



Ministry of Environment, Forest and Climate Change  
Government of India

# INDIA COOLING ACTION PLAN

Operationalizing Recommendations for Research and Development  
for low GWP alternatives & Cooling Technologies







## Overview of ICAP

India is a growing economy characterized by low penetration of air-conditioning, rising per capita income, rapid urbanization and a largely tropical climate all of which would lead to a rise in the cooling demand. Addressing the rising cooling requirement is both a challenge as well as a unique opportunity, necessitating synergies in policies and actions to address the cooling requirement across sectors even while making cooling sustainable and accessible to all.

Increasingly, cooling is recognized as a developmental need that is linked with achieving many Sustainable Development Goals. A large part of the cooling demand is catered through refrigerant-based cooling globally across sectors such as buildings, cold-chain, refrigeration and transport. Refrigerants used in cooling equipment are regulated under the Montreal Protocol regime.

Within this context, the development of the India Cooling Action Plan (ICAP) has been a multi-stakeholder, integrated and consultative process to synergize actions for addressing the cooling demand across all sectors. The ICAP provides a 20-year perspective (2017-18 to 2037-38) and recommendations, to address the cooling requirements across sectors and ways and means to provide access to sustainable cooling. ICAP is the first-of-its-kind initiative in the cooling sector to be taken by any country in the world, which exemplifies integrated policy making and underscores the urgency of proactively and collaboratively addressing its cooling growth. The ICAP development process demonstrated high inter-ministerial and cross-sectoral collaboration in laying out actionable pathways to provide sustainable cooling to meet cooling needs while neutralising its negative impacts. It strikes a balanced approach to goal setting by establishing high-level nationwide targets but allowing the line ministries flexibility in setting their targets within a directional framework of recommendations.





## Development Framework

For the development of the ICAP, working groups were constituted for mapping the following thematic areas:

- a) space cooling in buildings, air-conditioning technology,
- b) cold-chain and refrigeration,
- c) transport air-conditioning,
- d) refrigeration and air-conditioning service sector,
- e) indigenous production of refrigerants, and
- f) research and development.

It was ensured that every working group had adequate representation from the Government (Ministries and related government entities), Industries (manufacturers, refrigerant producers, and industry associations), and the Knowledge sector (research institutions, academia and civil society organisations) to obtain triple-sector alignment, right from the start.



## Inter-ministerial Coordination

A Steering Committee with Representatives of various ministries was constituted for guiding and reviewing the documentation, reports, and recommendations developed by the ICAP thematic working groups.

An Inter-ministerial committee comprising subject matter experts, eminent representatives of think tanks, and industry representatives was also formed under the chairpersonship of the Secretary, MoEF&CC to oversee the development process. These Committees helped dovetail the recommendations of the ICAP with ongoing and planned policies and programmes residing with different ministries.



## Dovetailing existing Policies and Priorities

The ICAP recommendations were deeply embedded within the context of the Kigali Amendment to the Montreal Protocol i.e. refrigerant transition towards more climate-friendly refrigerants.

ICAP also highlighted Research and Development as a thematic area. R&D will spur innovation to enhance the energy efficiency of refrigeration and air conditioning equipment by improving the component efficiencies of compressors, fans, heat exchangers, and expansion valves, among other things. Secondly, R&D will unlock technologies and refrigerants that best suit Indian climatic conditions. Through sustained R&D efforts in both public and private sector the reliance on imported equipment and parts needs to be reduced. It is important to enable a conducive R&D environment to channelize resources and to help India pursue its Sustainable Development Goals.





## Overview of R&D Ecosystem in India

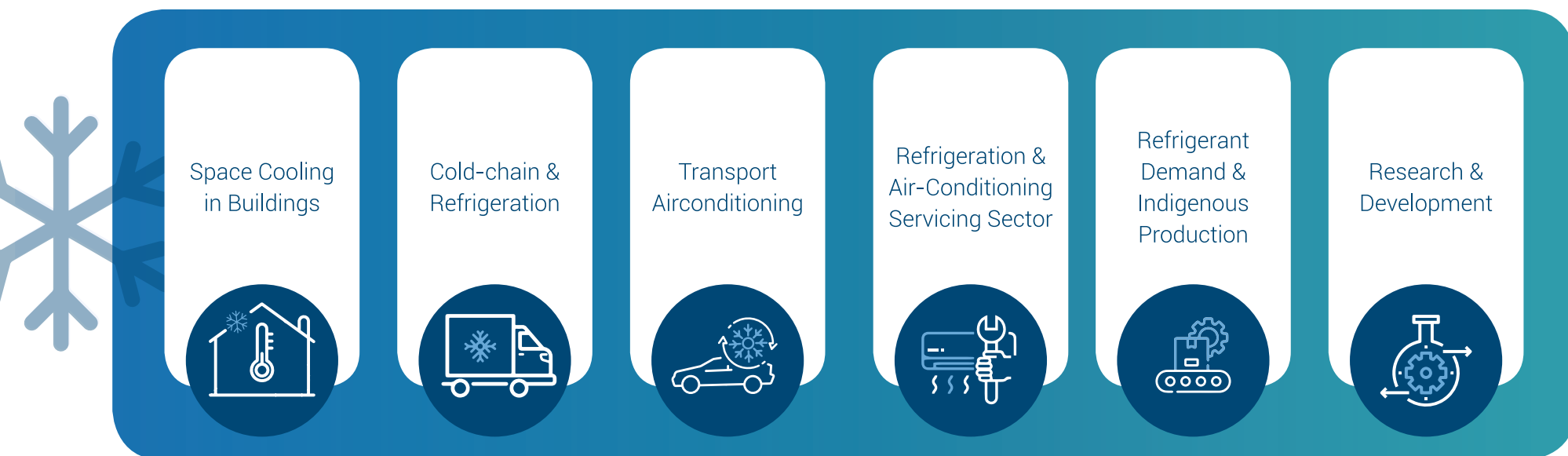
There is expertise available in different R&D and academic institutions on select aspects related to cooling. Important work is being carried out in Indian academic institutions, R&D institutions, and laboratories, such as the Indian Institute of Technology (IIT), National Institutes of Technologies (NITs), Indian Institute of Science (IISc), Council for Scientific and Industrial Research – Indian Institute of Chemical Technology (CSIR-IICT), and CSIR-National Chemical Laboratory (CSIR-NCL). The diverse expertise and facilities need to be explored and leveraged appropriately and linked to utilize the expertise and strengths of various institutions for result-based outcomes. The R&D initiative brings together government, research institutes and industry. For successful R&D efforts in low GWP refrigerants, there is a need for a concerted and coordinated mechanism between various stakeholders, including private companies with deep expertise in refrigeration and air conditioning research. As such, a robust enabling platform is a key need in fostering meaningful collaborations and linkages and supporting the R&D efforts.

The development of a robust R&D ecosystem in India will involve: further development of scientific manpower in the area; requisite academic and R&D institutional capacities; support for R&D activities on various facets of cooling; including cooling equipment, passive building design interventions, not-in-kind technologies and new emerging technologies. Participation of the industry is the key



# Operationalization of Recommendations

To operationalize the recommendations of ICAP, MoEF&CC has decided to constitute six thematic working groups.



Towards operationalizing the recommendations for each thematic area, thematic working groups comprising representatives from line ministries/ departments, industry and industry associations, think tanks and experts have been constituted by the Ministry to develop an implementation framework for the recommendations given in the ICAP for each thematic area. A Steering Committee under the Chairpersonship of Secretary, MoEF&CC has also been constituted to guide and oversee the implementation framework and finalize the action points identified by the Thematic Working Groups for operationalizing the recommendations.

The thematic working group on Research and Development during its two meetings has identified a list of action points for operationalizing the recommendations of the ICAP. The action points have been identified after mapping the recommendations given in the ICAP with the on-going government programmes/ schemes handled by different ministries/ departments/agencies of the Government and inputs provided by the members during the meeting. Further, the action points were discussed in the meeting of the Steering Committee and were adopted during the meeting, which are tabulated in Table-1.

Table-1

Action points for operationalizing the recommendations of India Cooling Action Plant (ICAP) for the thematic area on R&D

Sr. No.	Recommendations on R&D Sector as per ICAP	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Remarks
1	2	3	4	5	6
1.	Recognize Cooling as a National Thrust Area and promote R&D for cooling including areas related to building design and materials, new molecule development, equipment, servicing, refrigerant management etc.	DST's Building Energy Efficiency initiative has recognised Low Energy heating and cooling technologies as one of the thematic areas. Based on the outcomes of this program DST is in consultation with industry leaders for upscaling and deployment.	<ul style="list-style-type: none"> <li>Department of Science Technology</li> <li>CSIR</li> </ul>	<b>DST to recognize Cooling" as thrust area to promote R&amp;D in the following areas:</b> <ul style="list-style-type: none"> <li>Building Design and materials</li> <li>New refrigerant molecule development</li> <li>Low GWP and low cost not-in-kind technologies</li> <li>RAC Equipment (compressor, heat exchanger, controllers, motors etc.)</li> <li>Refrigerant life cycle management</li> </ul>	<p>DST is in consultation with industry leaders for upscaling and deployment of the R&amp;D outcomes from the Building Energy Efficiency Initiative.</p> <p>CSIR-IICT has capabilities to take up R&amp;D with requisite project/ financial support.</p>
2.	Develop National R&D Institutional framework for low-GWP refrigerants and RAC to make India a hub for manufacturing of energy efficient and low energy consuming cooling solutions and low-GWP alternative refrigerants and technologies.	<p>Following schemes of DST:</p> <p>(i) National Initiative for Developing and Harnessing Innovations (NIDHI) is an umbrella programme conceived and developed by the Innovation &amp; Entrepreneurship division, Department of Science &amp; Technology, Government of India.</p> <p>(ii) <b>DST, India is co-leading the Innovation Community on Affordable Heating and Cooling in Buildings as a part of Mission Innovation 2.0.</b></p>	<ul style="list-style-type: none"> <li>Department of Science and Technology (DST)</li> <li>CSIR</li> <li>Department of Industrial Policy &amp; Promotion and Internal Trade</li> </ul>	<b>DST to promote R&amp;D in the area of low GWP refrigerants and their applications as a priority area under National Research Foundation (NRF)</b>	<p>DST is in consultation with stakeholders to identify industry relevant problems on affordable smart HVAC systems and to develop future roadmap.</p> <p>CSIR-IICT has developed research capabilities in this area. The laboratory will participate in any national initiative by DST/ MoEF&amp;CC/ DPIIT.</p> <p>Communication is being sent to DST as part of the recommendations from the Workshop on Indigenous capacity development including research on low global warming potential (GWP) chemicals held on 4 August 2023.</p>

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3.	Constitute a steering committee for R&D with representation from the Ministry of S&T, Ministry of HRD, BEE, experts from academic and research institutions and industry	Mission Innovation of DST	Department of Science and Technology	<b>DST has constituted a national working group with experts from Industry and academia for preparing a R&amp;D action plan for sustainable cooling.</b>	<p>DST will strengthen the steering committee under MI 2.0 Innovation Community.</p> <p>CSIR to contribute in Steering Committee for R&amp;D.</p> <p>CSIR-NIIST has developed solid state refrigeration systems without using refrigerant gases.</p>
4.	Develop and facilitate a scientific and technical environment for basic research in materials and refrigerants, especially new next generation molecules and oils, and energy efficient cooling technologies such as compressors, heat exchangers, and controls				
5.	Nurture and leverage the expertise in academic and research institutes of excellence: CSIR-IICT, IITs, IISC, NITs, etc. for focused R&D on cooling technologies and solutions	Existing Research and Development (R & D) set up in institutes of excellence and higher learning.	<ul style="list-style-type: none"> <li>Ministry of Education</li> <li>Ministry of Science and Technology</li> <li>CSIR and its related Institutes/Laboratories.</li> </ul>	<b>Ministry of Education and Ministry of Science and Technology to strengthen the Institutes of higher learning and excellence for carrying out R&amp;D on cooling technologies.</b>	<p>Strengthening the following existing facilities by Ministry of Education:</p> <p>(i) Laboratory</p> <p>(ii) Faculty</p> <p>Mechanical Engineering for refrigeration and air conditioning</p> <p>Chemical Engineering for new generation refrigerants</p> <p>CSIR-IICT would welcome any initiative to make it Center of Excellence for focused R&amp;D on cooling technologies and solutions</p>



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6.	Constitution of R&D consortium using a Public Private Partnership (PPP) model with funding support to support and monitor the interdisciplinary research and development in cooling technologies	In the past, CSIR-IICT and REGMA collaborated for development of HFC-134a	<ul style="list-style-type: none"> <li>CSIR</li> <li>Department of Industrial Policy &amp; Promotion and Internal Trade</li> <li>Department of Science and Technology (DST)</li> <li>REGMA</li> <li>RAMA</li> </ul>	<p><b>CSIR, DST and Ministry of Commerce and Industry to promote Public Private Partnership Model for interdisciplinary research for sustainable cooling.</b></p> <p><b>DPIIT to promote any scheme for PPP model for research on sustainable cooling.</b></p>	<p>DST is liaising with industry leaders to explore joint programs. DST has supported several CSIR labs in development and prototyping of low energy HVAC technologies.</p> <p>CSIR-IICT would be willing lead any R&amp;D consortium in PPP model created for the purpose by DST/ MoEF&amp;CC/ DPIIT. May be created under Center of Excellence.</p>
7.	Broad-based research, development, demonstration and deployment of innovations contributing to thermal comfort		<ul style="list-style-type: none"> <li>CSIR</li> <li>Department for Promotion of Industry and Internal Trade</li> <li>Department of Science and Technology (DST)</li> <li>REGMA</li> </ul>	<p><b>DST has established a resource unit for affordable heating and cooling of buildings and is in consultation with stakeholders to support industry relevant R&amp;D in the field of low energy HVAC systems.</b></p>	<p>CSIR-IICT would participate and contribute in any such initiative by DST/ MoEF&amp;CC/ DPIIT.</p> <p>DST has informed that it is in consultation with stakeholders to identify R&amp;D requirements to develop affordable smart HVAC controls for improving thermal comfort.</p>
8.	Set up an inter-disciplinary autonomous Institute of Excellence for Cooling Technologies housed in one of the academic and/or research institutes, capitalizing on the expertise and R&D facilities available				
9.	Institutionalize mechanisms for Intellectual Property Rights (IPR) protections in consultation with relevant stakeholders	National iPAwareness Mission (NiPAM)	<ul style="list-style-type: none"> <li>Department of Industrial Policy &amp; Promotion and Internal Trade</li> </ul>	<p><b>DPIIT to promote awareness on IPR issues relating to refrigerants through its Cell for IPR Promotion and Management (CIPAM) involving RAMA and REGMA, for wider dissemination amongst the industry stakeholders.</b></p>	<p>DPIIT has a Cell for IPR Promotion and Management (CIPAM) which for promoting awareness on IPR issues</p>











*WHOM TO CONTACT TO LEARN MORE ABOUT OZONE*

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