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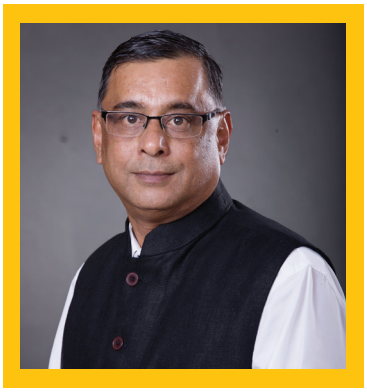
INNOVATING ENERGY

Sustainable Cooling – Addressing energy demand and climate change

INSIDE STORIES

In Focus

EESL reports reinforce the objectives of ICAP; says District Cooling System & energy efficient ACs can be the enablers of India's cooling revolution



Editor's Note

Saurabh Kumar

Executive Vice Chairperson
Energy Efficiency Services Limited

Dear Reader,

The aggregated nationwide cooling demand is projected to grow around 8 times by 2037-38 from the 2017-18 baseline. This means that India would require clean and green avenues for cooling. India has been leading the way in developing a framework for ushering in sustainable cooling and has created an integrated action plan for the same – the India Cooling Action Plan (ICAP).

ICAP has the development and use of a robust mix of cooling technologies, including the use of energy-efficient appliances, as one of its key focuses. Energy efficiency has considerable potential for emission reduction of the cooling sector and development of efficient ACs is now a key imperative. Our recently launced reports on "National District Cooling Potential Study for India" and "Market Assessment for Super-Efficient Air-Conditioners" also identify interventions such as District Cooling System (DCS) and energy efficient ACs as enablers of large scale emission reduction for the cooling sector. We briefly touch upon the findings of these studies in this edition.

This edition of the newsletter focuses on highly critical issue of sustainable cooling and delves into current and future interventions, which can help the nation meet its cooling needs efficiently. In "NCEEP will help EESL in building a strong ESCO market", we look at how the National Chiller Energy Efficiency Program (NCEEP) can accelerate the market penetration of energy-efficient chillers and catalyse investments in efficient central cooling technologies. The article "A greener footprint for Kerala with District Cooling System" explores the potential of DCS in reducing cooling related emissions in the state of Kerala. In "District Cooling Systems - A Climate Solution" we look at how district cooling can be the backbone of net-zero emission in Indian cities and contribute towards India's large climate goals. "Integrating energy efficiency to space cooling; combating climate change" delves into the need for creating cost effective and energy efficient cooling appliances, in a bid to conserve our environment.

Now, more than ever before, we need to make India's cooling sector sustainable and energy efficient. With ICAP, and other current and upcoming initiatives like DCS, Super-Efficient Air Conditioners (SEAC), NCEEP and absorption cooling, we already have the tools to achieve this. What we need now, is swift implementation and an increased adoption of eco-friendly and energy efficient cooling alternatives by both industrial and residential consumers.

A greener footprint for Kerala with District Cooling System

R Harikumar

Director of Energy Management Centre (EMC)
Government of Kerala

According to India's Cooling Action Plan, released in March 2019, the demand for space cooling in buildings will grow by 11 times between 2018 and 2038. By 2050, the IEA forecasts that India is likely to be the largest consumer of space cooling in the world, with space cooling becoming responsible for 28% of electricity demand and 44% of peak load. This demand will be concentrated in India's rapidly growing cities. It is therefore important to address and optimise the power demand of space cooling by using energy-efficient district cooling systems and trigeneration.

The terminology - District Cooling – may be a misnomer in a tropical country like India. District Cooling, in our parlance, does not necessarily refer to cooling an entire revenue district, but instead, refers to the centralised generation of chilled water, steam or hot water and then piping that to nearby buildings for air conditioning/ space heating. As a result, these buildings don't require their own chillers, air conditioners and boilers. Such a centralised system is considered to be highly effective in addressing challenges (to the individual building owner) like high capital and operating costs, reliability, flexibility, space constraints and environmental sustainability, while meeting their comfort and process cooling/heating needs. District cooling uses only 50% of primary energy consumption for cooling urban buildings, when compared to other cooling systems.

The southern State of Kerala shows diversity in its climatic conditions. The eastern highlands, including the mountain regions, predominantly have a cool climate. On the other hand, the coastal plains of western lowlands generally remain hot and humid for the most part of the year. Buildings coming up in this part would thus, require cooling. The future of Kerala's construction sector looks bright and promising in post-Covid days due to people's reverse migration. Besides, the proven healthcare system would give rise to additional infrastructure, turning Kerala into a destination for affordable medical treatment including traditional Ayurveda.

Also, the expected boom in IT and tourism sectors would call for more power demand in cooling. Energy Management Centre (EMC), the State Designated Agency (SDA) of Bureau of Energy Efficiency (BEE) in Kerala, in its efforts to enhance energy efficiency in all sectors of the economy, is keen to promote district cooling projects. EMC has recently organised a workshop on district cooling on 25 February 2021. This was attended by infra/IT companies and service providers like the public sector EESL and TABREED.

Thus, district cooling holds immense potential in mitigating the adverse impact of emissions from the cooling sector. Kerala, with its rich diversity in climate and topography, stands to benefit considerably from adoption of district cooling for its buildings and industries.

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Combating climate change by integrating energy efficiency to space cooling

Deba Ghoshal

Vice President & Head of Marketing
Voltas Ltd.

As energy consumption increases at an alarming rate, there is a need to address energy demand and climate change, both at an individual and an organizational level. Global warming concerns are at an all-time high and India Meteorological Department (IMD) has predicted that the upcoming summer season will be warmer than usual over most regions of India. With average temperatures soaring across the world, it is expected that consumers will look for a range of energy efficient cooling products to make their lives comfortable. Anticipating this increase in demand for energy efficient ACs. Voltas Limited, India's undisputed leader in cooling products, and the No. 1 AC brand, had announced its **partnership with Energy Efficiency Services Limited (EESL) to manufacture energy-efficient Inverter Air Conditioners**.

These Super Energy Efficient ACs (SEACs) offer faster and more cooling than any ordinary AC, and are 54% more energy efficient than conventional 3-star ACs, that too at an affordable price. They also ensure low-noise operation, longer life, energy savings, and better capacity control. Voltas is proud to partner with EESL under the 'Super-Efficient Air Conditioning Program' for residential and institutional customers. The approximate investment in this programme is around ₹190 crores, which is partially met through a grant from the Global Environment Facility (GEF) and a grant and a loan from the Asian Development Bank (ADB).

As a Tata Group company, it is Voltas' constant endeavor to provide customers with technologically advanced, environment friendly, and best-in-class products and services. Having said this, our approach towards environment has always gone beyond the need of compliance, in line with the Tata heritage.

Voltas has been working closely with the government and meeting the norms in the residential, light commercial and commercial segment well in advance of Regulation. As part of our commitment towards a sustainable future, the organisation has taken a conscious decision to phase out Hydrochlorofluorocarbons (HCFCs) components across product categories. In Room Air Conditioners (RAC) & commercial refrigeration products, refrigerant R12 and R11 were replaced by refrigerant R22 and R134 respectively, as a long-term alternative. Side by side, our Research and Development team, in collaboration with certain chemical manufacturers has been exploring efficient refrigerants that result in lower CO_2 – equivalent emission reduction. This has prompted further research on the usage of L20 (a blend of R32+R125+R1234yf), a refrigerant with a lower Global Warming Potential (GWP) and zero Ozone Depletion Potential (ODP).

We've also developed cost-efficient RAC models by optimizing the outdoor unit with R32 refrigerant, thus improving the overall quality and performance. We have already moved to 100% use of R32 in Room Air Conditioners. With the required investment, our Pantnagar facility has been upgraded for safe production of the new refrigerant machines. Similar initiatives have been taken in Commercial Refrigeration products and Air Handling units.

As a market leader, we've always taken the ownership to innovate on products and solutions that are committed to not just our customers but

also the future and one that disrupts the market. This year, brand Voltas, has launched a new range of Pure Air Maha Adjustable ACs. It is a UV based split inverter AC and is equipped with state of the art Super UVC LED system, which quickly disinfects the indoor air by killing germs and pathogens like virus and bacteria. Voltas PureAir AC also has TIO2 (Titanium Oxide) coated air filtration system, which removes harmful gases and VOC (Volatile organic compounds) from indoor air to make the air perfectly healthy for human consumption. The brand has also launched a new range of Maha Adjustable ACs that allow flexible Air Conditioning upto 5 multi tonnage options.

With increasing concerns over global warming, it is critical for all organizations to focus on improving the energy efficiency of products to combat climate change. Voltas' differentiated positioning of energy efficiency is based on intelligent design and innovative cooling, doubling up to provide not only cost-effectiveness but also the highest levels of energy efficiency.

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NCEEP will help EESL in building a strong ESCO market

S. P. Garnaik

Business Unit Head (Lighting)
Energy Efficiency Services Limited

India is committed to reducing its greenhouse gas emissions to 33-35% of 2005 levels by the year 2030. Mitigating energy use and greenhouse gas emissions of buildings and industries are crucial in achieving this target. Presently, almost 30-40% of energy consumption in buildings can be attributed to cooling systems. Moreover, the market for cooling technologies is poised for rapid growth as the demand for cooling grows. The total nationwide cooling demand is expected to increase eightfold from 2017–2038 in terms of tonnage of refrigeration (TR). Cooling demand in buildings is expected to grow elevenfold during this time. Central cooling systems currently represent 26% of the cooling market, in terms of sales. About 20,000 chillers, equivalent to 4.3 million TR capacity, were sold in the past five years. The market is projected to grow at a CAGR of 8-10% over this decade.

The National Chiller Energy Efficiency Program (NCEEP) can ride on the present and future growth momentum to accelerate market penetration of energy-efficient chillers and catalyze investments in efficient central cooling technologies. The current installed capacity of chillers is about 6 million TR and is expected to grow to 38 million TR by 2050. EESL estimates a short-term market opportunity of 3.9 million TR for chiller replacement in space cooling and process chilling. Over the course of this decade, the chiller stock for replacement will be about 20 million TR, which represents a 7 billion USD market opportunity at present costs. Assuming a chiller plant lifecycle of 15 years, NCEEP can result in savings of 23 million MWh of electricity and GHG emissions reductions of about 21 million tCO_2e by the end of this decade.

NCEEP will assist India in enhancing the market penetration of energy efficient chillers and the efficiency of existing chiller stock, through innovative Energy Service Company (ESCO) investment and repayment models. NCEEP is an opportunity to invest more capital in energy efficiency markets through ESCOs and eventually build a strong ESCO market in the country. The Government of India had established EESL as a Super-ESCO to stimulate and nurture the ESCO market in India. EESL's ESCO and integrated Energy Efficiency Services model can be applied to build a robust ESCO market for chiller replacement.

EESL will galvanize demand and supply for energy efficient chillers through NCEEP and reinforce various national efficiency standards. It is only recently that chillers and few other chiller plant technologies have entered the ambit of national energy efficiency policies. NCEEP will improve the efficiency of the existing chiller stock and push up baseline efficiencies of chillers in the market. EESL's intervention will incentivize manufacturers to invest in research, development, and deployment of more efficient technologies by creating a demand-side pull.

NCEEP will help EESL achieve its many interlinked goals tied to its overarching mission of transforming the market for energy efficiency.

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District Cooling Systems - A Climate Solution

Lily Riahi

Coordinator, Cool Coalition
UNEP

Cooling is a topic that touches all of us. It is not only about thermal comfort, but also about protecting our most vulnerable from heat stress, keeping vaccines viable, food fresh from farm-to-fork, and workforces productive. But the conventional cooling industry is polluting and energy-intensive accounting for an estimated 7% of global greenhouse gas emissions. Cooling's large and growing demand for energy – in the major growth markets often generated with coal–undermines our efforts to get to a zero-emission grid and tackle climate change. We have already seen annual residential AC power consumption alone outstrip record additions of solar capacity on the grid and the demand is only set to grow. To win the race to zero, we need to catalyze action towards efficient, climate-friendly cooling. This action must support the adoption of comprehensive measures that avoid or reduce the need for mechanical cooling, improve efficiency of cooling solutions, and shift to the use of renewables and lower global warming potential refrigerants.

For many cities that have developed it, district cooling has emerged as the most efficient, climate-friendly and economic means to provide reliable air conditioning in a dense urban area and it can also be used to provide industrial cooling, such as for agricultural and medical cold storages. What is key is that that district cooling is being promoted alongside better urban design, building and industrial efficiency, and alternatives to air conditioning, such as fans. Many of the most successful companies in the district cooling industry are advancing this model as part of their service offer - advising building developers in the design phase to reduce cooling consumption and during operations on maintaining their HVAC system.

District cooling also allows cities to counteract many of the economic and environmental challenges of cooling. It makes thermal storage and trigeneration more economically competitive – helping to shift the peak power demand from cooling and reduce fossil fuel consumption. Phasing down and phasing out of planet warming refrigerants is easier with district cooling as the centralized approach unlocks better management, safer use of alternative and natural refrigerants and technologies that don't rely on such refrigerants at all. Finally, the use of renewables and waste heat for cooling is easier with the economies of scale offered by district cooling.

In India, district cooling is gaining momentum. The ambitious pilot cities, industry interest and government support we are seeing through the UNEP District Energy in Cities Initiative is heartening as are the new parallel activities from GIZ, Bureau of Energy Efficiency and ISHRAE. As set out in a recent report "District Cooling Potentials Study of India" which UNEP co-authored with EESL, **if India grasps the full opportunity of district cooling 25GW of peak power demand could be avoided, 27 million tons of CO_2 and 4,300 tons of refrigerants**. Finance will be crucial to this endeavor both for the upfront investment required and in project preparation. In this EESL can play a critical role and open the market as can support from development banks and private sector. In this regard it is exciting to hear of two UNEP partners, Tabreed and IFC, announcing a $400 million investment fund for district cooling in India recently.

India's Cooling Action Plan (ICAP) is exemplary in its comprehensive approach to tackle the cooling

challenge. District cooling is identified as a much-needed technology to meet remaining urban cooling demand following strong building efficiency measures and promotion of alternatives to mechanical cooling. ICAP's long-term recommendation of large-scale adoption of not-in-kind technologies such as district cooling needs action now – demonstration projects in cities can grow to city-wide systems in 15-20 years meeting existing and future demand. District cooling can be yet another area of global leadership for India in the cooling sector, with a homegrown industry driven by India's real estate expansion and economic growth. In doing so, district cooling can be the backbone of net-zero emission Indian cities, contributing to the goals of the Paris Agreement, Kigali Amendment to the Montreal Protocol and the 2030 Sustainable Development Goals while bringing cities relief from extreme heat and maintaining our food and vaccine supply chains.

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In Focus

EESL reports reinforce the objectives of ICAP, says District Cooling System & energy efficient ACs can be the enablers of India's cooling revolution

- EESL launched market assessment study for Super-Efficient ACs; Also launches a National District Cooling potential study for India
- 27 million tons of CO_2 emissions could be annually by using District Cooling System (DCS) with strong policy push
- DCS can be an innovative model to address the deteriorating climate situation

Energy Efficiency Services Limited, (EESL), a joint venture under the Ministry of Power, Government of India, with support from Global Environment Facility (GEF) and UN Environment Programme (UNEP) launched a market assessment study for Super- Efficient ACs. A report on District Cooling Potential in India was also launched in collaboration with UNEP, GEF, District Energy in Cities initiatives, EMPOWER Energy Solutions and Copenhagen Centre on Energy Efficiency with PwC as a knowledge partner. Both the studies explore the adoption of efficient and climate-friendly technologies for the urban cooling and Room Air-Conditioning (RAC) sector which can potentially reduce the energy requirements and environmental impacts associated with their use. These studies are an attempt to augment the objective of India Cooling Action Plan (ICAP).

India is the second fastest growing economy in the world. Increasing income levels, urbanization and rising temperatures have led to a growth in demand for room air conditioners (RACs). The market assessment study for Super- Efficient ACs provides a comprehensive overview of trends in Indian and global RAC market and analyses RAC component pricing, financing mechanisms, business models and go to market strategies to scale up the deployment of Super-Efficient Air Conditioner (SEAC) program in India.

The national cooling demand for space cooling in new commercial buildings or similar, lies in the range of 110 million TR by year 2037-38. The district cooling study estimates that by 2038 approximately 51 million tons of refrigeration (TR) of the national space cooling demand could theoretically connect to district cooling systems. If this level of demand were served by district cooling, it would reduce the need for up to 22GW of power capacity and reduce 27 million ton of CO_2 emissions annually. However, very strong policies and regulatory mechanisms would be required to trigger such market development and the study projects a more realistic scenario that 13 million TR is established by 2038 albeit still with significant policy support.

Ms. Geeta Menon, Joint Secretary, Ministry of Environment, Forests & Climate Change, Government of India, said, "As one of the first nations to release a cooling action plan, India has been early to acknowledge the role of cross-sectoral policies and technologies to address rising need for cooling. The cooling demand of citizens and institutions alike must be considered, in depth, to identify solutions that not only ensure low-emission, low-carbon solutions, but also enable cooling access for all."

Attending the virtual event, **Mr. Atul Bagai, Head, India Country Office, United Nations Environment Programme (UNEP)** said, "Through UNEP led District Energy in Cities Initiative, we have a community of countries, cities and industry providing necessary support and guidance to cities, states and national ministries in developing pilot District Cooling and trigeneration projects and supporting the development of conducive policy, institutional and regulatory frameworks in India."

With the country's growth, the demand for cooling has also rapidly increased. The 'National District Cooling potential study for India' undertakes a detailed exercise of estimating India's future space cooling demand and how much of that space cooling demand can be tapped by district cooling systems in India's largest cities. The report also indicates District Cooling System (DCS) as a proven technological solution, which has already been working in different cities worldwide. DCS contributes as a driver of urban sustainability, particularly when considered during the urban planning stage, and enables to integration of local, renewable and waste energy sources. A steering committee for development of DCS in India have also been constituted by the Bureau of Energy Efficiency (BEE) and Ministry of Environment, Forest and Climate Change (MoEFCC) to which, EESL has been appointed as the convener.

Mr. Abhay Bakre, Director General, Bureau of Energy Efficiency (BEE), said, "As a globally benchmarked cooling solution that has been proven in cities across the world, District Cooling can enable efficient and affordable access to cooling for India's citizens. While our Star Labeling Programme has created demand for efficient cooling solutions, the government's 'District Cooling Action in India' can play a vital role in delivering cooling at a suitable scale to the underserved across India's largest cities."

India currently has single ownership central cooling and ventilation plants; wherein completely private business models have been adopted. Given the current situation, hybrid ownership, which has the option of transferring the risk away from a single party, has the potential in addressing the technical, financial and capacity related barriers associated with DCS implementation and can deliver better risk sharing between private and public sector. Hybrid business models with an emphasis on PPPs and joint ventures should be prioritised and tested in the Indian context and could benefit from special power and water tariffs, financing options for district cooling service companies and should have involvement of expert contracting firms for various types of contracts and structuring.

Mr. Saurabh Kumar, Executive Vice Chairperson (EVC), EESL Group, said, "When effectively unlocked, India's immense latent demand for sustainable cooling solutions can trigger a virtuous cycle. With the rising scale of India's demand for cooling, bringing down cooling-related emissions can greatly reduce its climatic impact, and contribute to reducing global warming, just one of the many significant co-benefits that can be realised."

Speaking at the event, **Mr Rajat Sud, Managing Director, EESL** said ""Cooling represents for EESL the largest potential in energy efficiency savings, and these two studies are seminal in establishing policies, programmes & business model which can take this forward. In the RAC space, we have firmly established the Super Efficient AC which has 20% higher efficiency than 5 star rated AC. It is opportune that the study is being launched while we enrol private sales agents for promoting sales of these ACs at the same price as 5 star ACs."

The situation demands for an integrated policy framework for promoting district cooling and strong government engagement. It is important to consider special power tariffs to promote thermal storage, DCS expansion and residential connection. Establishment and standardization of project development process, business models and contracting can be taken into consideration.