



Ministry of Environment, Forest and Climate Change
Government of India

INDIA COOLING ACTION PLAN

Operationalizing Transport Air Conditioning Sector
Recommendations







मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
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सत्यमेव जयते

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MINISTER
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MESSAGE

The rapid pace of urbanization coupled with population and economic growth has led to exponential growth of the transport sector. This has led to increased cooling requirements in this sector. Mobile Air Conditioning (MAC) is growing rapidly and forms a significant proposition of the total cooling requirement in the country. Refrigerant demand for the mobile air conditioning sector has also been growing exponentially in the last three decades.

As the existing trajectory of increased transport demand will be associated with significant environment and socio-economic implications, it is imperative that policy measures are adopted to reduce cooling requirements, refrigerant consumption as well as energy demand in this sector in the country. Towards this, transport air-conditioning has been included as one of the thematic areas in the India Cooling Action Plan (ICAP) for providing an integrated vision towards reducing cooling demand in this sector.

Towards implementation of the recommendations of the ICAP in the transport air-conditioning thematic area, specific action points have been developed forging synergies with the ongoing programmes/ schemes of the concerned line Ministries and Departments. This has been done by mapping the recommendations with the concerned schemes to achieve sustainable and green growth in the transport air-conditioning sector.

I congratulate all who have contributed to finalising the action points and bringing out this Booklet.

(Bhupender Yadav)

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Message

The air conditioning applications for transport sector includes all mobile equipments, comprising passenger cars, bus air conditioning, reefer truck refrigeration etc. With the rising temperature, the requirement of air-conditioning has become an essential prerequisite for improving general comfort of passengers.

The National and State Government initiatives and investments to boost the economic and industrial sectors has led to significant growth in the transport sector, which is expected to increase demand for cooling and energy as well as refrigerant. Towards this, it is imperative that policy measures are adopted to reduce cooling requirements, refrigerant consumption as well as energy demand in this sector.

Transport air-conditioning, one of the thematic areas of the India Cooling Action Plan (ICAP), has specific recommendations for addressing the above issues and evolving appropriate policy measures for promoting sustainable cooling infrastructure in this sector.

The Thematic Group on transport air-conditioning, after extensive deliberations, has come out with specific action points for concerned Ministries/Departments/agencies, which have been detailed in the Booklet, the implementation of which will enable achieving the intended objectives.

I take this opportunity to complement the team associated with the preparation of this Booklet.


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MESSAGE

Transport air conditioning systems have shown significant growth in India in the last few years due to increase in passenger car segments, construction of metro rails, growth of cold chain industry and increased sales of high-end buses and reefer trucks, all of which result in increased energy consumption, refrigerant usage and the associated greenhouse gas (GHG) emissions.

Improvements in system efficiency, transitioning to low global warming potential environmentally friendly refrigerants and leakage free technologies, greater push for public transport infrastructure along with skilled servicing workforce and operational behavioural change are key to promoting sustainable cooling in transport. These aspects have been addressed as recommendations in the India Cooling Action Plan (ICAP) under the transport air-conditioning thematic area. Towards operationalizing the ICAP, specific action points indicating roles and responsibilities of associated line Ministries/Departments have been finalised based on the recommendations of the Thematic Working Group.

The Booklet on actions points for implementing the recommendations of the transport air-conditioning is very timely and once implemented, will help in promoting sustainable cooling infrastructure in this sector.

I take this opportunity to compliment the team associated with the preparation of this Booklet.

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(LEENA NANDAN)



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Overview of India Cooling Action Plan

Cooling is a cross-sectoral requirement and an essential component of economic growth. Various sectors of the economy, including industries, residential and commercial buildings, cold chains, and transportation (personal, commercial, metro, and railways), rely on cooling. As the economy grows, there is a rapid increase in cooling demand and the need for air conditioning. The phase-out of Hydrochlorofluorocarbons (HCFCs) is currently started under the Montreal Protocol. Under the Kigali Amendment to the Montreal Protocol, Hydrofluorocarbons (HFCs) must be phased down according to the agreed schedule. Integrated actions across sectors regarding cooling will have a greater impact than isolated actions, resulting in significant climate benefits.

In this context, the development of the India Cooling Action Plan (ICAP) has been a multi-stakeholder, integrated, and consultative process aimed at synergizing actions to address cooling demand across all sectors. The ICAP provides a 20-year perspective (2017-18 to 2037-38) and offers integrated recommendations to meet cooling requirements across sectors while ensuring access to sustainable cooling. ICAP is the first initiative of its kind in the cooling sector undertaken by any country, exemplifying an integrated approach and highlighting the urgency of proactively and collaboratively addressing cooling growth.

The ICAP development process established high-level inter-ministerial and cross-sectoral collaboration, laying out actionable pathways to provide sustainable cooling while mitigating its adverse impacts. It strikes a balanced approach to goal setting by establishing high-level nationwide targets while allowing line ministries the flexibility to set their own targets within a directional framework of recommendations.

ICAP's overall goals are:



Reduction of cooling demand across sectors by

20-25%, by 2037-38



Reduction of refrigerant demand by

25-30%, by 2037-38



Reduction of cooling energy requirements by

25-40%, all by 2037-38



Unified training and certification system for

service technicians



Recognizing

"cooling and related areas"

as a thrust area of research under the national science and technology programme.



Development Framework

For the development of the ICAP, working groups were constituted to prepare relevant documentation to address the sustainable cooling issues for the following thematic areas:

1. Space Cooling in Buildings
2. Cold Chain Refrigeration
3. Transport Air-Conditioning
4. Refrigeration & Air-Conditioning Service Sector
5. Refrigerant Demand & Indigenous Production
6. Research & Development (R&D)

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



Inter-ministerial Coordination

A steering Committee with representatives of various ministries was constituted to guide and review 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, 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 are deeply embedded within the context of the Kigali Amendment to the Montreal Protocol i.e. refrigerant transition towards more climate friendly refrigerants.

ICAP also identified the Transport Air Conditioning (TAC) as a thematic area to address cooling requirements including reducing cooling demand, refrigerant transition, enhancing energy efficiency, and adopting cooling technology in transport air conditioning sector.

Additionally, ICAP aims to introduce a green labeling system for cars to encourage the adoption of energy-efficient vehicles, accelerate the use of low Global Warming Potential (GWP) refrigerants, promote public transport, and ensure good service practices by service technicians.

Further, ICAP recommendations also synergise with the programmes and schemes of Department of Science and Technology (DST), Bureau of Energy Efficiency (BEE), Ministry of Housing and Urban Affairs (MoHUA), National Council for Vocational Education & Training (NCVET), Ministry of Skill Development & Entrepreneurship (MSDE) and other agencies to bring a positive change in Transport Air Conditioning (TAC) Sector.



OVERVIEW OF TRANSPORT AIR-CONDITIONING

An accessible and well-connected transport infrastructure is a precursor to the socio-economic development of a country. The obstacles leading to immobility can restrict market growth, increase production costs, and decrease accessibility. Over the past 15 years, the road transport sector in India has experienced significant growth, with a Compound Annual Growth Rate (CAGR) of over 12% in terms of passenger-kilometer.

This growth is set to continue as rapid urbanization and increasing income levels drive up the ownership of passenger cars, the majority of which will be air-conditioned, at an expected annual growth rate of nearly 9% until 2040. The total number of buses is estimated to grow from ~2.2 million in 2017-18 to ~4 million in 2037-38. The sector's growth will have a huge bearing on the fuel as well as on the refrigerant demand which is estimated to grow from ~6000 metric tonnes (MT) in 2017 to 25000 (MT) by the year 2038.

To address these trends, policy measures are being implemented to improve vehicle fuel efficiency, promote energy-efficient technologies, encourage the use of public transport, and accelerate the adoption of electric vehicles. These initiatives aim to reduce cooling requirements, refrigerant consumption, and energy demand in the transport sector. As existing Mobile Air Conditioning (MAC) systems become outmoded, there is a shift towards developing advanced and innovative systems that prioritize energy efficiency, cost competitiveness, and durability. Global automakers are increasingly focusing on refrigeration systems with minimal environmental impact and high safety standards.

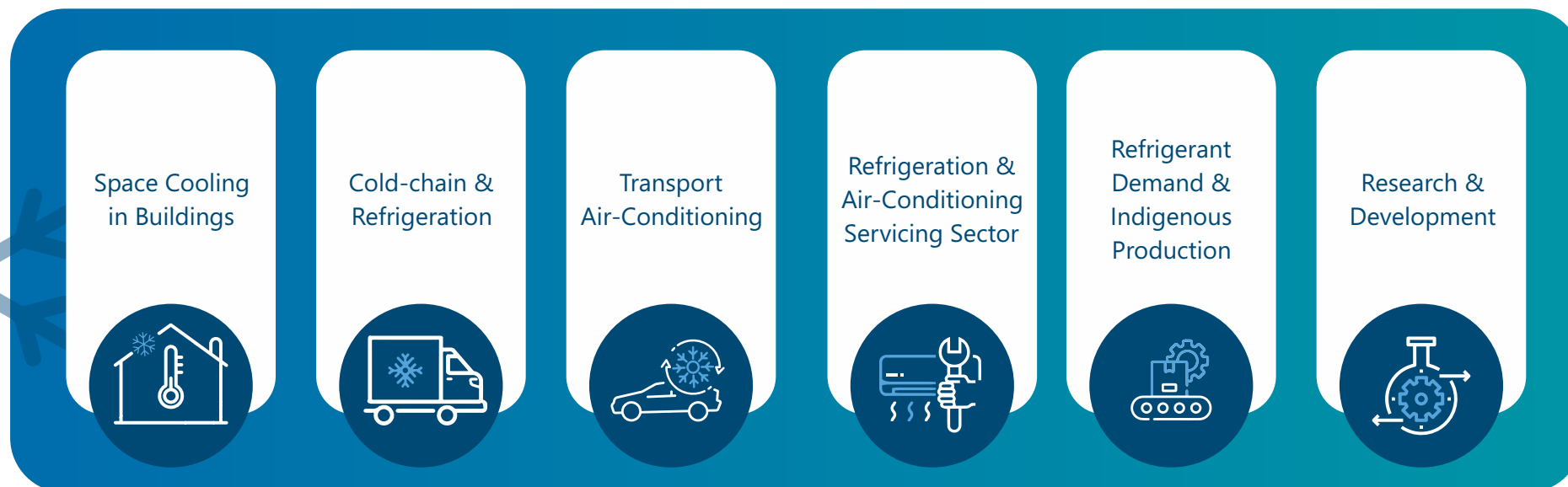


Components of the Transport Sector

Transport Sector			
Road Transport		Rail Transport	
Passenger cars	Buses	Railway	Metro

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 the implementation framework for the recommendations given in the ICAP for each thematic area. A steering Committee under the Chairpersonship of Secretary, Ministry of Environment Forest & Climate Change (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 Transport Air Conditioning Sector during its three meetings has identified a list of action points for operationalizing the recommendations of ICAP. The action points have been identified after mapping the recommendations given in ICAP with the ongoing 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 Plan (ICAP) for the thematic area on Transport Air Conditioning Sector


Sr. No.	Recommendations on Transport Air Conditioning Sector	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Highlights
A	B	C	D	E	F
1.	Promote development of low refrigerant charge energy efficient Mobile Air Conditioning System (MAC) through Research and Development	<p>Existing/ Ongoing schemes of Department of Science and Technology (DST):</p> <p>i. National Initiative for Developing and Harnessing Innovations (NIDHI) is an umbrella programme conceived and developed by the Innovation & Entrepreneurship division, Department of Science & Technology, Government of India.</p> <p>ii. DST, India is co-leading the Innovation Community on Affordable Heating and Cooling in Buildings as a part of Mission Innovation 2.0.</p>	<p>Department of Science and Technology (DST)</p> <p>Ozone Cell, MoEF&CC</p>	<ul style="list-style-type: none"> DST to promote R&D in the area of low refrigerant charge energy efficient Mobile Air Conditioning System (MAC). <p>(Action: DST)</p> <ul style="list-style-type: none"> Ozone Cell to explore possibility to submit a proposal on use of low GWP refrigerant including low refrigerant charge for air-conditioning in the transportation sector to Multilateral Fund Secretariat in this regard. <p>(Action: Ozone Cell)</p>	<ul style="list-style-type: none"> The Energy & Resources Institute (TERI) has brought out a white paper on Mobile Air-Conditioning (MAC) covering technology landscape, challenges and opportunities for sustainable cooling. TERI has recently published the road map to decarbonise the whole transport sector. TERI has been assisting the states to develop sectoral mitigation strategies aiming states to reduce their climate footprint. The roadmap includes the emission inventories and how the emission will reduce over the period of time and includes the direct and indirect emission that are contributing to transport air-conditioning. Society of Indian Automobile Manufacturers (SIAM) informed that Tata Motors and United Nations Industrial Development Organization (UNIDO) is carrying out a project on use of low GWP refrigerants in the MAC systems.



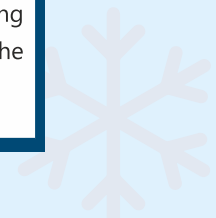
Sr. No.	Recommendations on Transport Air Conditioning Sector	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Highlights
A	B	C	D	E	F
2.	<p>Mandatory testing of all new manufactured air-conditioned passenger cars with Air conditioner 'ON' condition to provide realistic fuel efficiency and emissions profile for encouraging improved mobile Air conditioner efficiency.</p> <p>Policies for promotion of compliance with Corporate Average Fuel Efficiency (CAFE standards).</p> <p>Green Labelling systems for cars to promote efficient vehicles.</p>	<p>i. BEE has initiated discussions with stakeholders for creation of CAFE-III norms for M1 category of vehicles with GVW less than 3.5 Tonne</p>	<p>Ministry of Road Transport and Highways (MoRTH)</p> <p>Bureau of Energy Efficiency (BEE)</p>	<ul style="list-style-type: none"> BEE to introduce Testing Agencies (like ARAI) to include testing vehicles with 'AC ON' condition to provide realistic fuel efficiency and emissions profile for encouraging improved efficiency under CAFE Standards. <p>(Action: MoRTH & BEE)</p> <ul style="list-style-type: none"> BEE to develop and promote Green Labelling systems for cars to promote efficient vehicles. <p>(Action: BEE)</p>	<ul style="list-style-type: none"> One norm of CAFE has already been implemented under phase I and now phase II has also started. Phase II of CAFE standard program regarding fuel efficiency norms for M1 category of vehicles to be implemented by BEE. BEE and MORTH has already notified CAFE norms under Phase I (starting FY-2017 till FY-2021) and phase II has been implemented from FY-2022 with stricter fuel efficiency norms. This is on-going.



Sr. No.	Recommendations on Transport Air Conditioning Sector	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Highlights
A	B	C	D	E	F
3.	Policies for improvement of energy efficiency and adaptation of low-GWP refrigerants, especially in hybrid and electric vehicles.	<p>i. National Mission for Enhanced Energy Efficiency (NMEEE) / ROSHANEE:</p> <p>ii. The Roadmap of Sustainable and Holistic Approach to National Energy Efficiency (ROSHANEE) is a broader version of the National Mission for Enhanced Energy Efficiency (NMEEE) and includes current and potential areas of energy efficiency in each sector.</p>	Bureau of Energy Efficiency (BEE), Ministry of Power	<ul style="list-style-type: none"> • For adoption of low GWP refrigerants, this action to be linked with HFC Phase down schedule as per Kigali Amendment. <p>(Action: BEE & Ministry of Power)</p>	The Ozone Cell is undertaking project preparation of a demonstration project on design and development of smart dual secondary loop thermal system for electric bus along with water cooled condenser, chiller, and modification of compressor compatible with R-290 technology.
4.	<p>Reduction of refrigerant demand, energy demand and vehicular pollution by shifting the passenger traffic towards public transport.</p> <p>Building integrated and high-quality public transport systems in Tier 2 & Tier 3 cities to reduce the personalized vehicle demand.</p>	<p>i. Atal Mission for Rejuvenation and Urban Transformation (AMRUT) - Public Transportation</p> <p>ii. Urban Transport Metro Rail Projects</p> <p>iii. State Action Plan on Climate Change (SAPCC) covers transport section</p>	<p>Ministry of Housing and Urban Affairs (MoHUA)</p> <p>Ministry of Road, Transport & Highways</p> <p>(MoRTH)</p> <p>&</p> <p>TERI</p>	<ul style="list-style-type: none"> • Promote use of public transport like Metro train, Local train, Buses including electric vehicles. <p>(Action: MoHUA & MoRTH)</p> <ul style="list-style-type: none"> • Study to be undertaken to assess the reduction of cooling demand due to use of public transport in Tier 1 cities. <p>(Action: TERI)</p> <ul style="list-style-type: none"> • Study to be undertaken to assess the reduction of cooling demand due to creation of infrastructure for public transport in Tier 2 & Tier 3 cities. <p>(Action: TERI)</p>	



Sr. No.	Recommendations on Transport Air Conditioning Sector	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Highlights
A	B	C	D	E	F
5.	Adoption of Low GWP and energy efficient alternatives in transport air-conditioning		MoRTH, Ministry of Railways, BEE, & Ozone Cell, MoEF&CC	<ul style="list-style-type: none"> Strategy for adoption of low GWP and energy efficient alternatives to be worked out and align with HFC phase-down schedule under the Kigali Amendment for Mobile Air-Conditioning, transport Air-Conditioning including railways. (Action: MoRTH, Ministry of railways, BEE & Ozone Cell) 	Strategy to be worked out by Ozone Cell, MoRTH, Ministry of Railways, BEE and other concerned stakeholders.
6.	Skilling of service technicians in the MAC Sector including certification of trained technicians.		NCVET, Ministry of Skill Development & Entrepreneurship (MSDE) Society of Indian Automobile Manufacturers (SIAM), MoRTH, & BEE	<ul style="list-style-type: none"> Unified certification and training system to be developed for MAC Service technicians. (Action: NCVET & MSDE) Training programme to be conducted for AC service technicians on Good Servicing Practices. (Action: SIAM, MoRTH & BEE) 	NCVET & MSDE to notify unified certification and training system for MAC service technicians. Council on Energy, Environment and Water in association with SIAM is carrying out a study on certification for Refrigeration and Air Conditioning (RAC) technicians. Details of the Study to be shared by CEEW.





Sr. No.	Recommendations on Transport Air Conditioning Sector	Synergies to be made with existing governmental schemes/ programmes	Ministries/ Departments/ Agencies	Agreed Action	Highlights
A	B	C	D	E	F
7.	Management of refrigerants from end-of-life vehicles/ servicing		SIAM, MoRTH, & Central Pollution Control Board (CPCB)	<ul style="list-style-type: none"> Vehicle manufacturers/ service workshops and associations shall follow the CPCB guidelines for recycling/management of refrigerants generated from end-of-life vehicles/servicing. <p>(Action: SIAM & MoRTH)</p> <ul style="list-style-type: none"> Standard Operating Procedure needs to be developed for management of refrigerants for end-of-life vehicles/ servicing. <p>(Action: CPCB)</p>	The Central Pollution Control Board (CPCB) has issued guidelines for environmentally sound facilities for handling, processing and scrapping of vehicles at the end of life, in which management of refrigerant gases has been duly addressed.

Abbreviations

Abbreviations	Full form
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ARAI	Automotive Research Association of India
BEE	Bureau of Energy Efficiency
CAFE	Corporate Average Fuel Efficiency
CAGR	Compound Annual Growth Rate
CPCB	Central Pollution Control Board
DST	Department of Science and Technology
GWP	Global Warming Potential
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
ICAP	India Cooling Action Plan
MAC	Mobile Air Conditioning
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MoRTH	Ministry of Road Transport and Highways
MSDE	Ministry of Skill Development and Entrepreneurship
MT	Metric Tonne
NCVET	National Council for Vocational Education and Training
NIDHI	National Initiative for Developing and Harnessing Innovations
NMEEE	National Mission for Enhanced Energy Efficiency
RAC	Refrigeration and Air Conditioning
R&D	Research and Development
ROSHANEE	Roadmap of Sustainable and Holistic Approach to National Energy Efficiency
SAPCC	State Action Plan on Climate Change
SIAM	Society of Indian Automobile Manufacturers
TAC	Transport Air Conditioning
TERI	The Energy and Resources Institute
UNIDO	United Nations Industrial Development Organization







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