

FOCUS AREA 02

Decarbonizing Residential Cooling

District cooling and thermal energy storage research designed to shift peak demand and accelerate low-carbon cooling.

Research Context

Residential air conditioning presents two major challenges: a significant night-time peak in electricity demand and the widespread oversizing of installed cooling capacity in homes. To address this, we conducted a case study last year on a 387-Homes, residential complex in Hyderabad, demonstrating that district cooling can reduce installed cooling capacity by up to 90%. Furthermore, the night-time energy demand can be met using thermally stored energy, leveraging solar power available during the day.

At Plaksha, IVCCE has developed India's largest academic thermal storage research testbed, coupled with the campus centralized chilled-water cooling system and supported in part by the International Finance Corporation, World Bank Group. The living laboratory is intended for startups, manufacturers and solution providers to evaluate technologies in a field environment.

District Cooling and Thermal Storage Living Lab

The Thermal Energy Storage (TES) Living Laboratory, integrated with the district cooling system, enables night-time cooling for 220 rooms of Hostel-1 by storing thermal energy during the day and discharging it at night.



Thermal Energy Storage Living Laboratory monitoring facility

The system is now in the monitoring, verification, and performance optimization stage. The testbed serves as a platform for interdisciplinary research involving faculty, researchers, and students in collaboration with industry experts, covering experiments, modelling, and simulations to optimize thermal storage-based cooling systems.



Schematic of Thermal Energy Storage System

This lab functions as a testbed to generate real-world evidence on thermal storage performance under Indian conditions. It supports research on load shifting, peak demand reduction, energy efficiency, and reduced reliance on high-GWP refrigerants, while enabling behavioral, economic, social, and environmental assessments. We aim to support the development of national thermal storage standards and demonstrates the scalability of district cooling and storage solutions for decarbonized, resilient urban cooling across Indian cities.



Thermal storage plant piping network