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Alliance for an Energy Efficient Economy

NATIONAL COOLING ACTION PLAN METHODOLOGY

KIGALI COOLING EFFICIENCY PROGRAM

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Holistic Methodology for Developing a National Cooling Action Plan

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Note to the Reader

This document presents a holistic methodology for developing a National Cooling Action Plan (NCAP) that can be adapted to fit a country's specific context and priorities. The Methodology outlines a process that is within the reach of most countries today and can enable immediate and prioritized action towards climate-friendly cooling. Keeping in mind, the diverse stakeholders and their interests, the document is segmented into the following sections:

Section A. Context & Summary: Tailored for government entities and policymakers, this section presents a high-level overview of the cooling challenge and sets the context for the need for a national-level cooling action plan. It outlines the scope and structure of the proposed NCAP Methodology, provides an overview of the NCAP development process outlined in the Methodology, and shares important considerations that can support a robust NCAP development pathway for countries.

Section B. The NCAP Methodology: This section presents a detailed discussion of the NCAP Methodology describing each step and its objective and highlighting important considerations along the way. This section is intended for international and national consultants or entities who may be involved in the development or support of an NCAP.

Appendix. Introduction to the Data Assessment Frameworks: Tailored for the core data collection and analysis team, the Data Assessment Frameworks provides valuable guidance on how to do data collection and analysis for each sector – an integral and vital part of NCAP development. The frameworks are available online for download—as introduced in the Appendix—and should be used in conjunction with the detailed steps of the Methodology presented in Section B.

The NCAP Methodology was developed by the UNEP-led Cool Coalition, Economic and Social Commission for Asia and the Pacific serves as the United Nations (UN ESCAP) in collaboration with Alliance for an Energy Efficient Economy (AEEE) together with and built on the expertise of the Cool Coalition's NCAP Working Group facilitated by THE KIGALO Cooling Efficiency Programme (K-CEP). In addition to the core group of AEEE, KCEP, UNEP, UN ESCAP the NCAP working group consists of Birmingham University / Heriot Watt University, CLASP, Energy Foundation China, German Corporation for International Cooperation (GIZ), UNEP's OzonAction, Sustainable Energy for All (SEForALL), United Nationas Development Programme (UNDP), UNEP's United For Efficiency (U4E), and the World Bank Group (WBG).

SECTION A. CONTEXT & SUMMARY

The Cooling Challenge

Our world is characterized by climate change-induced warming, population growth, and rapid urbanization and development trends that are further intensifying the warming effects. Acting in parallel, these drivers are leading to an unprecedented increase in the global demand for cooling, including for over one billion people who face serious risks because they lack adequate access to cooling to support essential needs such as for health and wellbeing, productivity, and nutritious food.[1] There is significant and growing use of cooling in several sectors of the economy for satisfying critical needs related to thermal comfort in buildings, agriculture and food supply chains, storage and transfer of vaccines and medical products, transport, and industrial processes. It is estimated that the current baseline of an estimated 3.6 billion cooling appliances in use will jump nearly 4-times by 2050[2] if cooling is provided to everybody who needs it – and not just those who can afford it.

The current market behavior defaults to addressing the rising need for cooling largely with a greater dependence on mechanical means for delivering air-conditioning and refrigeration. These cooling systems are generally very energy intensive and largely reliant on fossil-fuel-generated electricity and refrigerants harmful to the climate –– thereby further multiplying the emissions and increasing global warming. In fact, cooling is the fastest growing GHG contributor in the world. Under a business-as-usual scenario, it is estimated that the energy requirement for cooling our buildings alone would jump by 300 percent ––to 6,200 Terrawatt-hour (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.[3]

On one hand, the growth in cooling is inexorably linked with the development needs and socio-economic progress of nations. On the other hand, the current cooling practices––and the associated additions to grid infrastructure and increased greenhouse gas emissions––are perpetuating a downward spiral where cooling is further warming our world necessitating even more cooling, and disproportionately impacting those that do not have adequate financial resources necessary to procure mechanical cooling solutions. And herein lies the cooling challenge!

Why Cooling Action is Needed at a National Level

The need of the hour is to equitably serve the growing demand for cooling without causing further warming. This requires targeted policy, technology, and market levers to enable holistic solutions to address cooling, leveraging synergies across sectors, utilizing passive cooling to the fullest extent possible and meeting the mechanical cooling needs with the lowest possible energy and emissions footprint. 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 tons 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.

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1 SEforALL. 2020. "Chilling Prospects: Providing Sustainable Cooling for All". https://www.seforall.org/sites/default/files/SEforALL_CoolingForAll-Report.pdf.

2 UNEP-IEA. 2020. “Cooling Emissions and Policy Synthesis Report”. https://www.unenvironment.org/resources/report/cooling-emissions-and-policy-synthesis-report

3 Rocky Mountain Institute. 2018. “Revolutionizing the Air Conditioner Industry to Solve the Cooling Challenge”. Colorado. https://globalcoolingprize.org/solving_the_global_cooling_challenge/

Given its cross-cutting nature, addressing cooling holistically requires engaging multiple public and private sector stakeholders, whose interests may not always align. National Cooling Action Plans (NCAPs) can be an important instrument to drive such alignment by establishing strong political will and meaningful nationwide directives, leveraging inter-linkages with national and international agendas, and setting direction and actionable targets for addressing access to cooling while reducing its environmentally harmful impacts and maximizing the socioeconomic benefits. As an important macro-level policy tool, NCAPs assist countries in identifying pathways to integrate comprehensive action to reduce energy consumption and related emissions from cooling, aligned with plans related to emissions from refrigerant transition. They also offer an opportunity for a country to consider how to improve access to cooling and address several Sustainable Development Goals (SDGs) that are closely interlinked with cooling, 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, (13) Climate Action.

Development and implementation of NCAPs holds the unique potential: to integrate policies otherwise addressed separately and manifest integrative benefit; and, to advance three internationally agreed goals simultaneously—the Paris Climate Agreement, the UN Sustainable Development Goals, and the Montreal Protocol's Kigali Amendment—while pursuing national priorities and socioeconomic benefits.

Development of a Holistic Methodology: Underlying Approach and Objective

While there are many benefits of an NCAP, including long-term socio-economic benefits, developing one is a significant undertaking, both in terms of time and effort. The endeavor to create a holistic Methodology for NCAP is a step towards reducing this time and effort, by providing an overarching process as a guiding framework, and sharing important considerations to support the process.

Existing NCAP development methodologies demonstrate a variety of approaches ranging from comprehensive, data-rich, resource-intensive NCAPs to quick turnaround initiatives targeted on establishing the foundations and addressing some specific priority sectors. Both sides of the spectrum represent a step in the right direction and the underlying takeaway is that there is no one-size that fits all. Given the urgency of the cooling challenge, and the importance of timely interventions, for some countries starting small or in phases may have its merits over delayed action for the sake of comprehensiveness. The key determining factor should be: *what are the immediate priorities in the country and what is the opportunity cost of delayed action?*

Thus, the NCAP Methodology takes the approach of—**think holistically and plan strategically**. This approach implies that the inter-linkages and synergies between the various aspects of cooling should be kept in perspective, and any steps towards climate-friendly cooling, even if applied in phases, should be designed with this integrated perspective of cooling. While a comprehensive NCAP would be an ideal aspirational goal where possible, a country should strategically design the NCAP to best balance it's pressing priorities with its resources and capacities, and to minimize the opportunity costs of business-as-usual cooling, while keeping an integrated view of cooling in perspective.

With this underlying approach in view, the proposed Methodology draws upon the shared experiences of several NCAPs developed thus far and strives to create a uniform guide map for NCAP development that can be readily tailored for use by any aspiring country. The underlying objective of the Methodology is to:

- ***Chart a holistic but modular Methodology for the development of National Cooling Action Plans that covers cooling comprehensively, including various sectors and end-uses, and considers access to cooling for all.***

The term 'modular' implies that while the NCAP Methodology will have a common development process, it will lend itself to customization based on a country's unique context and circumstances including priorities, resources, data availability, and preferred timeframes. This will allow a country a range of workable options, such as: to undertake a comprehensive NCAP, or to develop it in meaningful (and inter-connected) phases depending on their circumstances.

To support this objective, two foundational characteristics are imbued in every step of the Methodology:

- Adaptability is critical: Recognizing that there is no cookie-cutter solution to an NCAP, the Methodology is meant to provide guidance while affording NCAP development teams high levels of discretion and flexibility to adapt to countries' unique context and needs characterized by national objectives, priorities, and development goals, the availability and quality of data and existing knowledge-base, and the availability of financial and human resources.
- Simplification and prioritization are important: The methodology must be simple and logical enabling countries to prioritize (and/or sequentially select) the scope based on their resources, capability, and immediate priorities. In particular, the data collection—which is an intrinsic part of the NCAP development—must be kept relevant and simple; excessive data requests can overwhelm the stakeholders and even cause resistance and add unnecessary complexity.

Scope and Structure of the NCAP Methodology

Understanding cooling needs

Countries will have a varying level of access to cooling across their population: that is, while the cooling demand is delivered, or 'met', for some portion of the population, there is part of the population that lacks access to cooling. Typically, the pace and quantity of the growth in cooling demand will be due to a combination of factors such as urbanization, economic progress and increased purchasing power, and rising temperatures (these factors are typically accounted for in sales projection reports for cooling equipment). However, a portion of the cooling growth will also be driven by the existing lack of access to cooling. This is an important driver of cooling demand growth in alignment with the aspiration to enable cooling for all. For the purpose of this report—and to draw a distinction—this demand growth to bridge the lack of access to cooling is referred to as the 'unmet' cooling demand.

The *met* cooling demand essentially represents the cooling delivered through mechanical means—and therefore the energy and refrigerant consumption associated with cooling—and generally serves as a measure of the magnitude of cooling demand worldwide. The quantification of the *met* cooling demand (and its growth) across all sectors nation-wide—a key element of the NCAP development—is a significant undertaking in itself; over and above that, the reliable quantification of the *unmet* cooling needs in each sector is an even more challenging task—where modeling capabilities are required, and tested frameworks and models do not yet exist.[4]

The focus of this Methodology development is not to provide a modeling framework but rather to outline a process that is within the reach of most countries and can enable immediate and prioritized action towards climate-friendly cooling. Therefore, recognizing that most countries don't yet have means for robust quantification of the *unmet* cooling demand due to lack of access to cooling, the proposed data analytics hinges largely on the quantification of the *met* cooling demand that is more likely within the reach of the countries. That said, the process seeks to incorporate relevant parameters from the SEforALL Needs Assessment[5] to ensure that the NCAP Methodology includes consideration of the *unmet* cooling demand and encourages countries to promote access to cooling, while also driving towards low-climate impact (lower energy and lower emissions) pathway to cooling. This growth in access to cooling is inexorably linked with the socio-economic progress of countries and meeting several Sustainable Development Goals (SDGs) such as (2) Zero Hunger, (3) Good Health and Well-being, (8) Decent Work and Economic Growth, and (10) Reducing Inequality.

Addressing Cooling needs: An Integrated Approach should be the norm

While charting recommendations to address the demand for cooling, an integrated approach is highly recommended and should be the norm. This approach calls for:

- First, reduce the cooling loads to the extent possible. Such as, through thermally efficient building design and construction, and passive cooling practices in case of the building sector
- Then, serve the cooling loads efficiently. Such as, with appropriate and efficient cooling equipment and solutions that deliver the required amount of cooling with less energy and lower overall emissions
- And optimize the cooling operations and behaviors. Such as, through good O&M practices, user adaptations etc. to ensure that cooling is delivered only to where and when it is needed

Such an approach can most optimally address the cooling needs while maximizing the potential benefits through integrative effects. 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 greenhouse gas (GHG) impact of cooling solutions.

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[4] At the time of the development of this report, there is no tested framework for quantification of the 'unmet' cooling needs. However, a proposed model based on SEforAll Needs Assessment Framework, and jointly developed by Heriot Watt University, Centre for Sustainable Cooling and SEforAll is available as a resource. https://www.researchgate.net/publication/342106753_'Cooling_for_All'_Needs-based_assessment_Country-scale_Cooling_Action_Plan_Methodology

[5] For a deeper dive into the assessment of the unmet demand on cooling, the SEforALL Needs Assessment Framework [hyperlink]" provides guidance for specific sectors.

The NCAP Development Process

To proposed process for the NCAP development has two distinct elements:

- **NCAP Methodology:** An overarching Methodology lays out the sequence of steps and activities involved in the NCAP development (Figure A-1), including guidelines, good practices, and available resources where applicable. The Methodology can be customized and 'owned' by each country, specific to their priorities and unique context, and will cover guidelines for the entire range of activities a country should undertake - from the initial country assessment to the final development of the NCAP recommendations. The overview of the NCAP Methodology is summarized below in this section. Section II of this publication describes the Methodology in deeper detail, intended as a reference for international and national consultants and entities who may be involved in the development of NCAPs.

- **Data Assessment Framework:** Data analysis is an integral and vital aspect of the NCAP Methodology. To adequately support this aspect, the Methodology includes a toolkit of Data Assessment Frameworks, one for each of the commonly applicable cooling consumption sectors—Space cooling in buildings; Food cold-chain; Healthcare cold-chain; Mobile air-conditioning; and Industrial process cooling. The Frameworks provide directional—rather than prescriptive—guidance on the data analysis, identifying the key data inputs that can be used to estimate the current and future cooling demand and its impacts, and different pathways that the countries could adopt to go about the calculations. The frameworks also provide guidance on potential intervention actions—for lowering the climate impact of cooling—that could be considered for the respective cooling sectors.

  The Frameworks are presented in the Appendix of this publication and serve as an important tool that practitioners/consultants can use and adapt for countries with varying priorities, capabilities, and data quality, leveraging multiple options to arrive at the intended outcomes. The frameworks are not intended as a modeling exercise but rather as an approach that is within the reach of most countries and can enable prioritized action towards climate-friendly cooling. That said, the data points identified through the frameworks could be applied as inputs towards a modeling approach should a country be so inclined.

  Further, to enable countries to incorporate considerations for the unmet cooling demand, the frameworks for space cooling in buildings, food cold-chain, and healthcare cold-chain also provide high-level guidance on indicators that can help gauge the extent of lack of access to cooling in the country, such that it can be kept integral to future outlook of cooling.

The NCAP Methodology

The Methodology consists of three sequential stages—Contextual Assessment and Planning, Cooling Demand Assessment, and Synthesis and NCAP Creation (Figure A-1)—that lay out the process of developing an NCAP. Each stage consists of respective steps with progressive activities that are summarized below.

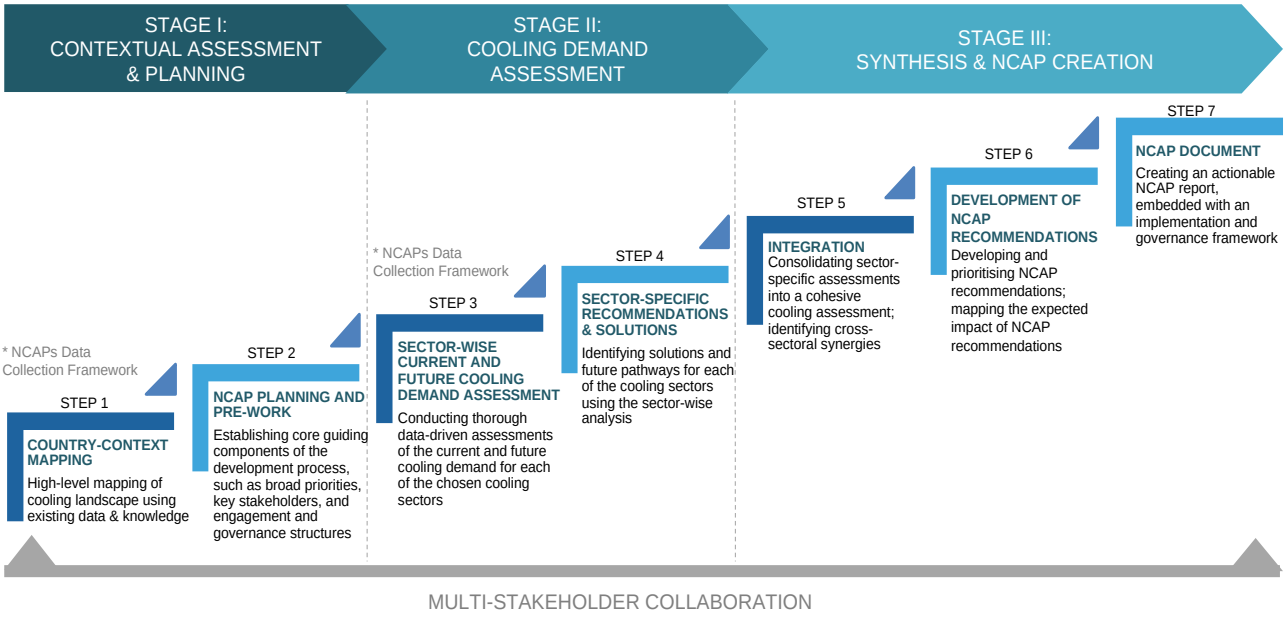

Figure A-1: A Holistic Methodology for NCAP Development

Stage I: Contextual Assessment and Planning – this foundational stage will help inform priorities of the NCAP specific to the country and guide the overall planning process. It also establishes the board contours and key stakeholders for the country's NCAP development. There are two important steps in this stage -

1. **Country Context Mapping -** The first step entails a comprehensive assessment of the cooling landscape in a country covering aspects such as socio-economic growth drivers for cooling demand, international/national targets and commitments, policies and programs related to cooling and mapping other relevant factors including, but not limited to, technology trends, market trends and existing knowledge-base and resources. Both quantitative, as well as qualitative information, are essential components for this step. A Data Assessment Framework, developed as part of the Methodology toolkit to guide the Context Mapping, is introduced in the Appendix.
2. **Planning and Pre-work –** this step provides an opportunity to establish the NCAP's scope and contours best suited for the country in terms of priorities, context, resources, and the urgency for action. During this step, some of the important considerations include identifying the nodal government entity such as the Ozone Cell that will drive the NCAP development process and establish a framework that enables effective multi-stakeholder engagement.

Stage II: Cooling Demand Assessment is the most data-intensive analytical step vital to the NCAP development. It constitutes a thorough data-driven assessment of the current and future cooling demand (and impacts) that will inform sector-specific priorities, including quick and high-impact interventions, and the longer-term strategic interventions. To support and guide the activities in this stage, the Methodology includes a toolkit of Data Assessment Frameworks—as aforementioned—that provide detailed guidance on how best to leverage the available information and data to help quantify the country's current and future cooling demand.

3. **Sector-wise current and future cooling demand assessment –** The cooling demand assessment essentially includes setting the *Baseline* that is, existing cooling demand, and future growth projections in terms of the met and unmet cooling demand and the associated impacts in terms of energy consumption, GHG emissions, and refrigerant demand, as applicable. This step entails relevant data collection and analysis for each of the targeted sectors — and the Data Assessment Frameworks (introduced in the Appendix) provide valuable guidance to support this step. The future growth projections should generally include: a *Business As Usual (BAU) Growth Scenario* that assesses how the *Baseline* will evolve based on the ongoing level of effort; and at least one *Intervention Growth Scenario*, which assesses how the cooling growth will evolve based on accelerated efforts across policy, technology, and market enablers. A comparative assessment of these two future scenarios will inform the foundational logic and assumptions behind the key sector-wise recommendations.

4. **Sector-specific Recommendations and Solutions** - This step calls for the NCAP development team to draw insights from the sector-specific analysis to derive meaningful solutions and future pathways to address the cooling growth in the respective sectors. The outcomes of the cooling demand assessment provide the basis for identifying several recommendations across different cooling sectors. The Data Assessment Frameworks also include sector-specific recommendations examples that are meant to provide a starting point for considering and developing recommendations. The recommendations should also align with and/or build upon relevant existing national efforts and policies (for example, building and construction guidelines, MEPS analyses, HFC phasedown plans, roadmaps, etc.). Countries may consider context-approariate criteria for prioritization of the recommendations—for example, key criteria may include level of effort (anticipated to implement the recommendation), expected Impact (the extent to which the proposed recommendation will benefit the country) and the associated cost to prioritize these recommendations.

Stage III: Synthesis and NCAP Creation – this stage entails first, consolidating sector-specific assessments into a cohesive nationwide cooling overview, and identifying cross-sectoral synergies, establishing actionable recommendations with broad buy-in; and finally, outlining guidance for the creation of the NCAP including guidance to ensure that the NCAP becomes an actionable document and has the 'ownership' and governance structure in place for guiding and monitoring implementation actions, and future calibration if need be.

5. **Integration –** This step involves the aggregation of the sector-wide assessment outcomes into an integrated nationwide overview. This aggregation should be done to enable sector to sector comparison, to better understand the relative importance of sectors—in terms of their current size and future growth and size measured by cooling demand, demand-side energy consumption, and refrigerant demand and GHG emissions—and to determine key areas for intervention to best meet the country's objectives.

6. **Development of NCAP Recommendations -** The logical next step is to derive meaningful recommendations and integrative pathways to transition the country towards sustainable and low climate-impact cooling - the ultimate purpose of the NCAP. The Methodology includes a guiding framework to support countries in the prioritization of the multiple recommendations that may emerge from the data assessment and synthesis process. To the extent possible, the NCAP may include ball-park estimates of the financial resources anticipated for the proposed recommendations, to inform the distribution of government budgets. This step should also enlist - and quantify to the extent possible - the various energy and climate benefits as well as socio-economic co-benefits that are anticipated through the proposed NCAP recommendations.

7. **NCAP Document -** As the ultimate step in the NCAP development process, the Methodology provides guidance on crafting the NCAP document. In addition laying out the essential elements of an NCAP document, the Methodology includes important pointers to facilitate the operationalization of the NCAP - such as, embedding an implementation and governance framework into the NCAP, including a monitoring protocol (to monitor the progress of NCAP implementation), including key success factors (to help gauge the efficacy of the proposed recommendations), and a process for recalibration (reviewing or updating the NCAP at interim milestones). It is also helpful to include information on financial support and resources available for implementing the NCAP such as MDBs, Bilateral Development and National Development funding.

Throughout the seven steps of the NCAP development process, ensuring effective stakeholder engagement is critical for achieving well-rounded information and leading to holistic outcomes and integrative benefits. The various stakeholders that should be engaged, can be grouped into the following four categories:

Table A-1: Various stakeholder groups that should be engaged in the NCAP development

Stakeholder category	Description
NCAP development team	The core development team would include representation from the leading entities responsible for driving the development of the NCAP, including involved development agencies and the nodal government entity that would 'own' the NCAP.
Researchers and analysts	This group would include research entities, academia, and civil society organizations.
Government entities	This group would include ministries and/or related government entities connected to various sectors and aspects of cooling.
Private sector and industry	This group would include manufacturers and industry organizations and associations, financial institutions, etc.

Challenges and Considerations

It is useful to recognize, right at the outset, some of the typical challenges that countries may encounter while undertaking an NCAP, and to strategize in advance to mitigate these. The most common challenges may be:

- **Ownership to drive the agenda:** Typically, there is no single government entity ("Ministry of Cooling") to lead a unified policy action on cooling and addressing cooling falls across several existing government agencies. Thus, establishing which government organization "owns" the NCAP could be a challenge.
- **Multi-stakeholder collaboration:** The cross-cutting nature of cooling requires significant public and private sector collaboration, as well as inter-ministerial coordination, not only for the development of the NCAP but also for ensuring buy-in to support future implementation efforts.
- **Resource-intensive undertaking:** Developing an NCAP can be a resource intensive undertaking and requires financial as well as significant and skilled human resources.
- **Data challenges:** Data availability, its quality and reliability are a common challenge. Generally, the available data points to only the *met* cooling demand, with very limited (if any) view into the *unmet* cooling demand.

Drawing upon the existing NCAP experiences and expert inputs, the Methodology presents several important considerations that can help circumvent these challenges and support a robust NCAP development pathway for countries. Table A-2 summarizes these broadly applicable considerations, mapping them against the respective challenges they may help mitigate.

Table A-2: Typical Challenges and Key Considerations

	KEY CONSIDERATIONS	TYPICAL CHALLENGES			
		Ownership to drive the agenda	Multi-stakeholder collaboration	Resource-intensive undertaking	Data challenges
	Developing an NCAP 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.	X	X		
	Ideally, the stakeholders engaged in the development of the NCAP should include participants from across the triple-sector—that is, the public sector, the private sector, and the knowledge sector (civil society and academia)—who can actively contribute in the form of knowledge sharing as well as data inputs.		X	X	X
	The development process for an NCAP should include a mechanism for effective stakeholder engagement and inputs such that there is an alignment of the diverse interests of stakeholders and the proposed policies and solutions have a broad buy-in. This is a crucial step that primes the stakeholders that are ultimately responsible for on-the-ground implementation of policies and recommendations.	X	X		
	An important consideration is to align the cooling action plan—to the extent possible—with existing national priorities and policies, such as refrigerant transition plans, energy-efficiency targets, and nationally determined contributions. Not only does this encourage inter-ministerial cooperation, but it also maximizes potential benefits through synergistic actions.		X		
	Leveraging and building upon existing data-driven research and any government databases and engaging in-country experts – such as from academia, civil society organizations and industry – would be key. Countries should also leverage support and resources from multilateral organizations that have experience in development of NCAPs, as well as leverage any available tools or modelling frameworks.			X	X
	While a comprehensive NCAP would be an ideal aspirational goal where possible, a country should strategically design the NCAP to best balance it's pressing priorities with its resources and capacities, and to minimize the opportunity costs of business-as-usual cooling, while keeping an integrated view of cooling in perspective.			X	X

Endnote

The focus of the NCAP Methodology is to outline a process that is within the reach of most countries *today* and can enable immediate and prioritized action towards climate-friendly cooling. The Methodology would support any country undertaking an NCAP by reducing the development time and effort through an overarching process as a guiding framework, addressing typical questions and complexities through the discussion of the steps and activities, and sharing important considerations as well as available resources to support the process.

The shape a country's NCAP will take – that is, its scope, level of detail and focus areas – will ultimately be informed by a thorough assessment of its unique cooling landscape, its priorities, and the resources and capabilities available to the country. But given the severity of the cooling challenge—where the impacts of business-as-usual cooling are no longer limited to nations but cascade globally—any holistically planned NCAP, designed with an integrated perspective of cooling, will be a significant step in the right direction.

SECTION B. THE NCAP METHODOLOGY

Introduction

This section presents a detailed discussion of the NCAP Methodology describing each step and its objective. Intended as a reference for the international and national consultants or entities who may be involved in the development of NCAPs, the section sequentially walks the reader through the NCAP development process, highlighting important considerations along the way.

Supplementing the Methodology, a toolkit of Data Assessment Frameworks is introduced in the Appendix (and available online), which will provide valuable guidance to the experts on how to do data collection and analysis for each sector - an integral and vital part of NCAP development.

Before embarking on the NCAP development, some overarching guiding principles worth reiterating are:

- Adapt and customize: The proposed Methodology is intended as guidance, and not prescriptive, and as such countries should use their discretion to adapt it to their unique context and needs characterized by national objectives, priorities, and development goals, the availability and quality of data and existing knowledge-base, and the availability of financial and human resources.
- Think holistically, plan strategically: The NCAP will be "personal" to each country and should be designed to best balance the country's pressing priorities with its resources and capacities, and to minimize the opportunity costs of business-as-usual cooling, while keeping an integrated view of cooling in perspective.
- Ensure multi-stakeholder collaboration: Throughout all the steps of the NCAP development process, ensuring effective stakeholder engagement is critical for achieving well-rounded information, and leading to holistic outcomes and integrative benefits. Ideally, the development process should engage stakeholders from across the triple-sector, that is, the public sector (ministries and related government agencies), the private sector (manufacturers, industry organizations and financial organizations), and the knowledge sector (researchers, civil society, and academia).

The NCAP Methodology

The Methodology consists of three sequential stages—Contextual Assessment and Planning, Cooling Demand Assessment, and Synthesis and NCAP Creation (Figure B-1)—that lay out the process of developing an NCAP.

- Contextual Assessment and Planning: The 1st stage entails a cooling context mapping as a foundational step for any country undertaking an NCAP development, followed by the essential planning work to establish the core elements and contours of the NCAP specific to, and best suited for, the country's unique needs and cooling context. The countrywide cooling context assessment highlights baseline conditions and the preparedness for integrated actions toward sustainable cooling and provides data-backed context and view into the country's priorities, thus helping inform the planning and tailored preparation for the NCAP development.

- Cooling Demand Assessment: The 2nd stage involves quantifying the current and future cooling demand for all relevant sectors and deriving meaningful future pathways to sustainably address their cooling growth. This step involves extensive data gathering and analysis.

- Synthesis and NCAP Creation: The 3rd stage is where it all comes together into a cohesive NCAP for the country. This stage involves integrating sector-specific assessments into a cohesive nationwide cooling overview identifying cross-sectoral synergies, developing and prioritizing NCAP recommendations and action plan with broad stakeholder buy-in, and finally, drafting the NCAP as a macro-level policy document to guide and accelerate the country's transition towards sustainable cooling. For each of the three stages, this section discusses the respective steps in detail.

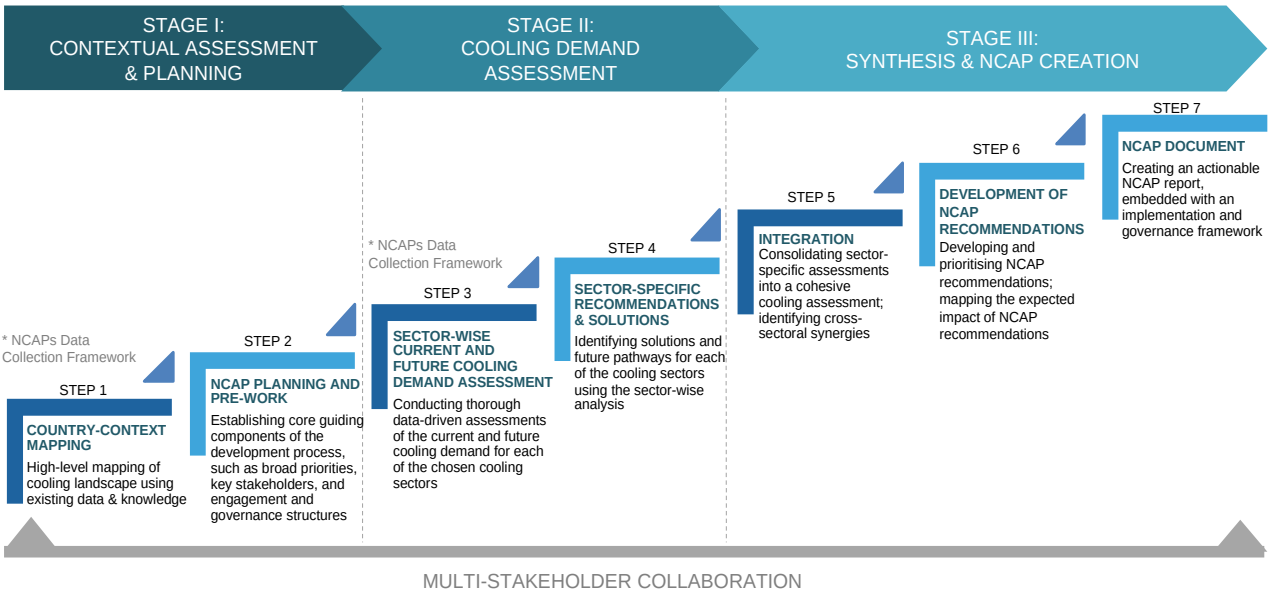

Figure B-1: A Holistic Methodology for NCAP Development

The NCAP development process is a mix of two types of activities:

- Analytical activities: These activities include investigation, information gathering, data collection and analysis to compute the intended numerical outcomes. Steps 1, 3 and 5 of the Methodology are largely analytical activities (depicted in darker blue in the figure).
- Synthesis activities: These activities include seamlessly integrating the various components into a whole and using deductive reasoning to identify the solutions and future pathways that the NCAP will recommend. Steps 2, 4, 6 and 7 of the Methodology are largely synthesis activities.

Stage I: Contextual Assessment and Planning

This foundational stage consists of two steps. The first step—country context mapping—highlights the baseline conditions with respect to cooling in the country and maps the socio-political and regulatory environment as readiness indicators for cooling interventions; this contextual assessment then helps determine the core elements and priorities of the NCAP specific to the country and guides the NCAP planning process as the next step.

Step 1: Country context mapping

A comprehensive assessment of the cooling landscape in a country is the foundational step towards planning an NCAP. This forward-looking assessment should encompass an understanding of the country's cooling needs as driven by the climate, socio-economic factors and national priorities, the current status of cooling across all sectors, and all possible growth drivers, such as population growth, existing lack of access to cooling, income growth trends, urbanization, and construction trends in the country. In addition, other relevant factors that could have an impact on the demand or supply of cooling—including, but not limited to, prevalent technology trends, manufacturing base for cooling equipment, and market purchase behaviors—should be factored into the assessment.

Some important objectives of the country Context Mapping include the following:

- **Assessing (and signaling) political will.** Even though cooling is closely tied to several Sustainable Development Goals (SDGs), for some nations, cooling may not necessarily be positioned as an immediate priority, among other competing national priorities, especially in countries where adoption of cooling technologies is still nascent. However, in countries in tropical climates experiencing population growth, economic growth and urbanization trends, cooling adoption is expected to have – in fact already has– a significant impact on the energy systems in the region and the environment. Therefore, it may be important for policy makers to establish cooling as a priority and signal a political will to catalyze action for greater access to climate-friendly cooling. By building the evidence to inform policy decisions and creating the requisite visibility to build the case for sustainable space cooling as a priority area, Context Mapping can help garner support from stakeholders and drive alignment.

- **Mapping the existing policies and programs that relate to cooling.** Mapping the policy landscape helps identify synergies across different areas of cooling and supports inter-government alignment. This can be an important foundation towards supporting the future implementation of the NCAP's recommendations.
  An important consideration is to align the cooling action plan—to the extent possible—with existing national priorities and policies, such as refrigerant transition plans, energy-efficiency targets, access to cooling (mitigating heat stress, increasing farmers income, access to nutritious diet, effective vaccine management), and nationally determined contributions. Not only does this encourage stakeholder interest, it also maximizes potential benefits through synergistic actions.

- **Presenting data-backed context to a country's cooling profile.** While each cooling sector is important, countries, depending upon their unique context and socio-economic factors, will have a unique cooling profile, that is, relative size and importance of the different cooling sectors. The Context Mapping provides a qualitative as well as quantitative data-backed view into a country's cooling sectors, highlighting the nuances and priorities. Such assessment helps build the case for integrated and prioritized actions toward climate-friendly cooling, which can help catalyze alignment among stakeholders.

- **Mapping existing knowledge-base and resources.** Context-mapping is an opportunity to investigate the resources, knowledge-base and capabilities existing within the country. Government databases, and particularly the knowledge residing within the National Ozone Units can be an important resource to inform the country assessment.

The abovementioned and additional objectives of Context Mapping are summarized in the table below with qualitative guidance on the aspects to explore.

The country Context Mapping is meant as a high-level but comprehensive assessment that mostly relies on existing data, secondary research, and inputs from experts. Both quantitative as well as qualitative information are important components for this step. A Data Assessment Framework, developed as part of the Methodology toolkit to guide the Context Mapping, is introduced in the Appendix.

Table B-1: Qualitative guidance for Step 1

Objective area	Aspects to explore
COMPOSITION OF THE COOLING SECTOR	
1. Where is cooling most used/needed in the country?	COOLING SECTORS ● A preliminary/high-level mapping of important areas of application (sectors) of cooling. For example: Space cooling in buildings Mobile/transport air-conditioning Cold-chain and refrigeration (food and healthcare) Industrial process cooling (such as for textiles, data centers etc.)
2. What are some of the important cooling-related (indirect/second order) services/industries?	● A preliminary/high-level mapping of important services/industries which support cooling. For example: Servicing/maintenance of cooling equipment Indigenous production of refrigerants R&D in the area of cooling, etc.
DRIVERS OF COOLING DEMAND GROWTH	
3. What is driving the demand for cooling in the country?	DEMOGRAPHIC & SOCIO-ECONOMIC FACTORS ● Rate of population growth ● Urban versus rural population distribution ● Rate of urbanization ● Rate of economic growth/purchasing power ● Growth in electrification CLIMATE & ENVIRONMENTAL FACTORS: ● Climatic conditions (number of high-heat days), and seasonal temperature and humidity variations ● Recent heat-wave events ● Urban agglomerates i.e., issues related to population density and urban heat-islands, etc. LACK OF ACCESS TO COOLING ● Extent of the unmet cooling needs ● At-risk or heat-vulnerable population OTHER MISCELLANEOUS ASPECTS ● Grid de-carbonization plans ● Any unique sector-specific driver, such as interests of the current/incoming political agents, etc.

4. What is the current and expected rate of growth of cooling demand in the country?	● Sourcing preliminary intelligence from existing secondary research, industry experts, industry association bodies, government agencies, etc. ● Estimated/projected rate and extent of cooling growth, in terms of new cooling equipment bought, increasing cooling energy consumption, etc.
CURRENT COOLING PRACTICES	
5. What are the socio-cultural and market characteristics related to cooling practices in various sectors?	● Cooling practices and behaviors in the respective sectors ● Average market efficiency levels for cooling equipment with respect to respective sectors ● Awareness level of users and stakeholders ● Typical purchasing behaviors ● Manufacturing capacities
6. What seem to be the underlying factors and/or barriers for lack of market demand for climate-friendly cooling?	● Availability of access to financing ● Availability of information to consumers to make informed choices ● Professional capacities in the cooling sector
7. Are there any enablers to spur market demand for climate-friendly cooling?	● Financial instruments intersecting with cooling sectors
CURRENT & FUTURE IMPACTS OF COOLING	
8. What are the broad impacts – current and future – of the business-as-usual cooling and its projected growth?	● Sourcing preliminary intelligence from existing secondary research, industry experts, industry association bodies, government agencies, etc. ● The socio-economic 'cost' of doing nothing more (business as usual (BAU): Loss of health and productivity Social inequity Addition of generation capacity Power cuts and other impacts on the power grids, etc. ● The environmental 'cost' of doing nothing more (business as usual (BAU): Carbon emissions (direct + indirect) ● Aggravated urban heat islands, etc.
9. What are the power grid parameters?	● Grid carbon intensity, transmission losses etc. ● Grid de-carbonization plans
COOLING RELATED POLICY LANDSCAPE	
10. What are the country's international and internal commitments/targets	● Global commitments (for example): NDC for the Paris Agreement Refrigerant management for the Kigali Amendment to the Montreal Protocol Sustainable Development Goals 2030, etc.

that intersect with cooling?	● National priorities and commitments (promised national targets, for example): Carbon emission reduction Energy efficiency mandates Thermal comfort for all Food security related initiatives Immunization
11. What is the current policy landscape to address the growing cooling demand while neutralizing its negative impacts?	● A broad mapping of the various programs and initiatives of different government entities at the federal and state levels ● Any inter-linkages that might exist between the national policies
COOLING STAKEHOLDER MAPPING	
12. Who are the key government stakeholders (line ministries) that intersect with cooling?	● Government entities/ministries that are responsible for various aspects of cooling, could include: Environment and climate change, Energy & power sector Urban and rural development Science and technology New and renewable energy Housing Agriculture and farmer welfare Large industries and MSMEs Transport Any government entities focused on Energy Efficiency, Finance, etc. Questions 1, 2 and 3 will help inform who are the key Government entities/ministries that should be engaged in the Cooling discussion.
13. Who are the key non-government stakeholders in the country's cooling discourse?	● Non-government stakeholders: Equipment and refrigerant manufacturers Industry associations Academia and research bodies Think tanks Civil society, etc. ● To what extent is there harmonization/alignment on the need to prioritize action on cooling?
AVAILABLE INFORMATION & RESOURCES	
14. What is the level of availability of data in the country?	● Gathering some pre-intelligence about the kind of data available, identifying important sources (such as, national ozone units, ministry of energy, industry associations), how old/new the data might be, how accessible the data is
15. Who will develop the NCAP?	● A broad assessment of the in-country expertise and capacities available among the various stakeholder entities ● Any other resources that the country can leverage

Intended Outcomes of Step 1

An effective country-wide Context Mapping fulfills the following outcomes:

- **Informs priorities**
  - Highlights the needs and challenges related to cooling that are most critical
  - Builds a case for addressing cooling sustainably to support the national and global climate commitments
- **Highlights potential gaps and opportunities**
  - Identify where the immediate and longer-term opportunities for cooling interventions exist, and what is the level of readiness for such interventions
- **Supports alignment**
  - Provides an informed basis for bringing alignment among stakeholders in the cooling sector
- **Guides next steps**
  - The contextual assessment helps inform the broad contours and key elements for the country's NCAP development.

Step 2: NCAP Planning and Pre-work

While a holistic and comprehensive NCAP should be the aspiration, in reality, this aspiration will likely have to be balanced with a country's priorities, context, resources, and the urgency for action. Step 2—Planning & Prework—is the opportunity to draw out this balance and establish the scope and contours of the NCAP best suited for the country's specific context. Countries will have varying starting-points with respect to where they currently are in the journey towards climate-friendly cooling. Some countries may have the foundational policy elements (such as, equipment efficiency standards, vehicle emission standards) in place and supported by basic market instruments (such as, financing schemes, consumer awareness drives) to drive towards efficient and climate-friendly cooling; whereas some countries may not have a start on focused action to address climate-friendly cooling. The in-country resources and institutional capacities to support climate-friendly cooling will also vary widely among countries. Thus, drawing upon the country Context Mapping, this step establishes the core guiding components of the NCAP development, such as a country's broad priorities, the contours and scope of the NCAP, the key stakeholders who should be engaged in the NCAP development process.

Other important considerations during this step are:

- **Identifying a nodal government entity** that will drive the process is important early-on. ***This nodal entity is key for ensuring 'ownership' of the NCAP development process and for driving effective collaboration and buy-in from multiple relevant government bodies.*** In many countries, the Ozone Unit has become the logical go-to entity for 'driving' the NCAP development – as they own a lot of the relevant data by virtue of managing the HCFC Phase-out Plans. Other agencies can be considered to take the lead, such as the Ministry of Energy, Ministry of Environment, to name a few.

- Establishing a mechanism that enables **effective multi-stakeholder engagement throughout** the NCAP's development is critical for ensuring that the resulting NCAP benefits from cross-functional synergies. Such a mechanism could include (but is not limited to) establishing cross-functional teams, a team-governance structure, and a stakeholder engagement process ***that drives alignment of the diverse interests of stakeholders such that the proposed policies and solutions have a broad buy-in. This is a crucial step that primes the stakeholders that are ultimately responsible for on-the-ground implementation of policies and recommendations.***

The table below summarizes the qualitative guidance for this step.

Table B-2: Qualitative guidance for Step 2

Questions to explore	Associated aspects
Who are the core-team members and resources for the development of the NCAP?	● Who will be the entity leading the country's NCAP development? ● Who are the core team members, and do they adequately represent the public and private sectors? ● What are the key databases, knowledge-partners and resources that will be leveraged?
What are the NCAP's broad priorities and objectives?	● What will be the NCAP's broad target/s? ● Examples: Cooling energy use reduction Carbon emission reduction Delivering SDGs Boosting not-in-kind cooling technologies Enhancing the servicing sector Supporting advanced R&D, etc.
Is there a nodal ministry/government entity that has the 'ownership' of driving the NCAP development?	● Is this the same entity that will ultimately adopt the NCAP? ● If not, what will be the process of NCAP adoption?
What are the NCAP's scope and timelines?	Given the existing resources (in terms of stakeholder bandwidth and available time) ● Which sectors will the NCAP focus on? ● Based on the available data and capabilities, what will be the best-suited approaches for the key variables, such as: ○ quantification of cooling demand ○ factoring in the unmet cooling needs ● What is the projected outlook, that is, the number of future years that the NCAP is considering (such as 10-year plan, or 20-year plan etc.)? When will the intermediate milestones be? ● What is the development timeframe (such as, is this 1-year endeavor/ shorter/longer)?
What will the NCAP multi-stakeholder engagement structure look like?	● Who will constitute the working group (expert committee) on each of the sectors identified in Step 1? Ideally this should see representation from these 3 sectors (i.e., triple sector approach): the public sector, private sector, and civil society & academia ● How will the inputs from the working groups be incorporated in the NCAP development process?
What will be the NCAP's governance structure?	● What is the process for oversight of the various NCAP sectors/ elements under development? How will collaboration within and across the working groups be ensured? ● What is the process for ensuring cross-sectoral alignment and integration into one cohesive cooling action plan? ● An inter-ministerial governance committee is highly recommended to provide oversight during the development of the NCAP, as well as to jointly align on the recommendations and targets of the NCAP.

Intended Outcomes of Step 2

This step establishes the board parameters—focus areas, intended scope and depth—and key stakeholders for the Country's NCAP development.

Re-cap summary of the Stage I of NCAP development Methodology

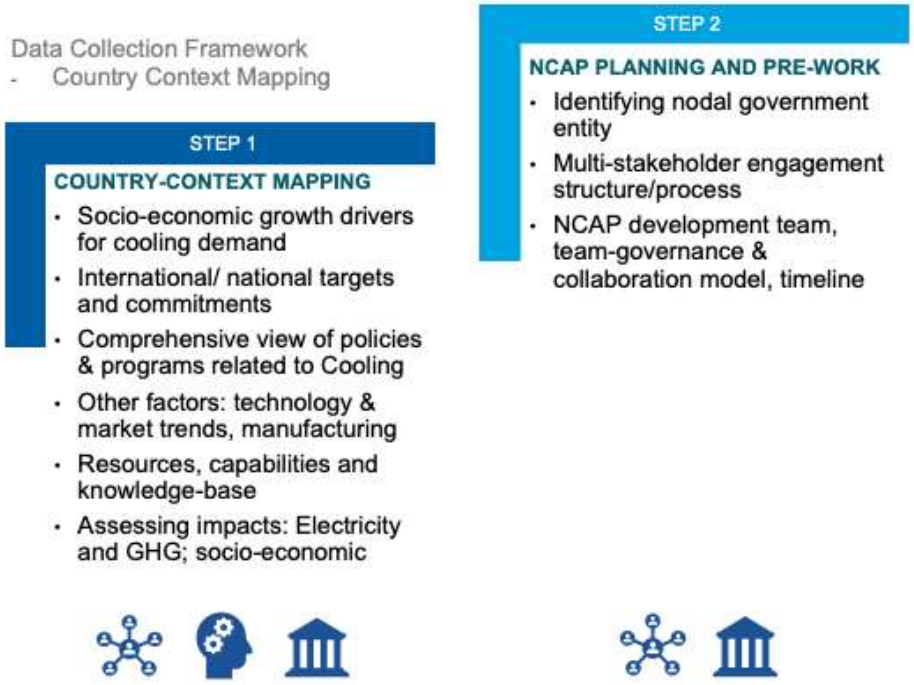

Figure B-2: Summary of Stage I of the NCAP Development Methodology

Stage II: Cooling Demand Assessment

The cooling demand assessment is at the heart of the NCAP development methodology. It constitutes a thorough data-driven assessment of the current and future cooling demand, across sectors, and its implications, in terms of cooling energy consumption, refrigerant consumption, and greenhouse gas (GHG) emissions from cooling. This data-driven assessment then constitutes the foundational logic behind the key recommendations of the NCAP that will help guide the country's cooling future.

Step 3: Sector-wise Current and Future Cooling Demand Assessment

This step is essentially about quantifying the current and future cooling demand for all the relevant sectors and entails two key objectives. The first objective is to establish the *Baseline* in terms of the met and unmet cooling demand and the associated impacts in terms of energy consumption, GHG emissions, and refrigerant demand, as applicable. It is important to estimate the *Baseline* as accurately as possible to minimize error margins in future projections – and this can be achieved using historical and current data (which are relatively easier to find). The next objective is to project the future growth of cooling at different levels of intervention. This future projection should include, first, *Business As Usual (BAU) Growth Scenario* that assesses how the *Baseline* will evolve based on the ongoing level of effort, that is, with the existing policies and measures. Secondly, it should include at least one future scenario which assesses how the cooling growth will evolve based on accelerated efforts across policy, technology, and market enablers - that is, an *Intervention Growth Scenario*. A comparative assessment of these future scenarios gives an informed view into the impacts of future growth, as well as the potential benefits, through various interventions and helps inform the sector-specific recommendations to sustainably address the cooling growth.

Relevant and targeted data collection is an important starting point for the cooling demand assessment. At the onset of the assessment, it is recommended that the NCAP development team should review any available recent and relevant studies and resources from credible organizations. ***Leveraging and building upon existing data-driven research and any government databases and engaging in-country experts – such as from academia, civil society organizations and industry – would be key. Countries should also leverage support and resources from multilateral organizations that have experience in development of NCAPs.*** These resources and publications can help reduce the data collection effort. The Data Assessment Frameworks are a critical tool at this step and provide detailed guidance in terms of what essential data inputs are required, different options for calculations, and how to work with the best available information to derive outcomes. Table X below summarizes some guidance on data gathering, followed by a description of the Frameworks (that are introduced in the Appendix).

Table B-3: Qualitative guidance for Step 3

Questions to explore	Associated aspects
What are some of the sector-specific data points related to cooling?	● The requirement here is for granular data for the detailed assessment of each sector (highly resource-intensive data collection) ● Met Demand examples: Technology mapping - cooling technologies predominantly in use Vapor compression-based technologies: Number of AC units in use - historical and future trends Average cooling capacity/unit Level of energy efficiency Runtime Diversity factor Age of the equipment Refrigerant type, charge/unit, and leakage rates during installation, operation, and decommissioning Other cooling technologies: Number of fans and air coolers units in use - historical and future trends Level of energy efficiency Runtime Age of the equipment ● Unmet Demand - some data points that may be indicative of the extent of unmet needs are: Percentage of households that do not own any cooling appliances. (In climates with high heat in combination with humidity, one may want to look at percentage of households that do not own ACs) Lack of access to electricity Required annual cold chain volume Food loss due to lack of cold-chain
Who might have this data?	The multi-stakeholder engagement structure (alluded to in Step 2) can be utilized to tap into multi-input sources: Primary & secondary research Existing databases and industry reports Expert interviews and surveys Sales & market intelligence reports, etc.
What is the level of confidence in the numbers collected?	● How old is the data? ● How transparent is the data? ● How was the data sourced? ● Might there be any bias? ● Are some of the numbers derived quantities? How were they derived? ● How well do the numbers align with other data sets?
What are the sensitivities around the numbers?	● How robust and substantiated are the numbers? Can they be used to position the country internationally? ● To what extent do the involved governance entities endorse the numbers – is the government's position more conservative/aggressive?
What are the assumptions/proxies that need considering?	● Contingency plan in the event of unavailability of good quality/adequate data ● Using expert inputs to make logical and informed assumptions /proxies/guesstimates

An Introduction to Data Assessment Frameworks

Stage III: Synthesis and NCAP Creation

The 3rd stage brings all the groundwork and analysis together into the creation of the cooling action plan. This stage entails consolidating sector-specific assessments into a cohesive nationwide cooling overview, identifying cross-sectoral synergies, establishing actionable goals and recommendations with broad buy-in, and outlining guidance that would facilitate NCAP's implementation. Ensuring effective stakeholder engagement is critical at this stage for achieving holistic outcomes and integrative benefits.

Step 5: Integration

Integration of the sector -wide cooling demand assessments into a cohesive overview of cooling in the country is a very crucial step towards the final synthesis and creation of the NCAP. While the sector-specific analysis is important to identify targeted opportunities and strategies to drive climate-friendly cooling within each sector, an aggregated countrywide overview is important: to understand the country-wide cooling growth trajectory and its implications; to grasp the relative share of cooling demand by sector in the country, which may point to a need for reprioritization of efforts; and last but not the least, to identify cross-sectoral or cross-functional synergies for accelerated action towards climate friendly cooling. (For example, identifying opportunities for harmonization of energy efficiency with the refrigerant transition efforts, which are typically handled by different ministries within a country). All of this becomes an important basis for the formulation and prioritization of the NCAP's recommendations.

Aggregation of the sectoral assessment outcomes into an integrated nationwide overview

Step 5 entails both analytical and synthesis components. The first activity—largely analytical—is the aggregation of the sector-wide assessment outcomes into an integrated nationwide overview. This aggregation should be done in a way to enable sector to sector comparison in terms of their current size and future growth and size measured by cooling demand, demand-side energy consumption, refrigerant demand, and GHG emissions. The comparison should also look at the relative savings potential estimated for each sector in Step 4. Such comparative assessment will help identify priority-areas for future interventions to provide sustainable cooling while securing environmental and socio-economic benefits for the society and establish key recommendations of the NCAP.

Suggested guidance for the aggregation activity is:

- It is recommended to use consistent units across sectors and sub-sectors to enable comparison across sectors as well as aggregation into a nationwide cooling view.
    - Annual cooling demand: The cooling demand can be expressed in terms of installed ton of refrigeration (TR) for refrigerant-based cooling technologies across sectors.
    - Annual demand-side energy consumption: Demand-side cooling energy consumption can be of two types: (1) electricity consumption; (2) direct fuel consumption. The cooling electricity consumption across sectors can be expressed in terms of units of electricity consumed, that is, the total electricity consumed by end-use, excluding T&D and production losses (for example, in billion units or TWh). The cooling energy consumption for mobile AC, refrigerated trucks/reefer vehicles, and other direct fuel run cooling systems can be expressed in terms of oil equivalents utilized towards cooling (for example, tons of oil equivalent (toe)).

- There is the option of converting the demand-side energy consumption to primary energy consumption using appropriate primary energy conversion factors. It should be noted that future values of T&D losses and the fuel mix can hugely impact the total primary energy supply (TPES) values for future years. The country should exercise its discretion on whether go ahead with this step, with the caution that unreliable estimations of the future values of T&D losses and the fuel mix can result in awry outcomes.
    - Annual refrigerant demand: The refrigerant demand towards cooling (including servicing) can be expressed by weight (for example, in metric tons (MT))
    - Annual GHG emission: The indirect GHG emission (due to energy consumption) and the direct GHG emission (due to refrigerant leakage) can be expressed in tons of CO2 equivalent (tCO2e).
- Creative and tailored data visualization, through graphs and charts, should be used to communicate the key NCAP results to relevant stakeholders, including policymakers, industry, and the R&D community.

Intended Outcome of Step 5

Consolidation of sector-specific assessments into a cohesive aggregate nationwide cooling assessment gives a view into the relative importance of sectors in terms of anticipated demand growth and opportunities for interventions to transition towards sustainable cooling, as well as highlights opportunities for cross-sectoral synergistic actions.

Step 6: Development of NCAP Recommendations

This critical activity combines the various components of the work thus far, applying deductive reasoning and prioritization to derive NCAP recommendations and integrative pathways to drive the country towards low-climate impact cooling and access to cooling for all. The sector-specific recommended interventions identified in Step 4 should be aggregated—into a menu of solutions—and reviewed as a whole at this stage to carefully identify synergies among proposed actions, any interdependencies among policy interventions, and alignment with ongoing efforts. It is crucial that this exercise engages all relevant public and private sector stakeholders in order to align interests and gain maximum buy-in to support effective implementation of the NCAP recommendations.

A governance body – such as a steering committee with representation from relevant ministries (as alluded to in Step 2) – can be helpful in enabling necessary stakeholder alignment. Such a governance body can be key for reviewing the outcomes of the NCAP, assessing the robustness of the recommendations against the country's objectives, assessing alignment with existing favorable policies and programs, and obtaining inter-ministerial buy-in.

Typically, the recommendations that emerge would fall under any of the three broad categories:

- Policy and regulatory interventions: the policy and regulatory enablers are the primary underpinning for scaling up sustainable cooling and should be the foundational step for countries. These may include equipment standards and labelling, and minimum energy performance standards, building energy codes, and vehicle emission standards, to name a few. Some policy measures may require advanced institutional frameworks - such as strategies for new and existing building interventions, and certain demand side energy management approaches - and these should be progressively applied once the foundational elements and readiness are ascertained.

- Technology interventions: These may include, enhancing the efficiency of existing cooling technologies, exploring not-in-kind and low-energy technologies, alternate refrigerant pathways, cooling solutions for off-grid or weak-grid locations, research, and development of radical solutions to achieve cooling with a low climate-footprint.
- Interventions for market enablement (or supporting instruments): These may include financing and debt subsidy instruments to promote sustainable cooling, innovative business models to deliver and scale-up sustainable cooling, public procurement, strengthening institutional and professional capacities (including training of RAC technicians), and enhancing consumer and stakeholder awareness. Broadly referred to as supporting instruments, these interventions are generally best leveraged when applied in conjunction with, or as a supplement to, other policy or technology interventions, to enhance their impact and maximize the benefits.

It is important to note that the integrative effects of interventions working in combination, in general, will be greater than those of individual interventions. For instance, the impacts and benefits of policy measures can be maximized with measures to advance appropriate institutional capacities and enhance users' and stakeholders' awareness in parallel; a drive for efficient technologies and refrigerants pathways can be meaningfully supplemented with a combination of financial and technical assistance. Thus, addressing cooling challenges effectively will typically require a multipronged approach incorporating a combination of interventions that are tailored to a country's market conditions. The recommendations should propose interventions that:

- Represent a holistic approach to low-climate impact cooling, including avoiding or 'right-sizing' the future cooling demand such as through passive cooling strategies, serving the cooling needs as efficiently as possible through technologies that provide the required amount of cooling with less energy and lower overall emissions, and optimizing the cooling operations through user behavior intervention and good O&M and servicing practices.
- Make use of synergies between processes and sectors, and harness all available energy resources, to achieve access to cooling for all.
- Be designed keeping in mind an optimal and synergistic combination of policy instruments, technology, and market enablers.
- Are in alignment with the high-level objectives of the country including any international commitments and national priorities.

Strategic Prioritization of Recommendations

While developing the NCAP, countries may come up with several recommendations across different cooling sectors. It will be necessary for the NCAP team to support the government stakeholders in carefully prioritizing the recommendations such that they best help the country in achieving its goals. For some countries, it may be important to garner some easy-wins first to build the momentum and catalyze concerted action; for some countries it may be critical to establish the foundational policies; and, for all countries it would be important to sequentially implement the recommendations in a way that build upon past actions and pave the way for future measures and pathways towards sustainable cooling.

The country may consider the following key criteria to prioritize the recommendations:

1. Level of Effort: This refers to the level of effort anticipated to implement the recommendation - lower the level of effort, greater is the ease of implementation. In determining the level of effort, countries should explore what are the possible challenges, as well as enablers for implementation. Challenges could cover aspects such as policy and regulatory barriers, institutional barriers, resource-intensity among others (these are further described in table X). On the other hand, a supportive regulatory environment, strong political will, or synergies with existing government schemes and programs will support ease of implementation, and therefore reduce effort. The anticipated level of effort may also serve as a basis for determining the time (months or years) required to implement a recommendation - though it is not always a direct relationship.
2. Expected Impact: This criterion considers the extent to which the proposed recommendation will benefit the country in terms of energy savings, emissions reduction, supporting access to cooling, or other socio-economic co-benefits aligned with the country's priorities and/or SDGs.
3. Associated Cost: Estimating the cost for the proposed recommendations can be a significant undertaking in itself requiring granular information and may likely fall outside the capacity of the NCAP development team. However, it is suggested that the NCAPs team should, to the extent possible, include ball-park estimates or categorization of the financial resources anticipated for the proposed recommendations, such as, categories of low-, medium- or high-cost measures. To enable this, available resources, and associated costs from a range of sources could be taken into consideration. This information would be meaningful for countries to consider during the prioritization process. An important consideration during prioritization would be to consider the overall cost-benefit aspect and not just the upfront cost of implementation.

Table B-5 presents these parameters, along with an indicative list of guiding questions that need to be researched to pursue this process.

Table B-5: Strategic Prioritization of Recommendations

S. No	Parameters	Guiding questions and considerations
1	Level of Effort	<u>Assess potential challenges to implementation.</u> ● Policy and regulatory barriers: ➔ Are there any changes required in the existing policy or regulatory framework? ● Institutional barriers: ➔ How many agencies/stakeholders need to be involved; are there any multi-agency complexities? ➔ Are adequate institutional capacities available? ● How resource-intensive will be the implementation process? Are skilled human resources available? ● Are the technologies available to support the recommendation? <u>Assess potential enablers that could support implementation.</u> ● Are there any synergies with existing government schemes and programs?

		Considerations: ● To the extent possible, identify the relevant body that can steer the implementation process and coordinate among the relevant ministries as well as the private sector entities. ● To the extent possible, provide timelines relevant to policy formulation and implementation. ● Based on available information, assess which recommendation can be taken up in the short-term, medium-term, and long-term.
2	Expected Impact	● What is the magnitude of energy and emissions reductions with respect to the country's commitments (national and global)? ● How far do these reductions help the country meet existing NDCs and formulate future NDCs? ● How scalable is the recommended action? ● What are the socio-economic co-benefits associated with the actions? How well does it support the country's priorities and SDGs? ● Who are the intended beneficiaries? Which segment of the population does the recommendation target (government, rural, urban, manufacturers, farmers)? Considerations: ● Identify quick wins and intervention areas that will result in the highest impacts in alignment with the country's priorities. For example, energy savings and grid benefits, reduction in emission, socio-economic benefits for the population including but not limited to energy equity, food security, health benefits etc.
3	Associated cost	● What is the expected magnitude of upfront investment (low-cost, medium-cost, and high-cost measures)? ● What are the existing or potential funding sources for the proposed recommendation? Consideration: ● In addition to the upfront cost, the anticipated cost-effectiveness of the proposed measure (excellent cost-benefit ratio, moderate cost-benefit ratio, and low cost-benefit ratio) should be considered in conjunction while prioritizing.

Countries may also use prioritization matrices, mapping various recommendations along the criteria most relevant to the country. One possible example - as an indicative approach is - to use an Impact-Effort matrix as shown in Figure B-5.[6] This matrix can help the country decide which recommendation to push towards based on the level of effort required and the expected impact. Countries may focus on the recommendation that will give them the most significant impact with the least amount of effort.

[6] This is an indicative example only. Countries may develop different matrices (with more dimensions) depending on the criteria more relevant to their context.

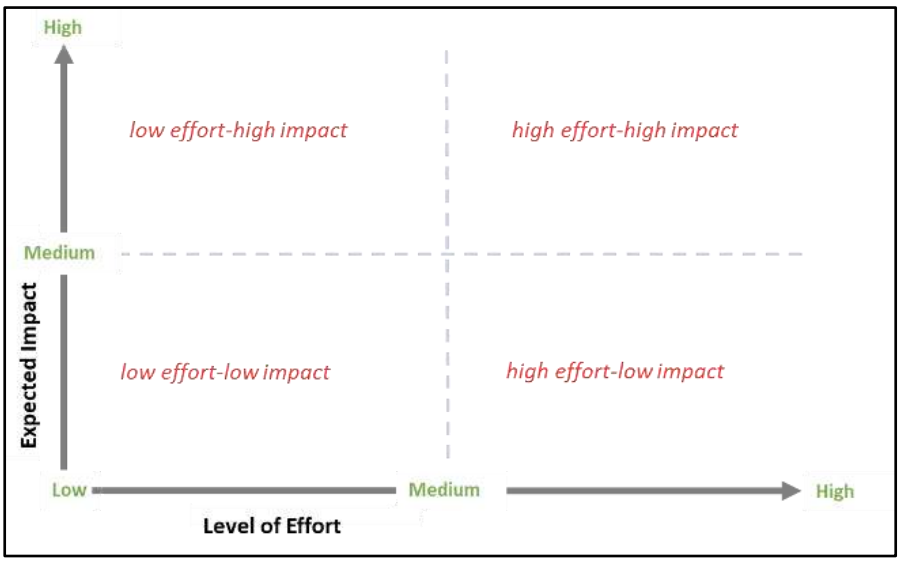

Figure B-5: Impact Effort Matrix

Impact Assessment

Once the recommendations and their priorities are established, the NCAP team should enlist the various anticipated benefits that could be achieved through their implementation. The expected energy and climate impacts should be quantified, for example, expressed in the form of TWh of energy saved, avoided grid capacity (and the associated avoided costs), and emission reductions. The development team should draw linkages to show how these positive impacts of the NCAP help support the country's national and international commitments (such as the Paris Agreement or Kigali Amendment to the Montreal Protocol). In addition, it is important to highlight the socio-economic benefits, especially highlighting linkages in support of the SDGs and any relevant national priorities.

To the extent possible, benefits of the NCAP can be roughly monetized to present a back-of-the-envelope cost-benefit analysis.

Intended Outcome of Step 6

This step delineates synergistic recommendations to effectively and sustainably address the country's current and future cooling needs, propose meaningful pathways for action, and help ensure alignment and buy-in among key stakeholders and government entities.

Step 7: NCAP Document

As the final step in the NCAP development process, the Methodology provides guidance on crafting the NCAP document, laying out its essential elements. This includes important guidance on including elements that will support the operationalization of the NCAP - such as, embedding an implementation and governance framework into the NCAP, including a monitoring protocol (to monitor the progress of NCAP implementation), including key success factors (to help gauge the efficacy of the proposed recommendations), and a process for recalibration (reviewing or updating the NCAP at interim milestones). This ensures that the resulting NCAP is a 'live' document, that is, an actionable roadmap that has 'ownership' and a governance structure in place for guiding and monitoring future actions towards low-climate impact cooling for all.

Key Elements of an NCAP Document

The following are suggested as the key elements that are meaningful to include in an NCAP Report. While broadly maintaining the suggested topics, countries can adapt this outline to best highlight and document the development process and thinking behind their unique NCAP.

- Cooling context: The cooling context should contain the following sub-contexts, which should come together to answer why the country has chosen to create an NCAP for itself.
  - Socio-economic context: Present the socio-economic context around cooling in the country including the cooling demand growth drivers and macro-trends. This context-setting should also touch upon the levels of access to cooling within the country for each of the cooling sectors and how access to cooling is important to meet the country's developmental needs and aspirations, especially in view of the prevailing (and changing) climatic conditions across the country and the heat-stressed population.
  - Policy context: Provide a high-level overview of the key government policies, programs, directives, targets, financial instruments etc. in the country that intersect with cooling, and their level of adoption and success. The linkages between national-level policies and any international commitments to multilateral agreements such as the Montreal Protocol, Paris Agreement, Sustainable Development Goals, etc., should also be specified.
  - Technical & market context: Include a high-level overview of the prevalent cooling technologies and practices, efficiency practices, and existing market behaviors as they relate to cooling.

  The context setting narrative can be substantiated with any available data from credible secondary literature/ resources. Countries may also include other relevant context-setting information that is specific to their unique cooling landscape. For example, an overview of power grid parameters including the deployment of renewable energy and its bearing on meeting the growing cooling demand could also be included if found to be relevant to the country's cooling discourse.

- NCAP introduction and orientation: This chapter is intended as an orientation to the NCAP and can including the following:
  - The main prompt for NCAP inception (such as a commitment made to an international multilateral agreement, national development agenda, exemplary political will by a line ministry, etc.)
  - NCAP's broad objectives
  - The scope and boundary of the NCAP and the rationale behind such choices
  - Definition of key terminologies used in the NCAP such as 'baseline', 'short/medium/long-terms', etc.
  - Description of how the future scenarios are built out, such as the number of projected future years, and interim milestones if any
  - Overarching assumptions and proxies used throughout the NCAP and their justifications
  - Broad organization of the NCAP report

- NCAP development framework: This chapter provides an overview of the country's NCAP development process including multi-stakeholder collaboration framework and may include:
  - Details of the various stakeholder groups identified and engaged through the development process
  - Description/organization of any working groups or expert-teams involved in the development process
  - The formation and responsibilities of high-level supervisory committees instated

- Aggregated nationwide overview of cooling: This chapter should present an aggregation of the sector-wide assessment outcomes into an integrated nationwide overview, including:
    - Sector to sector comparison in terms of their current size and future growth and size measured by cooling demand, demand-side energy consumption, refrigerant demand, and GHG emissions
    - The relative savings potential estimated for each sector

  This chapter essentially serves as an aggregated summary of the cooling demand assessment and intervention opportunities that will drive the country's transition to sustainable cooling. Creatively designed and easily understandable data visualization, through graphs and charts, may be used to communicate the key demand assessment findings.

- Sector-wise cooling demand assessment and outcomes: Separate chapters for each of the cooling demand sectors chosen for analysis (space cooling in buildings, food cold-chain, healthcare cold-chain, mobile air-conditioning, industrial process cooling, etc.) should be created, providing a sector-specific view that includes:
    - The present cooling requirement and the technologies available to cater to cooling requirements; projection of the future cooling requirement, the associated refrigerant demand and energy use under alternative future scenarios; assumptions for the projections and source of data used for the projections are mentioned at appropriate places
    - As an outcome of the sector-specific demand assessment, highlight sector-specific priorities, including the quick-wins and high-impact interventions, as well as the strategic longer-term intervention opportunities for the sectors

- Prioritized recommendations of the NCAP: This chapter should clearly present the synergies identified among proposed sector-specific actions, any interdependencies among policy interventions, and alignment with the ongoing efforts. It should clearly lay out the key criteria used to prioritize some recommendations over the other, the prioritized recommendations and at least a ballpark estimate of their expected impact in terms of energy savings, emissions reduction, supporting access to cooling, or other socio-economic co-benefits aligned with the country's priorities and/or SDGs.

- Implementation guidance: Include implementation guidance that will help support the operationalization of the NCAP. This may include an implementation and governance framework and drawing linkages between the NCAP recommendations and different government ministries and departments that align with, and may own responsibility for these. (The implementation guidance is discussed in further detail below.)

Embedding Implementation guidance in the NCAP

An important consideration is to embed some implementation and governance guidance in the report including elements that will support the operationalization of the NCAP - such that the NCAP is an actionable document. To outline the implementation guidance, countries may consider some key questions, such as:

- Are the NCAP targets and recommendations voluntary or binding?
- Will the NCAP be a 'living document', that is, will it remain open to incorporating new and emerging data/information?
- What institutional framework will be established to monitor the progress of NCAP implementation?

A good practice would be to institute a governing committee—for example, an "NCAP Unit"—within the nodal government entity, that can periodically review the NCAP recommendations, guide the country's cooling activities, and suggest course correction if the need arises.

To the extent possible, this step should draw out the inter-linkages between the NCAP recommendations and the different government ministries and departments (along with their on-going programs and initiatives) that align with these. This can support the future implementation process by identifying responsible entities for the various actions. Some key aspects of outlining a governance framework may include:

- ➔ Establishing a **monitoring protocol and ideally establishing (or noting requirement for)** an institutional framework to monitor the progress of NCAP implementation
- ➔ Indicating the **key success factors** that would help gauge the efficacy of the proposed recommendations
- ➔ Establishing a **process for recalibration** of the NCAP. This would entail reviewing—and if need be, updating—the NCAP at interim milestones (say, of 3-5 years), wherein the longer-term recommendations can be re-assessed with respect to the progress made and any new information or technologies that may have become available.

In countries with severe data gaps on cooling, the data collection practices, and monitoring systems initiated during the NCAP development should continue to be built-upon and enable meaningful revisions to the NCAP once enough key data become available.

Within the implementation guidelines, it is also helpful to include information on financial support and resources available for implementing the NCAP. These could include MDBs, Bilateral Development, National Development funding both on concessional and non-concessional basis, However, access to finance could be increased by connecting cooling with wider national development plans and NDCs, in order to secure longer term finance on both concessional and non-concessional basis.

Intended Outcome of Step 7

This step ensures appropriate documentation of the NCAP into a cohesive and actionable document which has the 'ownership' and governance structure in place for guiding and monitoring implementation actions, and future calibration if need be.

Re-cap summary of Stage III of the NCAP Methodology

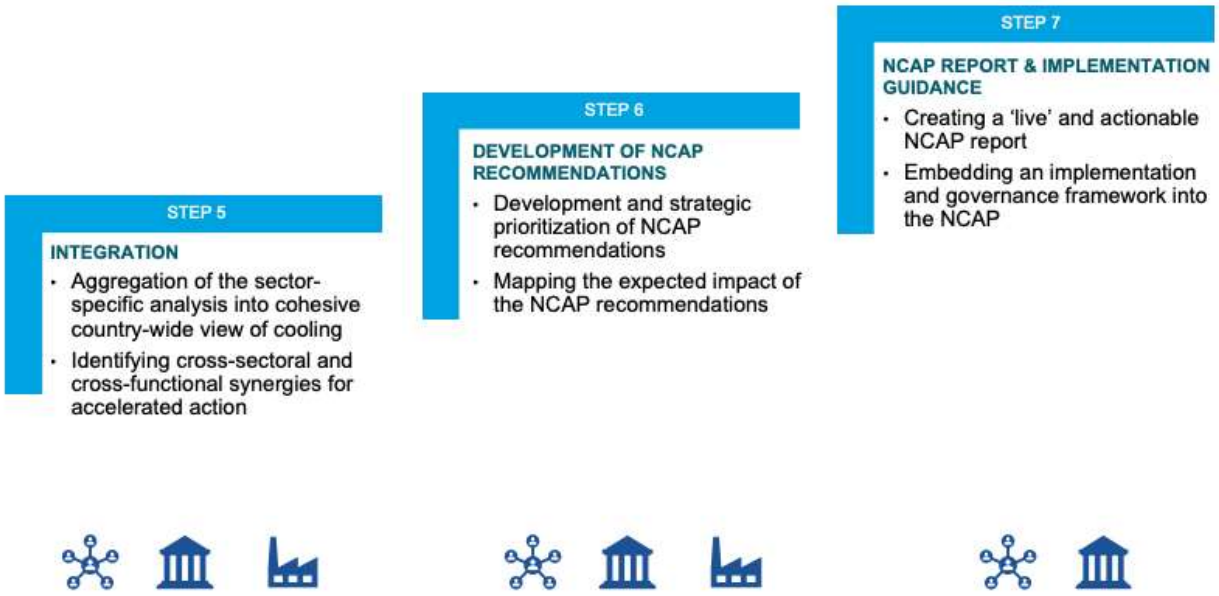

Figure B-6: Summary of Stage III of the NCAP Development Methodology

Potential resources for Stage III

- GIZ. 2020. "Measurement-Reporting-Verification (MRV) System for the RAC Sector." [Draft]

  The report outlines a blueprint MRV system based on international best practices applicable for the refrigeration and air conditioning sector in different countries. It provides a practical step-by-step approach for policymakers and enforcement bodies in this sector.

- GIZ. 2016. "Advancing Nationally Determined Contributions (NDCs) through Climate-Friendly Refrigeration and Air Conditioning". https://www.transparency-partnership.net/sites/default/files/giz_2016_advancing_ndcs_through_climate_friendly_refrigeration.pdf.

  This report provides high-level guidance for policymakers, national ozone officers, and ministries on key elements for sustainable cooling strategy development.

Endnote: NCAP as a 'living' policy document

For optimal outcomes, the NCAP should be a dynamic 'living' policy tool that is periodically updated and enriched as new information or technologies become available. The data on which the future scenarios are based can quickly become outdated, therefore countries should consider establishing a Measurement-Reporting-Verification system to get a continuous data assessment process and to monitor results from mitigation actions. The iterative updates to the NCAP should also include capturing any changes in the national context and priorities, and accordingly address the need for re-calibration of recommended actions (as indicated in step 7).

Thoughtful development and implementation of National Cooling Action Plans has significant and unique benefits: unlocking synergies from integrating policies otherwise addressed separately and leveraging opportunities to advance three internationally agreed goals simultaneously—the Paris Climate Agreement; the UN Sustainable Development Goals; and the Montreal Protocol's Kigali Amendment. More specifically, an NCAP could address poverty, reduce food loss, improve health, raise energy efficiency, manage our natural resources, support sustainable cities and communities and combat climate change concurrently.

Considering the global nature of the cooling challenge, the positive outcomes of any single NCAP would cascade into benefits that apply across the globe, accelerating the transition to low-climate impact cooling and supporting a healthier and cooler planet for all.

APPENDIX: DATA ASSESSMENT FRAMEWORKS

Introduction and Guidance

The Data Assessment Frameworks are intended as a tool to provide valuable guidance to the experts on how to do data collection and analysis for each sector. The Frameworks should be used in combination with the detailed steps of the Methodology presented in Section B. The use of these frameworks is intended to be 'directional' rather than prescriptive and the NCAP development team should exercise discretion to use the frameworks in a way best suited to the country's capacities, needs and context.

The Data Assessment Frameworks can be accessed online and include:

- For Step 1: Country Context Mapping
    - Data Assessment Framework: Country Context Mapping
- For Step 3: Sector-specific Current & Future Cooling Demand Assessment
    - Data Assessment Framework: Space cooling in buildings
    - Data Assessment Framework: Food cold-chain
    - Data Assessment Framework: Healthcare cold-chain
    - Data Assessment Framework: Mobile air-conditioning
    - Data Assessment Framework: Industrial process cooling

The Data Assessment Frameworks identify the key data input that can be used to estimate the current and future cooling demand and its impacts, and for each of the intended outputs, also suggest different pathways that the countries could adopt to go about the analysis and calculations. The frameworks also provide guidance on potential intervention actions—for lowering the climate impact of cooling—that could be considered for the respective cooling sectors.

The frameworks are not intended as a modelling exercise but rather as an approach that is within the reach of most countries and can enable prioritized action towards climate-friendly cooling. That said, the data points identified through the frameworks could be applied as inputs towards a modelling approach should a country be so inclined.

To enable countries to incorporate considerations for the unmet cooling demand, the frameworks for space cooling in buildings, food cold-chain, and healthcare cold-chain also provide high-level guidance on indicators that can help assess the extent of lack of access to cooling in the country.

NATIONAL COOLING ACTION PLAN METHODOLOGY

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Cool Coalition

in collaboration with:

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

and technical expertise by:

Alliance for an Energy Efficient Economy