution of 70% - Infrastructure development in the new/ existing industrial estates/areas in which the maximum eligible project cost is Rs 10.00 cr, with GoI contribution amounting to 60%	The scale of industries under the programme is small. DCS can provide cooling to cluster of such industries or large-scale industries.

Government Initiatives	Nodal Ministry/ Department	Relevance to DCS (Highly relevant-HR; Relevant-R; Slightly Relevant-SR)	Investments and Funding	Remarks
India Infrastructure Project Development Fund (IIPDF)	Department of Economic Affairs, Ministry of Finance	**R-** The corpus fund was created for supporting development of PPP projects that can be offered to the private sector. The IIPDF is available for project development costs like feasibility studies, financial structuring, environmental impact assessment etc. For DCS projects, this becomes highly relevant as feasibility studies are a major aspect in case of any site deciding to move ahead with it for cooling.	The funding can be maximum of 5 cr for a project. Any cost above this has to be incurred by the Project Sponsoring Authority (PSA). The overall funding is a central sector scheme with total outlay of INR 150 cr for 3 years (2022-23 to 2024-25)	The scheme is good for initial investments in a DCS project but the overall funding is limited considering the investments associated with them. But it can give a good push to the technology.
PM GatiShakti Mission	A total of 21 Ministries are involved including MoHUA and MoP	**R-** PM GatiShakti National Master Plan provides comprehensive database of the ongoing & future projects of various Ministries i.e. Infrastructure Ministries & Ministries and States involved in development of Economic Zones, integrated with 200+ GIS layers. Thus, even though DCS cannot be directly integrated with the mission, useful data can be captured from GatiShakti database. The plan will provide the public and business community information regarding the upcoming connectivity projects, other business hubs, industrial areas and Surrounding environment. This will help in identifying potential sites for DCS at a very early stage. One of the important features of the PM GatiShakti - National Master Plan, is the establishment of new Economic Zones to boost ease of doing business in India. All the existing and proposed economic zones have been mapped, which further provides a huge database for potential DCS sites.		Discussion with BEE/MoP for exploring how this can be taken up.

Government Initiatives	Nodal Ministry/ Department	Relevance to DCS (Highly relevant-HR; Relevant-R; Slightly Relevant-SR)	Investments and Funding	Remarks
National Industrial Corridor Development Programme	National Industrial Corridor Development Corporation (it is an SPV)	**R-** Aimed at development of futuristic industrial cities in India which can compete with the best manufacturing and investment destinations in the world. Such industrial cities will have high potential for DCS as their cooling infrastructure.		Discussion can be initiated with NICDC for proposing them to conduct DCS feasibility studies for their upcoming industrial cities.
Atal Mission for Rejuvenation and Urban Transformation 2.0	MoHUA	**SR-** The overarching aim of the AMRUT 2.0 is making the cities 'water secure' and this will be achieved through circular economy of water. DCS might not relate much with the overall initiatives which are being planned under the scheme as of yet, but its water conservation potential is immense, and a sub-scheme around cooling which also aligns with the aim of saving water could boost its adoption.		DCS would not only lead to circular economy in terms of water, but also other utilities like power and waste management, and shall help in supporting increasing the share of renewables in cities, which will align with goals of other government initiatives like National Solar Mission and policies supporting adoption of other renewables.
Harmonized Master List (HML) for Infrastructure development	Department of Economic Affairs, Ministry of Finance	**HR-** The inclusion of any sector in the HML enables investors to avail infrastructure lending at easier terms with enhanced limits, access to larger amounts of funds as External Commercial Borrowings (ECB), access to longer tenor funds from insurance companies and pension funds and be eligible to borrow from India Infrastructure Financing Company Limited (IIFCL) etc.		This shall lead to direct inclusion or integration with schemes like NIP and IIPDF

Government Initiatives	Nodal Ministry/ Department	Relevance to DCS (Highly relevant-HR; Relevant-R; Slightly Relevant-SR)	Investments and Funding	Remarks
Plans/Guidelines	Nodal Ministry/ Department	Relevance to DCS		Remarks
URDPFI Guidelines	MoHUA	In order to further mainstream the adoption of DCS, a top-down approach is required where the guiding document, which provides a framework for city development /master plans, recognizes the need for energy-efficient cooling solutions. National-level planning guidelines 'Urban Development Plans Formulation and Implementation' (URDPFI) were framed in 1996 by the Institute of Town Planners, India. The URDPFI Guidelines, 1996, provided a plan preparation and implementation framework. They were recently revised in 2014. The guidelines include chapters on different aspects as well as the infrastructures of a city. The guideline discusses physical infrastructure under its subheadings in the infrastructure planning chapter. The sub-chapter details the utilities required/voluntary to be deployed in the cities like electricity, water supply, sewage network, domestic gas supply pipeline, Rain water harvesting, drainage, telecom etc. For DCS to be formally considered a utility for cities, its inclusion in this section becomes necessary.		The latest version of the document was released in 2014, thus its almost reaching a stage for further updations. PMU had shared a letter which could be sent out by BEE to MoHUA for seeking update on this. As mentioned by BEE in last project update meeting that letter had been shared with MoHUA but there is no further update on it as of yet.
Master Plans/ City Planning Documents/ Smart City Plans	Urban Local Bodies	ULBs are responsible for revising their development plans at regular intervals and introducing new reforms and policies with every revision. In order to mainstream adoption of District Cooling in our cities, its recognition as a utility or physical infrastructure in city planning documents becomes mandatory. Planning documents serve as vital communication tools for disseminating information about new technologies, including District Cooling, to stakeholders such as urban planners, private organizations, developers, policymakers, and consumers. Including District Cooling in these documents can raise awareness about its benefits, energy savings potential, and environmental sustainability, leading to increased stakeholder understanding and knowledge. Including District Cooling in the planning stage can be considered an integral part of urban infrastructure development, ensuring that the necessary provisions are implemented in new urban developments.		Top down approach through updating URDPFI guidelines is best case scenario. Proactive ULBs and Smart City SPVs showing interest can be strategically targeted.

Government Initiatives	Nodal Ministry/ Department	Relevance to DCS (Highly relevant-HR; Relevant-R; Slightly Relevant-SR)	Investments and Funding	Remarks
State Climate Action Plans	State DoEFCCs and MoEFCC	Climate action plans outline strategies to reduce greenhouse gas emissions and combat climate change. DCS, powered by renewable energy sources, offers a significant advantage in this regard: ▶ **Reduced Emissions from Buildings:** The building sector is a major contributor to greenhouse gas emissions, particularly through energy consumption for cooling. By promoting DCS in climate action plans, India can highlight its potential for significantly reducing emissions from this sector. ▶ **Aligning with Renewable Energy Goals:** Many climate action plans also aim to increase renewable energy generation. DCS can be a perfect complement to this goal. By integrating renewable energy sources like solar or wind power to run the central cooling plant, DCS becomes a carbon-neutral cooling solution, directly aligning with climate goals. ▶ **Quantifiable Emission Reductions:** Climate action plans benefit from including specific and measurable targets. By incorporating DCS adoption strategies and outlining the projected reduction in emissions achievable through this technology, these plans can demonstrate a clear pathway towards achieving climate targets.		
Building Codes		Building codes establish minimum performance standards for construction. By strategically integrating DCS into building codes, India can significantly accelerate its adoption: ▶ **Energy Efficiency Standards:** Existing building codes can be strengthened to include stricter energy efficiency requirements. This can be achieved by setting minimum performance targets for overall building energy use or specifically for cooling systems. DCS, with its inherent efficiency, becomes a natural solution for developers and builders to meet these stricter standards. ▶ **Technology Neutrality with Performance Focus:** Codes can be structured to be technology-neutral, focusing on achieving specific performance outcomes. This allows for innovation and flexibility in cooling system design. However, by outlining the energy efficiency benefits achievable with DCS, codes can nudge developers towards considering this sustainable option. ▶ **Phased Implementation:** Building codes can be updated with a phased approach, allowing for gradual integration of DCS. This can start with new construction projects in specific building types or geographical areas, eventually becoming a standard practice across the country.		

Appendix-B

Global Policy Landscape for District Cooling and Learnings for India

To effectively enhance the adoption and implementation of District Cooling Systems (DCS), a comprehensive regulatory framework addressing commercial, legal, and technical dimensions is essential. Such a framework, akin to those governing utilities like electricity and water, is crucial for fostering a conducive environment for DCS development and operation.

While the India Cooling Action Plan (ICAP) represents a step forward, it alone may not suffice to drive widespread adoption of DCS. Additional policies, programs, or legislative measures are required to actively promote the utility's uptake. Drawing insights from successful district energy markets worldwide, several best practice policies and programs emerge. By synthesizing these best practice policies and programs, India can develop a robust regulatory framework that accelerates the adoption and implementation of district cooling systems, contributing to energy efficiency, environmental sustainability, and economic development.

This document offers an in-depth exploration of DCS and their growing presence across regions worldwide. It begins by mapping the global penetration of DCS, providing a country-by-country analysis that highlights where these systems have been successfully implemented and the extent of their adoption. The document further delves into the specific policies and regulatory frameworks that have played a pivotal role in supporting and expanding DCS in various nations, offering a comparative perspective on the different approaches taken to promote energy-efficient and sustainable cooling solutions.

In addition to policy analysis, the document presents detailed insights into the current market capacity of DCS in each country, including the scale of existing infrastructure and the technological advancements that have been integrated. Where available, it also outlines future plans and projections for the expansion of DCS, providing a forward-looking view of how these systems are expected to evolve in response to growing urbanization, climate change, and energy demand.

Moreover, the document draws from global experiences to extract valuable learnings for India, offering a set of recommendations tailored to the Indian context. These insights are intended to guide policymakers, industry stakeholders, and urban planners in developing a robust and sustainable DCS framework that can address the country's unique cooling needs.

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
1. UAE	2022	The Abu Dhabi Department of Energy (DoE) issued the District Cooling Regulations and the District Cooling Applicability Regulations, approved by the Abu Dhabi Executive Council. The DoE is responsible for regulating all DC related activities including licensing all facilities, entities and persons carrying out DC activities as well as monitor their commitment to provide the optimum level of service.	Key Highlights of the District Cooling Regulations in UAE are: ▶ An administrative fine of not more than (AED 10,000,000) ten million dirhams shall be imposed on anyone who contravenes the provisions of this Regulation and the rules, policies, decisions, circulars, codes and licenses issued. ▶ The DC Code and the DC Metering Code are developed to ensure that DC Systems and Meters meet or exceed prescribed levels of reliability, efficiency and sound water management ▶ The Regulation has been developed to enhance market competition in the District Cooling sector in Abu Dhabi through making compulsory (subject to certain predefined criteria) a competitive tendering process in relation to the appointment of Offtakers by DC Procurers, within a DC Authorised Service Area, served or to be served by District Cooling. ▶ The Regulation has been developed to enhance transparency and fairness of DC Tariffs and charges applied by Licensees in their District Cooling contractual services arrangements in the Emirate. The country also announced the Water Management in District Cooling Plants policy. Under the new policy, water sources can be used in district cooling systems if they prove to be the most feasible and cost-effective source. The policy regulates the mechanism of identifying potential sources of water that can be used by district cooling providers, such as recycled water, desalinated water, and seawater. (Source: District Cooling Regulations, Department of Energy, retrieved from- https://www.doe.gov.ae/-/media/Project/DOE/Department-Of-Energy/Media-Center-Publications/English-Files/Decision-44---District-Cooling-Regulation.pdf)	▶ UAE's District Cooling sector is also moving to increase Treated Sewage Effluent (TSE) adoption, which would reduce the overall water usage in the process. Empower, a major DCS operator in the region, aims to increase the proportion of TSE in total water consumption to 40% by 2025 from 13% in 2022. ▶ Current DCS Capacity (Empower and Tabreed operated cumulative, as of 2022): 1.4 mn Empower + 1.07 mn Tabreed = 2.47 million TR ▶ Empower management targets to increase capacity organically to 1.86mn TR by 2027 ▶ Tabreed's expected growth in connected capacity to 1.5mn TR globally by 2027 from 1.3mn TR (UAE + KSA + India) in 2022 ▶ Tabreed has demonstrated by over 2.2 bn kWh annual savings in energy consumption and 1.38mn annual prevention of CO2 emissions, across the GCC ▶ Tariff Structure has been set by Supreme Council of Energy. (Source: International Securities, 2023, retrieved from- https://www.intlsecurities.ae/resources/research/reports/equity/2023/q4/1--Hold.pdf)	▶ Development of DC Codes and regulations ▶ Monetary implications could be introduced once DC Codes/ regulations are introduced, in case of not abiding with them ▶ Dedicated or appointed department for DC related activities

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
2. QATAR	2023	Qatar General Electricity & Water Cooperation "KAHRAMAA" has established a District Cooling Services department (CD) with the intent to regulate and promote district cooling services in Qatar by utilizing best-in-class operational efficiencies in a more sustainable way. The department came into existence with the resolution from council of ministry on 2nd May 2012.	Qatar has a comprehensive DC regulation in place which has been designed with six ultimate goals: ▶ Human health and environmental safety ▶ Reliability ▶ Efficient use of water ▶ Efficient use of energy ▶ ▪Sustainability ▶ Cost-effectiveness The overall regulation document can be classified into two parts: ▶ District Cooling Design and Water Management Standards, which are mandatory, minimum requirements for the design of DC Systems that are deemed essential for meeting the KPIs. Key things mentioned in the regulation document include: ▶ Government agencies having jurisdiction governing DC System ▶ Laws and regulations governing DC Systems ▶ Fundamental principles for DC Providers operating the DC Systems ▶ District Cooling Services Key Performance Indicators (KPIs), which are mandatory, minimum requirements for the performance of DC Systems. The KPIs include: ▶ Compliance requirement ▶ Compliance reporting ▶ Reliability ▶ Energy efficiency ▶ Water management ▶ Energy marketing ▶ DC Provider annual information returns ▶ DC Retailer annual information returns (Source: Kahramaa District Cooling Services Department, retrieved from- https://c2e2.unepccc.org/wp-content/uploads/sites/3/2023/08/kahramaa-district-cooling-services-department.pdf)	▶ Current DCS Capacity: 1.15 million TR ▶ The installed capacity is 20% of total cooling capacity ▶ Number of plants in operation: 67; 31 of these plants use TSE for cooling plant makeup ▶ 2 of the cooling plants also use sea water for cooling plant makeup ▶ Regulating the DC sector and allowing it to reach its full potential will result in several benefits to the State of Qatar (from 2022 to 2030): ▶ Generation capacity: 143 MW ▶ Distribution capacity: 1315 MW ▶ Electricity consumption: 25000 Gwh ▶ CO2 equivalent emissions savings: 16 million tonnes ▶ Potable water consumption: 232000 million litres (Source: Kahramaa District Cooling Services Department, retrieved from- https://c2e2.unepccc.org/wp-content/uploads/sites/3/2023/08/kahramaa-district-cooling-services-department.pdf)	▶ Development of DC regulations ▶ Performance indicators for DC systems ▶ Dedicated department for DC related activities

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
3. SAUDI ARABIA	2018	The Kingdom of Saudi Arabia is the largest country in the Middle East, both in terms of population with approximately 33 million people and size of the economy, which is estimated at approximately USD 782 billion. Today, cooling efforts account for 50% of Saudi Arabia's total annual electricity consumption in buildings. This percentage rises up to around 70% at peak cooling demand, representing **the highest use of AC in the world**. Translated into consumption figures, they represented 101 (TWh) used by households and 70 TWh by businesses in 2018 (Kapsarc, 2020). Water and Electricity Regulatory Authority (WERA) regulates the district cooling, electricity and water	▶ A regulatory and financial framework for DCS has been developed for the country (details regarding it are not available in open domain) ▶ The Saudi government requires district cooling systems to be used in all government developments that require 15,000 tons of cooling or more. This policy helps to ensure that district cooling is being used in a significant number of large-scale projects in the country. (Source: Saudi Energy Efficiency Program, 2017, retrieved from- https://www.ief.org/_resources/files/events/2nd-ief-eu-energy-day/naif-al-ragass---saudi-energy-efficiency-center.pdf)	▶ The district cooling market is expected become the region's largest market by 2025, reaching a volume of 6.94 million TR ▶ 4% estimated district cooling penetration rate (2018) ▶ 11.5% district cooling CAGR (2019–2025) (Source: The Heat Is On, Business Sweden, retrieved from- https://swedish-cleantech.se/download/18.7328f80b-17742974fd5aafc2/1614071496450/District%20Cooling%20-%20The%20heat%20is%20on.pdf)	▶ Dedicated department for DC related activities ▶ Regulatory and financial framework for DCS ▶ Threshold barriers for implementing DCS, on the basis of aspects like cooling requirement, area, population etc.

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
4. SINGAPORE	2023	Cooling contributed towards 30% of Singapore's electricity consumption in 2019, and the demand is projected to grow by 66% between 2019-2030. It is a significant source of peak demand, comprising of nearly a quarter of peak demand in 2019 and 15% of total installed capacity. Singapore plans to reach economy-wide net zero emissions by or around 2050 and the evolution of its power generation mix is integral to this goal Energy Market Authority (EMA) regulates Singapore's electricity, gas industries and district cooling industries through legislation, policies and frameworks and codes of practice and more.	▶ Cooling Singapore Project: Singapore Government has taken steps to address the Urban Heat Island challenge by constituting a working group under the Urban Redevelopment Authority in 2017 ▶ District Cooling is provided for Singapore's financial district, with the government's active support in providing licensee, tariffs framework, collection, and data assessment. ▶ Standards and Obligations: this includes *Technical standards*, *Consumer obligations* and *Supplier/Licensee obligations* ▶ District Cooling Act: It was established to provide regulations and license to provide district cooling services in designated service areas. ▶ Designates the service area for district cooling services ▶ Every occupier/building owner within the service area shall use the district cooling services without exceptions ▶ Noncompliance by occupier/building owner to utilize the district cooling service or non-provision of services by the license holder, a fine not exceeding $10,000 or to imprisonment for a term not exceeding 12 months or to both and, in the case of a continuing offence, to a further fine not exceeding $250 for every day or part thereof during which the violation continues after conviction ▶ DC Service License: It is authorised to carry out District Cooling in the country and requires written approval from EMA ▶ District Cooling Services Supply Code, 2009: The purpose of the code was to provide minimum requirements for performance standards for cooling supply, rights and obligations of the license holder and the consumer, and technical requirements and services for the collection of connection. ▶ The supply temperature is within 6°C +/- 0.5°C under normal operating conditions ▶ The return temperature by the consumer shall be 14°C or higher. ▶ The consumer commits a lock-in period of 5 years for cooling supply based on the Cooling Contract capacity ▶ The tariffs will be monthly with information on the published tariffs approved by the authority, contract capacity, maximum demand and usage, taxes, payment due date, and contact details (Source: Framework of National-Local Policies and Regulatory Frameworks for District Cooling, Singapore Study Trip, 2023, retrieved from- https://niua.in/c-cube/sites/all/themes/zap/pdf/cool_city/UNEP_policy_presentation.pdf)	▶ Current Capacity: 208,000 TR ▶ This capacity is operated and installed by Keppel, serving across 80 developments ▶ First Plant was installed in 1998 (Source: District Cooling Developments in Singapore, Keppel, 2023)	▶ Establishing a DC Regulator and Regulations ▶ Targeted projects or integration with existing programs or projects which utilise the benefits of DCS like eliminating urban heat islands, resource circularity, refrigerant transition etc. ▶ Designated areas for district cooling services in city master planning

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
5. MALAYSIA	2023	Malaysia has established itself as a regional leader in district cooling, with over two decades of successful projects, including those in Cyberjaya and Putrajaya. Since 1997, the nation's electricity utility has been investing in district cooling both domestically and internationally. The Low Carbon Cities Framework in Malaysia also highlights district cooling as a vital strategy for reducing carbon emissions in urban areas. As Malaysia continues to expand district cooling in its cities, it is well-positioned to export its expertise to other countries with similar climates, offering transferrable best practices for sustainable urban development. KJTS is one of the largest DC players in Malaysia with over 25 DC plants either constructed or operated by them.	In Malaysia, there are no national policies directly encouraging or supporting district cooling.	▶ Current Capacity: 366244 TR (KJTS + Other operators) ▶ Total Plants: 33 (KJTS + Other operators) ▶ Electricity savings with DCS (2017-2022) by KJTS Group: 39,987,098 kWh ▶ GHG emission savings with DCS by KJTS Group (2017-2022): 24,871,975 kgs of CO2 (Source: District Cooling Developments in Malaysia, KJTS Group, 2023)	Even though there doesn't exist any dedicated policy or regulation for DCS in the country, adoption of DCS in Malaysia is among the highest in the region. The market players including DC operations, research organizations in the field, developers, and other DC stakeholders in India can seek inspiration from this.

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
6. THAILAND	2023	Thailand's district cooling market is poised for significant growth, driven by the country's high Cooling Degree Days (CDDs) of around 4,000 and an air conditioning utilization rate of approximately 30%. As economic development and population growth fuel an increasing demand for cooling, District Cooling Systems (DCS) are expected to play a pivotal role in meeting this demand. Recognized as one of the most sustainable solutions for air conditioning, DCS is anticipated to capture a substantial share of the market, aligning with Thailand's broader goals for energy efficiency and environmental sustainability.	▶ District Cooling has been specified as one of significant components in Thailand SMART City Criteria under Smart Energy category. ▶ Although projects have been developed, the sector is market driven, and there are no regulations, standards, or coordination bodies directly supporting DC developments. (Source: Energy Efficiency and District Cooling in Thailand, Energy Regulation and Conservation Division Department of Alternative Energy Development and Efficiency, Thailand, 2019, retrieved from- https://asew-expo.com/2024/download/webinars/webinar7/presentation_IntroductionDistrictCooling.pdf)	▶ Current Capacity (Operational or under construction): 210700 TR ▶ >500 million USD of potential investment between 2023-2033 or 8.3% CAGR market (Source: DISTRICT COOLING DEVELOPMENTS IN THAILAND, NXITY, 2023)	Targeted projects or integration with existing programs or projects which utilise the benefits of DCS like eliminating urban heat islands, resource circularity, refrigerant transition etc. The stakeholders in the sector shall have similar learnings as from Malaysia.

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
7. SWEDEN	2015		In District Energy, the policies and regulations exist for the District Heating market, but not for District Cooling.	▶ Current capacity of district cooling being delivered (as of 2015): 1 TWh ▶ Total District Energy (Heating + Cooling installed): 330 MW ▶ DC delivery in Sweden increased by 63% between 2004 and 2015 (Source: DISTRICT ENERGY IN THE ENERGY TRANSITION FROM THE EUROPEAN PERSPECTIVE, DEVCCO, 2022)	
8. FRANCE	2022	France's multi-year energy and climate programme includes a district cooling target by which it aims to increase the capacity of district heating and cooling networks by five times by 2030. France district cooling system is currently composed of 22 networks across the country. Mostly present in dense urban areas, the district heating and cooling (DHC) networks in France are supplied with 60% of renewable and recovered energies. However, district heating represents only 6% in the national heat sector for domestic heat water and heating system. On the other hand, cooling networks are much more recent and are experiencing significant growth.	▶ A working group on renewable heat and cooling was launched in March 2019 by the Ministry of Ecological and Solidarity Transition to identify and remove the barriers to the development of the sector. ▶ The Minister for Ecological and Solidarity Transition announced on 7 October 2019 the implementation of 25 measures to develop the DHC sector with 5 key objectives: i. increasing the mobilisation and attractiveness ii. improving consumer information and protection iii. strengthening the economic competitiveness iv. increasing renewable and recovery energy delivered v. enhancing innovation and investing in Research & Development ▶ Reduced VAT (from 20% to 5.5%) for the consumers (direct impact on the energy bill) in case more than 50% of the DH energy distributed in the systems is provided by renewables or waste heat ▶ Financial support for investments (not for the operation) through a fund called the "heat fund" (financial help nearly at the maximum support possible authorized by the EU framework) ▶ Energy savings certificates (CEE) can be used to connect buildings to the DHC. ▶ Obligation for each big new urban project (since 2010) to study the feasibility of integrated a district heating (creation or extension) along with other renewables energy technologies. (Source: National Policy Review, National Policy Framework, Current state of District Heating in France, 2019, retrieved from- https://vb.nweurope.eu/media/12185/france-heatnet-nwe_lt-wp11_update2020.pdf)	▶ Current capacity of district cooling being delivered (as of 2022): 1 TWh ▶ ▪Total District Cooling installed: 0.8 GW ▶ Started early 1990s (Source: DISTRICT ENERGY IN THE ENERGY TRANSITION FROM THE EUROPEAN PERSPECTIVE, DEVCCO, 2022)	▶ Introduction of financial benefits for DCS projects ▶ Inclusion of DCS as an infrastructure to be eligible to receive funding under schemes like National Infrastructure Pipeline, Sovereign green bonds and other infrastructure funding mechanisms

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
9. PHILIPPNES	2022	District cooling in the Philippines is poised for significant growth, driven by the country's climatic conditions and its evolving economic landscape. With Cooling Degree Days (CDD) around 3,500, the demand for efficient cooling solutions is increasingly critical. Despite the high CDD, the current air conditioning utilization rate remains below 10%, highlighting a substantial untapped market. As the economy and population continue to grow, the cooling demand is expected to surge, making district cooling an essential component in meeting future energy needs sustainably while managing the anticipated rise in cooling requirements.	No information regarding policy landscape for DCS in the country is available in open source.	▶ Number of operational plants: 1 ▶ Current Capacity: 12000 TR ▶ 39% reduction of electricity consumption / year ▶ 11,500 tons of CO2 savings / year (Source: Northgate District Cooling System, Engie)	

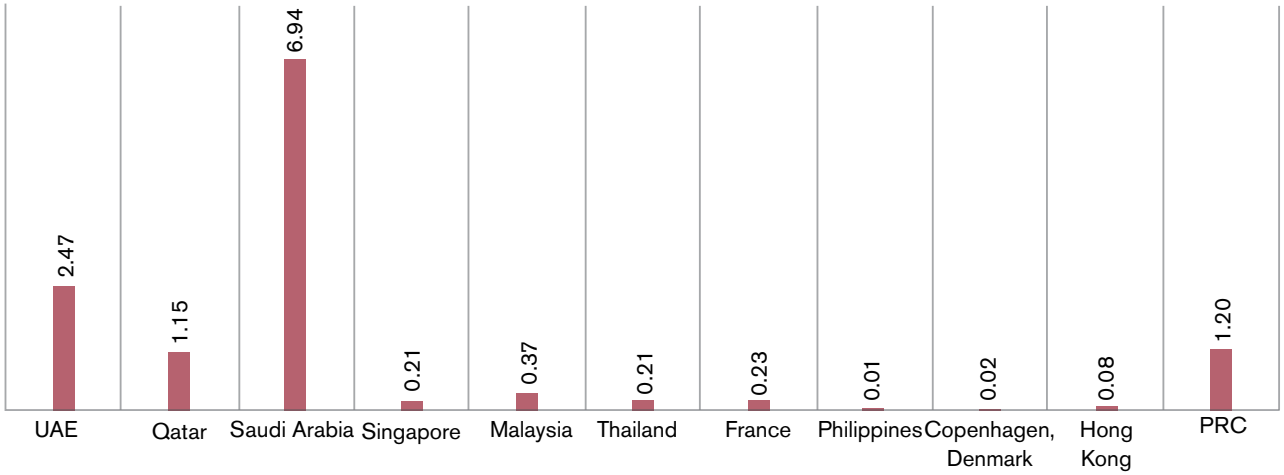
Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
10. COPENHAGEN, DENMARK	2023	In Copenhagen, several warm summers have increased the demand for air conditioning and cooling. That created a market for sustainable, city-friendly and cost-efficient solutions to meet the increasing cooling demand. The Greater Copenhagen Utility Company, HOFOR, has built a district cooling system, inspired by the well-functioning district heating system in Copenhagen. In the capital of Denmark, district cooling results in up to 70 per cent reduction in CO2 emissions and up to 40 per cent reduction in total costs compared to conventional cooling.	Details are available for District Heating but not District Cooling's policy landscape.	▶ Chilled water supplied to customers is produced by using seawater in the Adelgade and Tietgensgade DCS plant ▶ HOFOR has the led the DCS development in a phased manner, with 1st plant being installed in 2010, 2nd in 2013, 3rd in 2019 and 4th in 2021 ▶ Current Capacity: 87 MW ▶ Estimated Cooling Capacity Potential: 300 MW (Source: Morten Madsen, District cooling increasingly replacing traditional air conditioning in Copenhagen, 2023, retrieved from- https://ing.dk/artikel/district-cooling-increasingly-replacing-traditional-air-conditioning-copenhagen)	

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
11. HONG KONG	2021	Hong Kong's air conditioners account for 30 per cent of the city's energy use each year. While cool air brings much comfort to the residents of the subtropical city, the heavy use of electricity to run air conditioning systems is in fact taking a toll on the air quality. Veolia group, working on **water, waste and energy management** develops innovative air-cooling systems that replaces non-renewable resources with cleaner ones, while still meeting municipal needs and maintaining a comfortable, liveable environment. The plant is located in Kai Tak district.	District Cooling Service Ordinance: The District Cooling Services Ordinance has been in effect since 27 March 2015 and the Ordinance bestows the Government the necessary statutory authority to collect district cooling services charges from non-Government consumers of district cooling services at Kai Tak Development (KTD) and to use the revenue collected to offset the operating costs incurred by EMSD. It provides for matters relating to district cooling services provided by the Government, including the imposition of charges for the services; and to provide for other related matters. The Energy Efficiency Office (EEO) of the Electrical and Mechanical Services Department (EMSD) was established in 1994. One of its key roles is to regulate the district cooling services under the above ordinance and collect the charges for the services. The EEO's efforts are targeted to provide district cooling services to approved consumers through a series of actions, including publishing district cooling services supply conditions, technical guidelines and collaborating with different stakeholders. (Source: District Cooling Service Ordinance, 2015, retrieved from- https://www.elegislation.gov.hk/hk/cap624!en)	▶ Current Capacity: 284 MW ▶ Annual Electricity savings with it: 85 million kWh ▶ Annual GHG emission savings with it: 59,500 tonnes of CO2 ▶ Chilled seawater is used as a cooling medium ▶ 35% greater efficiency than standard air-cooling systems ▶ Upcoming Capacity Addition (by 2028): 178 MW ▶ Annual electricity Savings potential with the upcoming plant: 53 million kWh ▶ Annual GHG Savings potential with the upcoming plant: 37000 tonnes of CO2 (Source: Kai Tak District Cooling System, Environment Bureau Electrical and Mechanical Services Department, 2021)	▶ A dedicated agency for DC related activities ▶ DC Regulations or Codes

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
12. PEOPLE'S REPUBLIC OF CHINA (PRC)	2017	District cooling in the PRC is a relatively new technology that emerged in the early 21st century, gaining popularity after the 11th Five-Year Plan (2006–2010), which prioritized energy conservation and emission reduction. The government's 2012–2013 push for distributed energy projects, including gas-fired CHP and CCHP plants, as well as solar PV projects, further propelled district cooling adoption, especially as part of CCHP systems. Despite its newness, the sector has leveraged experiences from Japan, Europe, and North America. Today, district cooling is present in most tier 1 and tier 2 cities, mainly serving commercial complexes, development zones, and industries.	▶ 3 national codes for design, construction and operation of district cooling (updated in 2021-2022) ▶ 6 provincial guidelines for implementations of district cooling ▶ Over 12 guidelines for end-users of district cooling projects implementation and management ▶ Potential development on guidelines of GHG emission credit, including monitoring, reporting and trading through carbon market in 2023 ▶ For an installation project, if power consumption during peak hours can be permanently reduced, for example, by moving to valley time through the use of thermal storage technology, then a government subsidy of CNY500 per kilowatt is awarded by the Beijing government. In Shenzhen, the government offers an ice storage electric price of CNY0.28 per kilowatt-hour. ▶ The development of the energy service company (ESCO) model in recent years has increased the number of potential district cooling utility companies in the PRC that originate from equipment suppliers and contractors. Overall energy efficiency is their main concern, and district cooling could be one of the measures adopted. (Source: District Cooling in the People's Republic of China Status and Development Potential, Asian Development Bank, 2017, retrieved from- https://www.adb.org/sites/default/files/publication/222626/district-cooling-prc.pdf)	▶ Current Capacity: 4.2 GW ▶ Technology used: heat-driven absorption chillers, electrical compressor chillers, and ice storage ▶ Sources of energy: gas-fired CCHP plants, heat from CHP plants, and combined district heating and cooling systems ▶ Market growth potential of 5.39 TWh or 4.2 GW yearly (Source: District Cooling in the People's Republic of China Status and Development Potential, Asian Development Bank, 2017, retrieved from- https://www.adb.org/sites/default/files/publication/222626/district-cooling-prc.pdf)	▶ Financial benefits or incentives for DC projects ▶ Guidelines for DCS projects as per requirement ▶ Exploring for a viable business model

Country	Year of the data captured	Cooling Sector Overview and DCS Institutional Landscape	DCS Policy and Regulatory Landscape	DCS Penetration and Key Features	Learnings for India
13. GERMANY	2020	An innovative district cooling project is underway in Munich's climate-friendly "M-district," which uses near-surface groundwater to provide cooling for new office buildings. (Source: https://www.german-energy-solutions.de/GES/Redaktion/EN/News/2020/20201110-district-cooling-munich.html)	No further information regarding DCS in the country is available in open source.	No further information regarding DCS in the country is available in open source.	

Latest Available Current/Projected DCS Capacity (Million TR)



**The graph has been prepared based on the latest available data for each country, as represented in the above table. In case of Saudi Arabia, the projected capacity has been taken, which is for 2025, as information on currently installed capacity is unavailable*

Appendix-C

Proposed Revisions and Additions to the Concession and Service Agreements for District Cooling Plant Development

This document presents a set of proposed revision and additional contractual clauses tailored to the development and operation of a district cooling plant. It also incorporates a detailed tariff model to guide cost recovery, operational efficiency, and service accountability. The primary objective is to establish a clear, balanced, and equitable framework that supports effective implementation while ensuring fair risk allocation among all participating stakeholders.

The approach draws on the Hyderabad Pharma City model as a reference point, with relevant provisions adapted to better suit the specific needs. Several of the proposed revisions and their rationale are also informed by comparable clauses found in other PPP agreements reviewed during the course of research.

This document is intended to serve as a starting point for collaborative discussions and welcomes external review and constructive feedback to refine the terms and enhance fairness, transparency, and practicality for all parties involved.

All financial values and performance indicators provided are illustrative and subject to further review and stakeholder consultation.

For the purposes of this document, it is assumed that the district cooling plant will be located within the facility.

Original and proposed Revised clauses for the Concession Agreement

S.No	Clause	RFP Reference Original Clause	Proposed Clause	Rationale
1.	Concession Period	Higher of (a) is 33 (Thirty-Three) years from the Appointed Date and (b) 10 years from the last investment in the new module.	The concession period can vary from project to project and can be between 30 and 40 years.	The concession period has been adjusted to allow flexibility for the concessionaire to recover investments made over time, incentivizing continued improvement and investment in the cooling plant infrastructure.
2.	Performance Security	The Preferred Bidder has along with the execution of this Agreement, delivered to the Authority (within 30 days of issue of LOA) a Construction Performance Security (substantially in the format set forth in Schedule F) for a sum of Rs. 4,48,00,000/- (Rupees Four Crores Forty-Eight Lakh only) (as mentioned in Section I of the RFP), drawn from a Nationalized bank/ Scheduled Bank(excluding Cooperative Banks), and payable and enforceable in Hyderabad, Telangana (the "Construction Performance Security"). The Construction Performance Security shall be valid for minimum of Eighteen (18) months from its issue date	The supplier shall, for the performance of its obligations hereunder, provide to the utility no later than 60 days from the date of this agreement, an irrevocable and unconditional guarantee from a Bank for a sum equivalent to 3-5% of the total concession amount.	The Government of India recommends the performance security to be a 3-5% of the total concession amount.
3.	Termination upon delay	Without prejudice to the provisions of Articles 4.4 and 4.5, and subject to the provisions of Article 9.2, the Parties expressly agree that in the event the Appointed Date does not occur, for any reason whatsoever, within a period of [180 (one hundred and eighty)] days from the Execution Date or the extended period provided in accordance with this Agreement, then all rights, privileges, claims and entitlements of the Concessionaire under or arising out of this Agreement shall be deemed to have been waived by, and to have ceased with the concurrence of the Concessionaire and the Agreement may be terminated by the non-defaulting Party. Provided, however, that in the event the delay in occurrence of the Appointed Date is for reasons attributable to the Concessionaire, the Construction Performance Security, or the Bid Security of the Concessionaire shall be encashed and appropriated by the Authority as Damages thereof.	Termination for delay clause shall be exercised in the event the Appointed Date does not occur, for any reason whatsoever, within a period of [365 (Three Sixty-Five) days. In case of any delay in occurrence of the Appointed Date with reasons attributable to the Authority termination for delay shall be extended equivalent to delay attributed to authority and financial impact for this delay period equivalent to 120% of fixed charges shall be compensated to Concessionaire.	Extending the termination timeline provides a buffer for delays outside the Concessionaire's control, while compensation for Authority-caused delays ensures fairness in financial impact on the Concessionaire.

S.No	Clause	RFP Reference Original Clause	Proposed Clause	Rationale
4.	General Obligations of the Authority	a. The Authority shall, at its own cost and expense, undertake, comply with and perform all its obligations set out in this Agreement. b. Subject to and in accordance with the provisions of this Agreement and Applicable Laws, the Authority agrees to provide support to the Concessionaire and undertakes to observe,	(c) In the cases of disruption caused for utility services such as water, recycled water and power supply in the events other than Force Majeure or by other third-party agencies' actions or other Concessionaire's actions, Authority shall make reasonable efforts to restore the utilities within 48 hours, at its own cost. If such disruption is not restored within 48 hours, Authority shall pay to the Concessionaire by way of compensation, as recommended by Independent Expert and Tariff Committee.	The amendment incentivizes the Authority to prioritize timely restoration, while compensating the Concessionaire for disruptions helps maintain project viability and minimizes revenue loss during downtimes.
5.	Termination for Authority Default	(a) the Authority commits a material default in complying with any of the provisions of this Agreement and such default has a Material Adverse Effect on the Concessionaire; (b) the Authority fails to provide any land which is necessary and required for construction of any essential element or part of the Project Facility; or the failure by the Authority to make Demand Guarantee payments due under the concession agreement (d) the Authority repudiates this Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be abound by this Agreement.	(e) the Authority has failed to make any payment to the Concessionaire under this Agreement within the period specified therein. (f) a breach of any of the Project Agreements by the Authority has caused a Material Adverse Effect. (g) the Authority creates any Encumbrance in breach of this Agreement.	These specific clauses protect the Concessionaire's interests, ensuring the Authority meets its obligations and highlighting recourse available in cases of significant Authority defaults that impair project operations.
6.	Financial closure	Notwithstanding anything to the contrary contained in this Agreement, the Concessionaire covenants with the Authority that it shall achieve Financial Close within [120 (one hundred and twenty)] days from the Execution Date. If the Concessionaire shall fail to achieve Financial Close within the said [120 (one hundred and twenty)] days period, the Concessionaire shall be entitled to a further period of [60 (sixty)] days, subject an advance weekly payment by the Concessionaire to the Authority of [Rs. 100,000 (Rupees one lakh)] per week or part thereof as Damages for any delay beyond the said [120 (one hundred and twenty)] day period.	Financial Close timeline extended to 365 days from Execution Date without additional penalties.	Given the complexities in securing financial closure, this extension allows sufficient time without additional penalties, improving project feasibility and attracting potential investors or financiers.

S.No	Clause	RFP Reference Original Clause	Proposed Clause	Rationale
7.	Early closure	The Authority reserves the right to terminate the Project at any time and at its discretion (the "Early Closure") by issuing a Termination Notice, provided that before issuing the Termination Notice, the Authority shall by a notice inform the Concessionaire of its intention to issue the Termination Notice at least 90 days in advance.	The Authority reserves the right to terminate the Project at any time **prior to the Financial Close of the first 2,500 TR** at its discretion (the "Early Closure") by issuing a Termination Notice, provided that before issuing the Termination Notice, the Authority shall by a notice inform the Concessionaire of its intention to issue the Termination Notice at least 90 days in advance. The Authority will grant 15 (fifteen) days to the Concessionaire to make a representation, and may after the expiry of such 15 (fifteen) days, whether or not it is.	Limiting Early Closure to pre-Financial Close provides stability to the Concessionaire for initial project planning and investment while ensuring adequate notice and opportunity for representation in case of termination.

Additions made to the Concession Agreement

S. No	Clause	Addition
1.	Dispute Resolution	(a) The costs and expenses of the arbitration, including the arbitrators' fees and administrative costs, shall be borne equally by the Parties unless otherwise determined by the Tribunal in the Award. (b) All proceedings, including any information, documentation, or Award, shall be confidential and shall not be disclosed to any third party without the prior written consent of the other Party, except as required by law.
2.	Performance Standards and Key Performance Indicators (KPIs)	1. Definition of KPIs: The Concessionaire shall perform its obligations under this Agreement in accordance with the Key Performance Indicators ("KPIs") set forth in Table [X] hereto, which define the required performance benchmarks relating to the quality, reliability, safety, efficiency, environmental compliance, and service delivery standards of the Project. 2. Monitoring and Reporting: The Concessionaire shall monitor its performance against the KPIs and shall submit quarterly/annual reports (as applicable) to the Authority, evidencing compliance with the KPIs, certified by its Statutory Auditors or an Independent Engineer, as required. 3. Audit of KPI Compliance: The Authority may audit or cause to audit the KPI compliance at its discretion, and the Concessionaire shall provide full cooperation, access, and information in this regard. 4. Failure to Meet KPIs: In the event the Concessionaire fails to achieve any of the KPIs: (a) It shall be liable to pay liquidated damages as specified in Schedule [X]; and/or (b) The Authority may issue a notice requiring rectification within a specified cure period. 5. Serious KPI Breaches: Persistent or material breaches of the KPIs may constitute a Concessionaire Default and may entitle the Authority to exercise its rights under Clause [Termination/Suspension]. 6. Review and Revision of KPIs: The KPIs may be reviewed and modified mutually by the Parties at periodic intervals (every [3 or 5] years) or upon occurrence of a major Change in Law or Change of Scope.

Key Performance Indicators (KPIs) for District Cooling

Category	KPI	Description	Suggested Target (to be discussed with relevant stakeholders)
Operational	System Availability	% of time the cooling system is available and functional	≥ 99% uptime
	Unplanned Downtime	Hours of unscheduled system downtime	≤ 6 hrs/month
	Response Time	Time to respond to service disruptions or faults	≤ 2 hours
Energy Efficiency	Full load (kW/TR)	Indicator of design energy performance	The following targets have been referred from the ECSBC 2024 and BEE 5-Star rating guidelines: Component level: ▶ Chillers: 5 stars BEE star rating levels; ▶ For cooling capacity >= 1580 kW : 9 ISEER ▶ Chilled Water pumps: 14.9W/ kWr with variable primary pumping ▶ Condenser water pumps: 14.6 W/ kWr ▶ Cooling Tower fans: 0.35 kW/(ltr-sec.) ▶ System level: ▶ Water Cooled Chilled Water Plant: 0.19 kW/kW*
	Indian Seasonal Energy Efficiency Ratio (ISEER)	Indicator of operational energy performance	
Environmental	Carbon Emissions Reduction	Annual CO_2 savings compared to conventional cooling	Target set
	Water Usage per TR	Liters of water consumed per ton of cooling	≤ 5 liters/TR
	Renewable Energy Usage	% of electricity sourced from renewables	≥ 15–20% (if applicable)
	Refrigerant Leakage Rate	% of refrigerant lost annually	≤ 1%
Customer/ Social	Customer Satisfaction Score (CSAT)	Survey score measuring customer satisfaction	≥ 85%
	Complaint Resolution Time	Average time to close a service complaint	≤ 24 hours
Project Delivery	Construction Milestone Compliance	On-time completion of construction stages	≥ 90% of milestones on time
	Local Employment and Training	% of workforce sourced/ trained locally	As per contract (e.g. ≥ 30%)
Governance/ Reporting	Timely Reporting Compliance	% of reports submitted on time	100%
	Regulatory Audit Compliance	% of audits passed without major findings	≥ 95%

$$\text{* Total System Efficiency} = \frac{\text{Annual Chiller plant Energy Consumption (kWh)}}{\text{Annual Chiller plant } \textit{cooling generation} \text{ (kWrh)}}$$

Additions made to the Service Agreement

S. No	Clause	Addition
1.	Service Provider's Obligations	The Service Provider shall be responsible for and pay all costs of and relating to the supply of electricity and water required for the operation of the Equipment and the supply of Cooling Service
2.	Cooling Specifications	6.1 Service provider shall make available and deliver chilled water to the points of delivery at a temperature of [5 °C ± 1°C OR 6 °C ± 0.5°C]. 6.2 The Client shall ensure return water to the points of return at temperature [14] °C ± 1°C higher than the temperature at the point of delivery. In case of a failure to achieve such ΔT, the Customer and Service provider shall investigate and fix the cause of such failure at the sole cost of the Customer. Concessionaire shall be permitted to monitor all required data from the Customer's facilities that it serves and control the tertiary pumps and modulating valves installed to achieve the required ΔT. 6.3 During the operational phase, the facilities should be maintained appropriately to ensure that the return water temperature is correct, there will be a cost recovery mechanism to incentivize the achievement of ΔT.
3.	Supply Capacity	If an increase in Contracted Supply necessitates upgrading of or additions to the Equipment, the Service Provider may decline to increase the Contracted Supply. Alternatively, the Service Provider may charge the Client for the cost of any upgrade or addition or adjust the Cooling Capacity Charge to take these costs into account.
4.	Security Deposit	For the avoidance of doubt, no interest shall accrue on the Security Deposit and no interest shall be payable to the Client in relation to the Security Deposit.
5.	Insurance	Customer shall obtain and maintain at its own cost insurances including with respect to liability for personal injury, death, damage to physical property and shall include business interruption insurance occurring in or in relation to the Customer's premises and property and third-party liability, the ETS room and the low (secondary) side cooling system.
6.	Change in Occupant of Unit	If a Unit is sold by the current Owner or vacated by the current tenant, as the case may be, without the Service Provider being requested to issue a no-objection certificate prior to such incident, the Customer shall remain responsible for all charges up until the date a new Customer registers with the Service Provider; and signs a new district cooling metering services end-user agreement with the Service Provider. Such an agreement will not be signed with a new customer until all outstanding charges are settled. The Owner shall be responsible for paying the Capacity Charge directly.

DCS - TARIFF CARD

The tariff system is usually the most challenging aspect of a district cooling arrangement. While there are some typical tariff schemes which most district cooling providers adopt, each providers' scheme is different.

Tariffs typically comprise of a connection charge (to cover capital cost of the energy transfer station (ETS)), contract capacity charges (effectively an availability charge covering capex and fixed O&M costs) and a consumption charge (covering variable O&M costs including chemicals, electricity and water (potable/TSE)). Some district cooling providers also levy an efficiency charge, which penalises users who fail to utilise the thermal energy in the delivered chilled water resulting in lower efficiency and higher production costs at the central chiller plant.

-Here is an example of the tariff card for one of the DC projects in India.

1. NEW DCS CONNECTION CHARGES: (One Time Charge towards partial CAPEX Recovery)
2. DEMAND CHARGES (Fixed O&M + Remaining CAPEX recovery over XX years)

Sr.	Category	Rate (Rs.)	Unit
1.	Commercial	X	Rs per TR per Month
2.	Institutional	X	Rs per TR per Month
3.	Residential	X	Rs per TR per Month

3. CHARGES FOR DEMAND ABOVE CONTRACT DEMAND

Sr.	Category	Rate (Rs.)	Unit
1.	Commercial	X% more than demand charges	Rs per TR per Month
2.	Institutional	X% more than demand charges	Rs per TR per Month

4. SECURITY DEPOSIT (INTEREST FREE)

Sr.	Category	Amount
1.	Residential	1.5 months collection charges, as applicable
2.	Commercial	1.5 months collection charges as applicable
3.	Institutional	1.5 months collection charges as applicable

5. MONTHLY BILLING CHARGES (for Variable O&M (electricity, water) expenditure recovery)

A. CONSUMPTION CHARGES

Sr.	Category	Rate (Rs.)	Unit
1.	Commercial	X	Rs. per TR-Hr
2.	Institutional	X	Rs. per TR-Hr
3.	Residential	X	Rs. per TR-Hr

B. ADJUSTMENT CHARGES

Sr.	Category	Rate (Rs.)	Unit
1.	Commercial	X	Rs. per TR-Hr
2.	Institutional	X	Rs. per TR-Hr
3.	Residential	X	Rs. per TR-Hr

C. METER CHARGES

Sr.	Category	Rate (Rs.)	Unit
1.	Residential	X	One time at the time of connection
2.		X	Rs per Month

D. RETURN WATER TEMPERATURE ADJUSTEMENT

Sr.	Category	Remark
1.	Commercial	During the development phase, the return water temperature adjustment charges are not enforced but this will be evaluated as case to case based. The user may be penalized for not providing chilled water return temperature as per DCS Ready reckoner for loss incurred by DCS due to low return temperature
2.	Institutional	
3.	Residential	

E. DELAY PAYMENT CHARGES

Sr.	Category	Amount
1.	Commercial	18% interest per annum of the bill amount payment after due date
2.	Institutional	18% interest per annum of the bill amount payment after due date
3.	Residential	18% interest per annum of the bill amount payment after due date

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