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Efficient and Sustainable Cooling

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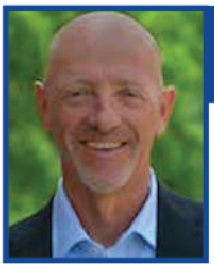

India's cooling challenge and role of Super-Efficient AC (SEAC) programme in combating it

Iain Campbell
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EDITOR'S NOTE

Dear Reader,

There has been a gradual shift towards sustainability, as the adverse effects of unchecked emissions and indiscriminate development have become apparent. We have become aware of how each of the sectors have the potential to be cleaner and ecologically viable. The ozone depleting refrigerants and high energy demand have cumulatively made the cooling sector a major contributor to climate change. There have been, however recent shifts that have helped the sector lower its emissions. India, with its visionary Indian Cooling Action Plan (ICAP) is one of the few nations with a prescient roadmap towards making its cooling sector sustainable.

In this newsletter, we take a look at the various aspects of sustainable cooling. We also explore some cutting-edge and futuristic solutions, that have the potential to be gamechangers in this sector. The insightful commentary - "Cooling for a low-carbon India" builds a compelling case for sustainable cooling and explores how decreasing the impact of hydrofluorocarbons (HFCs) presents the single greatest opportunity to reduce climate change. In the article "Cooling demand in India and its environmental impact; How switching to efficient cooling can provide considerable benefits" we delve into some potential cooling solutions and their benefits to the environment and the citizens, in terms of monetary savings. "Sustainability necessitates a cooler cold-chain" take us through the various nuances of the Indian Cooling Action Plan and how it addresses the cooling demand from the cold-chain sector. Air conditioners are anticipated to consume 45% of Indian households' power demand by 2050, which will increase expenditure for consumers and contribute to global warming. The article"India's cooling challenge and role of Super-Efficient AC (SEAC) programme in combating it" address this and explains how this initiative can be the catalyst for combating the rising threat of global warming and the significant value it can add to the lives of the consumers as well, by ushering in considerable savings in their electricity bills.

Thus, there is immense scope for sustainability and energy efficiency in the cooling sector. What we need are new and pioneering technological and policy interventions. The ICAP is one such step, along with the Super-Efficient AC programme. The common thread that binds interventions such as these is cross-stakeholder participation. It is imperative for the government, industry, financial players and research bodies to come together to work towards the common goal of making the cooling sector truly sustainable.

With Regards,

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Cooling in a low-carbon future in India

In most regions in India, extreme heat, with temperatures above 45°C is not a rare phenomenon anymore and many lives are lost every year to heat waves. By 2100, the number of deaths from heat exposure can double in many cities and cost the Indian economy as much as $450 billion by 2030. Access to comfort cooling is no longer a luxury, but a necessity to ensure productivity and health of the citizens.

Considering that a majority of India is yet to be transformed into built space, coupled with rising need for cooling and increasing per capita income in the country, there will be a significant rise in demand and sale of ACs. To respond to the urgent need for cooling, most citizens will look for the most affordable ACs (with low energy efficiency and high GWP refrigerant) that will add to the strain on India's power grid and hurt the environment. Inefficient ACs currently account for as much as 40 to 60% of summer peak power demand in major Indian metros. The current aggregated nationwide growth for cooling is expected to grow 2.2 to 3 times, just in the next decade, over the 2017 baseline. It is project that by 2050, India will need to generate 600 GW in new power to meet its cooling needs, wherein almost two-thirds of building energy demand will only be for ACs under business-as-usual scenario.

Special Report on Global Warming by Intergovernmental Panel on Climate Change (IPCC) asks governments across the world to come together to limit the global warming to 1.5°C using "drastic action", to which AC-led emissions – direct and indirect – may by themselves contribute to as much as 0.5°C increase by 2100. Decreasing the impact of Hydroflorocarbons (HFCs) presents the single greatest opportunity to reduce climate change. As a signatory to the global Kigali Amendment to phase out HFCs worldwide, India's reduction of HFCs for room ACs can achieve 25% of its target to avoid the use of HFCs equivalent to between 2 and 6 billion tons of CO2 through 2050. Simultaneously, climate benefits of air-conditioners energy efficiency improvement are also immense, considering the scale of our demand. According to a Lawrence Berkeley National Laboratory (LBNL) estimate, if India's ACs improved in average efficiency by 30% from 2015 levels, we can reduce our annual CO2 emissions by approximately 180 million metric tons per year – this is equivalent to about 10% of our total CO2 emissions reductions goals stipulated in our Paris Agreement Nationally Determined Contribution (NDC).

Increasing the penetration of highly energy-efficient ACs that use low GWP gases, and simultaneous lowering of sole reliance on refrigerant-based cooling equipment in the country is the way towards sustainably meeting the rising power demand. In a significant development, India has developed an integrated and holistic cooling action plan – India Cooling Action Plan (ICAP) – to make cooling greener and more energy efficient. In middle income group countries, like India, the high upfront cost of energy-efficient cooling appliances is one of the key constraints in their wide adoption. This can be mitigated through innovative financial models such as bulk procurement and demand aggregation that drive down prices. By leveraging economies of scale through demand aggregation, the costs for this futuristic green technology will come down significantly, making them accessible to the consumers. As a vital enabler of ICAP, these ACs can be one of the many solutions in giving India the sustainable cooling it needs.

India's Super-Efficient Air conditioner Programme – which enables the rollout of super-efficient ACs that are 40% more energy efficient and yet price-comparable to market available variants – is creating the market scale for sustainable cooling. In its pilot phase, the initiative will cover over 25 lakh residential and institutional consumers in South and West Delhi. These ACs are pegged to enable a reduction of peak power demand in these areas.

Sustainable cooling objectives can be achieved through passive cooling interventions for buildings, moving towards more low-GWP refrigerant based energy efficient air-conditioning equipment, operational efficiency enhancements, and use of next generation technologies. The move to sustainable cooling also requires a robust innovation ecosystem and a skilled air-conditioner service technicians' workforce. Measures like the ICAP are now more relevant than ever as they provide us with a platform to cohesively work towards our collective goal of sustainable development. It is time we joined forces to add to this momentum and ensure sustainable and clean cooling to all our citizen at the affordable cost.

Dr. Satish Kumar
CEO and Executive Director
Alliance for an Energy Efficient Economy

Sustainability necessitates a cooler cold-chain

Climate change is a global emergency. We are all adapting to a warmer world in our own way and are all uniquely vulnerable. In developing economies, it is statistically evident that rising global temperatures are affecting our health and productivity, along with compromising the broader economy.

The need of the hour therefore is adaptive Thermal Comfort for All, with both incremental and inclusive interventions. Timely and decisive action via first the development and now the implementation of the India Cooling Action Plan, presents India with a unique opportunity for potential long-term positive outcomes in addressing India's cooling needs. The requirement for space cooling is cross-cutting across multiple sectors, ranging from residential and commercial buildings, cold-chain, refrigeration, transport to industries.

India's cold-chain infrastructu

The cooling demand from cold-chain sector may constitute a small portion of the aggregated cooling demand, however, its significance with respect to driving energy efficiency in the country cannot be undermined. The sector has positive implications on the environment and is a growth driver for increasing farmer's income in the country. Also, carbon footprint of the food lost is quite significant and needs to be effectively tackled to transition towards a food secure economy.

On evaluation of the current cold-chain infrastructure, ICAP notes that there exists a huge gap (approximately 85-97%) between the required and the current capacity for the three components: pack-houses, reefer transport and ripening chambers. Thus, the aggregate capacity in the country to adequately manage, store and preserve the agricultural produce post harvesting is largely insufficient. This is also distinctly evident from the fact that 40% of food in India is lost in transit from farm to fork (Food and Agricultural Organization of the United Nations FAO, 2011). However, guidelines for driving energy efficiency in the cold-chain sector is largely missing in our country.

The ICAP identifies the trigger points of the cooling energy demand stemming from the cold chain sector. It also enumerates the current stock of pack-houses, reefer transport, cold storage, and ripening chambers and also underlines the subsequent energy consumption stemming from the different components. The document recommends positive interventions and potential synergies with government schemes to implement deployment of efficient compressors, improve insulation, optimise operations, resource upcycle and optimisation and adoption of an infrastructure with low Global Warming Potential (GWP) refrigerant-based cooling systems, that would help reduce the refrigerant demand and energy consumption in the cold-chain sector.

ICAP further lays out the roadmap for promoting energy efficiency in the cold-chain sector with a triple sector leadership approach of government ministries, industries, think tank, academics and R&D institutions.

ICAP nurses the dream of making India's cool cargo (also known as cold-chain) cooler!

Richie Mittal
President
Elect, ISHRAE

Cooling demand in India and its environmental impact; How switching to efficient cooling can provide considerable benefits

We all remember the good old days, when the summers were really hot, be it outdoors or indoors. Back then butter milk was better than any cold drink and each season, however extreme, had its own charm.

Mankind's biggest aspiration is to evolve. Though every evolution comes with its own set of pros and cons. The advent of air conditioning, for example has made most businesses climate neutral and economic activity has received a push just by the mere existence of air conditioners. Worker productivity has also enhanced to a large extent in several industry sectors, if not all. Several thermal comfort standards define the perfect conditions for human existence and the same were achieved to a large extent across the society, through air conditioning. Air conditioner was also promoted by the government and soon the dessert coolers were replaced by air conditioners.

However, their increased usage has led to growing concerns on CFC and HCFC emissions and global warming. Efforts are now being made to make air conditioning not just thermally comfortable but environmentally friendly as well. Though environmental impact is a very wide term, there is always a trade-off between economics, society, and the environment aspect.

Today, there exist several ways, to mitigate the environmental impact of cooling, ranging from being easy to moderately difficult and from being absolutely free to be a little costly. Depending on the scale of the project there are various choices that can be exercised and are now available in the market. The simplest of them being running your air conditioner at a temperature of 24oC, which is an initiative of the Indian Government as well. It is proven that each additional degree of temperature reduces the overall energy consumption of air conditioning by at least 2-3%. If we combine it with the number of air conditioners being used today, it reduces a large quantum of GHG emissions and also leads to massive cost savings.

Since, thermal comfort depends on both air speed as well as temperature, using a ceiling fan in conjunction with an air conditioner also helps in taking the room set point temperature even higher than 24oC. Ceiling fans have been used traditionally as well in Indian buildings and perform the same job of achieving comfort at a much lower energy cost.

Making insulated walls and roofs, so the heat from outside doesn't flow inside, using optimum amount of glass during construction and multi-stage cooling are some other mitigation options.

The Energy Conservation Building Code also sets up guidelines for efficient use of air conditioning and may be referred to.

In the end, the best advice that we can all use, is reducing all unnecessary consumption, as only this can prevent our world from suffering further from the harmful effects of global warming.

Iain Campbell
Senior Fellow
Rocky Mountain Institute

India's cooling challenge and role of Super-Efficient AC (SEAC) programme in combating it

India will become the world's largest market for room air conditioners (ACs) in the coming decades. This growth will be fueled by India's large and increasingly urbanised population and a hot and humid climate that is getting hotter each day. This makes a surge in usage of room air conditioners not only inevitable but also essential for the economic development and well-being of its people. However, this growth contributes to one of the largest ends-use risks to climate, with the proliferation of energy-guzzling air conditioners that use conventional high global warming potential (GWP) based refrigerants. And therein lies India's cooling challenge.

The Government of India's Cooling Action Plan (ICAP) raises a call to action projecting that cooling energy consumption is likely to grow four-times over the next twenty years. Business-as-usual is no longer an option and the ICAP strongly recommends catalysing a step-change in the efficiency of ACs while maintaining affordability. EESL's Super-Efficient AC (SEAC) programme, launched in February of 2019, is set to deliver this mandate.

Under this programme, EESL has introduced to the market super-efficient inverter ACs at a price of INR 41,300 (US$603) for a 1.5-tonne unit. These ACs are designed specifically for Indian conditions, to run efficiently up to 52° Centigrade and across a range of voltages.[1] Priced comparably to the most commonly purchased star-rated ACs today – BEE 3-star – the super-efficient ACs offer 50 percent greater energy efficiency. In addition, they use a lower-GWP refrigerant (R-32), thus reducing the carbon footprint of cooling by at least 50%.[2]

EESL's approach to address the overall climate impact of air conditioning, in an affordable manner aligns fully with the philosophy behind the Global Cooling Prize (GCP) – that the technology and know-how exists today to achieve cooling with a significantly lower climate impact. What's needed is the right market levers to catalyse innovation. A case in point, the GCP initiative has led to potentially eight viable and robust technology solutions that can provide an alternative to a conventional AC with 80% less climate impact with 50% lower lifecycle cost. While such new and disruptive technologies will understandably take time to scale, they represent the future; and in the meantime, the SEAC programme is filling the gap and addressing the cooling challenge with viable solutions right now! The first phase of the programme - deploying 50,000 ACs in Delhi – would mitigate around 1,20,000 t CO2 annually, shave off 22 MW of Delhi's peak power demand, and save customers INR 4000 annually over the life of the AC. Once scaled, the programme's impact on consumers, the electricity systems and our environment would be far reaching.

With the policy framework and leadership of ICAP, the innovative business model of SEAC and the technology demonstration of the Global Cooling Prize, we have an opportunity to effectively meet India's cooling demand long into the future, without further warming our planet.

1 http://www.igsd.org/igsd-teri-and-nrdc-congratulate-energy-efficiency-services-ltd-eesl-and-voltas-for-affordable-acs-protecting-climate-and-the-ozone-layer/
2 http://www.igsd.org/igsd-teri-and-nrdc-congratulate-energy-efficiency-services-ltd-eesl-and-voltas-for-affordable-acs-protecting-climate-and-the-ozone-layer/

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