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Bureau of Energy Efficiency
Ministry of Power, Govt. of India

Federal Ministry for Economic Affairs and Climate Action

IKI INTERNATIONAL CLIMATE INITIATIVE

on the basis of a decision by the German Bundestag

Workshop Report:

REGIONAL WORKSHOP ON 'COOLING INDIA'S CITIES'

June 28, 2024 | Taj Coromandel, Chennai

Hosted by
Bureau of Energy Efficiency,
Gesellschaft für Internationale Zusammenarbeit (GIZ) & Tabreed India


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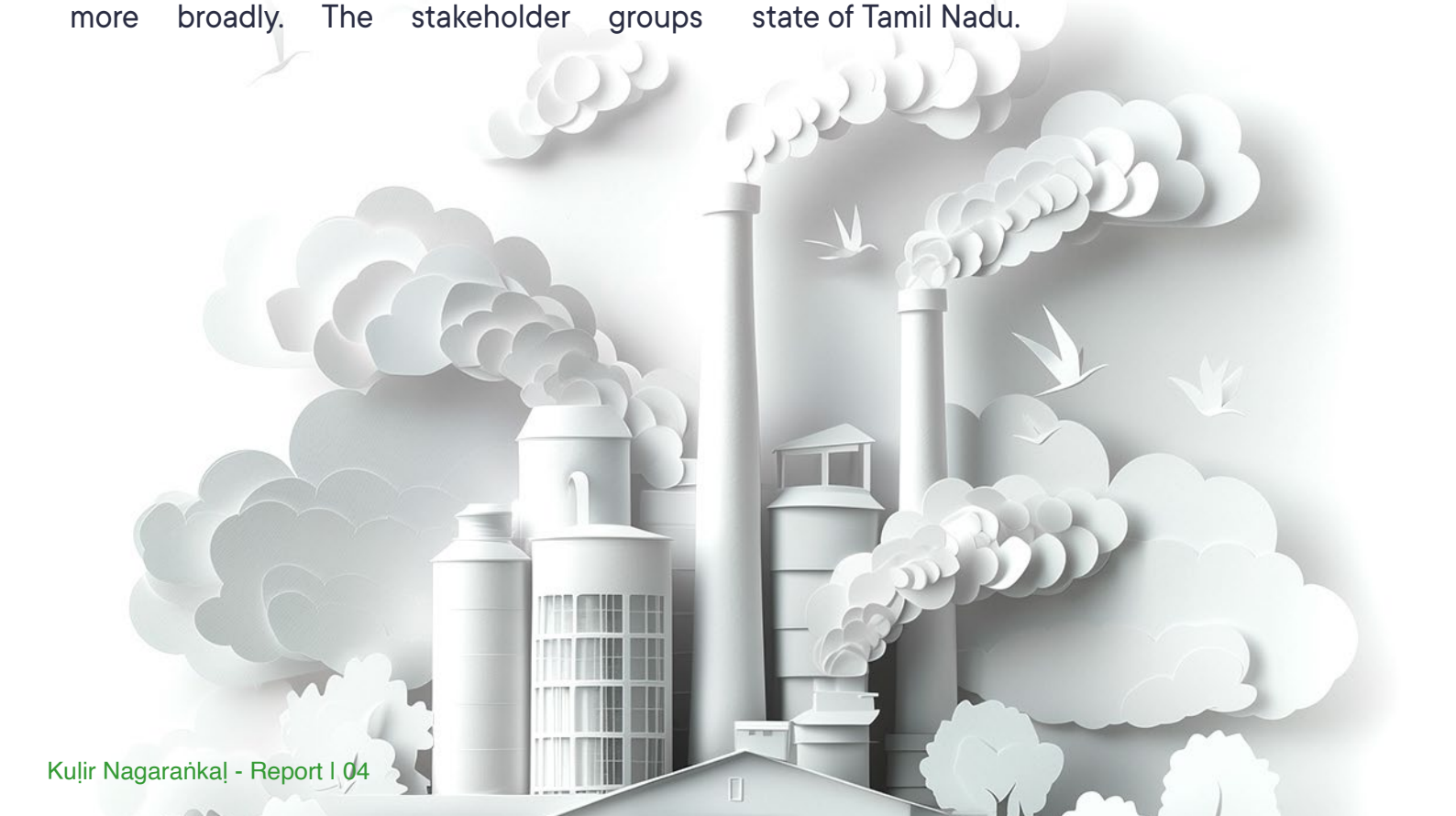
The Regional Workshop on Cooling India's Cities, held in Chennai on 28th June, was hosted by Bureau of Energy Efficiency (BEE), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and Tabreed India. It is an initiative undertaken as a part of the Memorandum of Understanding signed between Tabreed India and GIZ to accelerate adoption of sustainable cooling practices through multi-stakeholder dialogue and consultations, capacity building and awareness workshops showcasing context and region specific potential for District Cooling, and bilateral exchange between governments for an enabling regulatory environment. During the workshop, a report jointly published by Tabreed and GIZ titled "Kuḷir Nagaraṅkaḷ - District Cooling's Impact on TN's Resource Use Landscape" was presented to showcase the potential opportunities for the State.

The workshop saw a wide and varied participation from stakeholder groups that presented diverse perspectives and challenges on the cooling conundrum in Tamil Nadu and India more broadly. The stakeholder groups included **government officials** from the State Planning Commission, the government's apex advisory body on evidence-based policy for holistic growth, the Commissionerate of Municipal Administration, the nodal supervisory body department between Municipalities and Municipal Corporations (except for Chennai), Tamil Nadu Energy Efficiency Services Ltd, **academia** from IIT Madras, Anna University, **private sector representatives** from r**eal estate developers to urban planners, consultants and architects to manufacturers** such as Tata Realty, Brigade Group, Danfoss and **multilateral and industry organisations** such as United Nations Environment Program (UNEP), C40, World Bank, International Finance Corporation (IFC), ISHRAE, Alliance for Energy Efficient Economy (AEEE).

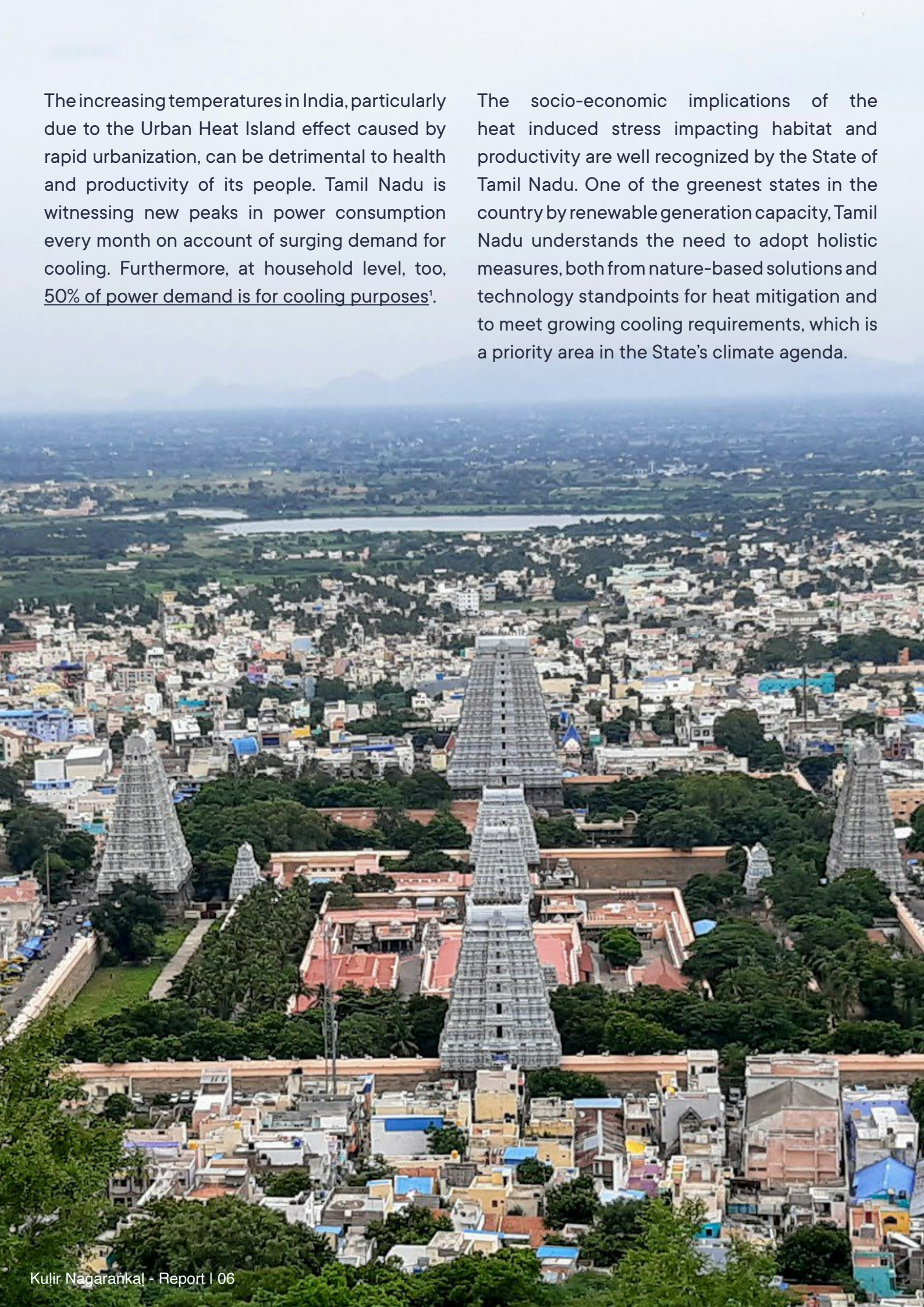
The ensuing discussions, key takeaways from which are summarized below, were enriching and hopefully can inform an enabling policy and regulatory environment that can support accelerated adoption of district cooling in the state of Tamil Nadu.



I. Tamil Nadu, a Leader Amongst States

The increasing temperatures in India, particularly due to the Urban Heat Island effect caused by rapid urbanization, can be detrimental to health and productivity of its people. Tamil Nadu is witnessing new peaks in power consumption every month on account of surging demand for cooling. Furthermore, at household level, too, 50% of power demand is for cooling purposes[1].

The socio-economic implications of the heat induced stress impacting habitat and productivity are well recognized by the State of Tamil Nadu. One of the greenest states in the country by renewable generation capacity, Tamil Nadu understands the need to adopt holistic measures, both from nature-based solutions and technology standpoints for heat mitigation and to meet growing cooling requirements, which is a priority area in the State's climate agenda.



1. Chennai's multi-pronged approach to climate action

The State has taken strong initiative to complement its action plan on climate change through a number of workstreams on urban planning and development through master-planning, including heat mitigation strategy for Tamil Nadu, first through passive measures such as increasing tree cover and water bodies, envisaging its cool roof policy and the reduction of asbestos and other materials harmful both to human and planetary health. Second, through active measure including the electrification of transport and earmarking low emissions zones, heat maps to understand the urban heat island effect across the State. This is especially important given that Tamil Nadu is one the most urbanised state and has been urbanised in the most decentralised manner in comparison to other states.

Chennai, led by Chennai Metropolitan Development Authority (CMDA), is the first city in the country which has taken steps to **plan urban cooling in its third masterplan** envisaging development requirements until 2046[2]. CMDA in collaboration with UNEP, CEPT University and National Institute of Urban Affairs (NIUA) is conducting a study to understand the effect of urban heat islands in the city to then develop a strategy that informs appropriate technologies that can mitigate urban heat islands. The methodology adopted for the study can also be replicated easily for other cities in the country.

Industrial waste water, grey water reuse, solid waste management, peak demand management, round the clock renewable are important elements that the State is developing policies on as part of its circular economy agenda. The policies will also explore ways in which they can be integrated with urban cooling.

2. Vibrant research and development ecosystem

As a state research institute, IIT Madras Research Park along with Anna University has been leading the research and development ecosystem in the field of thermodynamics in the State and the country. Through a design thinking process which leverages digitization tools such as AI & IoT, the Universities have successfully showcased district cooling and energy systems as the way to meet cooling needs of the State sustainably. As a part of its overall impetus towards research and development, IIT Madras has also set an ambitious target to encourage students to drive innovations for sustainable technologies by supporting the incubation of 100 start-ups[3] in 2025.

IIT Madras installed a District Cooling system about 15 years ago, making it **one of the first district cooling systems in the country,** and one which includes a Thermal Energy Storage solution. The university has showcased economic viability of district cooling and energy system with **a 30% reduction in opex**[4], backed by 1200 data points captured every minute going back 5 years. Furthermore, this new fuel in the form of data can be utilized for putting together knowledge products to create stakeholder awareness and inform incentives and policies to make District Cooling the default choice. Other aspects of the University's efforts include **integrating circular economy principles** into the District Cooling system through the use of recycled water, plants covering the cooling towers to bring in aesthetic elements and help cool the water, increasing cooling tower's efficiency and utilizing waste heat rejected from the District Cooling system in the cafeteria for washing utensils and heating food, etc – all of which demonstrate the successful integration of technologies within District Cooling.

3. District Cooling Steering Committee

The State Planning Commission has set up a dedicated District Cooling Steering Committee with **representation from all leading stakeholder groups** such as Tamil Nadu Industrial Development Corporation (TIDCO), Indian Institute of Technology (IIT) Madras and United Nations Environment Program (UNEP). District Cooling is being actively considered by the State government[5] as an adaptation strategy to address heat impacts in the built environment, across commercial, residential, industrial sectors and data centres. The Committee is tasked with the responsibility of developing a **policy roadmap for implementing District Cooling solutions across the State.**

Beyond passive measures being considered, District Cooling can support resource circularity, mitigate formation of urban heat islands by preventing heat rejection in the surrounding atmosphere (and instead on treated water) and provide more equitable access to cooling through the inherent surplus capacity available in a District Cooling system. The roadmap seeks to make the adoption of this technology commercially viable and ready for adoption on a large scale to benefit the end user. For this, an enabling environment will include determining how District Cooling can be implemented in a phased manner as a public good and then mandating use in high-density areas such as those earmarked as special economic zones through exploiting interlinkages with existing policies adopted in the State including the Energy Conservation Building Code (ECBC) code, Pollution Control Board (PCB) permitting system, Tamil Nadu Town and Country Planning Act, Tamil Nadu District Municipalities Act, Tamil Nadu Combined Development and Building Rules (TNCDBR), which are policies that already have built-in objectives around energy efficiency, greenhouse gas emission reduction and sustainability.

4. District Cooling Market Sizing and Regulatory Interventions

The Tabreed and GIZ report highlighted the market potential of District Cooling in the State with specific illustrations of impact on greenfield and brownfield projects through reduced mechanical load, energy consumption and associated greenhouse gas emissions if district cooling was incorporated. For greenfield projects, incorporation of District Cooling at the master planning stage itself, after requisite feasibility studies, is an important step to ensure adoption of District Cooling. However, greenfield projects can often be delayed due to external macro-economic and political factors. . On the other hand, brownfield projects, which prima facie may seem complicated to incorporate district cooling, are the lowest hanging fruit for maximizing impact and showcasing benefits of the technology given that they have shorter timelines (already exist and have existing chiller system), and with interconnections and smart design interventions can aid in quick implementation of District Cooling. For example, the Taramani and Perungudi cluster of commercial establishments currently have an installed cooling capacity of 51,450 RT. By aggregating and optimising cooling demand, the case studies show that through diversity benefits the mechanical load can be reduced by 26% and through the use of larger, industrial grade energy efficient equipment power demand can be reduced by up to 45%.

The report also showed how District Cooling and Energy offers an advantage in terms of reliability, energy efficiency, and optimum resource utilization. It frees up rooftop and basement space to be utilized for recreational purposes or more rooftop solar and wind energy. Additionally, it can use Thermal Energy Storage systems to store energy during off peak hours and to utilize in peak hours, thus shaving the peak and unburdening the grid. In addition, reusing treated sewage effluent from Sewage Treatment Plants (STPs) can minimise dependence on potable water and waste heat from waste to energy plants can be utilised to power District Cooling systems to cool water. A district cooling service provider with expertise in the technology takes over end to end responsibility of the entire cooling infrastructure from designing, building, financing to operations and management, ensuring the lowest lifecycle cost for the users.

To foster growth of District Cooling, the government should establish **clear policies and regulatory frameworks** that promote and incentivise adoption of District Cooling systems. This can include fiscal and non-fiscal incentives, streamlined permitting processes for projects that incorporate District Cooling, setting mandatory energy efficiency standards and linking the same to annual reporting for maintaining green building certifications to drive the transition towards more sustainable cooling solutions.

II. Challenges in implementing District Cooling system highlighted during the roundtable consultation

1. District Cooling viewed as a technology, not market model

Viable and efficient cooling technologies have existed for decades, but the concern is more around adoption of these existing technologies. Older and obsolete technologies are often favored by developers given the familiarity, apparent economic case and easier provisions for service and replacement. This is despite the benefits that District Cooling can offer through more optimal use of power and water, prevention of refrigerant leakage and other systems benefit.

While **technology lock-in** might be a concern, District Cooling systems are flexible enough for adapting to new and latest technologies, because of the modular build out approach undertaken for District Cooling systems. Additionally, even when District Cooling is under consideration skilling and training levels of technicians and operators, know-how and awareness levels of architects, design consultants and contractors is a major concern area and constraint to adoption.

As such, it appears that the problem is not so much with technology as much as with the lack of enabling market mechanisms and models, which can be facilitated through conducive policy environment. As with the advent of any new technology, there is bound to be policy friction and resource competition and addressing this through building a consensus amongst adopters can be a challenging and time-consuming process. However, as seen in adoption across Asia, Europe and other regions, it is the city and municipality that can lead the deployment of the technology very effectively through support from State Government.

2. Peaking power demand, grid under-capacity

Power utilities struggle to meet **power demand** especially during summer when daily power demand peaks. In May 2024, power demand peaked at 20,700 MW in Chennai on account of surge in cooling demand from air conditioning. Even as the largest renewable energy producing State, Tamil Nadu struggled to meet peak cooling demand requirements due to variability of renewable energy sources. Given the challenges around meeting night-time power demand from cooling, Tamil Nadu is actively pursuing adoption of large-scale, **grid-based battery energy storage** solutions, which are not commercially viable yet and may have end of life impacts not completely understood yet. All of this when juxtaposed against the State's net zero and decarbonization goals raise to the fore the issue of, firstly, meeting cooling demands of residential, commercial and industrial sectors, and secondly, doing so in a sustainable manner.

3. Complexity in existing regulations and current market dynamics

Primary adopters of district cooling are **real estate developers** that typically have to undergo a number of complex approval processes to procure regulatory permits such as fire permits, environmental clearances from pollution control board, various state/municipal and central permissions – all of which make executing a real estate project not the most straight forward process. Secondly, this regulatory burden is applicable separately for procurement of all basic services – electricity, water, sewerage, gas. The fear then is that **District Cooling is an added layer of complexity, adding to the existing regulatory burden of developers.** Policy development should also be seen from the lens of the implementation entity and regulations streamlined for driving growth and sustainability. A one stop solution with a single window clearance system that can support provision of all related services and products in District Cooling can be helpful.

Furthermore, market pressure from tenants for in-house, SLA-based, highly reliable cooling have resulted in most developers building in-house capabilities for developing and operating captive cooling systems. There is a lack of incentive or motivation to optimize energy use as power costs are typically pass-through. As such, given the current market dynamics, outsourcing of cooling is not preferred. Similarly, for residential development until there is a policy push from the government, there is not enough motivation for the user or the supplier to change the status quo. This is so because residential property has emerged as an attractive investment asset for renting and leasing, which means that the owner does not pay electricity bills and is not concerned about energy efficient systems, and the tenant does not have a say on the system the developer should install even though the tenant pays the increasingly high electricity bills.

For other use cases, too, there are varied set of challenges to adoption of district cooling – for industrial, concerns around variation in temperatures from -20 to +25 Celsius that need to be met; for data centres, stringent requirements on reliability of cooling and power resulting in N+N infrastructure built out; for residential, owners' association/resident welfare association's preference against central systems and so on.

4. Monopolistic tendencies with a District Cooling system

District Cooling systems, where a single provider supplies cooling to multiple customers, exhibit monopolistic tendencies. These systems require significant upfront investments, creating barriers to entry for competitors. The high capital costs and economies of scale discourage competition, consolidating market power within one provider. In this, District Cooling systems are similar to natural monopolies like electricity and water – it is more efficient for a single provider to serve an area than for multiple providers to build redundant infrastructure, reinforcing monopolistic tendencies. Furthermore, customers often have long-term contracts, typically 20 to 30 years, to ensure a return on investment. These contracts limit customers' ability to switch providers, and, the tariff structures, usually a mix of fixed and variable charges, lack price competition, potentially leading to tariff lock-in.

5. Uncertainty for Base Investment Case in District Cooling systems

Existing urban environments are often densely populated and have limited available space. Retrofitting these areas to accommodate cooling infrastructure can be disruptive and expensive. The process involves significant logistical challenges, such as the installation of extensive piping networks without predefined easements in urban corridors. Without these easements, laying down the necessary infrastructure becomes a cumbersome and costly endeavour, often requiring extensive negotiations and modifications to existing city layouts. Additionally, securing the necessary land for constructing district cooling plants and obtaining rights-of-way for pipeline installation is another formidable challenge. Urban land is a highly contested resource and acquiring it for new infrastructure projects can be complex and time-consuming. The process often involves navigating a web of regulatory approvals, land acquisition negotiations, and potential opposition from existing landowners or other stakeholders.

Viability of District Cooling depends on consistent and predictable demand for cooling services. Ascertaining demand in absence of policy can also be challenging due to factors such as urban development patterns, population growth, and changing climate conditions. Uncertain demand makes it difficult to ensure that the system will operate at optimal capacity, which is crucial for economic viability. These challenges hinder the flow of private capital into cooling infrastructure, jeopardizing the development of efficient and sustainable cooling solutions.

III. Solutions and Opportunities

The transition to District Cooling needs a long-sighted approach that sufficiently balances implementation of new state policies, incentivisation of the private sector, and generating consumer demand. Passive measures should be incorporated, to the extent possible, to reduce the mechanical demand for cooling, and district cooling should be considered to meet the residual demand. In high density areas, District Cooling can be explored in a more holistic way through policy tools, whether through interlinkages with existing policies at central, state and city level or through enforcement of new policies such as mandating for certain zones.

1. Enabling Policy Landscape to encourage adoption

Until there is optionality towards approach to cooling, it is likely the chosen path will always be to select the most cost effective, economically viable, profit maximizing option, without enough consideration to social and environmental aspects. Only when we **overlay the systems'** costs (associated with power infra for the Discom, water availability for municipality, climate and the planet) through mandating and other such policy mechanisms, will a more sustainable approach be actively chosen.

District Cooling is a viable alternative to traditional cooling, given the benefits of the technology also recognised by the State. The development of **a roadmap for District Cooling** as an addition to the already launched District Cooling guidelines can serve as an anchor for greater adoption of the technology. CMDA's heat island and associated studies being undertaken to identify hot-spots in high density areas can inform the areas where district cooling can have the most impact through urban planning and mitigation measures to reduce heat gain. The success of District Cooling requires an approach that brings together all stakeholders - the state, private sector, urban planners, and financers for **cohesive action, awareness, and assessment.**

Government policies can ensure that appropriate safeguards can be built-in to address challenges to the benefit of the adopter and end user. The technology has been around for more than a decade and has had takers across the world including in Asian countries like Singapore and Malaysia. **The broad regulatory pillars that have made the transition successful in these countries and can be used by Tamil Nadu to inform its District Cooling policy roadmap** include:

a) **Zoning:** This should be done as a part of master planning to earmark high building density areas in the city masterplan to assess the socio-economic feasibility of District Cooling systems. Even for areas already developed, based on power tariff applicable in Tamil Nadu, the cooling demand in a given 1 sq km area can be assessed to understand feasibility of district cooling. For instance, within a given 1 sq. km area, if the likely built-up area is more than 4 million sft or has 10,000-15,000 RT installed cooling capacity; based on benchmark capital costs for standalone and District Cooling systems, a District Cooling will be more cost effective than all other conventional forms of cooling due to reduction in mechanical load.

b) **Mandating:** Followed by zoning and getting visibility on high-impact areas, policy tools such as mandating adoption of district cooling within the area may be used. For instance, if Nungambakkam is envisaged as a high-density commercial development, all present and new developments should mandatorily have to sign up for district cooling to meet their buildings' cooling needs.

c) **Easier permitting regimes:** Developments that choose to sign up for district cooling can have a prioritized, fast-track approval process.

d) **Energy consumption standards:** Buildings should have to mandatorily report their energy consumption and energy efficiency. Based on the standards set up, a penalty system can also be implemented which entails revocation of certification for non-compliance. Similarly, green building certification can provide additional points to projects that incorporate District Cooling in the masterplan.

e) **Reporting and Social Mandate:** District Cooling systems set up in proximity to housing and commercial establishments of vulnerable communities can have a social mandate to ensure District Cooling piping network expands to these areas to provide subsidized or free thermal comfort.

2. Risk Sharing & Mitigation for technology lock-in and market preferences

As the market for District Cooling system evolves, the need for robust risk-sharing and mitigation strategies becomes paramount, **addressing concerns related to technology lock-in and market preferences. By implementing regulatory measures** such as licensing requirements, tariff controls and innovative contractual mechanisms, stakeholders can ensure the long-term viability and adaptability of District Cooling system, while protecting the interests of both providers and users.

a) **Licensing:** To ensure provision of cooling by technically and financially competent private sector players for a merchant District Cooling system concession, a licensing regime can be adopted based on a pre-agreed criterion of nomination. Mandatory licensing for District Cooling system providers should be based on stringent criteria, including adherence to the latest technology standards, innovative solutions, and flexibility in infrastructure development.

b) **Technical Standards:** Secondly, all licensed players should have to adhere to technical standards for minimum performance through a comprehensive list of key performance indicators. The standards can also emphasize flexibility in District Cooling system build-out, include trigger points for replacement and retrofits that ensures, preventing long-term dependence on obsolete systems. This mitigates the risk of technology lock-in by promoting the use of cutting-edge technologies. Regular reviews and updates to the standards a ensure providers remain compliant with technological advancements.

c) **Contractual mechanisms:** Model Concession Contract (MCC) structures that can support tendering activities of government entities and layout the provisions of the contract to be entered into between, one, the master concessionaire (grantor) and the service provider (District Cooling system company), and two, between the service provider (District Cooling system company) and off takers (lessors, buyers and owners of buildings in a said area). On the private side, innovative contractual mechanisms, such as back-to-back agreements between tenants and developers and developers and District Cooling system providers, can distribute risks and obligations appropriately between developers and District Cooling system providers. These contracts transfer responsibilities from developers to cooling service providers, ensuring consistent and reliable services for tenants. Clearly defined service level agreements (SLAs) outline performance standards and maintenance requirements, benefiting all stakeholders.

3. Merchant District Cooling adoption for large-scale impact

For District Cooling to really have an impact, it has to happen at scale and not, for example as captive central cooling plants within a campus. **Merchant District Cooling** is the way forward for large scale impact. This will require greater awareness at the consumer level. Better narrative building will allow the Indian consumers to see the application of the technology and its environmental benefits in a more personalized way (similar to piped gas for cooking). A cost-benefit analysis which takes into account the initial expenditure and evens it out with the long-term benefits like power savings and progress in reducing greenhouse gases may be required to create appeal among the consumers and boost demand.

Furthermore, if planned well at the design stage, district cooling and energy systems with their **inherent surplus capacity can also provide access to cooling to more vulnerable sections** of the society. District Cooling should be in the **national infrastructure pipeline** for it to be meaningfully adopted on a commercial scale.

When integrated as an energy system, the impact can be more exponential from a **sustainability, circularity and resilience** point of view. For example, natural gas supplied through the city gas distribution network can be used as an alternate fuel source to eliminate the need for grid power and diesel gensets. The support through TES installations that store and discharge chilled water during off peak hours also aid in optimising mechanical installation and reducing grid reliance. Waste heat recovered from a Waste to Energy plant or a power plant can be used to power chillers in a DCS that cool water. District Cooling can help reduce the dependency on potable sources through the use of treated sewage effluent (TSE) from Sewage Treatment Plants (STPs). Options should be explored to make the technology **self-sufficient**. A holistic, systems' approach is required to scale adoption of District Cooling systems.

4. District Cooling for integrated resource use and demand-side management

Since the vast majority of the energy needs, at 50-70%, of a building stem from cooling, Thermal Energy Storage systems associated with District Cooling can be a key lever for demand side management for the State to stabilize its grid by smoothening peaks and reducing per unit cost of power consumed. Further, when Thermal Energy Storage systems are set up at project sites to store chilled water for cooling, battery storage requirements at grid level can be significantly eased.

Merchant District Cooling systems when integrated as energy systems, can have an exponential impact from a **sustainability, circularity and resilience** point of view. For example, natural gas supplied through the city gas distribution network can be used as an alternate fuel source to eliminate the need for grid power and diesel gensets. Thermal Energy Storage installations that store and discharge chilled water during peak hours also aid in optimising mechanical installation and reducing grid reliance. Waste heat recovered from a Waste to Energy plant or a power plant can be used to power chillers that cool water in a District Cooling system. District Cooling can help reduce the dependency on potable sources through the use of treated sewage effluent (TSE) from Sewage Treatment Plants (STPs). Options should be explored to make the technology self-sufficient. A holistic, systems' approach is required to scale adoption of District Cooling systems.

5. Regulatory Models for District Cooling

Regulatory frameworks play a crucial role in ensuring the efficiency, reliability, and fairness of District Cooling systems. Models akin to those implemented by the Airport Regulatory Authority and for District Cooling system in mandated zones in Singapore can provide valuable insights into effective governance and oversight for mandated District Cooling system areas. These models typically include caps on capital expenditure (capex) recovery rates, efficiency standards, and rigorous auditing processes to uphold compliance, with the threat of license revocation for non-compliance.

a) **Public-Private Partnership (PPP):** The DC system in mandated zones in Singapore are developed through PPP model. Through a tendering process, a district cooling company is awarded the tender to design, build, own and operates the DC system under a concession agreement with the government.

b) **Minimum Demand Offtake:** In designated areas, buildings are required to connect to the DC system. This mandate ensures a critical mass of customers, which is essential for the system's economic viability.

c) **Cost-Reflective Pricing:** The tariff structure is designed to be cost-reflective, ensuring that the charges are based on the actual cost of providing the service. This includes capital expenditure, operational expenditure, and a reasonable return on investment.

d) **Two-Part Tariff:** The pricing typically involves a two-part tariff – one, a fixed capacity charge based on the contracted cooling load and two, a variable usage charge based on actual consumption. This structure incentivizes efficient use of the cooling service. The pricing model is transparent, providing customers with a clear understanding of the charges and the basis for these charges.

e) **Efficiency Metrics:** The District Cooling system must meet specific energy efficiency metrics that are regularly reviewed and updated to reflect technological advancements and best practices. Buildings connected to District Cooling system can also earn points towards green building certifications.

f) **Regular Audits:** Regular audits are conducted to ensure compliance with efficiency standards. These audits are performed by independent third parties to ensure objectivity and transparency.

5. Cooling as a Utility

Rapidly increasing heat experienced across the country has made cooling a necessity for survival and a thriving economy. India and more specifically the State does not have sufficient infrastructure or capacity to cater to such demand. There is a need for a **Cooling as a Utility** structure, wherein Cooling is treated as a public good. If cooling is recognized as a utility, a lot of the challenges faced by district cooling service providers can be effectively addressed – approvals for a utility plot for setting up a district cooling plant, easement rights for corridors to lay out network, etc.

If planned well, District Cooling is cost effective and doesn't require any financial support, beyond a conducive, enabling regulatory environment for its uptake. This could take the form of preferential power tariffs for District Cooling system serving mixed-use developments with affordable housing segment or SMSE, tax breaks where applicable, transmission of social benefits to the District Cooling system provider where the cooling needs of the more vulnerable sections of the society are met.

a) **Preferential Power Tariffs:** Offer preferential power tariffs for District Cooling system providers serving mixed-use developments, which include residential areas with vulnerable populations. This reduces operational costs and enables providers to offer lower rates to low-income users.

b) **Industrial/Commercial-to-Residential Cross-Subsidization:** Higher tariffs on commercial users within a mixed-use development can subsidize the cooling costs for residential users, especially those from vulnerable sections of society. Similarly, industries and high-usage commercial entities within the District Cooling system network can be charged premium rates, with the additional revenue used to offset the costs of providing free or subsidized cooling to low-income households.

c) **Tax Breaks and Incentives:** Provide tax breaks and financial incentives to District Cooling system providers who extend services to vulnerable communities. This can include deductions for investments in infra-structure that serves low-income households.

d) **Social Benefits Credits:** Establish a system where District Cooling system providers receive social benefits or credits which would have otherwise been needed for serving vulnerable populations. These credits can be used to offset other regulatory costs, incentivizing the extension of services to underserved area.

The question that then remains is how can cooling be considered amongst the bundle of utilities, and how the process of deployment and adoption of cooling solutions can be accelerated. Here, greater dialogue between the state government, private stakeholders, research institutions and civil societies, and urban local administration can be helpful.

Conclusion

While a lot of the solutions posited in the above section may seem medium to long-term, they are relevant given Tamil Nadu's ambition on climate. District Cooling can help unlock a number of environmental and social benefits in addition to the reduction of power demand from aggregation benefits and integration of complementary technologies to accelerate circularity in energy, water and waste use. Treating cooling as a central utility democratizes access to cooling services, ensuring affordability and resilience across diverse urban landscapes, complementing Tamil Nadu's climate ambitions.

The government of Tamil Nadu has taken important steps in the right direction by setting up a dedicated District Cooling Steering Committee. Work is ongoing to make the adoption of this technology commercially viable and ready for adoption on a large scale to benefit the end user. This will be a revolutionary change in the cooling landscape of the state. Awareness about this technology is a pre-requisite for its growth and expansion. The present cooling solutions are harmful for the environment and do not take a long-term view.

Focus on enabling commercial and large-scale viability of District Cooling technology is required through innovative business models and solutions. There is a need for mindsets to change on existing socio-economic norms regarding cooling, to fashion a unique development trajectory for the State and the Country. A common shared vision for sustainable cooling can propel diverse stakeholder efforts in the right direction to instill confidence in developers and end users alike for wider adoption.

It is about time that stakeholders in India are able to tell the story of District Cooling to the Indian people in a better way, such that it invokes interest and intention to act. As a society we may be hesitant to change, but never resistant to change.

Notes

1. Keeping cool in a hotter world is using more energy, making efficiency more important than ever
   Source
2. Chennai's Third Master Plan (2027- 2046): CMDA To Finalise Studies By November
   Source
3. IIT Madras Sets Ambitious Goal Incubating 100 Start Ups:
   Source
4. Outstanding Energy Saving Technology:
   Source
5. T.N. signs pact with U.N. Environment Programme to implement urban cooling initiative:
   Source