



5MM COPPER TUBING

Enabling Just Transition in
the RAC Industry

BACKGROUND



India is among the
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India is among the countries with the most cooling degree days in the world, with over 3,000 per year. A cooling degree day is a measure of the demand for energy needed to cool a building. The imperative of ensuring a thermally comfortable environment is driven by the notion that cooling is a developmental necessity, and is going to increase given the economic growth trajectory of India. Thermal comfort contributes significantly towards the health, productivity, and wellbeing of people in hot climatic zones. Thus, it is crucial to ensure the thermal comfort of billions of people around the world, including over 1.4 billion in India.

The role of refrigerant-based cooling solutions has been widely documented in ICAP, which highlights the significance of upgrades required in room air cooling technologies such as room air conditioners (RACs), the stock of which is projected to increase to about ~580 million by 2037-38 from its baseline values of ~40 million in 2017-18. Similar trends are projected in the demand for RAC refrigerants and energy use, which are expected to increase by 8x and 6.5x, respectively, in the non-intervention or reference scenarios¹ accompanied with increase in greenhouse gas (GHG) emissions. Addressing these emissions has been a part of India's mitigation strategy, which includes the phasing out of ozone-depleting hydrochlorofluorocarbons (HCFCs) in compliance with the Montreal Protocol framework. While HCFCs were first replaced with hydrofluorocarbons (HFCs), the HCFC Phase-out Management Plan (HPMP)-II mandates that the country gradually phase down HFCs and shift to non-HFCs and other low-global warming potential (GWP) and natural refrigerants.

India's ratification of the Kigali Amendment in August 2021 and its declaration at the 26th United Nations Climate Change Conference of Parties (COP26) in 2021 to become net-zero by 2070 also indicates its renewed commitment to enhanced climate action.

1. Ministry of Environment, Forest & Climate Change (2019). India Cooling Action Plan. New Delhi: Ministry of Environment, Forest & Climate Change.

These commitments necessitate a more rapid shift towards super energy-efficient sustainable space cooling products, which will entail technological improvements in RAC components to make them compatible with a new class of greener refrigerants.

Enabling component-level efficiency gains in RACs, as shown in the Figure 1 below, can foster implementation of the ICAP goals and contribute to the achievement of international commitments. One innovation that can lead to such efficiency gains is the substitution of large diameter copper tubes with small diameter 5 millimeter (mm) inner grooved copper tubes (IGTs) in RAC heat exchangers. This has been embraced by the RAC industry globally to meet climate commitments and reduce the space cooling energy and refrigerant demand.

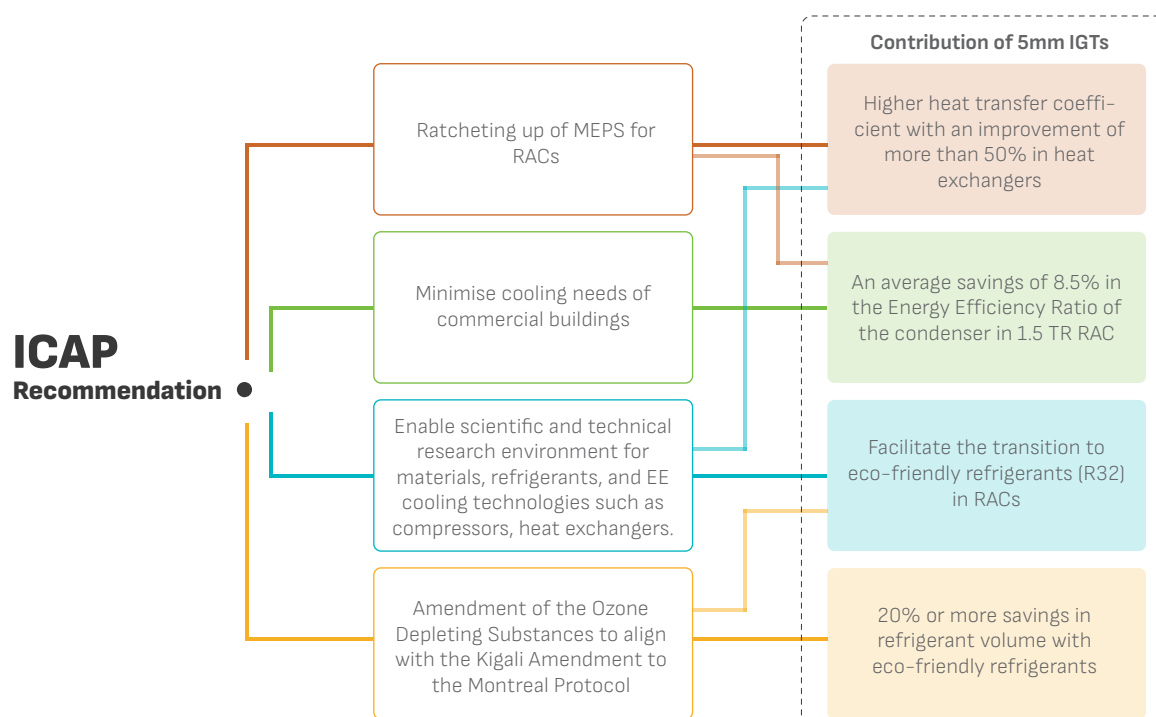
On average, 5mm IGTs lead to an energy savings of 8.5% and refrigerant savings of more than 20% and require less material than 7mm diameter copper tubes while providing the same cooling performance. The use of IGTs thus contributes to making RACs more affordable and energy-efficient in alignment with the COP26 Product Efficiency Call to Action, Sustainable Development Goal (SDG) 12, India's Kigali Ratification, ICAP, and India's commitment to becoming net-zero by 2070.

5mm IGTs can be an integral component in the transition towards super energy-efficient RACs and contribute to achieving the national target of saving 150 million tonnes of oil equivalent (MTOE) by 2030 and achieving India's climate commitments.

SIGNIFICANCE OF SMALL DIAMETER IGTs FOR INDIAN RAC INDUSTRY

Our research establishes that the adoption of 5mm IGTs can facilitate implementation of the ICAP recommendations and achievement of the 2037-38 targets. Figure 1 portrays the contribution of 5mm IGTs towards ICAP recommendations.

Figure 1: IGT contributions to India's climate commitments and ICAP goals²



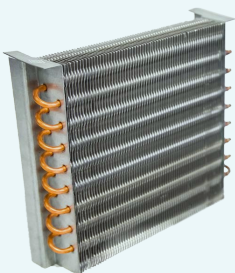
2. Small Tube Copper Is Economical and Eco-Friendly | The MicroGroove Advantage," accessed December 17, 2021, <https://microgroove.net/>.

SITUATION AT A GLANCE

The transition from 7mm to 5mm IGTs has been noteworthy in the case of condenser coils with 5mm IGT based condensers, accounting for 37% of the overall RAC market share. However, there are several challenges in adoption of 5mm IGTs on the evaporator side, which requires more research and development efforts.

Figure 2: Transition to 5mm tubes in RACs³

Condenser



63%
7 mm

37%
5 mm

Evaporator



99%
7 mm

1%
5 mm

The extent of transition from 7mm to 5mm IGTs in condensers and evaporators is depicted in Figure 2. The total demand for condenser heat exchangers and outdoor unit assembly is largely met through domestic manufacturing and most of the OEMs have installed in-house fabrication lines for manufacturing and assembly of 5mm IGT outdoor units.

However, in the case of evaporators, the transition to 5mm tubes is still in the experimental stage, as there are several technical issues related to managing the higher pressure drop caused by the reduced tube diameter and the optimisation of evaporator circuitry and fin redesign to deliver the required capacity. Our research reveals that only 1% of evaporators currently use 5mm IGTs (see 2).

There are no domestic IGT manufacturers in India, and the Free Trade Agreements (FTAs) with the Association of Southeast Asian Nations (ASEAN) region, which is the primary source of tube imports, are making investment in local manufacturing unviable. Copper tubes, particularly the small diameter 5mm IGTs in India imported from China, Vietnam, Malaysia, and Thailand, account for 90% of all imports into India, and Indian manufacturers are left with only a 10% market share, translating to a loss of foreign exchange towards the import payments. At the same time, the same agreement levies a 5% duty on copper-based raw material (copper cathode) imports, leading to an overall price escalation of 5-6% when copper tubes are manufactured domestically.

The lack of domestic manufacturing capacity and supply chain issues with trade disruptions during the 2019 coronavirus disease (COVID-19) pandemic has resulted in slow integration of small diameter IGTs in RACs. This has led to a delayed mitigation response that could otherwise build timely and much-desired resilience in the sector and contribute comprehensively to achieving the country's commitments on climate actions.

Imported copper tubes are cheaper than domestically manufactured copper tubes. Consequently, in the last five years, twenty large manufacturers accounting for 70% of the industry's total capacity have shut down operations because they were unable to withstand competition from cheap imports.

3. Stakeholder interaction with copper tube manufacturers, RAC manufacturers, & heat exchanger manufacturers.



THE CHALLENGE

The lack of domestic manufacturing capacity and incomplete transition to 5mm IGTs within the RAC industry can be attributed to several factors on the demand and supply side of the industry including:

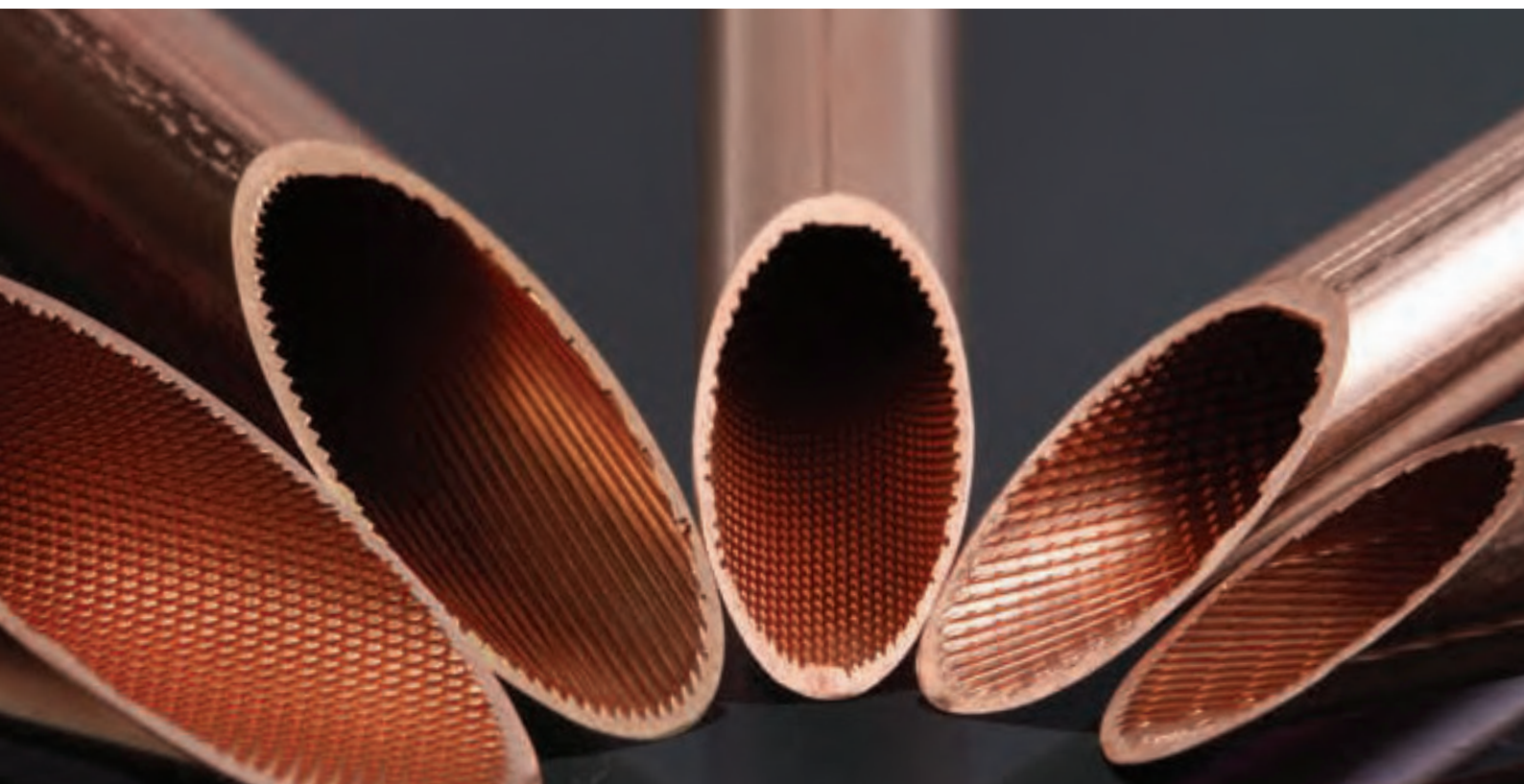
SUPPLY SIDE CHALLENGES

- There is a 5% customs duty on copper cathode, whereas finished copper products such as imported copper tubes and pipes attract 0% duty from countries like Vietnam, Malaysia, and Thailand under the Free Trade Agreement with ASEAN.
- There is a requirement of high capital expenditure (CAPEX) to set up an IGT manufacturing line in India. Because of the unfavorable policy environment due to the FTA, companies are hesitant to make any investments until there is an enabling environment for domestic manufacturing.
- The Indian copper tube industry presently only manufacturing plain tubes and lacks modern technology and precision machinery required for manufacturing of 5mm IGTs.

DEMAND SIDE CHALLENGES

- The wall thickness of the 5mm IGT is very low (~0.20 mm), making it fragile and difficult to handle during heat exchanger manufacturing and final assembly; hence leading to limited adoption.
- Utilization of smaller diameter IGTs requires redesigning of heat exchangers and in the absence of adequate R&D infrastructure facilities the transition has been incomplete.
- To manufacture heat exchangers with 5mm inner groove tubes, separate assembly line are required which entail investment in a new set of tools and machinery worth 3.5-4 Cr for a production capacity of 1.5 lakh heat exchangers per annum.

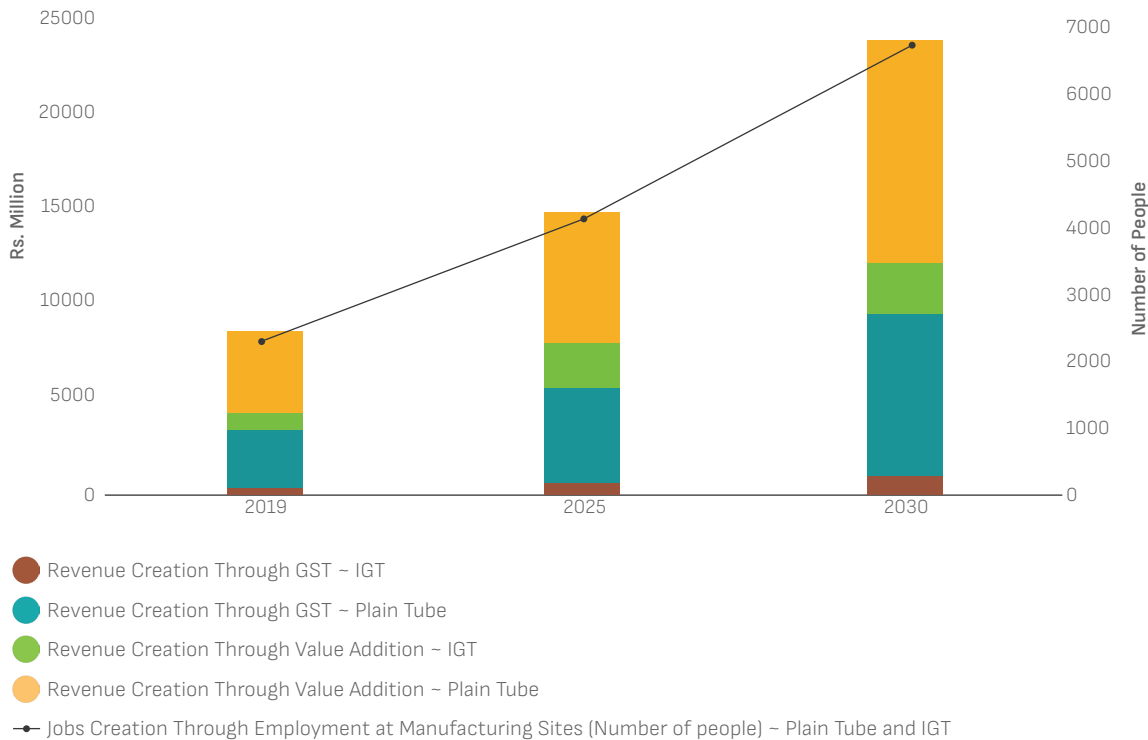
Further, lack of domestic manufacturing capacity and 100% dependency on imports for components has slowed down the pace of IGT integration into the consumer durables, due to trade disruptions and logistics because of global pandemic of COVID 19.



THE OPPORTUNITY

Figure 3 shows an analysis of the estimated potential for opportunity creation through domestic manufacturing, based on RAC demand alone.

Figure 3: Potential for opportunity creation through domestic manufacturing⁴



A complete transition and domestic manufacturing are the need of the hour, as this can help ensure timely and much-desired climate resilience, enhance the copper tube manufacturing sector, and significantly contribute to India's Panchamrit Vision and its ambition of becoming Atmanirbhar (self-reliant).

The opportunity in value addition is estimated based on RAC sales data from ICAP, copper tube quantity in RACs from Avalon Market Research, and the copper tube conversion cost from stakeholder consultations. Looking at tax revenue, since there is no duty on copper tube imports, the government only gets the goods and services tax (GST) that is paid on the imported tubes. However, if India starts up domestic manufacturing, the government will receive the excise duty paid by manufacturers, in addition to GST. The additional tax revenue due to domestic manufacturing would therefore be the 12.5% excise duty applicable on copper tubes. Hence, the opportunity in the tax revenue generation is estimated only considering excise duty revenue. The corresponding estimates for job creation are based on ICAP's RAC sales data, Avalon's copper tube quantity data, and employment-related data obtained through stakeholder consultations.

4. AEEE analysis with data sourced from ICAP, Avalon Market Research, and interactions with copper tube, RAC, & heat exchanger manufacturers.

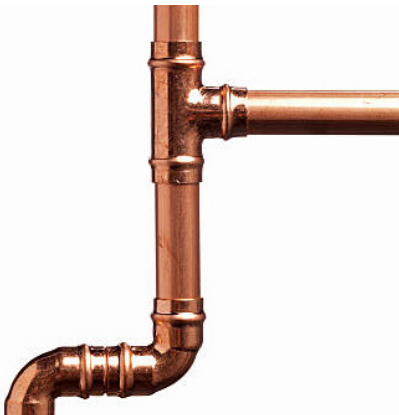


Figure 4: Challenges and proposed solutions⁵

CHALLENGES



5. The challenges mapped and illustrated in the figure pertain to the period of this study, i.e August 2021 - February 2022.



SOLUTION

Rationalization of Import Duties

- Rationalise the component of import duty on copper cathodes (should be 0%) and finished copper goods (should be 5%).

Financial Assistance & Capacity Building

- Leverage financial assistance from domestic policies such as PLI, Atmanirbhar Bharat and Credit Linked Capital Subsidy Schemes.
- Policies such as zero effect and zero defect certification schemes can be instrumental in creating a green manufacturing line of IGTs.

Technology Upgradation and Skill Building

- Attract multinational companies to bring in investments through foreign direct investment route and establish joint ventures for small diameter IGTs and component manufacturing which will in turn lead to knowledge and skill enhancement.

INTERNATIONAL COPPER ASSOCIATION, INDIA

The International Copper Association (ICA) is the leading advocate for the copper industry. It is a non-profit organisation bringing together the copper industry and its partners to make a positive contribution to the UN Sustainable Development Goals and support markets for copper. ICA is engaged in the promotion of the beneficial usage of copper for safety, health, the environment, and energy savings. ICA India's activities focus on helping end-users to better understand and appreciate the positive attributes of copper. ICA India actively promotes copper through seminars, workshops, and training programmes throughout India, in collaboration with other organisations, institutions, and trade bodies.

ALLIANCE FOR AN ENERGY EFFICIENT ECONOMY

Alliance for an Energy Efficient Economy (AEEE), is one of the leading organizations in India that works on creating awareness about energy efficiency as a resource. It is a policy advocacy and energy efficiency market enabler with a not-for-profit motive. We advocate for data-driven and evidence-based energy efficiency policies and research.

We foster a culture of energy efficiency in India, working with industry, government and civil society organizations. AEEE advocates for Thermal Comfort for All, and a Lean-Mean-Green philosophy to design and construct net-zero energy-water-waste built environments, sustainable transportation and robust energy data frameworks for better policymaking and implementation, to build a culture of energy efficiency in India. We are committed to achieving India's energy transition for a climate-resilient and energy secure future and meeting India's commitments to India's Nationally Determined Contributions and UN Sustainable Development Goals 2030.

Alliance for an Energy Efficient Economy

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