

Latest developments in National Cooling Strategies and National Cooling Action Plans in the MENA region and Türkiye

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ABSTRACT

This paper explores the latest policy developments to advance sustainable cooling in the Middle East and North Africa region and Türkiye as supported by the Cool Up programme which is led by Guidehouse Germany GmbH and funded by the German International Climate Initiative. The focus is put on the development of the National Cooling Strategies and National Cooling Action Plans to address cooling needs in a holistic manner. Methodological aspects including data collection and analysis as well as stakeholder engagement are highlighted. Key aspects of modeling and different scenarios are explained. The analysis leads to the identification of different strategic intervention areas and relevant policy measures essential for promoting energy efficiency and uptake of the natural refrigerants. Policy measures also contain monitoring and evaluation structure which aim is to support policymakers and stakeholders in strengthening the implementation. Therefore, National Cooling Action Plans play a critical role in ensuring sustainable cooling solutions in the region.

KEY WORDS

National Cooling Action Plans, Sustainable cooling, Stakeholder engagement, Modelling emissions, Monitoring and Implementation

INTRODUCTION

The aim of the Cool Up programme is to promote accelerated technological change and early implementation of the Kigali Amendment to the Montreal Protocol as well as the Paris Agreement in the MENA region. The programme focuses on enabling natural refrigerants and energy efficient solutions in its partner countries Egypt, Jordan, Lebanon, and Türkiye to mitigate the effects of rising cooling demand. The Cool Up approach is based on four pillars: reducing cooling demand, phasing down hydrofluorocarbons (HFCs), replacing and recycling inefficient equipment and refrigerants, and training and raising awareness. Cool Up is led by Guidehouse Germany GmbH and funded by the International Climate Initiative (IKI) of the German Federal Ministry of the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV).

The activities being performed within the Cool Up programme concentrate on the developments of National Cooling Strategies (NCS) and National Cooling Action Plans (NCAPs). This paper puts an emphasis on the NCAP development in Jordan and Türkiye as examples.

The paper starts with background information on the relevance of cooling and then dives into landscape of existing domestic policies and compliance with the international commitments of Cool Up partner countries. After that, workflow of the NCAPs development will be described. Focus will be on the methodology, sectors covered, data collection approaches (bottom-up and top-down), and data used for modelling. It is followed by the insight into stakeholder engagement process, reflected in active meeting participation and providing data inputs. An assessment of the existing and collected data is followed by outcomes of NCAP modelling, where different scenarios were developed to forecast direct and indirect greenhouse gas (GHG) emissions of different cooling sectors by 2050. The scenarios reflect different ambition levels and policy measures. Finally, key policy recommendations, derived from the strategic intervention areas, related to energy efficiency, refrigerants and finance, are presented, along with their implementation, monitoring and evaluation steps.

OVERVIEW OF THE STATUS IN THE MENA REGION AND TÜRKIYE

The MENA region is exceptionally vulnerable to the impacts of climate change. It is currently warming at double the global average and predicted to be 4°C warmer by mid-century [1]. In the MENA region, cooling demand is primarily driven by macroeconomic and environmental factors, including population growth, rising household incomes, economic development, and increasing average temperatures. These factors contribute to greater demand for space cooling and refrigeration across key sectors such as building, transport, healthcare, food and beverage as well as tourism.

Projections indicate that space cooling will experience the highest growth, with demand expected to increase substantially by 2050 [2]. As demographic and economic trends continue, a larger population will require cooling, while higher incomes will enable greater adoption of air conditioning and refrigeration technologies. Additionally, targeted economic initiatives, such as the expansion of the tourism sector, will further amplify cooling demand, particularly in the hospitality industry and commercial spaces.

Given the cross-sectoral nature of these drivers, sustainable and efficient cooling solutions will be critical to addressing the region's increasing demand while mitigating negative environmental and economic impacts. Therefore, countries in the MENA region have started

taking steps to address growing cooling demand. Under the Kigali Amendment, Article 5 (A5) countries are required to phase down Hydrofluorocarbon (HFC) consumption in stages. The first step is a freeze on HFC consumption levels, which begins in 2024 for most A5 countries and in 2028 for a smaller group. The goal is an 80% reduction in HFC consumption by January 1, 2045. To identify activities needed to achieve this, countries develop Kigali Amendment Implementation Plan (KIPs).

At the international level, as of February 2025, 163 parties ratified the Kigali Amendment to the Montreal Protocol [3]. Among these signatories, eleven countries are in the MENA region. Furthermore, relevant commitments are laid down in the Nationally Determined Contributions (NDCs) to the Paris Agreement, where countries embody their efforts to reduce GHG emissions. So far, out of the Cool Up partner countries, Lebanon submitted updated its NDC in 2020, Jordan and Türkiye in 2021, and Egypt in 2023 [4].

At the national level, countries have already adopted different strategies which partially address growing cooling demand. As it can be seen in Figure 1, on the example of Jordan, various overarching, climate and energy efficiency strategies and action plans are being developed.

To address cooling needs in a holistic manner, Jordan adopted a National Cooling Strategy (NCS), while Egypt is currently developing it. An NCS complement the previously mentioned strategies by adding specific cooling sector related aims and measures. It addresses the lack of a specific cooling sector related strategy and targets by developing specific recommendations for refrigeration and air conditioning (RAC), adding a layer of specificity around cooling that will bring economic, environmental, and social benefits across sectors and accelerate the uptake of sustainable cooling.

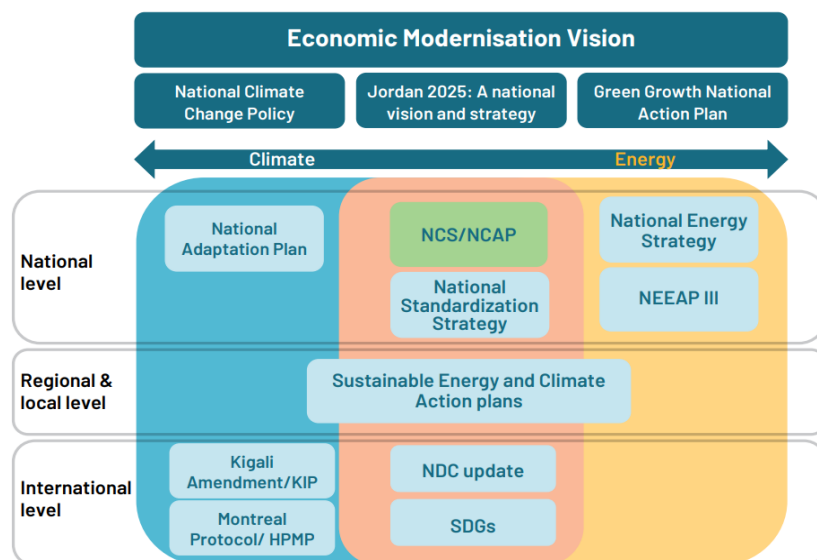


Figure 1. Climate and energy policy overview of Jordan [2]

NCAP METHODOLOGY AND DATA COLLECTION

National Cooling Action Plans (NCAPs) are strategic frameworks developed by countries to address the increasing demand for cooling while minimizing its negative environmental and economic impacts. These plans aim to guide national efforts towards more sustainable and efficient cooling practices. By addressing each country's specific cooling requirements and

potential solutions, NCAPs provide a comprehensive roadmap for implementing these solutions. (Figure 2) Recognizing the interconnected nature of cooling across various sectors, NCAPs integrate policies often addressed independently – such as those related to energy, climate, health, agriculture, and housing – into a cohesive strategy to achieve cumulative benefits.

The development of NCAPs is a multi-stakeholder consultative process that involves key actors from the public and private sectors as well as civil society. The process of developing NCAPs has started in 2018, with India being the first country that has launched a national cooling plan in 2019. Other countries that have developed a NCAP are Sri Lanka (2019), Rwanda (2019), Chile (2020), Panama (2020), Trinidad and Tobago (2020), Grenada (2021), Bangladesh (2021), Mexico (2022), Kenya (2022), Nigeria (2022), South Africa (2023), Cambodia (2023), Indonesia (2024) and Gambia (2024) [5].

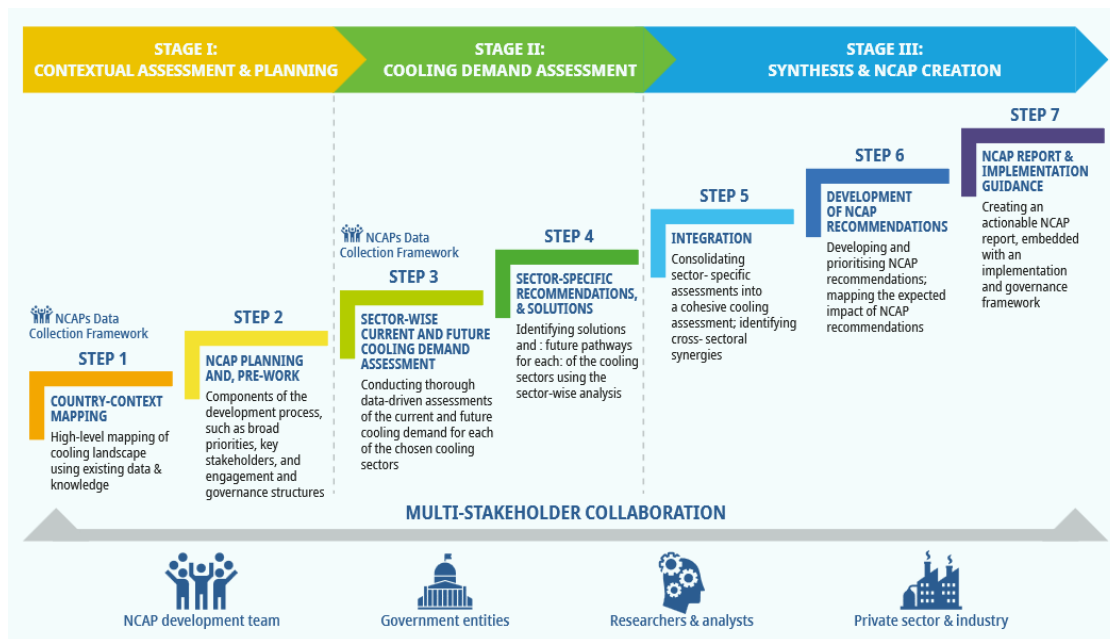


Figure 2. The NCAP methodology developed by the UNEP Cool Coalition [6]

In June 2023, the Turkish Climate Change Directorate announced the launch of the first NCAP for Türkiye at the Cool Up Thematic Group meeting [7]. It was followed by the Cool Up Kick-off Working group meeting in Jordan in November 2023 [8]. In May 2024, the National Ozone Unit (NOU) of the Egyptian Environmental Affairs Agency (EEAA), held Cool Up Kick off meeting for Egypt’s NCAP [9].

The detailed description of the NCAP data collection and modelling from Jordan and Türkiye will be presented in the following paragraphs and chapters.

Data collection

The objective of the cooling sector mitigation scenario modelling is to enable shaping national policies and roadmaps relating to refrigerant transition, energy performance for the different types of equipment, to promote higher efficiency appliances, including MEPS, labelling scheme, natural refrigerants, consumer awareness, capacity building for key stakeholders, and a M&E framework.

The RAC subsectors in scope include residential and commercial AC, mobile air conditioning, industrial refrigeration, commercial refrigeration, domestic refrigeration, and transport refrigeration.

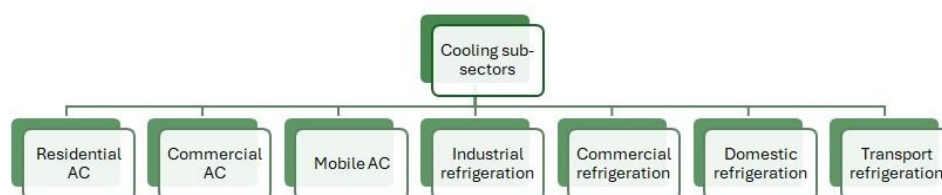


Figure 3. Overview of RAC subsectors [10]

Data collection framework Data collection has been carried out to provide an overview of historic and current trends as well as projections of future market characteristics about the cooling landscape in each country.

The data used for the modelling shown was collected from various primary and secondary sources. On the example of Türkiye, current and historical data are based, where available, on factual data from the sources listed in Figure 4. Projections are estimated based on statistical data, economic growth projections, information from trade associations, manufacturers, importers, etc.

Expert interviews Primary data was collected through expert interviews with relevant stakeholders, which largely include technology providers, importers, equipment operators. If possible, site visits were also conducted. The bottom-up data collection process followed a six-step sequence: identifying data needs for subsector modelling, developing tailored questionnaires for stakeholder interviews, selecting stakeholders covering at least 80% of the market share, conducting interviews over four months with follow-ups as needed, processing and verifying data through expert confirmation and secondary sources, and finally compiling a comprehensive dataset for modelling and documentation. In Türkiye, interviews with 35 stakeholders were conducted in the period from January to April 2024. In addition to that, experts from industry association ISKID gathered data through interviews with 27 sector representatives. In Jordan, interviews with 14 stakeholders were successfully conducted in the period from March to May 2024.

Data from government sources in Jordan and Türkiye was gathered from studies, reports, and customs data to provide a strategic overview of cooling and refrigeration applications, including manufacturing, imports, energy consumption, and energy efficiency standards (MEPS). In Jordan, contributions came from the Ministry of Environment, Chamber of Industry and Energy, Environmental Sustainability Unit, Department of Transport, NERC (Royal Scientific Society), and the Customs Department. In Türkiye, data collection was supported by the NCAP working group hosted by Cool Up, involving multiple ministries. Outreach to government entities took place in autumn 2023, and as of February 2023, the Directorate of Climate Change launched two databases—EKOMVET and FARAVET—to monitor HFCs and equipment. These systems provided insights into operational leakages of RAC systems, which informed the NCAP modelling.

Country-level data Multiple secondary data sources were used to assess the cooling sector in Türkiye and Jordan. Cool Up published market assessments on both countries [11, 12],

providing a foundation for understanding the upscaling potential of sustainable cooling technologies and supporting NCAP modelling. In Türkiye, publicly available sector data (2016–2020) [13] and a market research report [14] were used to analyze air-conditioning and refrigeration trends, including forecasts up to 2028. Additional data came from a survey on alternatives to ozone depleting substances [15], energy statistics [16], and the Collaborative Labelling and Appliance Standards Program (CLASP) [17]. Similarly, in Jordan, national surveys on HFCs and ODS alternatives [18], contributed to understanding market dynamics.

Measures applied to address data gaps Even though the data collection process included a large number of relevant stakeholders and entities concerned, for some data points data gaps persisted even after multiple follow up with stakeholders. To address identified data gaps, the Cool Up programme utilised various approaches such as triangulation of data points using different data sources, cross valuation, reliability analysis, and use of expert opinions.

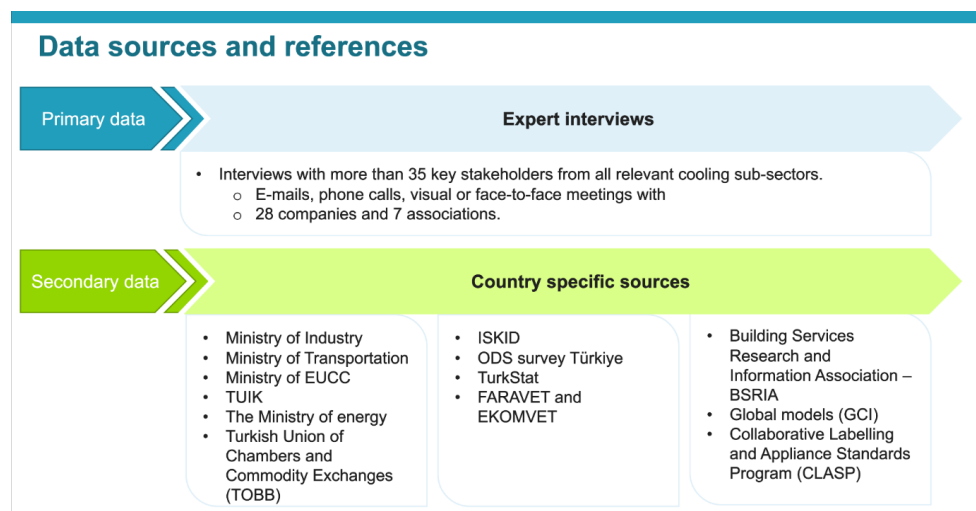


Figure 4. Data sources and references in Türkiye [19]

STAKEHOLDER ENGAGEMENT

The stakeholder consultation processes for the NCAP development in Jordan and Türkiye aimed at addressing the needs and perspectives of various groups impacted by cooling policies in a holistic manner. A structured and inclusive process involved a range of stakeholders, including government agencies, private sector entities, technical experts, and the public.

Stakeholder Identification and Grouping

Stakeholders were identified through a comprehensive selection using an integrated approach, which referred to engaging all relevant groups and individuals whose expertise, interests, and responsibilities were essential to the success of the development and future implementation of the NCAP. This ensured inclusiveness and collaboration across sectors and disciplines and created well-rounded, actionable solutions that considered technical, social, environmental, and economic dimensions. The integrated approach included cross-sectoral representation, such as government, industry, academia, civil society, and the private sector. It ensured multi-level collaboration for policies to align with local needs and country commitments.

The process started with stakeholder mapping and analysis, including the identification of all potential stakeholder groups and assessing their roles, influence, and interests. Next, integrated

platforms for engagement, including collaborative action planning, were established. In Jordan, the Steering Committee was responsible for making strategic decisions and approving final documents, while in Türkiye, the NOU took on that role. The Cool Up Working Group in both countries had a role in providing feedback, high-level policy input, and sector-specific recommendations while validating assumptions, identifying interlinkages, and ensuring alignment.

Stakeholder Engagement Methods

Throughout the process, the stakeholders were engaged via constant communication with the NCAP development team. Initial roundtables provided a broad overview of the NCAP objectives, outlined critical points, and served as a starting point for gathering high-level insights from key stakeholders.

Building on this foundation, detailed information was gathered through interviews and focus groups. Such in-depth interviews engaged industry players, technical experts, and community representatives, who brought valuable perspectives on specific challenges and expectations. That allowed stakeholders to discuss targeted topics in a structured environment that encouraged sharing both technical and social insights.

Respective of the country, the Cool Up Working Group or the Steering Committee meetings and feedback sessions were held to present findings and initial recommendations, creating a platform for stakeholders to review, discuss, and provide feedback on the NCAP draft by focusing on specialized areas such as energy efficiency standards and refrigerant regulations. These sessions facilitated dialogue and allowed stakeholders to validate the plan, ensuring their perspectives were reflected before the NCAP was finalized. Those Cool Up meetings were always recognized as important by all stakeholders and always received a great response to the invitations, resulting in around 40 to 50 participants in Jordan [20] and 80 to 90 participants in Türkiye [21], covering all relevant sectors.

Incorporation of Stakeholder Views

Stakeholder feedback was categorized to address diverse needs while balancing public interests, industry priorities, and regulatory feasibility. Conflicting viewpoints, such as economic considerations versus environmental impact, were mediated through a collaborative approach. A summary of stakeholder feedback was incorporated into recommendations (measure cards), detailing which suggestions were adopted and why, and was shared further with involved parties to ensure transparency. The NCAP underwent several iterations, with stakeholder views incorporated progressively, and key decisions, such as prioritizing certain technologies or focusing on specific refrigerant needs, were refined based on iterative input. In Türkiye, to ensure that responsible implementation and monitoring agencies were informed, bilateral meetings were also held prior to the Cool Up Working Group meetings.

Outcomes and benefits

The engagement process provided broad-based support for NCAP development and helped set up adapted and practical policy recommendations. The engagement process also created and improved awareness of climate-friendly cooling and built capacity among public, private, and civil groups to contribute to sustainable cooling solutions.

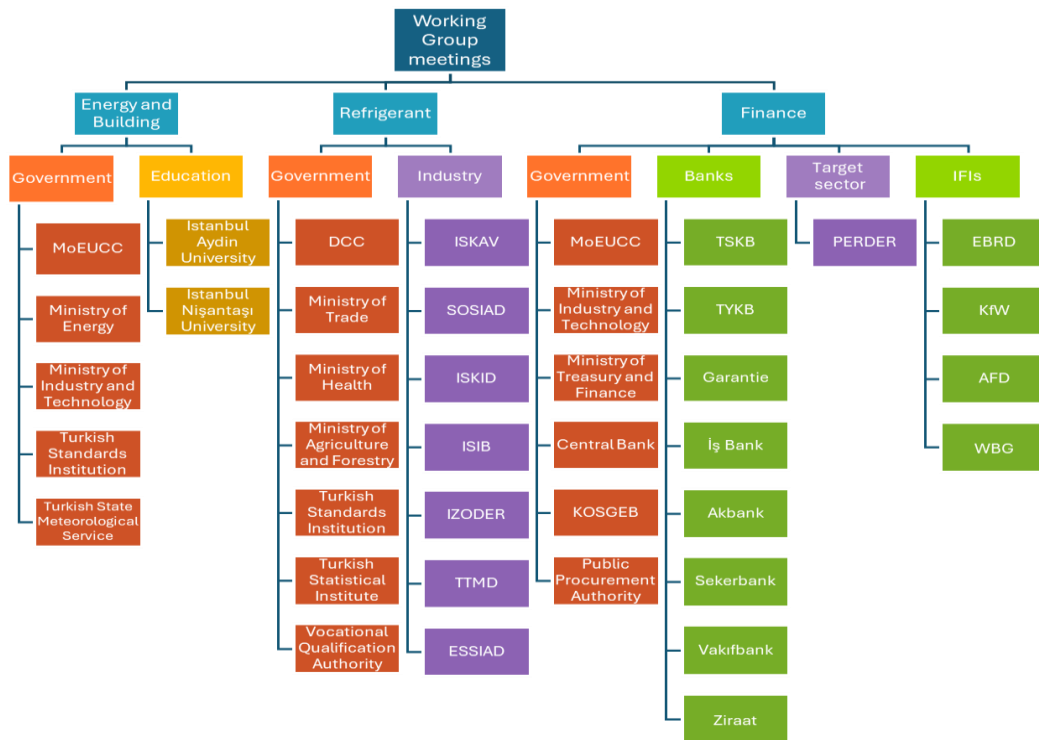


Figure 5. Overview of the stakeholders participating in the Cool Up Working Group meetings in Ankara, Türkiye, in July 2024 and January 2025 [21]

NCAP MODELLING

For the scenario-making, a model called “Cool Paths” was developed within the Cool Up programme was used to estimate direct and indirect emissions. The model translates real-world inputs into model input parameters to assess cooling sector developments under different scenarios. It considers existing and expected policies and technological advancements. Through preprocessing, the model estimates the number of cooling units and systems based on sales data while evaluating policy impacts on refrigerant mix, system efficiency, and building efficiency. The model then defines general parameters. It provides projections for 2020, 2030, and 2050, covering stock numbers, leakage rates, grid CO₂ factors, building stock quality, and efficiency improvements. Additionally, it assesses new systems annually, considering refrigerant mixes and seasonal energy efficiency ratios (SEER) based on local climate conditions.

The NCAP in each country considers one business as usual (BAU) and two mitigation cooling pathways until 2050 (Mitigation Scenario 1 and Mitigation Scenario 2). The pathways reflect different transition of the cooling sector market until 2050. For each mitigation scenario, direct and indirect emissions reductions were determined compared to the BAU scenario. The comparison between the BAU and the mitigation scenarios show the range of potential impacts of additional measures such as increased use of natural refrigerants, more ambitious efficiency (RAC and building performance) due to improved codes and standards related and other policy instruments such as financing schemes. Compared to Mitigation Scenario 1, Mitigation Scenario 2 requires a swift, multi-faceted transition of the entire market and a corresponding policy framework. Examples in mitigation scenario 2 are ambitious policy measures targeting aspects that are relevant in terms of the abatement potential, including refrigerant transition, decarbonization of power generation and further efficiency improvement in industry and buildings.

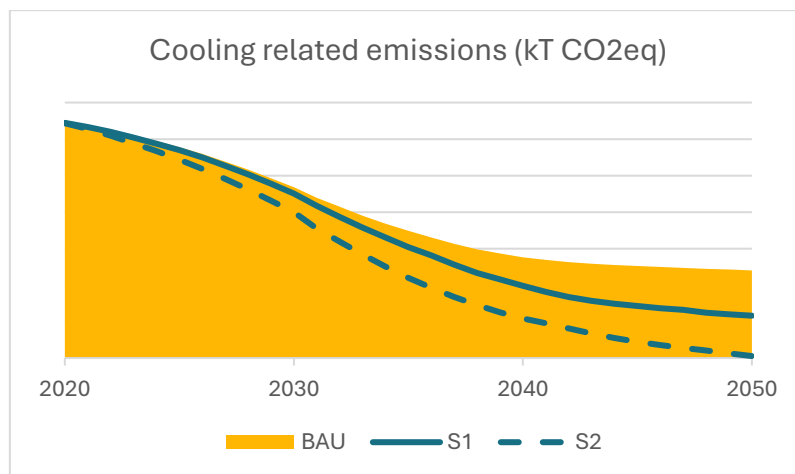


Figure 6. Example of cooling related (direct and indirect) emissions. This figure is for illustrative purposes only and does not represent real data.

STRATEGIC INTERVENTION AREAS AND POLICY MEASURES

Based on the modelling results and in close collaboration within the NCAP working group and steering committee, a set of measures were developed to achieve the goals of the NCAP, namely, to reduce greenhouse gas emissions while promoting equitable access to affordable cooling for all. The measures were grouped along the strategic intervention areas (Figure 7). In Jordan, these were identified in the NCS and lay out the path for Jordan to transition to sustainable cooling across sectors. Türkiye applied a similar structure.



Figure 7. Strategic intervention areas in NCS of Jordan [10]

The measures target the entire spectrum of cooling related emissions, emphasizing holistic approach. Energy efficiency targeting to reduce the cooling CO₂eq factor of cooling equipment, is addressed at both the building and the equipment level, with key measures featuring tighter appliance of MEPS and building codes but also labels and passive cooling. The refrigerant transition is addressed via comprehensive phase down and ban schedules, whose crucial measure is adopting or updating the existing F-gas regulation at the national level, accompanied with safety standards. Market transition and readiness are ensured by the proposal for targeted financing incentives such as subsidized interest rates, cash-back incentives, grants or import levies, as well as capacity building in policy and finance circles, and most importantly at the technician level through training and certification. In Jordan, there is a total of 33 measures.

The proposed policy measures are categorized into short-term (2025–2027), medium-term (2028–2033), and long-term (2033–2040) measures. Short-term measures are high-priority and address urgent barriers, medium-term measures support decarbonization but may depend on prior steps, and long-term measures aim for full decarbonization but require future reassessment.

Acknowledging the efforts previously taken by other countries and lessons learned on their path to develop NCAPs [6, 22], Cool Up approach develops clear guiding implementation steps, recognize key monitoring entities for each policy measure and establishes broader monitoring and evaluation structure for all the measures, as represented in the Figure 8.

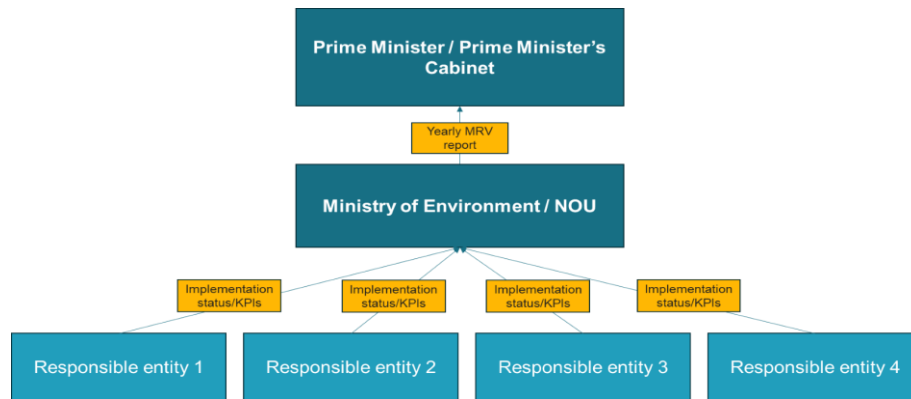


Figure 8. Monitoring and evaluation structure of the NCAP [10]

CONCLUSION

Through this paper, development process of the overarching NCAPs documents in Jordan and Türkiye, reflecting on the data collection and intensive stakeholder engagement has been described. The role of various international, governmental, research, industry and finance stakeholders has been emphasised. Their valuable inputs resulted in the unique modelling and proposed policy measures. To achieve significant CO_{2eq} emissions reductions, key measures, related to the energy efficiency, refrigerants and finance need to be implemented. And to assure their proper monitoring and evaluation, associated framework is also included as a part of the measures.

Overall, the existing and upcoming actions pose challenges for key actors, including government entities, industry, the financial sector, and individuals; but also offer significant market potential, paving the way for the widespread adoption of sustainable cooling solutions in the MENA region. Beyond the development phase, stakeholder collaboration remains essential for the successful implementation, monitoring, and continuous refinement of the proposed measures. The shared learning experience has deepened the understanding of sector-specific challenges and built a strong foundation for joint action. Sustained engagement across sectors will be crucial in overcoming obstacles, mobilizing resources, and translating policy recommendations into effective, on-the-ground action.

NOMENCLATURE

AC	Air Conditioning
BAU	Business as usual
BMUV	German Federal Ministry of the Environment, Nature Conservation, Nuclear

	Safety and Consumer Protection
BSRIA	Building Services Research and Information Association
CLASP	Collaborative Labelling and Appliance Standards Program
EEAA	Egyptian Environmental Affairs Agency
GHG	Greenhouse gas
HFC	Hydrofluorocarbon
IKI	International Climate Initiative
ISKID	Air Conditioning and Refrigeration Manufacturers Association
KIPs	Kigali Amendment Implementation Plan
MENA	Middle East and North Africa
MEPS	Minimum Energy Performance Standards
NCAPs	National Cooling Action Plans
NCS	National Cooling Strategies
NDCs	Nationally Determined Contributions
NOU	National Ozone Unit
ODS	Ozone Depleting Substances
RAC	Refrigeration and Air Conditioning
SEER	Seasonal energy efficiency ratios
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization

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ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to the Cool Up programme partners (led by Guidehouse Germany GmbH) for their invaluable contributions, collaboration, and expertise throughout this project. Their commitment and support were instrumental in achieving the objectives outlined in this paper.

We also extend our appreciation to all external stakeholders for their valuable insights, feedback, and engagement during the process. Their close collaboration with Cool Up played a crucial role in shaping the outcomes of the NCAPs and ensuring the relevance of our work.