

**POLICY
BRIEF** **4** **GREEN
COOLING**

Implementing the India Cooling Action Plan: Way forward

Summary

The India Cooling Action Plan (ICAP) released in March 2019 is a roadmap for sustainable cooling in India. With two years having passed since the release of the ICAP, this Policy Brief assesses the state of implementation and proposes the way forward.

Analysis of short-, medium- and long-term goals of the ICAP reveals that the most progress has been made on short-term recommendations for space cooling focusing on energy star ratings and energy conservation for buildings. However, this progress is not at par with the goals set by the ICAP. Other areas such as compliance, infrastructural improvements and capacity building have seen least momentum in terms of policy action. To this end, while the ICAP aims to leverage inter-ministerial coordination and synergies between existing policies for its implementation, so far the Ministry of Power and Ministry of Skill Development and Entrepreneurship are the only ones with active programmes with the Ministry of Environment, Forest and Climate Change (MoEF&CC) that target cooling.

In order to make the ICAP more implementable, we propose three priority actions:

- (1) Creating a sectoral focus and priority list for its implementation. This will require active leadership from the Ministry of Environment, Forest & Climate Change;
- (2) Identify state/UT's role in implementation of the ICAP which will help in its localised implementation; and
- (3) Include the goals of ICAP as a part of India's Nationally Determined Contributions which will facilitate synergies as well as channel funding into sustainable cooling.

Irrespective of the shortcomings of the ICAP discussed below, within a year of its release the country and the world were severely afflicted by the COVID-19 pandemic. The slow progress made in developing a implementation plan is thus, an acceptable outcome in wake of the devastation the pandemic has brought. This assessment takes into consideration these challenges and poses this assessment as a way forward in ICAP's development and not a commentary on its failures.

Background

The India Cooling Action Plan (ICAP) was released for public comments in October 2018 and published in March 2019 as a roadmap for sustainable cooling in India. The ICAP adopts a multi-stakeholder, multi-sectoral approach to “synergise actions for addressing the cooling demand across all sectors”.¹ In practice, the ICAP prioritises energy efficient and climate-friendly cooling in appliances, buildings, cold chain, and transport sectors. Further, activities such as training and certification of the service sector, R&D for innovation and manufacturing of refrigerants and equipment in the country have been prioritised.

The ICAP has chapters on space cooling, cold chain, transport air-conditioning, servicing sector, local manufacturing and R&D. Each of these chapters describe the current scenario of the sector and pave the way forward with short-, medium- and long-term recommendations. India’s Cooling Action Plan is a seminal document that has helped in the identification of cooling priorities while simultaneously integrating Montreal Protocol and Kigali Amendment mandated refrigerant transition.

Objectives, targets, co-benefits

The ICAP identifies five broad objectives as follows:

- (i) Assessment of cooling requirements across sectors in the next 20 years and the associated refrigerant demand and energy use.
- (ii) Map technologies available to cater for cooling requirement including passive interventions, refrigerant-based technologies, and alternative technologies such as not-in-kind technologies.
- (iii) Suggest interventions in each sector to provide for sustainable cooling and thermal comfort for all.
- (iv) Focus on skilling of refrigeration and air-conditioning service technicians.
- (v) Develop an R&D innovation ecosystem for indigenous development of alternative technologies.

The ICAP quantifies its targets as follows:²

- (i) Reduce cooling demand across sectors by 20-25% by the year 2037-38.
- (ii) Reduce cooling energy requirements by 25-40% by 2037-38.
- (iii) Reduce refrigerant demand by 25-30% by 2037-38.
- (iv) Recognise cooling and related areas as a thrust area of research under the nation’s Science & Technology Programme.
- (v) Train and certify 100,000 servicing sector technicians by 2022-23 under Skill India Mission.

The ICAP’s overarching goal is to “achieve sustainable cooling and thermal comfort for all while securing environmental and socio-economic benefits for the society.” Some of the co-benefits identified by the ICAP are as follows:³

- (i) Thermal comfort for all with specific focus of cooling in affordable housing projects.
- (ii) Sustainable cooling with low emissions from cooling.
- (iii) A robust cold chain infrastructure for doubling farmers’ incomes.
- (iv) Augment domestic manufacturing of air conditioning and related cooling equipment.
- (v) Robust R&D on alternative cooling technologies.

Stakeholders

The ICAP engages several stakeholders from the government, industry and research centres in its conceptualisation, writing and implementation. For each of these stages, stakeholders were identified and grouped as follows:

- **Working group:** Separate working groups were created for each of the priority area with representation from the government, industry associations, think tanks and research entities. Working groups were responsible for identifying⁴ and writing the chapters for the respective priority area.
- **Steering Committee:** The outputs of the working groups was overseen and reviewed by a Steering Committee, chaired by the Additional Secretary, MoEF&CC and with representation from various Ministries, industry associations, and civil society organisations.
- **Empowered Steering Committee:** An Empowered Steering Committee chaired by the Secretary, MoEF&CC and constituted of subject experts and representatives from think tanks and the industry discussed and approved the ICAP.

At this point, while representatives from relevant Ministries are a part of the different steering committees, the level of their participation is unclear. There is no involvement of specific states/UTs either through consultation or review of the ICAP during the conceptualisation and writing phase; nor is there evidence of any form of communication between the centre and states/UTs after the ICAP was published.

Implementation framework

The implementation framework described in the ICAP recognises the urgency of collaborative efforts and identifies synergies between existing policies and programmes. However, an implementation plan currently does not exist.

The ICAP beckons concerned Ministries to create their own programmes to achieve its goals. The schematic below (see Table 1) identifies the different government departments and entities as well as programmes for synergies to address cross-sectoral cooling needs.

The inter-Ministerial Empowered Steering Committee established under the approval of the Union Cabinet for the implementation of the Montreal Protocol was proposed as a suitable entity to monitor the implementation of the ICAP. However, the

forementioned Empowered Steering Committee met last on 26 March 2018, wherein the timeline for the ICAP draft was discussed.⁵ Although a meeting was scheduled for 21 January 2020, it is unclear if the meeting was held nor is the outcome of the meeting available.⁶

The ICAP also calls for the setting up of a Cooling Secretariat headed by the Ozone Cell, MoEF&CC to support the Empowered Steering Committee. The Secretariat is further envisaged to interact with and coordinate actions under the ICAP with the central ministries and allied departments, research institutions, industry/ industry associations, and state departments (agriculture department, urban local bodies and energy development agency). However, so far a Cooling Secretariat has not been established.⁷

Table 1: Inter-linkages between various government programs relevant to cooling

Global priorities	Climate change sustainable development goals							
Departments & entities	Ozone Cell	Bureau of Energy Efficiency Energy Efficiency Services Limited State Designated Agencies (SDA)	Central Public Works Department National Buildings Construction Corporation State PWD Development Authorities	National Center for Cold-chain Development (NCCD)	State Transport Departments State Road Transport Undertaking	Department of Heavy Industry	Electronics Sector Skills Council of India	Ministry of Science and Technology (DST) Technology Information Forecasting and Assessment Council
Programs & Initiatives		Standards & Labelling, Energy Conservation and Building Codes, CAFÉ-Corporate Average Fuel Economy BEEP-Business Energy and Emissions Profile ESEAP- EESL's Super-Efficient AC Program	Pradhan Mantri Awas Yojana - Housing for All Smart Cities Mission Government E-Market place	Doubling Farmers Income (DFI) Gramin Agricultural Markets (GrAMs)	Atal Mission For Rejuvenation and Urban Transformation - Public Transportation Metro Rail Projects CAFE norms	Faster Adoption and Manufacturing of (Strong) Hybrid and Electric Vehicles India	Pradhan Mantri Kaushal Vikas Yojna Government E-Market-place	Mission Innovation

Source: India Cooling Action Plan, 2019

Drawbacks of the ICAP implementation framework

The ICAP aims to leverage existing policies and programmes instead of creating a new umbrella of policies for sustainable cooling. Using data collected through an online survey conducted in August 2020 and expert interviews in April 2021 with industry and policy experts⁸, we identified the following issues with ICAP's implementation framework.

Box 1: Stakeholder survey and expert interviews

Judgmental sampling method, also called purposive sampling, was used to select the respondents for the survey conducted online in August 2020. This is a non-probabilistic sampling technique in which the sample members are chosen only on the basis of the sample's knowledge and judgment. Therefore, only those industries operating in the field of natural refrigerants and not-in-kind-technologies were approached, other than those in the mobile air conditioning businesses. Similarly, research and academic institutions, consultants and government agencies working in the field of natural refrigerants and not-in-kind-technologies were selected. The survey questionnaire was developed to address aspects such as awareness towards the ICAP, refrigerant use and impediments to mainstream natural refrigerant and not-in-kind technologies

In order to further supplement this data, semi-structured interviews with seven policy and industry experts was conducted in April 2021. These interviews focused on gathering qualitative data on implementation of the ICAP and barriers for adopting natural refrigerant and not-in-kind technologies in India. Annexure 2 contains a list of experts consulted for the survey and interviews.

Synergies

The ICAP relies heavily on a 'synergy' between stakeholders, ministries, policies and programmes.

Synergy refers to cooperation between entities that in turn "produces a combined effect greater than the sum of the individual effects." Such an approach is, in fact, beneficial in realising multiple

goals and targets. However, it is important to note that cooling and access to it, has emerged as a developmental issue only recently. Thus, aspects of cooling are not always a part of government programmes or commitments. Further, in the absence of a formal mechanism that facilitates ministries to work with each other, coordination between government agencies specifically for ICAP is not likely to happen. The synergies, thus, proposed by the ICAP cannot be a spontaneous response, rather needs to be a deliberate and continuous activity spearheaded under the leadership of the Ozone Cell and the MoEF&CC.

Financial resources

The ICAP briefly discusses the issue of funding. The document alludes to Line Ministries, State Governments and Urban Local Bodies seeking additional funding to fast track the implementation, perhaps in reference to expanding existing financial resources of on-going programs. However, there is no evidence or communication with regard to where this additional funding can be obtained.

Multilateral funding from Montreal Protocol and Paris Agreement are additional sources as cooling is well recognised by them. However, the timelines for these are long-term as neither has India ratified the Kigali Amendment nor has cooling been explicitly mentioned under India's Intended Nationally Determined Commitments (INDC).

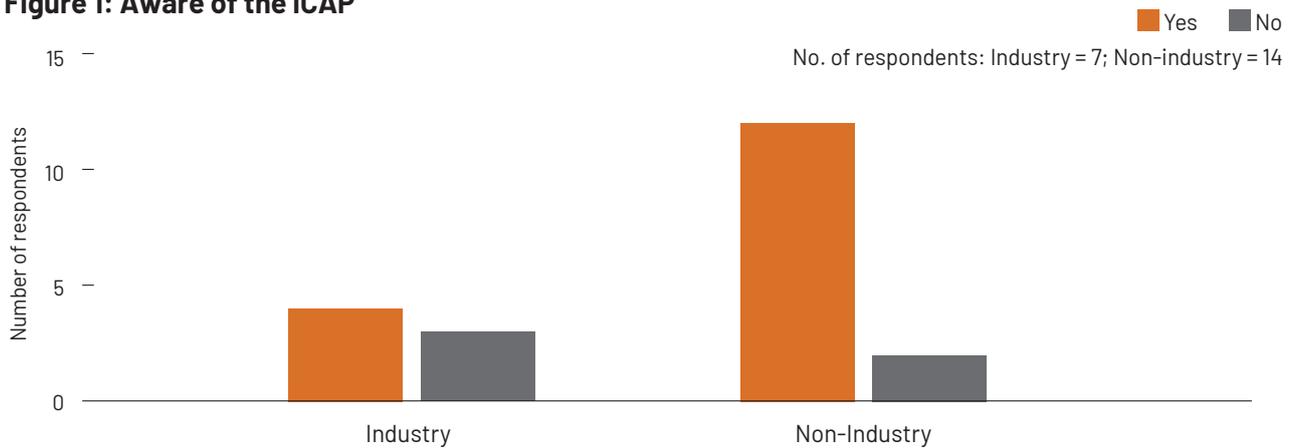
Financing of the ICAP needs to be understood and explored for its continuous, uninterrupted implementation. In the absence of a funding mechanism, its implementation may be sporadic and unfocused. There is also apprehension among stakeholders, that in the absence of a definitive funding source, the cost of ICAP implementation will have to be borne by individuals.⁹

Inter-Ministerial Cooperation

Access to cooling and the principles of sustainability and climate-friendly cooling have been introduced to the policy discourse by the ICAP. The MoEF&CC and more importantly the Ozone Cell leads this discourse. Efforts on energy efficiency policies targeting cooling appliances, equipment and buildings are being led by the BEE. However, the ICAP also necessitates the participation of several Ministries and Departments that may not entirely recognise the significance of sustainable cooling.

Inter-ministerial coordination becomes very important as sustainable cooling requires the

Figure 1: Aware of the ICAP



Source: Author analysis (2021)

involvement of several ministries. For instance, the Ozone Cell, MoEF&CC regulates refrigerant gas usage however, energy efficiency of air conditioners falls under the purview of the BEE. Thus projects on cooling, even when comprehensive, may not be implemented to reap all benefits without the involvement of all concerned ministries.

Localising implementation and awareness levels

The ICAP in its implementation framework identifies Agriculture, Urban Local Bodies, and Energy Development Agencies as the three critical State Departments. However, so far there is no evidence of communication between state departments and the Ozone Cell or MoEF&CC. Thus, awareness at the state- and city-levels on the ICAP is largely absent.¹⁰

It is important to recognise that even if awareness is achieved at local-level, implementation of the ICAP cannot be a simple trickle down effort. Thus prioritising actions, such as building energy conservation, public procurement of energy efficient cooling equipment and addressing urban heat island effect under smart city plans are opportune ways for local governments to further deliver on the agenda set by the ICAP.¹¹

Like local governments, among industry too awareness on the ICAP is largely absent. Through a survey conducted in August 2020, we found that businesses already involved in natural refrigerants and non-conventional cooling technologies were more likely to be aware of the ICAP, in addition to indicating a positive impact of these on their businesses. Non-industry stakeholders showed awareness on the ICAP due to their involvement in policy and programmatic action in preparation

of the Kigali Amendment. Figure 1 depicts relative awareness levels of industry (4 out of 7) and non-industry stakeholders (12 out of 14).

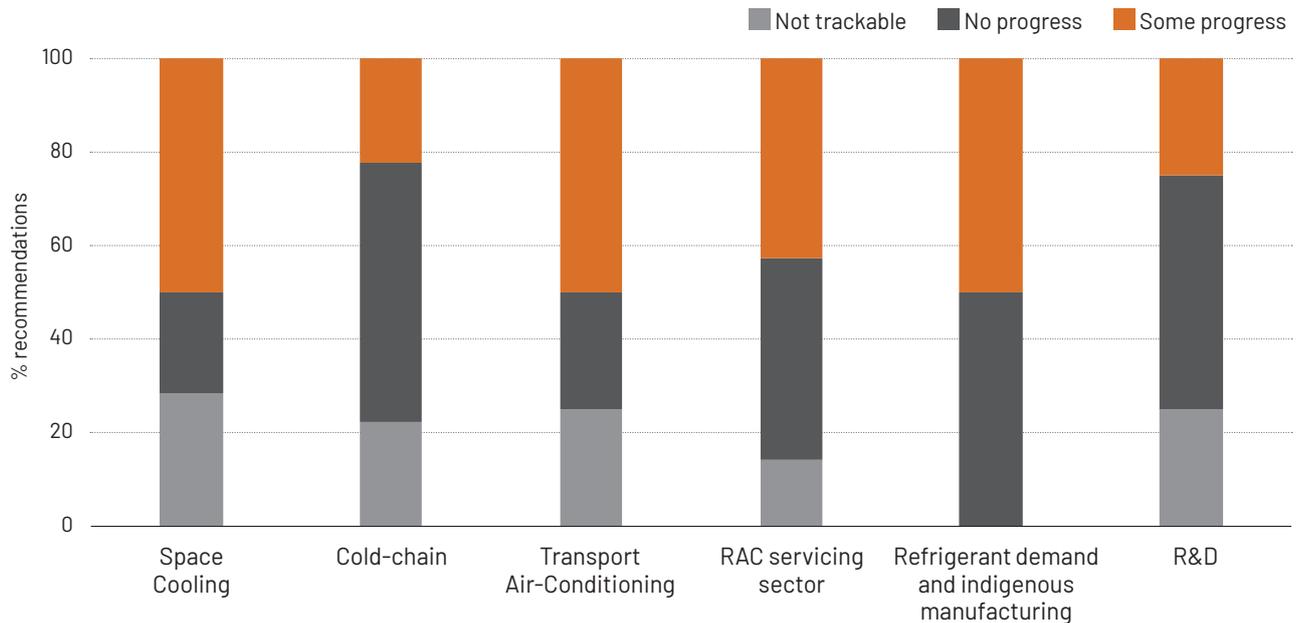
Implementation status of the ICAP

The ICAP has been lauded for its vision and holistic approach. However, two years since its release the ICAP remains unimplemented. Notwithstanding some of the things ICAP got right, the release of the draft ICAP in 2018 was accompanied by critiques of the document by sector experts. A critical issue identified was the absence of an implementation plan or enforcement mechanism in the action plan. The critiques pointed out that financial planning, concrete timelines and targets, and monitoring, verification and enforcement mechanisms were completely absent from the cooling action plan.¹² The ICAP, when released in March 2019, defers this responsibility to the implementation phase. In this section we explore the current status of ICAP's implementation, issues with implementation and challenges.

We assessed sector-wise short, medium and long-term recommendations of the ICAP. For this, each recommendation was examined for policy or programmatic action or commitment made by the concerned government department (see ANNEXURE 1).

The total number of recommendations and consequently short-term recommendations vary substantially among sectors. On the upper range are space cooling, cold-chain and servicing sector with 14, 9 and 7 short-term recommendations.

Figure 2: Progress made on ICAP’s short-term recommendations (2019-2024) as of May 2021



Source: Author analysis (2021)

While transport air-conditioning, refrigerant demand and indigenous manufacturing and R&D had 4, 2 and 4 short-term recommendations. While the number of recommendations may not be a measure of the importance of the sector or the quality of recommendations, it certainly points to certain sectors being a priority or needing more work than others. It may also point to longer-term recommendations being more vital for some sectors (e.g., R&D) than others, an important consideration for the implementation plan.

ICAP’s short-term recommendations are for 2019-2024, while medium and long-term recommendations are scheduled for the periods 2024-2029 and 2029-2038, respectively. We examined the short-term recommendations to find that they fell under one of three categories: ‘some progress’, ‘no progress’ or ‘progress not trackable’ (see Figure 2). None of the recommendations have been fully realised, that is, so far only incremental progress has been achieved. The status of ‘some progress’ was awarded to recommendations where an executive order or amendment was made in the desired direction. Recommendations that were too ambiguous were classified under progress not trackable.

The following broad observations were made based on this analysis:

- Most progress has been made on short-term recommendations for space cooling focusing on energy star labelling and energy conservation for buildings. However, this progress is not at par

with the goals set by the ICAP. For e.g., the ICAP has recommended the ratcheting up of Minimum Energy Performance Standards (MEPS) for room air-conditioners which has not been implemented so far due to industry opposition.

- Recommendations related to standards (e.g., MEPS, safety standards, CAFE) have shown relatively more progress. Other areas such as compliance, infrastructural improvements and capacity building have seen least momentum in terms of policy action.
- Government departments actively involved in various aspects of the ICAP have been the BEE, BIS, and ESSCI. To this end, in implementing mandatory and voluntary standards for various cooling appliances and equipment, the BEE often invokes the ICAP in meeting documentation.
- Several recommendations of the ICAP are ambiguous and thus, difficult to track. For example, under R&D a medium-term recommendation is – “Develop and facilitate a scientific and technical environment for basic research on materials and refrigerants, next generation molecules and oils, energy efficient cooling technologies such as compressors, heat exchangers and controls. Creating an ecosystem for R&D is an important recommendation”. With recommendations of this nature further deliberations are necessary to define targets and quantifiable outcomes.

Box 2: Kigali Cooling Efficiency Program (K-CEP) and National Cooling Action Plans

The Kigali Cooling Efficiency Program (K-CEP) has been instrumental in supporting the development of Cooling “Efficiency” Plans for thirteen countries.¹³ Further, there are more than twenty countries working on developing their cooling plans.¹⁴

K-CEP proposed a set of guiding principles for developing National Cooling Plans.¹⁵ These principles comprised of the following components:¹⁶

- best practices;
- regulatory instruments;
- priority sectors; and,
- content overview.

Viewing the ICAP in the context of these guiding principles sheds some light on the aspects of ICAP that are futuristic while simultaneously recognising its short-comings.

The best practice suggested by K-CEP is the close linking of cooling plans to economy, trade, jobs, health and energy security.¹⁷ To this end, through chapters on R&D, local manufacturing and service sector skilling, the ICAP has pronounced access to cooling as an essential developmental need. The ICAP further recognises space cooling, cold-chain, transport air-conditioning as priority sectors, along with servicing sector, R&D and manufacturing.

K-CEP has identified three regulatory instruments to be considered as a part of the NCAP: MEPS, safety standards for natural refrigerants and financial mechanisms and procurement.¹⁸ Each of these have been included as a part of the ICAP under short-term recommendations. MEPs have been recommended to be ratcheted up for air conditioners, mandated for fans and introduced for evaporative coolers. Similarly, safety standards for natural refrigerants used for cold storages and other flammable refrigerants were proposed as a short-term recommendation. Procurement was suggested as an essential need to promote both energy efficient cooling equipment and skilled servicing sector technicians.¹⁹

- Finally, the chapter on refrigerant demand and indigenous manufacturing and the recommendations thereof, have focused entirely on synthetic refrigerants HFOs as low-GWP alternatives. Given the goal of the ICAP, this needs to be revisited to address the importance of natural refrigerants in the refrigerant transition.

The ICAP sets reduction in cooling demand, cooling energy and refrigerant use as targets for 2037-38. States have an important role to play in achieving each of these targets. Some examples of localising ICAP are given below.

Several states like Tamil Nadu, Karnataka, Assam, Andhra Pradesh and Rajasthan have enacted statespecific legislations for public procurement.²⁰ Thus, public procurement can be used to promote energy efficient and low-GWP refrigerant-based cooling appliances/equipment as well as not-in-kind technologies.

Next, with the ECBC expanding into states and building by-laws, energy conservation from buildings

will be legislated by the municipalities. Thus, both cooling energy and cooling demand can be addressed at a local level. As states have a greater understanding of issues like urban heat islands rather than global warming potential of refrigerants,²¹ integrating sustainable cooling under smart cities and allied efforts is necessary.

There is scope for state energy departments to address issues under demand side management to optimise cooling energy demand. A key need is the promotion of energy efficient air conditioner for residential use by State Energy Departments.

Finally, there is perhaps an opportunity for states/ UTs to be involved in better refrigerant management practices and limit their emissions during manufacturing, installation, use, maintenance and disposal. A key regulation to leverage here is the Environment Impact Assessment, 2006, especially for the installation, use and maintenance stages of the cooling equipment.

Key lessons and way forward

By assessing the drawbacks of implementation plan and status implementation, we propose the following key lessons and the way forward. The COVID-19 pandemic has certainly challenged the pace of ICAP's implementation, thus impinging its progress. This is an opportunity for the Ozone Cell and MoEF&CC to show their leadership and drive the implementation of the ICAP.

Need for priority areas and focused approach for ICAP

The ICAP was the first-of-its-kind Cooling Action Plan in the world to be released since the signing of the Kigali Amendment to the Montreal Protocol in 2016. Since then, other countries like China²² and Rwanda²³,

Cuba, Panama, and Trinidad and Tobago published their Cooling Action Plans.²⁴ Cooling Action Plans developed by other countries can be a reliable source of lessons for augmenting our own. Here we focus on the China Green Cooling Action Plan (CGCAP).

Drawing from China's Green Cooling Action Plan, the ICAP will benefit from developing a focus and prioritising sectors in its implementation plan. At the moment, space cooling and cold chain appear to be a chief priority for the Ozone Cell²⁵. This is a great first step. In addition, the following can be considered:

- ICAP's short-term goals defined for (2019-2024) must be broken down into clear and measurable targets for immediate implementation. For instance, one of the short-term recommendations is to promote wider penetration of climate responsive built spaces to provide thermal comfort. This recommendation is difficult to implement without specifying the type and number of buildings, among other things. This

BOX 3: China's Green Cooling Action Plan and comparison with the ICAP²⁶

China Green Cooling Action Plan (CGCAP) was released in 2019. Below are some key features of the CGCAP:

- Sectoral focus is on space cooling for residential air conditioners and VRF units and cold chain.
- Applications such as cooling in public buildings, industrial facilities, data centres, cold-chain logistics, as well as manufacturing quality, testing, and monitoring brought under the purview of green cooling through performance evaluation and standards.
- Ambitious improvements in energy efficiency of equipment proposed, defined both quantitatively (by 2022 MEPS for residential ACs will be raised by 30% and VRF ACs by 40%) and qualitatively (MEPS shall reach or exceed the entry-level requirements of developed countries).
- Creation of a menu of green cooling in the form of packaged appliances will be used for government procurement and demonstration projects.
- Promotion of retrofitting inefficient technology with green cooling through incentives and green procurement.

Below are key observations based on a comparison between the CGCAP and the ICAP (see ANNEXURE 3):

- The CGCAP has created measurable short- and medium-term targets.
- Both CGCAP and ICAP largely rely on leveraging existing policies, however, CGCAP also identifies opportunities to augment these to promote green cooling. For e.g., accelerated MEPS, regulations to promote green cooling technologies.
- CGCAP focuses on supply-side structural reform whereas ICAP fosters a more holistic vision of developing both demand and supply-side measures.
- R&D is a focus area of both CGCAP and ICAP, however, the approach is different. While the CGCAP identifies aspects of cooling technology in need of R&D, the ICAP proposes a framework to create an R&D ecosystem.
- CGCAP is appliance/ equipment centric, whereas the ICAP takes into consideration passive cooling. Retrofitting projects in space cooling and cold chain forms a significant source of energy conservation in the CGCAP, whereas this is not the case for the ICAP.

can further help with addressing ambiguity or 'progress not trackable' status of several recommendations.

- Synergies (i.e., existing programmes) for each sector as a part of the recommendations list need to be clearly linked to the recommendations. For instance, if the Make in India is the relevant programme and the goal is to further indigenous production of refrigerants, then the modalities need to be detailed.
- MoEF&CC and the Ozone Cell must leverage policies and programmes under their control such as the Ozone Depleting Substances (regulation & control) Rules 2000 and the Environment Impact Assessment Act (2006).
- Finally, it is important to note that while certain sectors and short-term goals need to be prioritised, simultaneously, a mechanism needs to be put in place to prepare for other sectors as well as medium-, long-term goals. For this, the Ozone Cell can rely on researchers and experts from research and civil society organisations to set the agenda.

Localisation

The ICAP sets reduction in cooling demand, cooling energy and refrigerant use as targets for 2037-38. States have an important role to play in achieving each of these targets. Some examples of localising ICAP are given below.

Several states like Tamil Nadu, Karnataka, Assam, Andhra Pradesh and Rajasthan have enacted state specific legislations for public procurement.²⁷ Thus, public procurement can be used to promote energy efficient and low-GWP refrigerant-based cooling appliances/equipment as well as not-in-kind technologies.

Next, with the ECBC expanding into states and building by-laws, energy conservation from buildings will be legislated by the municipalities. Thus, both cooling energy and cooling demand can be addressed at a local level. As states have a greater understanding of issues like urban heat islands rather than global warming potential of refrigerants,²⁸ integrating sustainable cooling under smart cities and allied efforts is necessary. There is scope for state energy departments to address issues under demand side management to optimise cooling energy demand. A key need is the promotion of energy efficient air conditioner for residential use by State Energy Departments.

Finally, there is perhaps an opportunity for

states/UTs to be involved in better refrigerant management practices and limit their emissions during manufacturing, installation, use, maintenance and disposal. A key regulation to leverage here is the Environment Impact Assessment, 2006, especially for the installation, use and maintenance stages of the cooling equipment.

There is scope to do a greater amount of work under state/ UT involvement in the ICAP. Under state/UT action the communication of the goals of the ICAP with state governments needs to be a priority. Hand-holding states to address energy efficient and low-GWP refrigerant-based cooling under public procurement, building energy conservation programs, and smart city projects can also be a strategy under ICAP's implementation plan.

Synergies and funding

The ICAP adopts a synergistic approach that can not only compound the intended impact but also leverage financial resources of existing programmes. However, in order to create synergies both leadership and planning are imperative. The goal is to integrate cooling into the agenda of existing policies and programmes while simultaneously enrolling government officials in this integration. To achieve this, an extensive mapping exercise should be carried out to link the targets of ICAP with policies. With leveraging programmes, while the ICAP identifies relevant programmes, there is certainly scope for further integration.

The ICAP rightly points to cooling being a cross sectoral requirement and an essential element for economic growth. This is however not reflected in India's INDCs submitted to the UNFCCC in 2015.²⁹ The INDC (2015) includes a range of mitigation measures, some of which are relevant to achieve sustainable cooling: enhancement of energy efficiency in appliances and industry and developing climate resilient urban centres under the smart city mission and city rejuvenation programs. Under adaptation strategies identified in the INDC, cooling is relevant to strategies such as agriculture, health as well as state action plans on climate change. K-CEP's guiding principles for NCAP suggested harmonising Montreal protocol's HFC phase-down timeline with the five yearly NDC ratcheting timelines of the UNFCCC.³⁰ Thus, the INDCs can act as a critical source of synergy required in the implementation of the ICAP. The lack of such a mention, can affect anything from public perception, policy making to financial assistance allotted for sustainable cooling projects.

From a qualitative perspective, the ICAP in its implementation, can consider INDC's doctrine of climate justice, approaching access to cooling as an issue of equity and sustainable development. In doing so, the ICAP can truly embody its goal of being a multi-stakeholder, cross-cutting attempt at providing access to cooling.

Way forward

Outside of the mechanism for implementation of the ICAP, there are aspects of the ICAP that are still lacking, such as:

- The ICAP does not identify natural refrigerants as an essential need for India's refrigerant transition. Thus, no plan for R&D or demonstration projects for this exists in the plan.
- There is no plan of action for the promotion of climate-friendly technologies like natural refrigerant-based cold chain or not-in-kind technologies for residential clusters.
- Access to thermal comfort through passive cooling and natural refrigerant or not-in-kind technologies is limited to affordable housing projects. There is certainly a scope to go beyond housing to public buildings (e.g., court houses, government offices) and infrastructure (e.g., railway stations, bus stations) projects to demonstrate these technologies.
- Taking a leaf from China's Cooling Action Plan, the ICAP needs to address retrofitting green cooling technology in the existing infrastructure.

Box 4: Civil Society initiatives under the ICAP

The India Cooling Coalition (ICC) is "a multi-stakeholder group comprised of non-profits, academic and research institutions, and industry associations who are engaged extensively in sustainable cooling research and application."³¹ The ICC was a culmination of three years of work done, across two phases, by the Sustainable and Smart Space Cooling Coalition (SSSCC).³² In the initial two phases (2016-17 and 2017-19) the focus of SSSCC was on space cooling for buildings and contributed significantly to the framing of the ICAP.³³ The Coalition structure comprises of a steering committee, secretariat, working group, members (comprising of not-for-profits and research organisations) and associate members (comprising of private companies).³⁴

The Coalition was setup to provide a national non-governmental platform for dialogue between national and international stakeholders. ICC further aimed to provide recommendations on policy initiatives to ensure the success of government programs on smart cities, smart grid, housing, buildings, universal access to power, cold chain, transport sector, refrigeration servicing sector while ensuring affordable and sustainable cooling for all.

In December 2019, the Children's Investment Fund Foundation (CIFF) granted a four-year fund to The Energy Resources Institute (TERI) to oversee cooling efficiency activities in India. This fund gave rise to Alliance for Sustainable Habitat, Energy Efficiency, and Thermal Comfort for all (SHEETAL). SHEETAL was setup to facilitate the implementation of ICAP, achieve the critical objectives of ICAP and for improvisations in India's climate policies and strengthening the foundation of an enhanced NDC commitment. The main themes of research planned under this grant are Research & Development, Sectoral Action and Enabling Action.³⁵

The work outputs of SHEETAL aim to:

- Facilitate the implementation of the ICAP to ensure country-wide access to cost-effective cooling with a specific focus on vulnerable populations,
- Achieve significant reduction in energy demand for cooling and cooling demand relative to business-as-usual scenario, and
- Catalyse a movement towards HFC phase-down pathways under the Kigali Amendment.

The implementation partners for SHEETAL are Alliance for Energy Efficient Economy (AEEE) and Council on Energy, Environment and Water. AEEE leading projects on - sectoral actions with a specific focus on space cooling and enabling action with a specific focus on behavioural change.³⁶ The overall activities defined under SHEETAL to support the implementation of the ICAP are as follows:³⁷

- Policy advice and analysis on detailed sectoral actions required.
- Facilitate communication between the government, industry, and consumers.
- Tracking performance and incentivising implementation.
- Ensuring the full mainstreaming of cooling across different line ministries.

ANNEXURE 1

Current state of implementation of the ICAP’s short-, medium- and long-term recommendations

Space Cooling			
	Recommendation	Synergies	Status
Short term recommendations (2019 - 2024)	Promote wider penetration of climate responsive built spaces to bring indoor temperatures within acceptable thermal comfort band through passive cooling thus reducing cooling load.	1. Pradhan Mantri Awas Yojana - Housing for All 2. Smart Cities Mission 3. National Mission on Sustainable Habitats 4. National Mission on Enhancing Energy Efficiency 5. Government E-Marketplace	Progress not trackable
	Further Government support towards targeted programmes to enable thermal comfort for economically weaker sections and low income groups. Wider adoption of ECBC-R in affordable housing projects.		As of 2021, the PMAY website indicated that about 48 lakhs of the 1.12 Cr houses have been built. ¹ Unclear if elements of ECBC-R and thermal comfort were included. ² While there is no current assessment, a 2018 report by AEEE states there is ample opportunity to include thermal comfort in the construction of these homes. ³
	To incorporate relevant provisions of energy efficient building design stated in ECBC to minimise active cooling needs by using passive design elements for all commercial (non-residential) buildings in statutory environment clearance, where applicable		As on 31st October, 2020 264 buildings have been awarded star rating under various categories. ⁴
	Mandatory disclosures and third-party verification of building cooling requirement and energy use for all commercial buildings that have a connected load of 100 kW or higher.		Progress not trackable
	Mandatory minimum indoor temperature settings (adaptive thermal comfort standards) in commercial buildings to reduce cooling requirement and energy consumption and promote healthy living/ working environment.		In 2019, the Ministry of Power notified that all brands and types of star-labelled ACs shall ensure default setting of temperature on the appliance at 24 degree Celsius wef 1/1/2020. ⁵

	Recommendation	Synergies	Status
	Nation-wide adoption and enforcement of ECBC for both commercial and residential sectors at the municipal and urban and local body level and through development of city level action plans		14 States and 2 UTs namely, Rajasthan, Odisha, Uttarakhand, Punjab, Karnataka, Haryana, Himachal Pradesh, Kerala, Andhra Pradesh, Telangana, Tripura, West Bengal, Uttar Pradesh, Arunachal Pradesh and Union Territories (UTs) of Andaman & Nicobar and Puducherry have notified ECBC for their states. Other states are at advance stages of adopting the ECBC. Proposal for notification of ECBC is submitted for Cabinet approval in 7 states viz. Goa, Jharkhand, Madhya Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim. ECBC Cells of BEE, housed at State Designated Agencies (SDAs), are supporting implementation of ECBC at State level. As on 31st October, 2020, 48 ULBs from 5 States have incorporated provisions of ECBC for building approval process. As on 31st October, 2020, 264 buildings have been awarded star rating under various categories. ⁶
	Ratchet up MEPS for Room ACs while taking into account most energy efficient models available and their affordability		MEPS revision proposed by the BEE in the 11th Technical Committee Meeting (March 2019) proposed ~5.2% improvement in MEPS (for 3-star ACs) annually. However, this was countered in the 12th TCM with a 3.7% improvement in MEPS annually ⁷ . There was opposition from research and civil society organisations, however is unclear. The last TMC was held on 20/01/2020 - however, the meeting notes show continued resistance from industry on revision of MEPS as per the ICAP.
	Mandatory star labelling for fans and introduction of MEPS for evaporative coolers		"This was noted in the 13th TMC conducted on 20/01/2020. BEE stated that market analysis study for desert cooler will be conducted by BEE and the star rating program is likely to be launched by this year. BEE requested the manufacturers and RAMA to submit the market share and performance data including the list of major manufacturers for both packaged airconditioners (also known as ductable ACs) and desert coolers. RAMA assured that the necessary details would be submitted within before 10th February 2020. Voluntary star labelling program for Deep Freezers and Light Commercial Air Conditioner launched on March 8th, 2020." ⁸
	Institutionalise Demand Side Management programmes with DISCOMS to replace inefficient ACs with EE appliances		EESL launched a public procurement program for a super-efficient AC. So far around 1, 300 Super-Efficient Air Conditioners have been sold. ⁹
	Implement eco-labelling programme for cooling appliances		No progress. A study of its feasibility was released in 2020 ¹⁰
	Promotion of DR-enabled cooling technology with real-time power consumption display		Progress not trackable

IMPLEMENTING THE INDIA COOLING ACTION PLAN: WAY FORWARD

	Recommendation	Synergies	Status
	Mandatory public procurement guidelines for highest star rated energy efficient ACs, fans, chillers etc. with low-GWP options wherever feasible		No progress
	Incentives coupled with awareness campaigns to drive market demand of energy efficient cooling appliances and equipment		Progress not trackable
	Encourage development of urban heat action plans for all cities with a population of 2.5 million or more		No progress
Medium term (2024-2029)	Institutionalise installation of thermal storage with cooling systems and differential (Time of Day) power tariffs to minimise peak power requirement.		No progress observed in the revised Tariff Policy ¹¹
	Promote use of not-in-kind technologies including trigeneration system, district cooling, thermal energy storage etc.		No progress observed (based on stakeholder interviews)
	All new construction - both residential and commercial - should be 100% ECBC compliant. The minimum stringency levels of ECBC compliance should be revised periodically to ECBC + Super ECBC requirements		As on 31st October, 2020, 264 buildings have been awarded star rating under various categories. ¹²
	Programs to reduce cooling energy use in existing buildings through retrofits and improved O&M practices		EESL RAISE (Retrofit of airconditioning to improve indoor air quality for safety and efficiency) program attempts retrofit of air-conditioning for better indoor air quality. The system will be energy efficient. ¹³ However, this is a demonstration project, at best. There is still a need to promote this on a large scale.

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¹ <https://pmaymis.gov.in/>

² <https://pmaymis.gov.in/assets/pdf/book.pdf>

³ https://shaktifoundation.in/wp-content/uploads/2018/10/Mainstreaming-thermal-comfort-for-all-and-resource-efficiency-in-affordable-housing_1.pdf

⁴ <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1684579>

⁵ <https://pib.gov.in/PressReleasePage.aspx?PRID=1598508>

⁶ <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1684579>

⁷ <http://www.beestarlabe.com/Home/ViewMinutesMeeting?EqplD=1>

⁸ 13th Meeting notes - <http://www.beestarlabe.com/Home/ViewMinutesMeeting?EqplD=1>

⁹ <https://eeslindia.org/en/super-efficient-ac/>

¹⁰ <https://www.clasp.ngo/research/all/a-study-on-the-feasibility-of-ecolabeling-in-india/>

¹¹ <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1684579>

¹² <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1684579>

¹³ <https://eeslindia.org/en/raise/>

Cold-chain			
	Recommendation	Synergies	Status
Short-term	Encourage development of cold chain infrastructure with use of low-GWP refrigerant based energy efficient cooling systems	1. Doubling Farmers' Income Initiative 2. Gramin Agricultural Markets	Progress not trackable
	Development of safety standards for flammable and toxic refrigerants for cold storage and other segments of the cold chain		In 2020, the Bureau of India Standards (BIS) adopted IEC 60335-2-40:2018 and ISO 5149 and Code of Practice for design and installation of the closed-circuit ammonia systems (MED 3(14430)). Both of these standards target natural refrigerants, aiming to make them safe to use in all types of cooling applications. ¹
	Develop programme for retrofitting of existing cold storages to reduce cooling, refrigerant demand and energy consumption		Progress not trackable
	Commercial refrigeration equipment like water coolers, display cabinets, freezers etc. to be brought under BEE star rating.		Voluntary star labelling program for Deep Freezers since March 2020 ²
	Periodic review and enhancement of energy efficiency norms of refrigerators.		No progress ³
	Standardise all design, construction and associated specifications for small, medium and large cold-chain infrastructure components.		No progress
	Link the incentives being provided for development of cold-chain infrastructure with adoption of energy-efficient design, construction and maintenance practices and low GWP refrigerant and renewable technologies.		No progress ⁴
	Provide specialised training facilities for cold chain professionals and technicians to promote proper utilisation and operation of technology, as well as energy efficiency.		No progress
	Provide training to farmers so that they can better manage their produce both pre-harvest and post-harvest		No progress
Medium term	Effective recycle/retrofit/ replacement programs for inefficient old refrigerators		No progress
	Retrofit cold storage buildings (refrigerated warehouses) by installing insulation and replacing inefficient cooling and refrigerating equipment, and install improved controls to significantly improve the EPI.		No progress

Sources:

¹ BIS representative

² <https://pib.gov.in/PressReleaseDetail.aspx?PRID=1684579>

³ Last updated in 2013 and 2016 for frost free and direct cool refrigerators. <https://www.beestarlabel.com/Content/Files/FFRnoti.pdf> [3] <https://www.beestarlabel.com/Content/Files/Schedule5-DCRefrigerator.pdf>

⁴ <https://mofpi.nic.in/Schemes/related-schemes-other-agencies>; <https://www.nsspl.in/cold-storage-subsidy-2020-in-india/#:~:text=Pre%2Dcooling%20unit-,Rs.,Scheduled%20areas%20for%20individual%20entrepreneurs.>

Transport Air-conditioning			
	Recommendation	Synergies	Status
Short-term	Promote development of low refrigerant charge energy efficient Mobile Air-conditioning System	1. National Mission on enhancing Energy Efficiency	No Progress
	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.	2. Atal Mission for Rejuvenation and Urban Transformation (AMRUT)-Public Transportation.	Progress not trackable
	Policies for promotion of compliance with CAFÉ standards	3. Urban Transport Metro Rail Projects. 4. Corporate Average Fuel Economy (CAFÉ) Norms.	CAFÉ 2 norms that aim to make cars more fuel efficient are scheduled to come into effect in 2022 ¹ . However, in January 2021, a delegation from SIAM pushed for the postponement of this to April 2024 ² .
	Green Labelling systems for cars to promote efficient vehicles	5. Faster adoption and manufacturing of hybrid and electric vehicles (FAME) Scheme	Green sticker mandated as part of BS VI compliance from October 2021 ³ . Implementation status unknown.
Medium and Long-term	Policies for improvement of energy efficiency and adaptation of low-GWP refrigerants, especially in hybrid and electric vehicles		No Progress
	Reduction of refrigerant demand, energy demand and vehicular pollution by shifting passenger traffic towards public transport. Building integrated and high-quality public transport systems in Tier 2 and Tier 3 cities to reduce the personalised vehicle demand.		Progress not trackable

Sources;

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RAC servicing sector			
	Recommendation	Synergies	Status
Short term	Assess demand and availability of trained RAC service technicians across the country, as well as the availability and quality of training institutions	National Skill Development Mission, Pradhan Mantri Kaushal Vikas Yojana, Government E-Marketplace	No progress
	Industry to participate in training delivery and commitment to employ a fixed number of trained candidates		Progress not trackable

	Recommendation	Synergies	Status
	Establish an e-platform that collates all available trainings for technicians from different training providers, as well as to address some of the key challenges such as, social security, job opportunities, etc, for all the technicians.		No progress
	Establish public procurement policies for government departments and organisation to engage services of trained & certified technicians and creating mass awareness among the consumers		No progress
	Develop standardised curricula and training processes including training duration, trainers qualification and training infrastructure across multiple agencies		ESSCI has qualification packs in line with the National Occupational Standards for air conditioning and refrigeration servicing technicians and engineers. ¹
	Operationalise central voluntary certification scheme through a single government entity under a single framework		Training and certification available for various AC and refrigeration under Recognition of Prior Learning programme by the ESSCI and NSDC ²
	Certification of about 50% service technicians by 2022-23		About 60,000 technicians have been trained and certified by the ESSCI under Skill India Mission
Medium term	Establish new training centres/ Centres of Excellence and upgradation of training centres.		No progress
	Promote online refresher training courses on new and upcoming technologies as skill enhancement support for technicians		ESSCI has qualification packs in line with the National Occupational Standards for air conditioning and refrigeration servicing technicians and engineers. ³
	Introduction of Social Security Schemes with adequate health and life insurance coverage for the RAC service technicians		No progress
Long term	Universal mandatory certification for all technicians		No progress
	Customer awareness programmes reinforcing the need for hiring only certified technicians		No progress
	Ensure universal coverage of Social Security Schemes for technicians		No progress

Sources:

¹ Reviewed here: https://www.ceew.in/sites/default/files/CEEW%20-%20Safety%2C%20Upskilling%2C%20and%20Good%20Servicing%20Practices%20for%20Cooling%2016Jul20_0.pdf

² Reviewed here: https://www.ceew.in/sites/default/files/CEEW%20-%20Safety%2C%20Upskilling%2C%20and%20Good%20Servicing%20Practices%20for%20Cooling%2016Jul20_0.pdf
Personal communication with the Ozone Cell

³ Reviewed here: https://www.ceew.in/sites/default/files/CEEW%20-%20Safety%2C%20Upskilling%2C%20and%20Good%20Servicing%20Practices%20for%20Cooling%2016Jul20_0.pdf

Refrigerant demand and manual			
	Recommendation	Synergies	Status
Short term	Develop safety standards for flammable refrigerants considering IEC 60335-2-40	Make in India	BIS has adopted IEC 60335-2-40 in 2020
	Development and production of low-GWP alternative refrigerants to the widely used high-GWP HFCS like R 404a and R 407a		No progress
Medium term	Amendment of the Ozone Depleting Substances (regulation and Control) Rule 2000 to align with the Kigali Amendment to the Montreal Protocol		No progress
	Indigenous development and initiation of production of HFOs and low-GWP blends of HFO and HFCs		No progress
	Monitoring and enforcement of Regulations of Petroleum & Explosives Safety Organisation (PESO) with respect to the use of disposable cylinders		No progress
Long term	Commercial Scale production of HFOs		No progress

R&D			
	Recommendation	Synergies	Status
short term	Recognise cooling as 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.	Mission Innovation, Start-up India	Global Cooling Prize was established in 2019 by the Department of Science & Technology and the Rocky Mountain Institute to find a breakthrough in residential cooling technology that will have 5X less climate impact and costs no more than 2X of the standard technology in India today.
	Develop National R&D Institutional Framework for low-GWP refrigerants and RAC to make India a hub for manufacturing of EE and low-energy consuming cooling solutions and low-GWP refrigerants		No progress
	Constitute a steering committee for R&D with representation from the Ministry of Science & Technology, HRD, BEE, experts from academia and research institutions and industry		No progress
	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.		Progress not trackable
Medium term	Constitution of R&D consortium using public private partnership model with funding support to monitor interdisciplinary research and development	No progress	
	Broad based research, development, demonstration and deployment of innovations contributing to thermal comfort	Progress not trackable	

	Recommendation	Synergies	Status
	Develop and facilitate a scientific and technical environment for basic research on materials and refrigerants, next generation molecules and oils, energy efficient cooling technologies such as compressors, heat exchangers and controls.		Progress not trackable
	Institutionalise mechanisms for Intellectual Property Rights protections in consultation with relevant stakeholders		Progress not trackable
Long term	Setup an interdisciplinary autonomous Institute of Excellence for Cooling Technologies housed in one of the academic and/or research institutes, capitalising on the expertise and R&D facilities available		No progress

Source:

<https://dst.gov.in/sites/default/files/GCP-Announcement%20Web%20Content.pdf>

ANNEXURE 2

List of experts consulted for the survey and interviews

Survey

Name	Affiliation
Ms. Shikha Bhasin	CEEW
Mr. S P Garnaik	EESL
Dr. M.P.Maiya	IIT-M
Ms. Ritika Jain	Shakti Sustainable Energy Foundation
Dr. Bijan Kumar Mandal	IEST, Shibpur
Mr. Aswani Kumar Sharma	WIPRO
Dr. M V Rane	IIT-B
Dr. Neeraj Agrawal	DBATU
Mr. Ashish Rakheja	AEON
Ms. Nisha Menon	DESL
Mr. Rajmohan Rangaraj	DESL, Veolia Environment Engineering Council
Mr. Piyush Patel	Paharpur Cooling Technologies
Dr. Prasanna Rao Dontula	A.T.E Group
Mr. Shubhashis Dey	Shakti Sustainable Energy Foundation
Mr. Mohanlal Basantwani	Shankar Refrigeration & Engineering
Mr. Rajendra Bhavsar	Refcon Technologies & Sysetms Pvt Ltd
Mr. Nikhil Raj	Neptune Refrigeration Co P Ltd
Mr. Shatrughan Kumar	Trans ACNR Solutions Private Limited
Mr. Ramesh Kumar Gupta	EVAPOLER ECO COOLING SOLUTIONS
Mr. Madhusudhan Rapole	Oorja Energy Engineering Services Pvt Ltd
Mr. Sudharshan Rapolu	TechnoDyne RS

Name	Affiliation
Interviews	
Mr. Tanmay Tatagath	Green Building Analyst, Executive Director Environmental Design Solutions
Ms. Sumedha Malaviya	Manager Energy Program, WRI India
Mr. Madhusudhan Rapole	Oorja Energy Engineering Services Pvt Ltd
Ms. Smita Chandiwala	Energe-se
Dr. Satish Kumar	AEEE
Mr. Vivek Ghilani	cBalance
Mr. Krishna Nagahari	Danfoss

ANNEXURE 3

Comparison between China’s Green Cooling Action Plan and India Cooling Action Plan

Indicators	CGCAP	ICAP
Targets	<p>2022</p> <ul style="list-style-type: none"> 30% improvement in energy efficiency levels of cooling products such as residential ACs and VRF ACs. Increase market share of green and high-efficiency cooling products by 20% with annual electricity savings of 100tWh. <p>2030</p> <ul style="list-style-type: none"> Energy Efficiency of Cooling of large-scale public buildings shall be increased by 30% Overall energy efficiency levels of cooling shall be improved by 25% Market share of green and high-efficiency cooling products shall be increased by more than 40%, which produces annual electricity savings of 400tWh. 	<p>2022-23</p> <ul style="list-style-type: none"> Train and certify 100,000 servicing sector technicians <p>2037-38</p> <ul style="list-style-type: none"> Reduction of cooling demand across sectors by 20 to 25% Reduction of refrigerant demand by 25 to 30% Reduction of cooling energy requirements by 25 to 40% <p>Recognition of cooling and related areas as a thrust area of research under the national Science & Technology programme to support development of technological solutions and encourage innovation challenges.</p>
Policy instruments	MEPS, Green procurement, leverage existing fiscal, taxation and financial policies	MEPS, Public procurement, Building Codes, Standards, leveraging synergies
Sectoral Focus	Space Cooling, Cold chain, Energy Efficiency	Space Cooling, Cold chain, Transport air-conditioning, Manufacturing and R&D
Priority Actions	<ul style="list-style-type: none"> Strengthen the guidance of standards with actions such as: MEPS exceeding entry level requirements of developed countries, continual improvement of energy efficiency and their endorsement through government policies, and Standards for green design, manufacturing quality for overall greening of the sector. 	<ul style="list-style-type: none"> Promote development and commercialisation of technology pathways, especially low-energy cooling technologies, which would reduce the energy footprint of active cooling

Indicators	CGCAP	ICAP
	<ul style="list-style-type: none"> • Expand the supply of green and high-efficiency cooling products through the implementation of the 'Guiding Catalogue for Green Industries', R&D on alternative technologies and increase research on environment friendly refrigerants and actively promote the reuse and safe disposal of refrigerants. • Promote green and high-efficiency cooling product consumption through green procurement and government procurement. • Advance energy-saving transformation through demonstration projects on energy-saving retrofits of central AC systems, data centres, cold chain logistics. • Deepen international cooperation on the Paris Agreement and the Montreal Protocol and demonstrate improving energy efficiency, reducing GHG emissions and phasing out HFCs. 	<ul style="list-style-type: none"> • Accelerate the energy conservation in space cooling through implementation of building energy codes, adoption of thermal comfort standards, ratcheting up energy efficiency in RACs and fans and enhance consumer awareness through eco-labelling. • Public procurement of energy efficient cooling equipment and skilled technicians for public buildings • Thermal comfort for affordable housing • Skill building of the servicing sector • Ensure harmonisation of policies • Create an ecosystem for promoting R&D
Stakeholders	Municipalities, Xinjiang Development and Construction Corps Development and Reform Commissions, Departments under The Ministry of Industry and Information Technology, Departments (Bureaus) of Finance, Ecology and Environment Department (Bureaus), Housing and Urban-Rural Development Departments (Bureaus), Market Regulations Bureaus (Departments, Commissions), Government Offices (Administration Department).	Ozone Cell, Ministry of Environment, Forest and Climate Change, Ministry of Power, Bureau of Energy Efficiency, Department of Science and Technology, Ministry of Skill Development and Entrepreneurship, State Departments, Industry Associations, CSIR, NCCD
Other elements	Supply side structural reform	Integrated approach to sustainable cooling

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- 4 Namely, space cooling in buildings, air-conditioning technology, cold-chain and refrigeration, transport air-conditioning, refrigeration and air-conditioning servicing sector, local manufacturing and R&D.
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- 6 <http://ozonecell.nic.in/home-page/montreal-protocol-implementation-in-india/committees/committees-empowered-steeringcommittee/>
- 7 Based on personal communication with the Ozone Cell, dated 10 May 2021.
- 8 August 2020 – Survey of seven industry (micro, small and medium scale businesses) and fourteen non-industry personnel (policy researchers, architects, consultants). The industry respondents comprised of: commercial refrigeration or CR (e.g. water coolers, deep freezers), commercial air conditioning (CAC), residential air conditioning (RAC), industrial refrigeration (IR) and mobile air conditioning or MAC (for buses and trucks). Non-industry respondents comprised of: researchers, academics, architects and real estate contractors. April 2021 – Semi-structured interviews with seven with industry and policy experts.
- 9 Based on seven semi-structured interviews conducted with industry and policy experts conducted between 13/04/2021 and 23/04/2021.
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- 33 The SSSCC operated in two phases (2016-17) and (2017-19). In phase 1 (2016-17) SSSCC focused on sustainable and smart space cooling resulting in the 'Thermal Comfort for All – Sustainable and Smart Space Cooling' report released by the MoEF&CC in 2017. In phase 2 (2017-19), additional members CPR, GKSPL, GSI, IGBC and TERI were added to the coalition to drive the agenda put forth by the ICAP.
- 34 The following organisations are a part of the ICC: Shakti Sustainable Energy Foundation – (Funder), AEEE (Secretariat), CEPT Research and Development Foundation, CPR, Centre for Study of Science, Technology and Policy, CEE, CLASP, CEEW, Glazing Society of India, ICLEI, IGBC, ISHRAE, MNIT, NRDC, Prayas (Energy Group), The Climate Group, TERI, University of Birmingham and WRI.
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