India Cooling Action Plan: lessons in integrated cross-sectoral policymaking

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Abstract

India currently has low access to cooling, but its population growth, economic progress, and rapid urbanisation, coupled with global warming trends, will drive an 8X increase in the demand for cooling in the next two decades. While India's projected cooling growth is in step with its development needs, this growth, under a business-as-usual scenario, portends adverse power system and environmental impacts. Against this backdrop, the Ozone Cell of the Ministry of Environment, Forest, and Climate Change, Government of India proactively led the development of the India Cooling Action Plan (ICAP) 2019 – an essential macro-level policy tool to manage India's cooling growth while neutralising the potential harmful impacts and securing important socio-economic benefits for the population. ICAP is widely recognised as a model national cooling action plan for its depth, cross-sectoral spirit, and multi-stakeholder development framework. The ICAP development process (Jan 2018 to Mar 2019) demonstrated high inter-ministerial collaboration and active participation from the triple sector – with 13 public sector, 8 private sector, and 4 knowledge sector entities as part of the core Working Groups, and many other stakeholders engaged through a collaborative process. The team of authors from the Alliance for an Energy Efficiency Economy (AEEE) were intimately involved in the ICAP development process from inception to completion. AEEE led two of the seven Working Groups established for sector-specific analysis and supported the Ozone Cell in the synthesis and integration of all the working-group outputs into a cohesive ICAP report, providing strategic guidance in the Steering and the Inter-ministerial Committees. This paper will present the lived-in experience of the AEEE ICAP team, in terms of the lessons gleaned from the innovative ICAP development process that can find broad applicability in integrated and cross-sectoral energy efficiency policymaking for long-term socio-economic benefits and synergies, in not just cooling but also other end-uses that cut across multiple government portfolios.

Introduction: A Case for Integrated Policymaking

The Ozone Cell of the Ministry of Environment, Forest, and Climate Change, Government of India launched the India Cooling Action Plan (ICAP) in 2019 to steer India's long-term future of cooling from imprudence to sustainability. The ICAP has been widely recognised for its integrated national-level policymaking and cross-sectoral collaboration comprising active representation from the triple-sector, that is, the public sector, the private sector, and the knowledge sector. AEEE was intimately involved in the ICAP development process, from its inception in January 2018 to its completion in March 2019. AEEE led the sector-specific analysis for space cooling in buildings and the food cold-chain, supported the Ozone Cell in the integration of all sectoral outputs into a cohesive nationwide cooling action plan, and provided strategic guidance in inter-ministerial committees. AEEE is now supporting the implementation of the recommendations of the ICAP through many avenues. The authors will present in this paper their lived-in experience, discussing key lessons and

broad takeaways – what worked and what could have been done better – that can find wide applicability in integrated policymaking as a critical step towards sustainable development.

It is now widely understood that the 21st century's complex environmental and developmental challenges, especially in the milieu of the enormity of climate change, cannot be solved by a single ministry or department, for example, the ministry of environment or the ministry of climate change or equivalent. For that matter, it cannot be solved by many different ministries and departments (such as finance, social welfare, urban/rural development, water, transportation, agriculture, etc.) working in silos or in unsynchronised coordination. This is because the design and implementation of policies and programmes of nearly every ministry can have a significant bearing on the environment and on the future sustainability of communities. Also, some sectoral policies turn out to have unexpected and often unwanted consequences (or externalities) that were not taken into account in the process of policymaking. Thus, synchronisation between many ministries and organisations is becoming increasingly imperative for effective policymaking in high-impact areas – for example, high and growing greenhouse gas (GHG) emitting end-uses such as cooling and/or heating across sectors urban mobility, sustainable food systems, etc.

Integrated policymaking entails synergistic dovetailing of ongoing and emergent public policies and programmes either laterally through parallel ministries and departments or vertically through different tiers of government [1]. This can help align end objectives and targets and even set more ambitious ones. This sets in powerful integrative effects such that the whole coherent policy achieved through integrated policymaking is more than just the sum of the individual policies and programmes. In today's world, multiple factors have increased the number of actors involved in the policy process, such as the emergence of the information society, greater emphasis on public participation and the increasing role of non-governmental organisations, pressure groups and agencies in the decision-making process. Thus, the definition of integrated policymaking can be expanded in the context of pressing global challenges such as climate change to include actors beyond the government. The public sector (government ministries and their appointed entities), the private sector (innovators, manufacturers, industry associations, financial institutions, etc.), and the knowledge sector (researchers, academia, civil society organisations, etc.) will need to work in tandem and with equal enthusiasm if non-trivial challenges such as reaching net-zero GHG emissions by 2050 have to be met [2]. For example, setting a policy that the private sector isn't ready or willing to implement will not do any good. Similarly, if the public sector is unable to demonstrate the usefulness of a new product produced by the private sector, through say, public procurement programmes, consumers at large may continue to default to poorer incumbent technologies for a longer time. That is why it is very important that the triple-sector works in complementary ways – and integrated policymaking has the potential to make this happen by assimilating seemingly disparate actors right from the start and initiating and sustaining dialogue among them.

Cooling: The Perfect Candidate for Integrated Policymaking

Climate change-induced warming trends, population growth, and rapid urbanisation are driving an unprecedented increase in the global demand for cooling across sectors, including thermal comfort in buildings, agriculture and food supply chains, storage and transfer of vaccines and medical products, transport of people, and industrial processes. This growth in cooling is inexorably linked with the socio-economic progress of nations and meeting several Sustainable Development Goals (SDGs) such as (2) Zero Hunger, (3) Good Health and Well-being, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (10) Reducing Inequality, (11) Sustainable Cities and Communities, and (13) Climate Action. It is estimated that the current baseline of approximately 3.6 billion cooling appliances from the combined sectors of space cooling, stationary refrigeration, and mobile cooling in use globally will grow nearly 4-times by 2050 [3] if cooling is provided to everybody who needs it – and not just those who can afford it.

However, the current cooling needs are largely met by air-conditioning and refrigeration that runs on mostly fossil fuel generated electricity and high Global Warming Potential (GWP) refrigerants. In fact, energy demand for cooling is one of the fastest-growing GHG contributors in the world. Under a business-as-usual scenario, global emissions from air conditioning and refrigeration are expected to rise 90 % from 2017 levels by 2050 [4]. Also, the global energy requirement for cooling our buildings alone is estimated to jump by 300 % to 6,200 TWh in 2050, and the associated stock of room air conditioners will cumulatively emit enough GHG emissions to warm the planet by 0.5 °C by 2100 [5]. Thus, cooling is perpetuating a downward spiral by causing further warming necessitating even more cooling, and disproportionately impacting those that do not have adequate financial resources necessary to procure mechanical cooling solutions – a concern that has been heightened by the COVID-19 pandemic. This makes cooling a high-impact end-use area that urgently needs innovations in integrated policymaking, especially in hot and humid emerging economies where the total cooling demand is still largely unmet.

By virtue of its cross-cutting nature, cooling makes for a perfect candidate for integrated policymaking. For example, a country's policies and programmes around developing an uninterrupted cold-chain for the passage of agricultural produce, meat, and fish from farmers, meat producers, and fishermen, to end consumers would typically be shared by the ministries of agriculture, animal husbandry, and fisheries. Similarly, the ministry of housing and urban development or the ministry of power may be responsible for establishing building energy codes in a country to promote thermal efficiency of buildings, thereby reducing the need for mechanical cooling – this reduced cooling demand would then be met by a combination of efficient and low-energy cooling strategies. In another example, air-conditioning in cars, buses, and trains would fall within the purview of the ministry of road transport and railways. However, cooling in different sectors managed by separate ministries is linked by common growth drivers, air-conditioning and refrigeration technologies, and environmental targets (for example, Paris Agreement of 2015, the Kigali Amendment to the Montreal Protocol of 2016, and the UN Sustainable Development Goals 2030). It is clear then that

any serious and meaningful effort to manage a country's cooling future would need integrated and cross-sectoral policymaking that can bring together ministries representing different cooling consumption sectors and ministries and departments offering common sustainable cooling solutions in the form of scientific innovations in cooling, energy efficiency benchmarks, refrigerant transition pathways, service sector upskilling, etc. Integrated policymaking would also help drive alignment between public sector and private sector entities, whose interests may not always naturally align when it comes to the public good. The benefits of doing this are far-reaching. Improving the cooling industry's energy efficiency together with the transition to climate-friendly refrigerants can reduce GHG emissions by 210–460 billion tonnes of CO_2e over the next 4 decades – these GHG emission cuts will be important to limit the global temperature rise to 1.5 °C [3].

India Cooling Action Plan (ICAP) 2019: A Flagship Initiative of Government of India

The Ozone Cell of the Ministry of Environment, Forest and Climate Change, Government of India displayed strong political will and exemplary leadership to develop a plan to harmonise the energy efficiency of refrigeration and air-conditioning equipment with refrigerant transition pathways for enhanced climate action (as agreed in the 29th Meeting of the Parties to the Montreal Protocol). Launched in March 2019, the ICAP is the first-of-its-kind initiative of its scale in the cooling sector to be taken by any country in the world that exemplifies integrated policymaking and underscores the urgency of proactively and collaboratively addressing its cooling growth.

The ICAP development process (Figure 1) demonstrated high inter-ministerial and cross-sectoral collaboration in laying out actionable pathways to provide sustainable cooling over the next 20 years (2017–18 to 2037–38), 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 own targets within a directional framework of recommendations. ICAP's high-levels goals are: (a) reduction of cooling demand across sectors by 20–25 %, (b) reduction of refrigerant demand by 25–30 % (c) reduction of cooling energy requirements by 25–40 %, all by 2037–38 (d) training and certification of 100,000 service technicians by 2022–23 and (e) recognising "cooling and related areas" as a thrust area of research under the national science and technology programme [6]. While the ICAP outwardly addresses cooling and cooling-related practices, its rationale lies in delivering far-reaching socio-economic benefits to the Indian people such as:

- It strives to bridge the social inequity issue of urban heat islands by reinforcing the need for climate-appropriate building design as the foundational approach, coupled with energy-efficient cooling appliances, and behavioural adaptations such as adaptive thermal comfort practices. While the high upfront cost of energy-efficient equipment remains a concern for several consumers, ICAP encourages market transformation mechanisms such as driving down the procurement costs through demand aggregation and bulk procurement, and creating awareness on lifecycle costs (versus the upfront cost as the basis for purchasing decisions).
- The ICAP proposes building a robust cold-chain infrastructure to provide important market linkages, which will help increase smallholder farmers' income, strengthen food security, and drive down food prices.
- It highlights the refrigeration and air-conditioning servicing sector as an immediate opportunity, not only for appropriately handling refrigerants and reducing emissions, but also for providing increased green employment and better livelihoods through training and certification.
- The ICAP supports other government missions like Make in India and *Aatmnirbhar Bharat* (Self-reliant India) by promoting indigenous production of cooling equipment and refrigerants. Further, it opens new opportunities for students and young professionals interested in research and development and cooling-related start-ups.

Lessons and Takeaways from the ICAP Development Process

AEEE was intimately involved in the creation of the ICAP, which gave the authors an opportunity to experience and learn from the integrated policymaking process. AEEE had three primary roles in the development of the ICAP:

- Leading the cooling demand assessment and strategic mapping of priorities in the assigned thematic areas – space cooling in buildings, and cold-chain & refrigeration.
- Supporting the Ozone Cell in the overall aggregation of the multiple thematic area analyses into a cohesive ICAP, including the development of the anchoring elements, goals and recommendations.
- Supporting the Ozone Cell in coordinating critical inputs from the Steering Committee and the Inter-ministerial Committee during the ICAP development process.

AEEE's role also extended beyond the ICAP's development into the on-the-ground implementation, affording a meaningful vantage point that covers the operationalisation of the ICAP. AEEE is part of an implementation focused Steering Committee, formed by the Ozone Cell after publication of the ICAP, and is also supporting the implementation of ICAP recommendations through multiple avenues. The key lessons and takeaways from this experience, that can find broad applicability in integrated policymaking from the ICAP development process are:

One nodal entity. The Ozone Cell was at the helm of the ICAP development process and the key coordinator between various participating entities. It played a crucial role in planning the steps and stages of the development process, managing the development timeline, scheduling working group meetings, coordinating cross-ministry dialogue and comment, closing communication gaps, providing strategic guidance, settling disagreements, soliciting public comment, and giving the ICAP a befitting launch and national coverage.

Integrated policymaking would require a nodal government entity that not just 'owns' the development process but also drives effective collaboration and buy-in from multiple relevant government bodies.

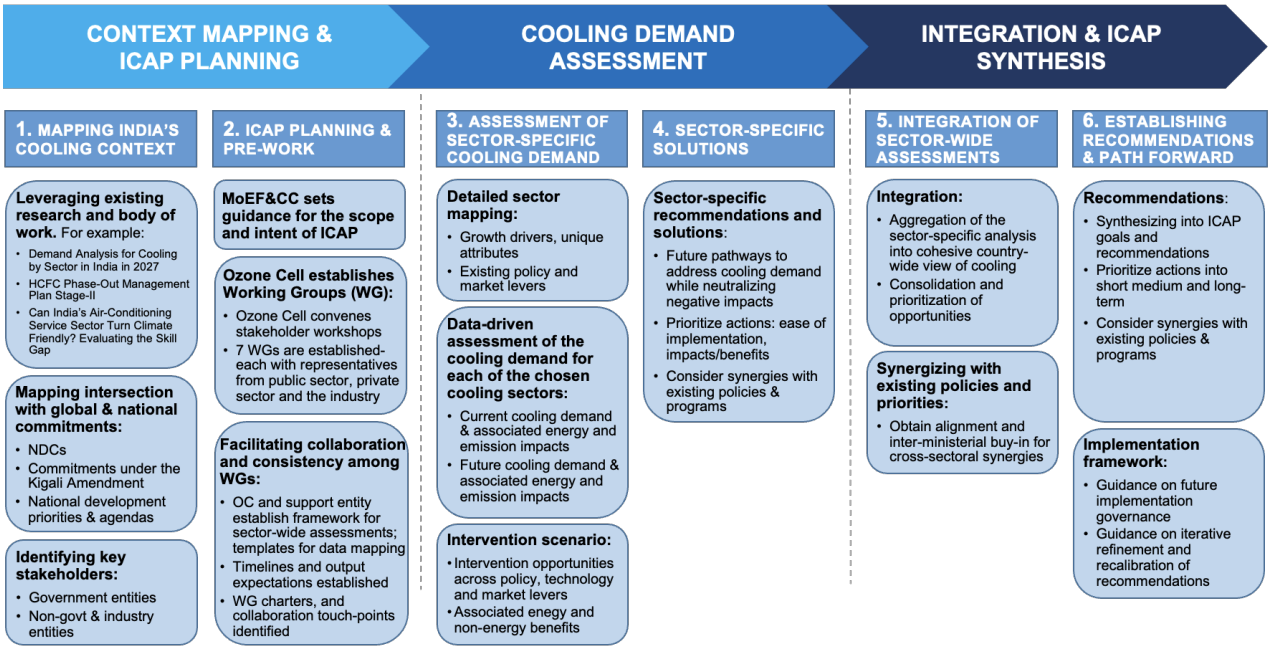

Figure 1. Development Process for the India Cooling Action Plan.

Triple-sector development framework. For the development of the ICAP, the Ozone Cell constituted working groups for mapping one or more of the following thematic areas: space cooling in buildings, air-conditioning technology, cold-chain and refrigeration, transport air-conditioning, refrigeration and air-conditioning service sector, indigenous production of refrigerants, and research and development. These working groups were tasked with setting the context, conducting the data analyses, and charting future recommendations for the identified thematic areas. To obtain triple-sector alignment right from the start, the Ozone Cell ensured that every working group had adequate representation from the public sector (ministries and related government entities), the private sector (manufacturers, developers, and industry associations), and the knowledge sector (research entities, academia and civil society organisations). 13 public sector, 8 private sector, and 4 knowledge sector entities participated in the core working groups (see Figure 2), and many other stakeholders engaged through a collaborative process. This approach helped bring alignment among different stakeholder groups from the triple-sector on the data outcomes and the future recommendations (in terms of their urgency, feasibility, and cost-benefit trade-offs, etc.).

The development process should include a collaboration framework that enables the active engagement of the relevant stakeholders, drives alignment among diverse interests, and catalyses synergistic action.

Inter-ministerial coordination and buy-in. An independent Steering Committee with representatives of various ministries was constituted for guiding and reviewing the documentation, reports, and recommendations developed by the thematic ICAP working groups. An Inter-ministerial Committee comprising subject matter experts, eminent representatives of think tanks, and industry representatives was also formed under the chairmanship of the Environment Secretary to oversee the development process. This Committees helped dovetail the recommendations of the ICAP with ongoing and planned policies and programmes residing with different ministries. For example, the ICAP recommended ratcheting-up the minimum energy performance standard (MEPS) and Standard & Labelling (S&L) for common cooling appliances such as room conditioners at an accelerated pace as compared to historical trends; for this recommendation to become workable, it was very important to obtain the buy-in of the Bureau of Energy Efficiency (BEE) of the Ministry of Power which has the mandate on designing and implementing India's S&L programme.

Integrated policymaking requires a high-level steering committee or governance body that can provide oversight during the development process, help achieve cross-sectoral integration, and drive effective collaboration amongst relevant government bodies.

The role of data. A key challenge faced during the process was ensuring robust data in multiple areas, including estimating the cooling demand through both top-down and bottom-up analyses, aligning this demand with the refrigerant production in the country, getting reliable sales data (historic and current) for different cooling appliances and estimating building area and AC penetration etc. To address this challenge, the working groups used the best available information/data on the subject – such as government publications, where available, industry estimates, surveys and research publications – and applied multiple methods including exhaustive stakeholder consultations and expert inputs to close the data-gaps and make informed assumptions where needed. Some examples of the various data sources leveraged in the ICAP development are:

- **Research publications.** A cooling demand analysis study conducted by AEEE [7] served as an important precursor study for the ICAP data assessment. Many key input parameters used in this study became a starting point for deliberations and discussion among the working groups and were

further refined to make them more accurate and acceptable. This precursor also pointed the working groups towards the main data gaps that were then plugged through informed assumptions and proxies vetted by industry experts. Besides this, the ICAP data assessment also helped vet some of the estimates by international organisations such as the International Energy Agency (IEA) [8] and Lawrence Berkeley National Laboratory (LBNL) [9] on India's cooling demand growth and its associated impacts. The ICAPs multi-stakeholder development process allowed many diverging estimates to be discussed and refined during the working group meetings. All assumptions that can significantly impact the estimates and projections were discussed at length and agreed upon before being incorporated in the final ICAP.

- **Government publication/database.** Bureau of Energy Efficiency (BEE) database (on beestarlabel.com, now unavailable) of production volumes and energy efficiency levels for appliances covered by mandatory S&L such as room air conditioners and domestic refrigerators played a critical role in getting buy-in from industry representatives and associations, especially on data points such as the future growth rate in the sales of cooling appliances. In the case of fans, which is still not mandatorily under BEE's S&L programme, it was difficult to reach consensus as easily; a top-down (i.e., using household and fan ownership data) approach, dependent on many assumptions, was used to estimate the baseline and future stock of fans – naturally, the level of confidence in the fan estimates was lower than in the room air conditioner estimates which were founded on data published by a credible government source. In another example from the cold-chain sector, data published by the National Centre for Cold-chain Development [10] played a foundational role in assessing a needs-based estimate of the baseline and future stock of the different linkages of an integrated food cold-chain.
- **Energy models.** NITI Aayog's energy model 'India Energy Security Scenarios (IESS)' [11] was sourced for data on GDP, population, per-capita income, urbanisation, and ownership of cooling appliances. In some cases where the IESS data did not inspire enough confidence in the working groups, newer or more correct data was used – for example, the built-up area of India's commercial building stock [12].
- **Industry estimates.** The refrigerant demand in each of the cooling consumption sectors was initially estimated bottom-up, but this relied heavily on a large number of assumptions, making the refrigerant demand estimates uncertain. However, a work-around was found in the form of refrigerant production data made available by the Refrigerant Gas Manufacturers Association (REGMA) – these top-down estimates were used to verify the bottom-up estimates to gain confidence in data and obtain cross-sectoral buy-in.

A data-driven assessment should constitute the foundational logic behind integrated policymaking. The first step should be to leverage and build upon existing research conducted nationally and globally, and draw information from government databases. Where reliable data is not available in the public domain – these data gaps can be plugged in by engaging subject matter experts, such as academia, civil society organisations, and industry. Data can become a leveller in terms of driving consensus; public disclosure of data helps bring quick alignment.

Dovetailing existing policies and priorities. At the high level, the ICAP recommendations were deeply embedded within the context of the Kigali Amendment of 2016 to the Montreal Protocol, i.e., harmonising the energy efficiency of cooling appliances with the refrigerant transition towards more climate-friendly refrigerants. At the more in-depth level, the ICAP cross-referred and forged synergies with ongoing and planned government policies and programmes residing with different ministries, such as:

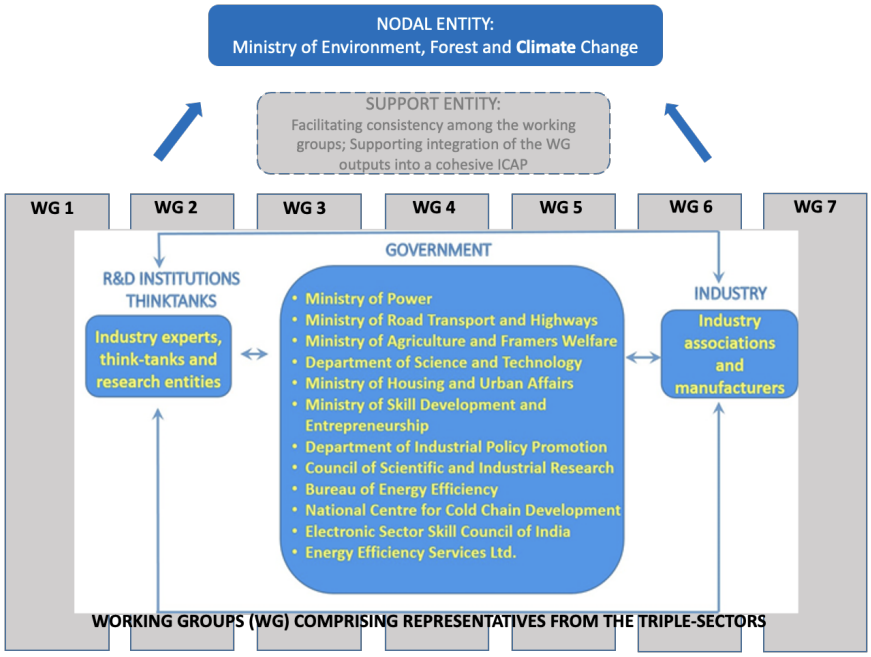

Figure 2. Multi-stakeholder Development and Input Framework For the ICAP.

- Nationwide adoption and implementation of BEE's Energy Conservation Building Code 2017 can lead to significant reduction in cooling demand in commercial buildings.
- BEE's S&L programme already covers Room and Split Air-Conditioners, Chillers and Fans and can be expanded to include evaporative air-coolers and fast growing Variable Refrigerant Flow air-conditioners. Setting aggressive performance standards for these cooling appliances will be one of the key strategies to achieve sustainable cooling in India.
- *Pradhan Mantri Awas Yojna* (PMAY) is an ambitious affordable housing scheme to enable housing for all and it will be critical to ensure thermal comfort – through thermally efficient envelope design – in these newly constructed units as the current focus is on cost, speed and scale.
- Smart Cities Mission can adopt policies such as ECBC and float tenders requiring thermal comfort guidelines to be met in PMAY scheme to fast track the implementation of ICAP.
- Doubling of Farmers' Income by 2022 can be effectively enabled by linking the scheme to cold-chain infrastructure development recommended by the ICAP, which will require significant investments in the near term.
- National Skill Development Mission has already set a goal to train 100,000 service technicians that can – in direct alignment with the ICAP – directly translate to better refrigerant management before the end of life of room air-conditioners as well as better performance of those RACs that are operated and maintained by registered technicians.

An important consideration is to align the recommended actions of the integrated policymaking to the extent possible – with existing national priorities and policies and international commitments. Not only does this encourage inter-ministerial cooperation, but it also maximises potential benefits through synergistic actions.

Implementation framework. The ICAP report suggests an implementation framework (Figure 3) to operationalise its recommendations:

- The already existing Inter-ministerial Empowered Steering Committee for the implementation of the Montreal Protocol approved by the Union Cabinet could be additionally tasked with overseeing the implementation of the ICAP.
- Add capacity in the Ozone Cell to act as a Cooling Secretariat in order to provide support to the Empowered Steering Committee and coordinate actions emerging from the ICAP.
- The related line ministries of the Government of India, State Governments, and Urban Local Bodies could seek additional financial resources, if required, beyond available resources for fast-tracking implementation.
- Since cooling is an integral part of the Montreal Protocol as well as the Paris Agreement, multilateral funding mechanisms could also make resources available.
- Working groups matching the ICAP thematic areas will be constituted to closely monitor the implementation of the ICAP recommendations (this process began in September 2019).

It is important to instate an implementation framework that clearly outlines a monitoring protocol and establishes a recalibration process for updating the recommendation with respect to the progress made and any new information or technologies that may have become available. While not included in the ICAP, but in hindsight, defining key success factors and a process for measurement and verification would help map the progress and re-calibrate actions as needed,

Guiding philosophy. ICAP recognised that cooling is a developmental need, and India's aggregated cooling demand is going to increase in alignment with its economic growth and rapid urbanisation. It brought attention to the importance of 'Thermal Comfort for All' (as opposed to 'cooling') [13] through a holistic and balanced approach, i.e. first, reducing the cooling loads to the extent possible using thermally-efficient building design and construction practices and passive cooling strategies; then, serve the reduced cooling loads efficiently with appropriate and efficient cooling equipment; and optimise the cooling operations and behaviours through good operation and maintenance practices and user adaptations. Over and above this three-pronged approach, accompanying measures that support the transition to power that comes from renewable sources will be important contributors to further lowering the GHG impact of cooling solutions.

Though not imperative, an underpinning philosophy can help guide the integrated policymaking process, especially in terms of bringing alignment among those stakeholder groups whose interests may not always naturally align. In these cases, the underlying philosophy can be used as a touchstone to resolve disagreements, obtain quick consensus, and identify priorities.

Beyond ICAP Development: Further Observation and Learnings

It has been just over two years since the launch of the ICAP. Programs and initiatives are already underway to advance the intent of the ICAP (despite some slowdown due to the pandemic). As aforementioned, AEEE is supporting the operationalisation of ICAP through multiple avenues: as part of the Implementation Steering committee established by the Ozone Cell, as part of the India Cooling Coalition (discussed later in the paper), and directly involved in a multi-year program to implement ICAP recommendations. Our observations below are drawn from the author's involvement in the implementation process and also informed by the authors' experience in developing a globally applicable methodology for National Cooling Action Plans under the auspices of the Cool Coalition (discussed later in the paper), and its ongoing pilot testing in a couple of countries. We share the following observations and lessons that may be meaningful to other countries advancing on similar journeys:

It is important to find the right balance between comprehensiveness and timeliness. A comprehensive cooling action plan would ideally be an aspiration for every country – one that incorporates a holistic assessment of current and future cooling needs across all sectors, including a quantification of the unmet cooling needs, that is, serving the cooling needs for those who currently have lack of access to adequate or any cooling. Such a holistic assessment at the national level would require a robust modelling framework that looks at a bottom-up ap-

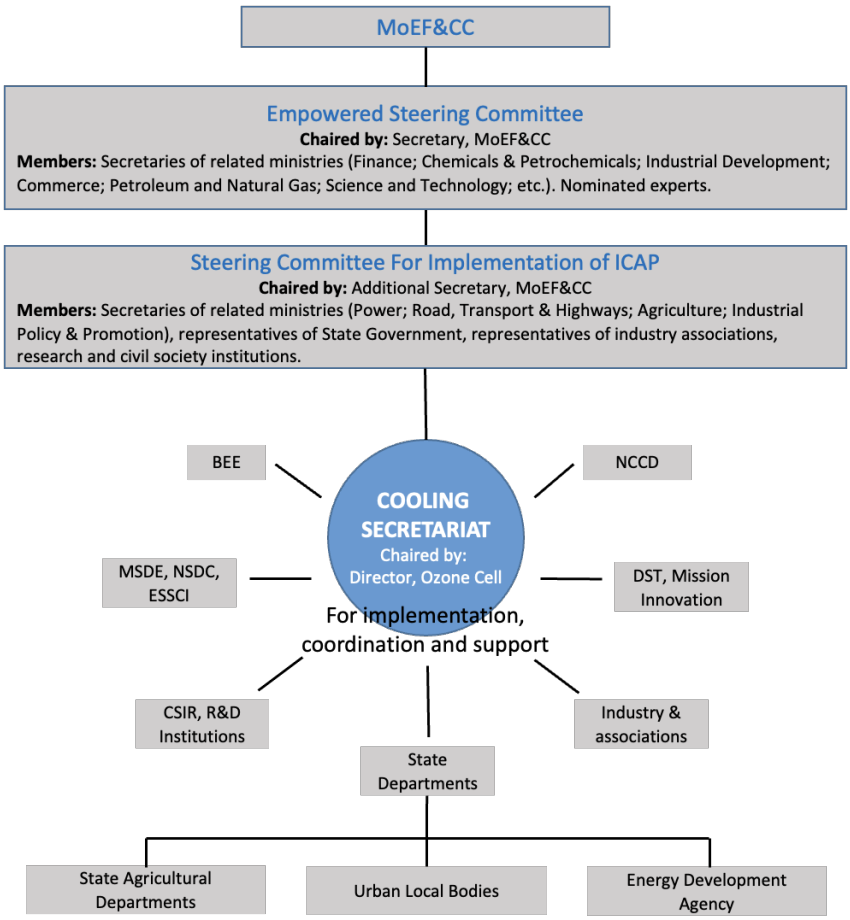

Figure 3. ICAP Implementation Framework [6].

proach to estimate cooling and refrigeration demand and simultaneously couples that with a macroeconomic model to forecast the demand and look at different technological and behavioural pathway and policy frameworks to arrive at the energy requirements that a country may need – currently and in future – while completely meeting the cooling and refrigeration needs for the entire population. Such sophisticated modelling capabilities may not currently exist in many countries.

In the meantime, the cost of inaction to the people and the environment at large is high. For example, data shows us, most countries in the world could be delivering today's space cooling needs with less than half the energy use (and generating less than half the emissions) while delivering a lower lifecycle cost to users and consumers: technologies and strategies commonly exist to achieve this [16]. However, these remain largely unexploited, posing a significant opportunity cost to the government, the environment and to the population at large. Thus, given the urgency of the cooling challenge and the importance of timely interventions, the need for balancing comprehensiveness with timeliness is paramount, and in some country-contexts, starting small or in phases may have its merits over delayed action for the sake of comprehensiveness. The key determinants for a country are: what are the immediate priorities in the country, and what is the opportunity cost of delayed action? The 'right approach' would vary from country to country, and there is no one size that fits all.

Cast a wide net to leverage all possible resources and expertise. Developing a cooling action plan can be a resource-intensive undertaking: and while financial resources, in this case, may be relatively easier to address, the lack of adequate human resources pose a bigger challenge. There may be inadequate institutional capacities and skills among policymaking entities to bridge across multiple cooling sectors, find data and do the analysis and synthesis, and integrate the outcomes into a unified policy document with clear pathways for action. Actively engaging in-country experts from across the cooling value-chain, as well as the triple-sectors, can help bridge gaps in data and expertise. Countries should also leverage support and resources from multilateral organisations that have experience in the development of cooling action plans, as well as leverage any available tools such as modelling frameworks.

While global literature and intelligence are important to consider and leverage where applicable, policies and ensuing solutions will have to be tailored very specifically to the local needs and realities. A case in point is the cooling need for the agricultural cold chain sector in India. During the development of the ICAP, the cooling need assessment for India's agricultural cold chain was based on the best available data at the time – this data was rooted in the underlying assumption that a modern and uninterrupted cold chain infrastructure is required for all of India's agricultural produce. However, the important intersection between the agriculture sector and the need for climate-friendly cooling – catalysed during the ICAP development and

cross-sectoral discussions – has sparked a meaningful reassessment of what is the right cold chain model for developing countries with a significantly high percentage of smallholder farmers (such as, 80 % in the case in India). Even though global literature is reinforcing the benefits of an uninterrupted modern cold chain, this infrastructure has limited benefits in India's diverse smallholder agroecology. The takeaway is that there is no cookie-cutter solution. While there are indisputable benefits of appropriate technology and uninterrupted cold-chain where needed, a dominant percentage of India's agricultural sector may be better served by solutions that are focused on first-mile connectivity, low-energy cooling and providing a few days of storage. Dissipation of field heat, short-term preservation of shelf life, and washing, sorting and grading may be all that is required for almost 50–60 % of India's horticultural produce – which is typically sold in the local "farmers' markets" and consumed within a few days of harvesting in homes that do not always have refrigerators. These solutions can truly elevate the economic well-being of smallholder farmers by enabling them to command better pricing, reducing economic losses due to food loss, and in the process also minimising the GHG impact of food loss.

Robust data is key, but the lack thereof need not be a show-stopper. While data is crucial to the development of a cooling action plan, its availability, quality and reliability is a common challenge in most countries. Even where data is available, it typically gives a view into only the cooling demand that is being served; reliable quantification of the unmet cooling demand in a country – related to lack of access to cooling – is even harder and thus far the attempts to quantify it are limited.

That said, lack of good quality data in a country need not be a show-stopper! Leveraging any available government databases and existing country-specific research is a good starting point for gathering data. This should be supplemented with the growing international body of work and data-driven research in cooling, available in the public domain. Data gaps can be closed with logical assumptions grounded in best-available information, and for this, engaging in-country experts – such as from academia, civil society organisations and the industry – is very beneficial.

Countries should also consider building provisions within their cooling action plan to periodically revise the policy as new data (or even new technologies) become available. In fact, the cooling action plan can become a meaningful starting point for robust and transparent data on cooling – a government database that captures all the data gathered during the development process and iteratively updates this information would be significantly beneficial for implementation efforts and for ongoing future cooling-related work.

The future projections are only "projections" and should be carefully considered. While developing a forward-looking policy document like a cooling action plan, it is generally meaningful to have a longer time-horizon – for example, the ICAP provides a 20-year outlook into India's cooling future – because the benefits of energy efficiency and reduced emissions manifest themselves significantly and cumulatively only after 10–15 years. However, the flip side is that the longer the time horizon, the more challenging it becomes to reliably predict the distant future demand; the diverse numbers, with wide variation, projected by credible global organisations is a case in point [7], [8], [9], [14], [15]. Therefore, while assessing the cooling demand, the projections for the future growth in demand have to be carefully considered, keeping a balance between ambitious and realistic in view. A good practice is to consider a range for the future projections – such as looking at an ambitious growth as well as a moderate growth scenario – and accordingly maintaining flexibility for the longer-term actions. Further, this underscores the need for another good practice – that is, to maintain the cooling action plan as a "live" document that is revisited periodically and refined iteratively as new information becomes available.

Expanding communication and socialization with the implementers is highly beneficial for fast-tracked execution. The development process of the ICAP effectively managed to get engagement and collaboration of the ministries and entities at the centre-level and also mapped out the respective ICAP recommendations that fell within their ambit. In hindsight, such socialisation with key state or local actors also could have been beneficial for greater buy-in at sub-national government levels for fast-tracked implementation. While larger participation and socialisation can enable more buy-in, the collaboration process itself can become unwieldy – therefore, trade-offs have to be carefully considered specific to the context to determine the right level of, and means of, wider stakeholder engagement. For example, in the case of ICAP, it was envisioned to socialise the state-level actors and wider stakeholders through roadshows. While this idea did not take off, it would have been helpful in priming the stakeholders for implementation. Roadshows, webinars and workshops can be an effective way to create awareness. Where feasible, mechanisms for soliciting comments during key milestones in the development process may also be considered.

The Benefits: Windfall Gains from Integrative Policymaking

The importance and significance of a policy can be gauged from the interest it generates amongst various stakeholders – individuals and organisations who are galvanised into action because of the vision shown by a national government or the positive impact that can be created through the successful implementation of the policy. In a developing country's context, an important barometer is an interest shown by the international financial institutions (IFIs) and charitable foundations, who are increasingly playing a dominant role in identifying policies that have a critical role to play in addressing climate change. Over and above catalysing action towards the overarching objective – that is, sustainably addressing India's growth in cooling demand while neutralising its impacts – there are important outcomes and benefits emerging from the development of the ICAP, as summarised below.

National Benefits. These are largely rooted in or catalysed by ICAP's integrative approach that drove broad alignment by facilitating the cross-pollination of ideas across ministries and ensuring synergies of ICAP's recommendations with the ongoing policy agendas.

- **Escalating 'Thermal Comfort for All' to a national priority.** The ICAP's foundational philosophy focuses on 'Thermal Comfort for All' rather than 'Cooling for All' (which

can be restrictive in its connotation). This has helped broaden the appeal and applicability of the ICAP – for example, there is a strong focus on reducing heat gains in affordable housing for the Economically Weaker Section and Low-Income Group through Eco-Niwas Samhita (the residential building energy code), cool roofs, off-grid microsystems for cooling, and localised heat action plans. Additionally, there is an increasing emphasis on adaptive thermal comfort and user behavior adaptions. In June 2018, the Bureau of Energy Efficiency (BEE) of the Ministry of Power (MoP), Government of India, issued guidelines on the optimum temperature (24 °C) setting of air conditioners in major commercial establishments for voluntary adoption [17]; in the same spirit, the central government in consultation with BEE made 24 °C the mandatory default setting for all room air conditioners with effect from January 2020 [18].

- **Broadening the scope of BEE's S&L programmes to non-vapour compression cooling appliances.** Traditionally, BEE's S&L programme has focussed on energy-intensive vapour compression appliances such as room air conditioners. However, new studies [19] in the wake of the ICAP have highlighted the importance of fans and air coolers in terms of their large energy consumption and GHG footprint on account of the sheer size of their stock. Moreover, room air conditioners will still not become the main cooling appliance in the next 10–20 years in India, and a large number of residential consumers will rely on fans and air coolers to meet their thermal comfort requirements. Hence, this refocusing of priorities nudged by the ICAP is a positive shift towards effecting social equity (the need for which has been heightened by the COVID-19 pandemic) and broadening the appeal and usefulness of energy efficiency for beyond just the middle class.
- **Harmonisation of policies that never intersected before has caused a meaningful shift in approach**: India's cold chain sector was squarely under the ambit of the Ministry of Agriculture. The ICAP development process brought the agricultural and the environment ministries together highlighting critical interlinkages between agriculture and climate change. This confluence – as a direct outcome of ICAP's integrative process – has forced reassessment and a meaningful shift in the fundamental approach to address, and even quantify, the cold chain needs for India's agriculture sector. This has opened up the window for impacting many things in a positive way – including a heightened focus on the socio-economic well-being of smallholder farmers, and low climate-impact cooling solutions – and generated significant interest levels not just nationally but also internationally.
- **Formation of the India Cooling Coalition.** A multi-stakeholder group consisting of twenty non-profit organisations engaged extensively in sustainable cooling research and application to create this coalition [20]. The coalition aims to strategically mitigate the developmental challenges in line with various national and international commitments like India Cooling Action Plan (ICAP), the Kigali Amendment, Paris Agreement, and Sustainable Development Goals.

International Development and Interest. As the first major global economy to issue a national cooling action plan, the Indian government signalled a strong political will with the launch of ICAP – to proactively solve the country's cooling challenge and manifest broad benefits that cascade beyond national boundaries. This political will has, in turn, placed India on the international radar garnering significant interest in the support and acceleration of the transition towards sustainable and low climate-impact cooling.

- **Supporting global momentum for the creation of National Cooling Action Plans (NCAPs).** On World Ozone Day in 2019, the UN Secretary-General António Guterres released a message calling upon countries to develop National Cooling Action Plans (NCAPs) to deliver efficient and sustainable cooling and bring essential life-preserving services like vaccines and safe food to all people while driving climate action [21]. Following the UN Secretary-General's call to action, currently over 20 countries are developing National Cooling Actions Plans (NCAPs) – in addition to ones already published by Cuba, China, India, Panama, Rwanda and Trinidad and Tobago [22]. To support this momentum, the Cool Coalition (assembled by the United Nations Environment Programme [UNEP]) has undertaken a flagship initiative to establish a uniform and holistic methodology ("NCAP Methodology") for the development of NCAPs – that is within reach of most countries *today* to enable immediate and prioritised actions towards efficient and climate-friendly cooling, and that can be readily adapted to fit a country's specific context and priorities. India, as the first major global economy to launch a national cooling action plan, has served as an exemplar and the ICAP experience has been important in guiding the development of this 'global' NCAP Methodology. The Methodology is being developed by AEEE under the leadership of UNEP and United Nations' ESCAP Energy Division (ESCAP) and supported by the Cool Coalition's NCAP Working Group. The initiative has further validated that the ICAP's lessons in integrative policymaking are relevant and applicable to other countries aspiring to holistically address their cooling growth through low climate-impact pathways and leverage cross-functional synergies to maximise the impacts of their efforts.
- **Global Cooling Prize (GCP)**. The political will behind proactively addressing cooling, as demonstrated by the ICAP, has been an important factor in India being the launch-pad for a global innovation competition to develop a climate-friendly residential cooling solution with 5-times less climate impact as compared to today's typical room air conditioners. GCP was initiated by Rocky Mountain Institute (USA), and was launched in New Delhi in 2018 with critical support from India's Department of Science and Technology (a key stakeholder in the development of the ICAP) [23].
- **Mobilisation of Resources by International Financial Institutions and Foundations to Support ICAP Implementation**. The ICAP has attracted the interest and funding from Foundations, Multilateral and Bi-lateral entities – a clear signal about the importance of the policy. Organisa-

tions such as United Nations Environment Program, Kigali Cooling Efficiency Program (K-CEP), Children Investment Fund Foundation, The World Bank, GIZ, Green Climate Fund, International Energy Agency and many other IFIs and charitable foundations have either already funded ICAP related activities or have expressed willingness to commit resources on implementation of ICAP.

Conclusion

The paper shares the key learning from ICAP's integrative development process – highlighted in italics through the paper – and the broad benefits that emerged. A limitation of the ICAP development process was, not including a macroeconomic modeling to evaluate the impact of cooling on emissions. Incorporating such a modeling exercise would make the analytical outcomes more robust and should be considered as a future area of improvement. In parallel, the ongoing collaboration and alignment between the MoEFCC and other line ministries to help in the effective execution of India Cooling Action Plan would be important.

Beyond the direct application to cooling action plans in other countries, the ICAP's lessons and considerations are relevant to environmental and climate related policymaking at large, where the increasing call for greater policy integration is one of the most prominent, and where integration is frequently recognised as being crucial for sustainable development. For example, some key areas include: sustainable urban development (for example, India's planning and execution of Smart Cities Mission), GHG net-zero pathways for cities or regions, low-climate impact mobility solutions including transition to electric vehicles, and waste management, to name a few. Many of these areas involve the intricate inter-relation of multiple aspects – for example, urban planning, building energy efficiency, demand side energy management, mobility solutions, public health and social equity would all come to play in addressing sustainable urban development, involving a range of stakeholders and government ministries. Therefore, integrative policies become an imperative in effectively and synergistically addressing environmental and climate issues that have multiple inter-dependencies. In a world where the impacts of climate related policies are no longer limited to national boundaries but have wide global ramifications, integrative policymaking is the need of the hour bringing many benefits such as streamlined solutions, technology transfer, knowledge exchange and international cooperation.

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