Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag

INTERNATIONAL
CLIMATE
INITIATIVE

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

DISTRICT COOLING

# DRIVER OF RESOURCE CIRCULARITY

## COOLING CHALLENGES AND THE CASE FOR A CIRCULAR URBAN TRANSITION

India's built environment faces intensifying heat stress due to rising global temperatures, expanding urbanization, and changing land-use patterns. Frequent and prolonged heatwaves are straining infrastructure and intensifying cooling demand across sectors. Without intervention, the surge in conventional air-conditioning could significantly raise energy use and emissions, as well as leading to economic losses and undermining climate goals.

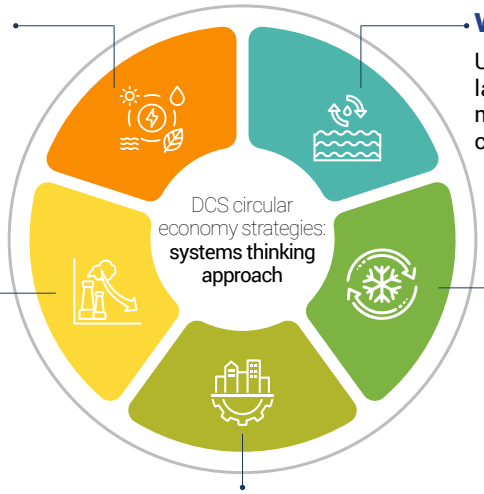
A shift toward circular, resource-efficient cooling such as District Cooling Systems (DCS) is essential to ensure a resilient, low-carbon future.

## DISTRICT COOLING: THE ENGINE OF RESOURCE CIRCULARITY

DCS are centralized networks that produce and distribute chilled water for indoor cooling to industrial, commercial, and residential buildings through insulated closed loop and industrial grade underground pipe network. DCS operationalizes circular economy principles by facilitating the circular use of energy, water, and materials within the built environment as shown in Figure 2:

*Figure 1: View of DC Plant and TES Tank at Urban City (representative illustration)*

*Figure 2: DCS circularity enablers*




**ENERGY CIRCULARITY**

Capturing and reusing waste heat from industries, data centers, and power plants reduces dependency on grid-based electricity and optimizes local energy flows.

**WATER CIRCULARITY**

Utilizing treated sewage effluent (TSE), lake water, ocean water, or greywater as make-up water minimizes freshwater consumption, closing the urban water loop

**URBAN POLLUTION REDUCTION**

Removing individual rooftop chillers and cooling towers mitigates noise, heat, and air pollution, while improving cityscapes and building aesthetics

**MATERIAL AND REFRIGERANT CIRCULARITY**

Centralized systems reduce the total quantity of refrigerant required, limit leakage risks, and extend equipment life, thereby reducing waste generation and maintenance burdens

**UTILIZATION OF EXISTING INFRASTRUCTURE**

Leveraging city infrastructure: enables energy source diversity & feasibility using City infrastructure like CGD, water supply networks, etc.

Moreover, DCS strengthens system resilience by integrating renewable and waste-based energy resources:

**Waste-to-Energy (WtE)**: Urban solid waste can be converted into thermal energy to power district cooling systems, as demonstrated in Barcelona's Districlima, where steam from a W2E facility drives the cooling network.

**Thermal Energy Storage (TES):** Enables off-peak cooling production and storage, optimizing load management, supporting renewable integration, and reducing energy costs.

**Distributed Renewable Energy (DRE)**: Integration of solar photovoltaic (PV) or hybrid energy systems further lowers carbon emissions and grid dependency.

Beyond energy and resource efficiency, DCS also enhances urban space optimization and capital productivity. By replacing decentralized chiller installations, buildings can reclaim up to 75% of mechanical plant space, which can be repurposed for green landscapes, rooftop solar systems, or additional leasable areas.

## DISTRICT COOLING AS A CORNERSTONE OF CIRCULAR, AND REGENERATIVE URBAN SYSTEMS

- **Global Momentum**: District cooling systems may form the backbone of circular cities, transforming waste heat into valuable energy. Cities like Helsinki, Copenhagen, and Stockholm showcase how surplus industrial and data center heat can meet over 80% of urban cooling demand, enhancing energy security and liveability.
- **India's Transition**: The India Cooling Action Plan (ICAP) identifies DCS as a scalable, low- carbon urban cooling pathway. Flagship examples like GIFT City and Hyderabad Pharma City highlight its efficiency and PPP-driven potential in advancing India's circular economy and net-zero goals.

## CONCLUSION: DISTRICT COOLING AS A PILLAR OF CIRCULAR AND CLIMATE-RESILIENT CITIES

District Cooling represents a paradigm shift, from fragmented, high-emission cooling to integrated, resource-efficient urban systems. By connecting the dots and interlinking energy, water, and waste streams loops, DCS aligns perfectly with India's Net Zero 2070 and Resource Efficiency and; Circular Economy goals. More than just an efficient utility, it serves as a systemic design intervention—redefining urban metabolism from a linear model to a circular one, and paving the path toward regenerative, climate-resilient, and resource circular city planning.

**Published by**

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

**Project**

Energy Efficient Cooling

**Registered offices**

Bonn and Eschborn, Germany

T +49 61 96 79-0
F +49 61 96 79-11 15
E info@giz.de
I www.giz.de/India

**Bureau of Energy Efficiency, Ministry of Power**

West Block 2,
R.K Puram, Sector 1
New Delhi – 110066, India

**On behalf of**

Federal Ministry for Economic Affairs and Climate Action (BMWK)

**Responsible**

Nitin Jain
nitin.jain@giz.de

October 2025