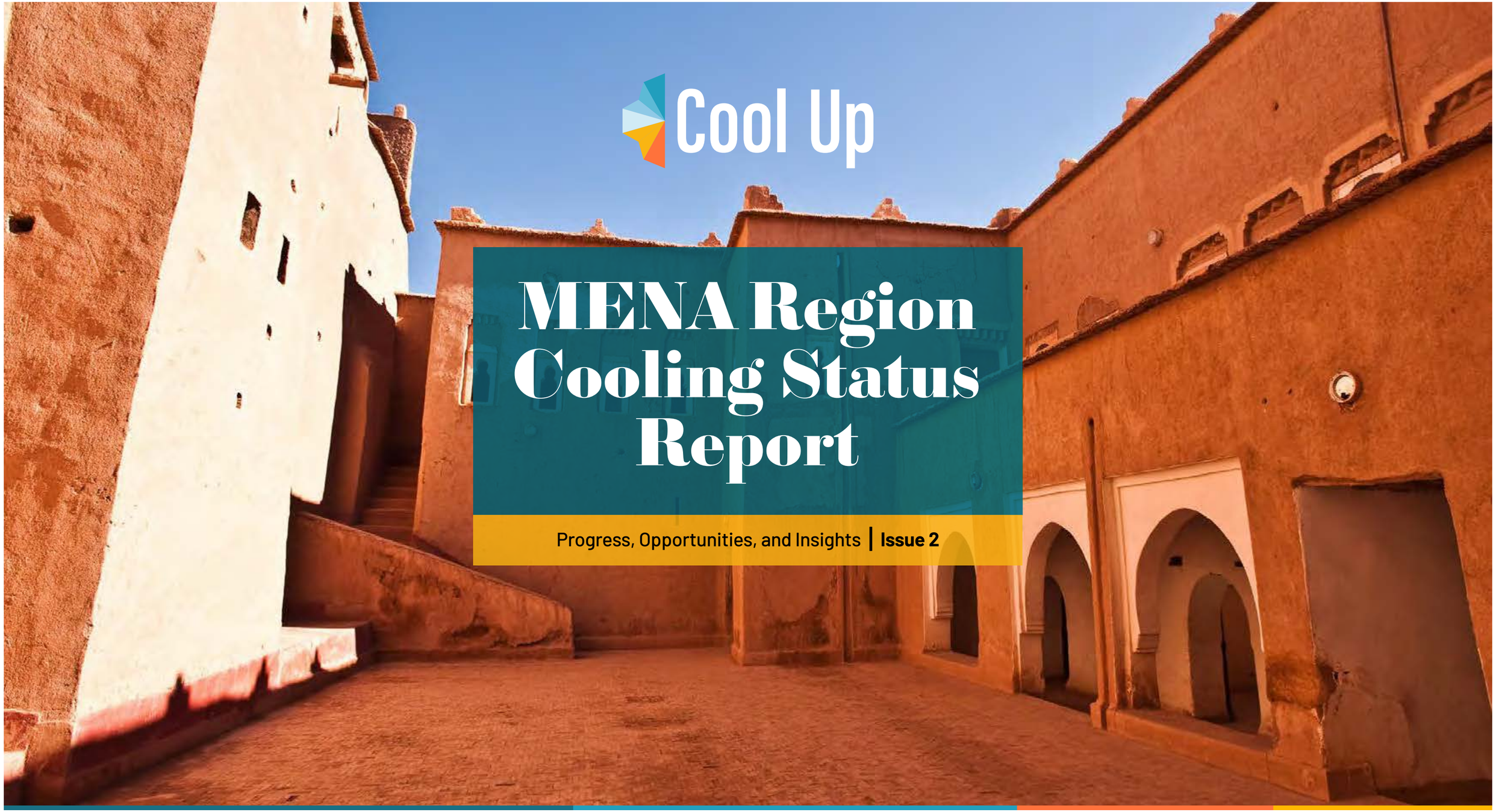


Cool Up

MENA Region Cooling Status Report

Progress, Opportunities, and Insights | **Issue 2**

Why is sustainable cooling important for the MENA region?

With temperatures in the Middle East and North Africa (MENA) rising at twice the average global rate, and cooling demand projected to grow significantly across the region in the coming decades, now is the time for regional stakeholders to act on cooling.

The MENA region is entering into a crucial period of action, with the opportunity to become a global leader in sustainable cooling. From 2024, a number of countries in the region will, for the first time, be working simultaneously to phase out the use of ozone-depleting hydrochlorofluorocarbons (HCFCs) and phase down the use of climate-warming hydrofluorocarbons (HFCs). Globally, we are also fast approaching important climate and development deadlines, such as those set under the Paris Agreement and UN Sustainable Development Goals (SDGs).

Now is the perfect chance for stakeholders in MENA to leapfrog to future-proof cooling solutions that are energy efficient, use natural refrigerants (if any), and are compatible with renewable energy sources.

In recognition of the important role that sustainable cooling has to play in climate mitigation and adaptation strategies, the COP28 Presidency has announced cooling as a central theme to this year's United Nations Climate Change Conference—which many are calling the 'Cool COP'—in the United Arab Emirates (UAE). To encourage global action on cooling, it is vital that stakeholders across MENA lead by example, coming to the table with ambitious commitments and following through with timely action. The great news is that we are seeing governments across the region becoming increasingly interested in sustainable cooling.

So, what efforts are currently underway in MENA to support the region's transition to sustainable cooling? Well, that is exactly the question we intend to answer in the following pages of this report.

Over the last year, we have seen Egypt become the latest country in the region to ratify the Kigali Amendment and the Gulf Cooperation Council (GCC) countries— Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE—have expressed their intention to do the same. Regional interest in National Cooling Action Plans (NCAPs) is also growing, with Jordan and Türkiye working to develop their own plans.

I continue to be inspired by the collaborative spirit of the many regional actors who have contributed their enthusiasm and dedication to our joint vision for sustainable cooling across the MENA region.

Katja Eisbrenner

Katja Eisbrenner
Programme Director, Cool Up programme

EXECUTIVE SUMMARY

MENA Region Cooling Status Report

ISSUE 2

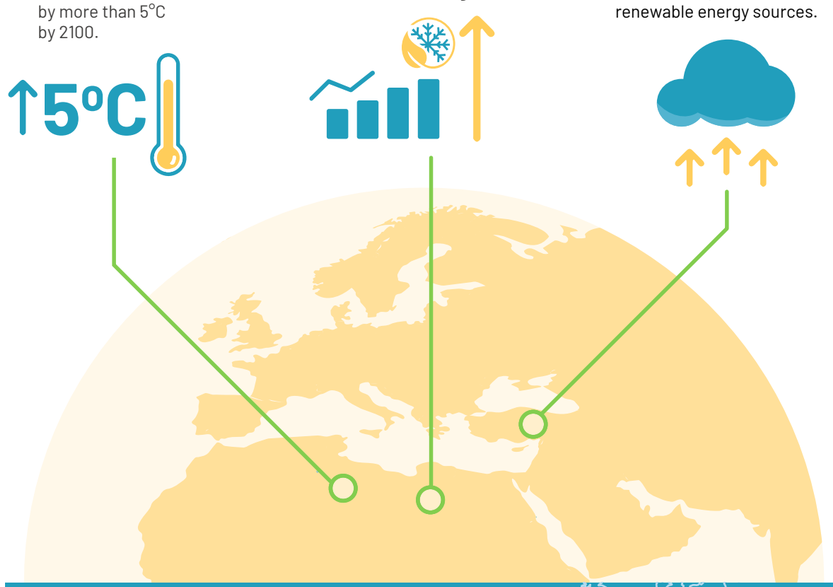
With temperatures in MENA rising at twice the average global rate, and cooling demand projected to grow significantly across the region, **now is the time to act on cooling.**

The importance of sustainable cooling in MENA and Türkiye

Temperatures in MENA and Türkiye are rising at twice the average global rate and could rise by more than 5°C by 2100.

The region is entering into a crucial period of action on climate, with the **opportunity to become a global leader in sustainable cooling.**

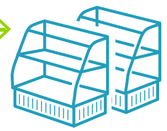
Sustainable cooling solutions are those which are **highly energy efficient, use natural refrigerants**, and are compatible with renewable energy sources.



Technology landscape

With greater emphasis being placed on sustainable cooling, the region's technology landscape will need to adjust accordingly.

In stock in MENA



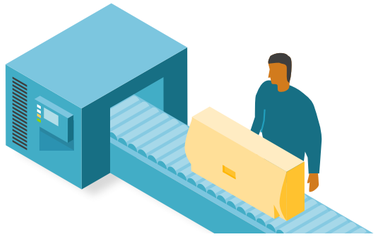
8 million commercial refrigeration units

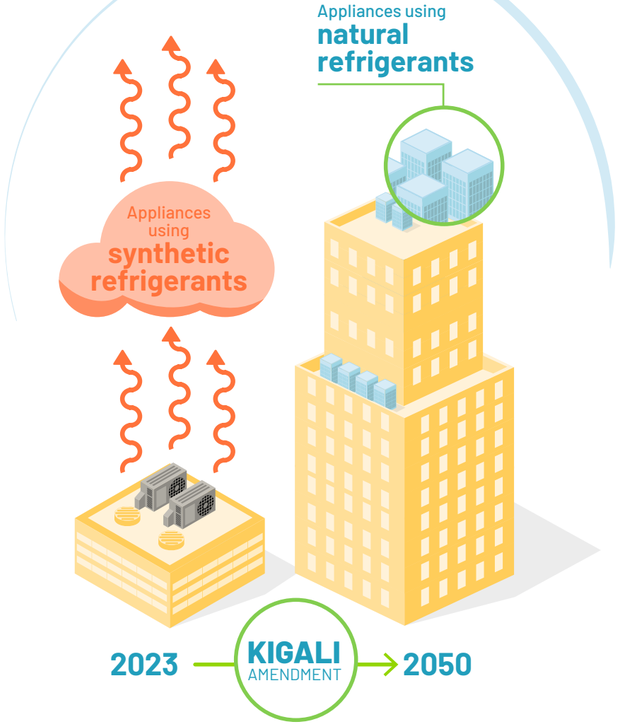
93 million of AC units

Existing cooling devices are often inefficient and rely on refrigerants with a high global warming potential.

Sustainable energy options

Regional manufacturers will need to develop and commercialise super-efficient equipment that use climate-friendly refrigerants and the necessary policies and finance must be in place to ensure adoption of these technologies.





Finance landscape

Access to finance is key to scale up the use of sustainable cooling solutions. **International finance** is needed both for driving technological innovation and for ensuring the rapid and wide-spread deployment of solutions.

National-level finance is also needed to help drive the region's RAC markets towards sustainable technologies and solutions through mechanisms like loans, rebates, tax incentives, bulk procurement, on-bill financing, cooling-as-a-service (CaaS), and many others.

Policy landscape

There are several policy-based approaches being adopted by governments across MENA and Türkiye to support sustainable cooling solutions, including **phasing down the use of F-gases, improving the energy efficiency of buildings and cooling technologies,** and deploying passive cooling solutions.

United Nations Climate Change

MENA region is scaling up on climate action: With Egypt hosting COP27 in 2022 and UAE hosting COP28 in 2023, climate change has become a top issue in the region.

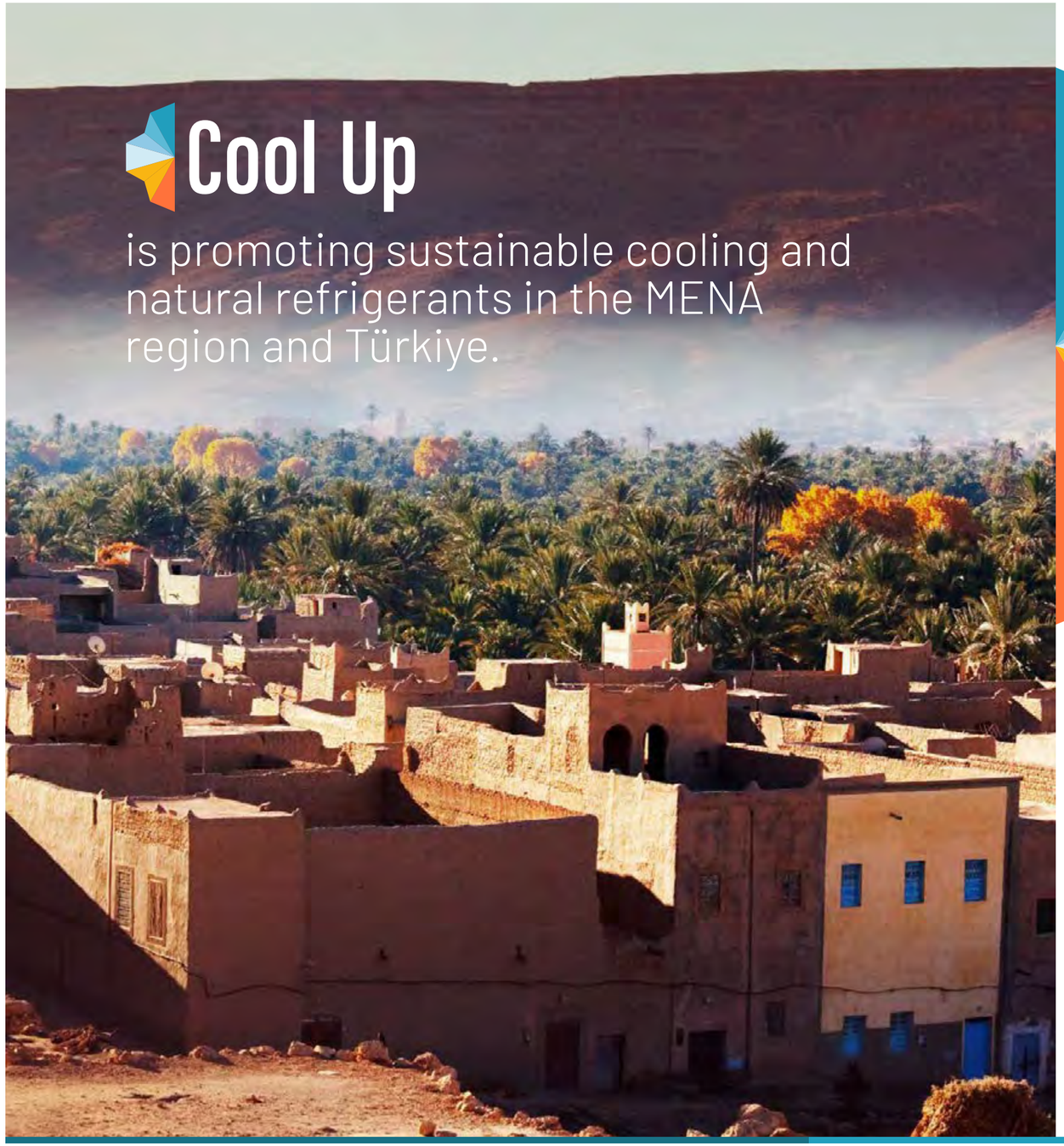
The COP28 Presidency designated cooling as a key topic in climate action and urged global leaders to act on cooling.

Cooling as central theme of the Cool COP.

"We cannot expand cooling on a business-as-usual basis. Without strong policy action, emissions from the sector will rise 7%–10% from today. To solve this dilemma, we need a rapid transition to energy-efficient and climate-friendly cooling."

Dr. Sultan Al Jaber, COP28 Presidency

Regional stakeholders should take this opportunity to lead by example by making ambitious commitments on cooling and following through with timely action.



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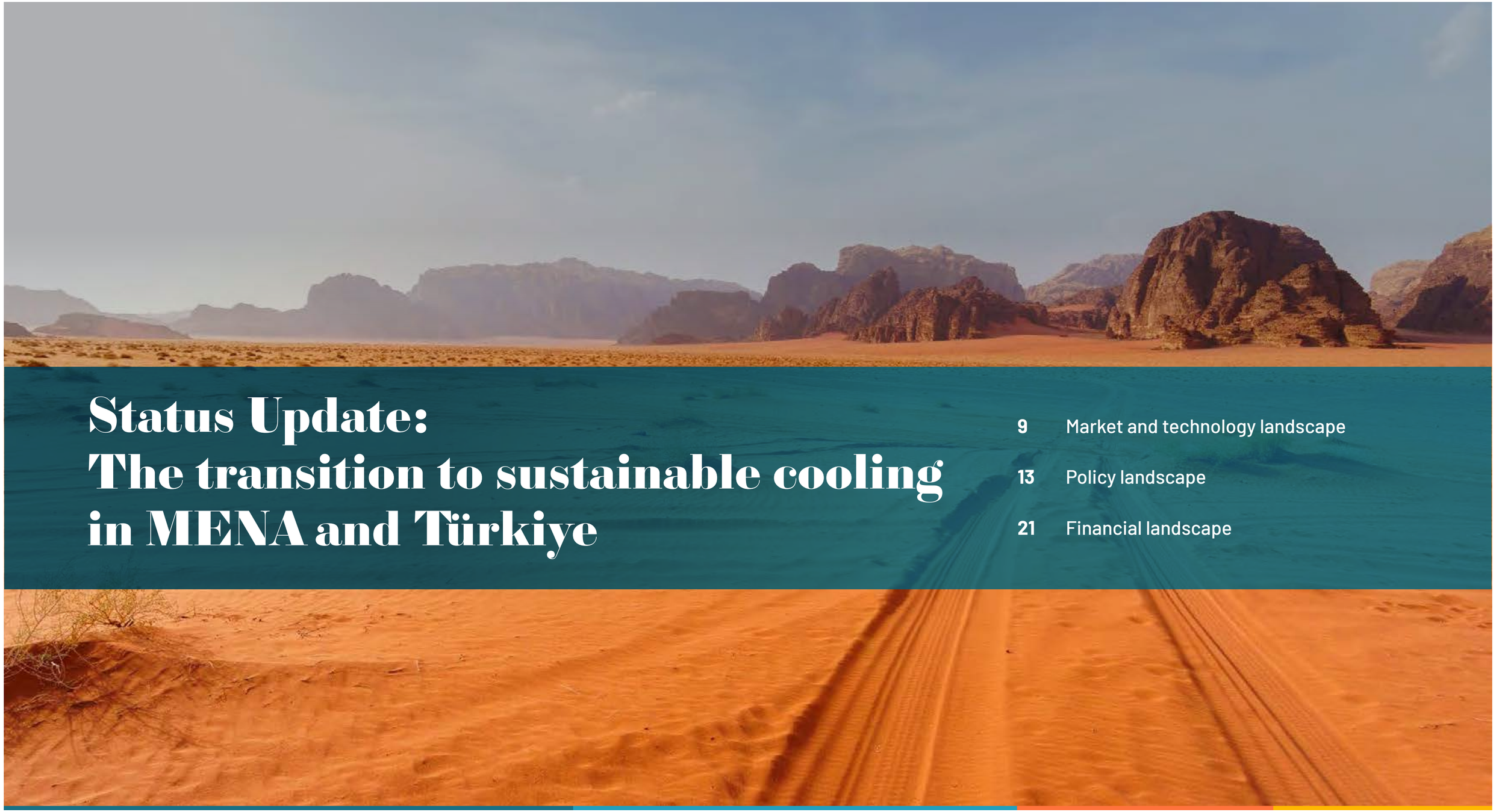
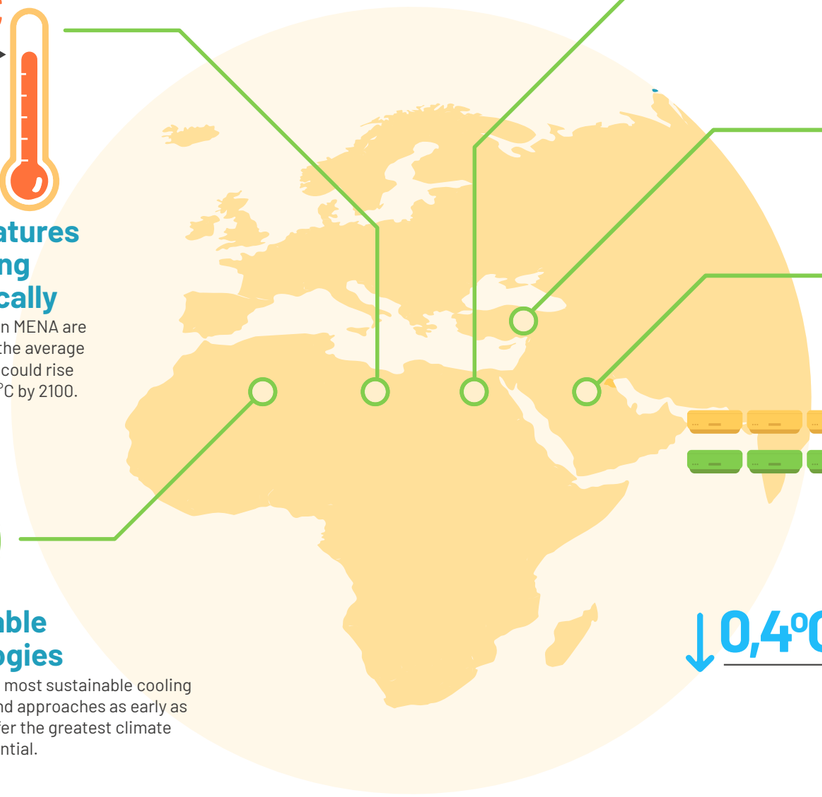


Status Update: The transition to sustainable cooling in MENA and Türkiye

Where are MENA and Turkiye in the transition to sustainable cooling?



↑5°C MENA

Average

Temperatures increasing dramatically

Temperatures in MENA are rising at twice the average global rate and could rise by more than 5°C by 2100.

Sustainable technologies

Introducing the most sustainable cooling technologies and approaches as early as possible will offer the greatest climate mitigation potential.

↑↑↑ 50%

Increase electricity demand

Without action, the growing demand for cooling —a significant consumer of electricity— will drive the region's rising energy demand, which is expected to increase by 50% by 2040.

2050 8 million

Commercial refrigeration

The number of commercial refrigeration units is projected to increase by more than 37% between 2020 and 2050, when there will be nearly eight million appliances installed.

AC units will increase 3 times more

AC demand in the region is expected to reaching more than 93 million unitary ACs in 2050, up from 35.6 million in 2020, representing an increase of 57%.

2020 **35** million AC units

2050 **93** million AC units

↓0,4°C

Average

KIGALI AMENDMENT

If fully implemented, the Kigali Amendment has the potential to avoid up to 0.4°C of global warming by 2100.

7 countries across the region have ratified the Amendment.

ENERGY

73% of residential cooling in 2022 in the Middle East **was covered by MEPS**, up from just 30% in 2010.

However, not all RAC technologies are covered by such policies and there is significant room for enhanced ambition in many countries.

NET ZERO

To achieve net-zero emissions by 2050, the average efficiency rating of new AC units must be approaching **best-available technologies by 2035.**

15 MENA countries have **submitted NDCs.**

12/15 Have made some reference to their RAC sector, which is three more than in 2022.

To date, **8 countries** in the region have set NET ZERO EMISSION GOALS

1 Only one country in the region **has developed a NCAP.**

NEEAP

The majority of the region's countries have a NEEAP, or a similar plan, either in place or under development.

Financial landscape

Financial support is needed both for driving technological innovation and for ensuring the rapid and wide-spread deployment of sustainable solutions.

There is potential for emerging opportunities in establishing financial mechanisms that promote the transition to sustainable cooling, particularly in MENA and Türkiye.

Less than 3% of global funding for climate initiatives from 2019 to 2020 was spent in the Middle East.

Regional stakeholders need to significantly scale up their investments in climate mitigation and adaptation.

Although the majority of climate finance will come from the private sector, **the region's governments are largely responsible** for mobilising and channelling finance.

The cooling challenge

Climate conditions in the MENA are harsh, with high temperatures and limited rainfall and groundwater making the region extremely vulnerable to the impacts of the climate crisis. While the effects of our changing climate have been observed in the region for some time, they are expected to become more impactful in the near future.

Temperatures in MENA and Türkiye are rising at twice the average global rate and could rise by more than 5°C by 2100.[1] If action isn't taken, temperature rise could leave some parts of the region uninhabitable, according to experts.

Even if global warming is limited to 2°C, researchers predict that the risk of heat-related mortality for people over the age of 65 in the region could increase by sevenfold by the end of the century.

These rising temperatures, combined with other factors such as a growing population, rising incomes, and increasing rates of urbanisation, are expected to create a boom in the region's demand for cooling—both refrigeration and air conditioning (RAC).

Without action, the growing demand for cooling—a significant consumer of electricity[2]—will drive the region's rising energy demand, which is expected to increase by 50% by 2040. Due to the fact that the region's electricity generation is mainly based on fossil fuels, a rise in energy demand will lead to a rise in greenhouse gas (GHG) emissions at a time when nations should be making meaningful progress towards net-zero.

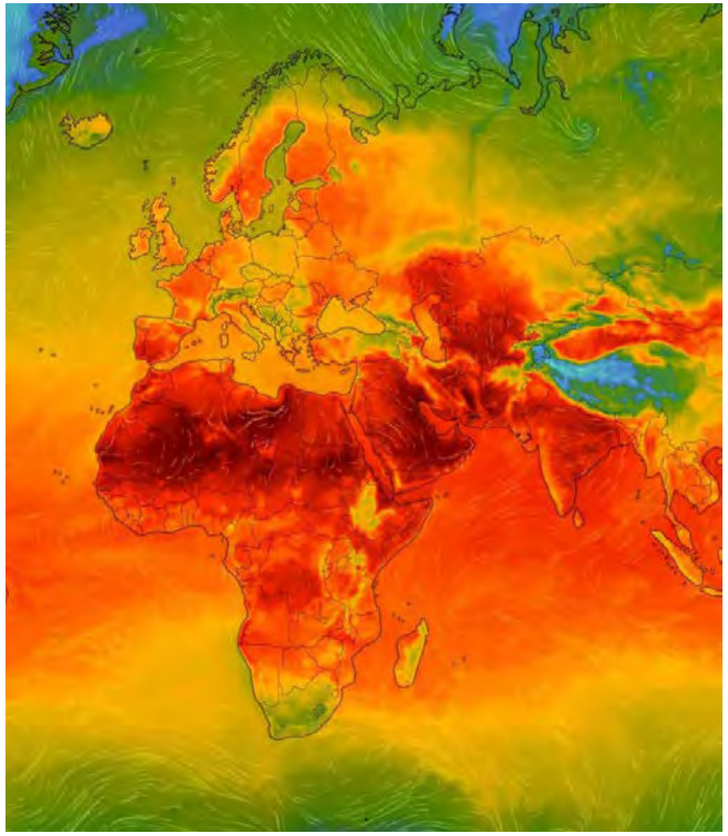
In addition to energy-related emissions, conventional cooling also results in direct GHG emissions from the use of fluorinated gases (F-gases), like HFCs as refrigerants. System leaks and incorrect disposal of cooling equipment release HFCs—which are often thousands of times more harmful to the climate than carbon dioxide (CO_2)—into the environment, having a detrimental impact for decades to come.

Temperatures in MENA and Türkiye are rising at twice the average global rate.

1 Zittis et al., Climate Change and Weather Extremes in the Eastern Mediterranean and Middle East.

2 Air conditioning systems consume up to 70% of the region's total residential and commercial electricity.

Without action, the growing demand for cooling—a significant consumer of electricity[2]—will drive the region's rising energy demand, which is expected to increase by 50% by 2040.



These direct and indirect emissions then feed into a dangerous loop in which they contribute to climate-related temperature rise, creating an even greater need for cooling and yet higher GHG emissions.

Access to cooling also varies dramatically across the region, with high rates of AC ownership in some countries and low levels in others. For example, in Saudi Arabia, roughly 63% of households are equipped with AC,[3] whereas in Türkiye, AC ownership is less than 20%.[4] Cooling access is a significant issue in a number of countries across MENA, including Algeria, Egypt, Iran, Iraq, and Morocco.[5]

The importance of sustainable cooling solutions

The adoption of sustainable cooling solutions—i.e. solutions that are highly energy efficient, use natural refrigerants[6], and are compatible with renewable energy sources—is crucial for countries to ensure the cooling needs of their residents are met and GHG emissions are kept to a minimum.

In addition to GHG emissions reductions, sustainable cooling solutions bring a host of other benefits, such as speeding up and reducing the cost of the clean energy transition, reducing food loss and waste, improving health and well-being, and reducing utility bills and infrastructure investments.

3 International Energy Agency, "Percentage of households equipped with AC in selected countries."

4 Enerdata, "Future of Air-Conditioning."

5 SEforALL, "Chilling Prospects: Tracking Sustainable Cooling for All 2022."

6 Natural refrigerants—CO^2 (R744), ammonia (R717), air (R729), water (R718), and hydrocarbons like R290 (propane)—have zero or near-zero GWP and are non-ozone depleting.

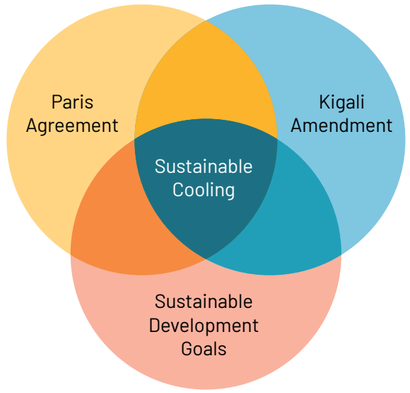
Traditionally, cooling has been overlooked in international fora. However, its significant role in the global ozone, climate change, and sustainable development agendas is becoming increasingly recognised. As depicted in the figure below, sustainable cooling lies at the intersection of the Paris Agreement, the Montreal Protocol (and its Kigali Amendment), and the UN SDGs.

Introducing the most sustainable cooling technologies and approaches as early on in the transition as possible offers the greatest climate mitigation potential and will avoid locking in excess emissions for decades to come as more people need and are able to afford cooling appliances.

Passive cooling techniques such as urban greening, reflective surfaces, and better building design (e.g. insulation, shading, ventilation, building orientation, window sizing, etc.), can help reduce the demand for mechanical cooling technologies like air conditioners (AC), while still providing thermal comfort.

Where mechanical cooling remains necessary, technologies—be they individual AC units, commercial refrigeration equipment, or large district cooling systems—should use natural refrigerants (if any), be super efficient, and use sustainable energy sources.

The importance of sustainable cooling for international climate and development goals



Sustainable cooling lies at the intersection of the Paris Agreement, Kigali Amendment, and Sustainable Development Goals.

In MENA and Türkiye, the transition to sustainable cooling is still in its early stages, but interest is growing. A number of existing policies, projects, and initiatives are proving that sustainable cooling solutions are viable and effective in the region.

Introducing the most sustainable cooling technologies and approaches as early on in the transition as possible offers the greatest climate mitigation potential

Market and technology landscape

Due to rising temperatures and economic development, the global RAC market is growing rapidly. Data suggests that there were some 87.3 million commercial refrigeration units[7] and 1.6 billion AC units[8] in use in 2018. These numbers are projected to rise to 122 million units and 5.6 billion units, respectively, by mid-century.

Separate analysis has estimated that the global RAC market could be worth roughly USD 170 billion (EUR 153 billion) by 2030, up from USD 135 billion (EUR 121 billion) in 2018.[9]

In MENA and Türkiye, the number of commercial refrigeration units is projected to increase by more than 37% between 2020 and 2050, when there will be nearly eight million appliances installed. AC demand in the region is expected to grow even faster, reaching more than 93 million unitary ACs[10] in 2050, up from 35.6 million in 2020, representing an increase of 57%.[11]

7 Green Cooling Initiative, "Global greenhouse gas emissions from the RAC sector."
8 IEA, "Air conditioning use emerges as one of the key drivers of global electricity-demand growth."
9 The Economist Intelligence Unit (EIU), "The Cooling Imperative."
10 Unitary air conditioning includes ductless and ducted splits, rooftop ACs, variable refrigerant flow (VRF) systems, and self-contained units.
11 Green Cooling Initiative, "Global greenhouse gas emissions from the RAC sector." Data for Iraq not available.

The region's RAC technologies market is estimated to have been worth roughly EUR 8 billion in 2018, with an expected annual growth rate of 5% until 2024[12].

As greater emphasis is placed on the sustainability of the RAC sector, the technology landscape will need to adjust accordingly, with manufacturers having to develop and commercialise super-efficient equipment that use climate-friendly refrigerants in all regions of the world.

Air conditioning market and technologies

Most of the conventional AC technologies available on the global market are also available in MENA and Türkiye, however the shares of those technologies differ from one country to another. Typical AC technologies can be distinguished as centralised and decentralised systems.

Centralised systems have several AC units that are served by one central cold production unit. These can be further distinguished into AC chillers, sorption water or brine chillers, and variable refrigerant flow (VRF) or multi-split systems.

Central systems

AC chiller

Chillers are connected to distribution (air or water) or delivery systems (fan coil units or chilled beams or ceilings). Central cold generation units are part of a central AC system, which can be categorised into three groups:

- Compression water/brine chillers
- Compression direct expansion (DX) chillers (incl. packaged rooftop and central)
- Sorption water/brine chillers

VRF/multi-split systems

Multi-split systems consist of one outdoor and several indoor units. VRF systems are sophisticated multi-split systems. Several outdoor units can support many indoor units (up to 64). The indoor units can be regulated individually.

Decentral systems

Single split units

Consist of an indoor and an outdoor unit and provide AC for one indoor zone

Self-contained (window/wall) units

Include window-mounted, through-the-wall AC units, and packaged terminal air conditioning, or PTAC, units. All components are enclosed in a single box to provide AC for one indoor zone.

Movable compact units

Small portable AC units that can be placed on the floor or a table

12 Ibid.

The number of commercial refrigeration and air conditioning units installed in MENA in 2050 is estimated to be 8 million and 93 million, respectively.

Decentralised systems have one AC unit that is served by one cold production unit. Typical decentral technologies are single split units, self-contained units, and portable compact units.

Decentralised systems like single split units are the predominant technologies for small-scale commercial and residential applications in MENA and Türkiye, while centralised systems are used more for large-scale commercial applications, including district cooling.

The demand for VRF systems is growing thanks to their efficiency. They are particularly popular in offices, stadiums, and supermarkets. In the residential sector, ductable splits are expected to dominate the region's space cooling market due to the significant number of high-rise developments, particularly in the UAE and Saudi Arabia.[13]

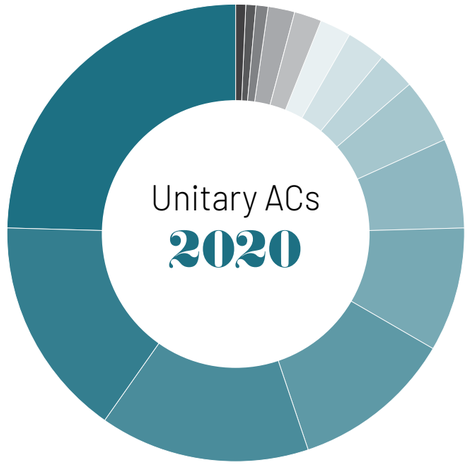
Early front-runner technologies have not been used at scale in the regional market yet or are still considered a niche product serving a specific demand. That said, there are a few good practice examples of sustainable AC solutions deployed across the region. These systems use natural refrigerants or are powered by renewable energy. See *Chapter 4.1. Current cooling technologies being used in the region* for more information.

Türkiye had the largest stock of installed AC equipment in existing buildings in 2020, with nearly 7.7 million units, followed by Saudi Arabia (5.6 million), Egypt (5.3 million), and Iran (4.1 million). These four countries are projected to remain market leaders in 2050.[14]

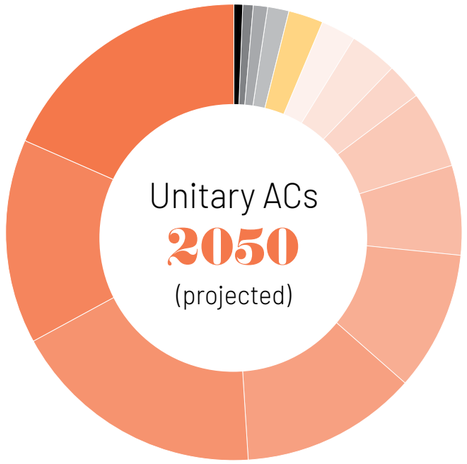
13 Oommen, "MENA HVAC market to grow 'at significant rate' till 2026."

14 Green Cooling Initiative, "Global greenhouse gas emissions from the RAC sector." Data for Iraq not available.

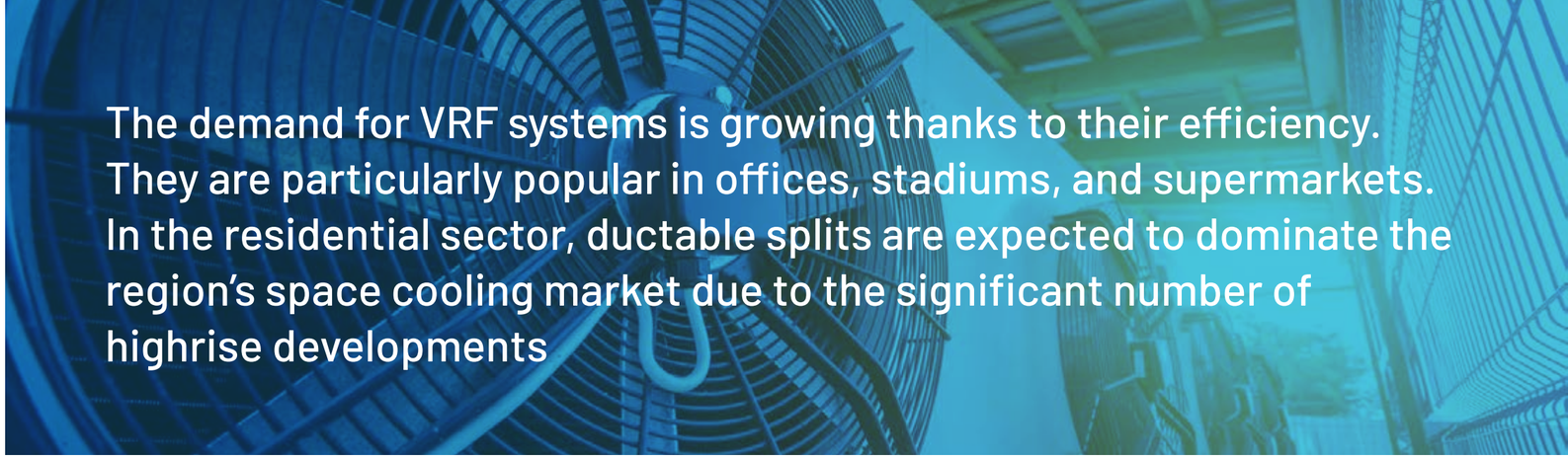
Unitary ACs by country in 2020 and 2050



24.6%	Türkiye
15.7%	Saudi Arabia
14.8%	Egypt
11.5%	Iran
8.7%	Algeria
6.4%	UAE
4.6%	Morocco
2.7%	Libya
2.7%	Syria
2.3%	Kuwait



18.4%	Türkiye
14.5%	Saudi Arabia
18.1%	Egypt
12.7%	Iran
9.8%	Algeria
6.3%	UAE
5.7%	Morocco
2.5%	Libya
3.3%	Syria
2.6%	Kuwait
2.3%	Tunisia



The demand for VRF systems is growing thanks to their efficiency. They are particularly popular in offices, stadiums, and supermarkets. In the residential sector, ductable splits are expected to dominate the region's space cooling market due to the significant number of highrise developments

Commercial refrigeration market and technologies

Most of the conventional commercial refrigeration technologies available on the global market are also available in MENA and Türkiye, with the adoption of said technologies varying from one country to another.

The commercial refrigeration technologies can be divided into three categories: centralised systems, condensing units, and stand-alone plug-in units.

These systems and units can either operate between 0°C and 8°C (medium temperature) for chilled produce, or between -18°C and -25°C (low temperature) for frozen products.

There are some examples of natural refrigerants and other sustainable solutions being adopted in MENA and Türkiye's commercial refrigeration sector, such as transcritical CO_2 systems and R290 (propane)-based refrigerated cabinets, however uptake is slow and on a small scale. See *Chapter 4.1. Current cooling technologies being used in the region* for more information.

Centralised Systems

Large distributed systems with multiple evaporators connected to a remote compressor pack and external condenser.
These systems can serve multiple cooling loads.

Central direct systems
The primary refrigerant is cooled in a direct expansion process and then circulated to cool the targeted medium, typically food.

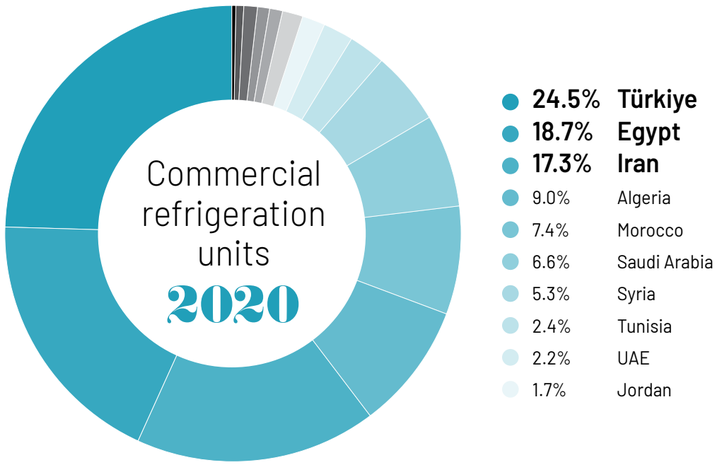
Central indirect systems
This includes an intermediate step where the primary refrigerants cools a secondary refrigerant, which is then circulated to cool the targeted medium.

CONDENSING UNITS
The evaporator in the refrigerated space is connected to a remote compressor and condenser. These systems can serve up to three cooling loads.

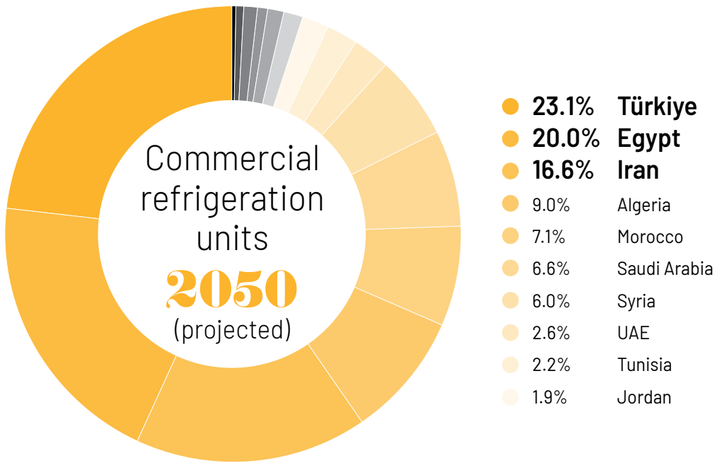
STAND-ALONE UNITS
Small, compact plug-in appliances that are similar to home refrigeration appliances. These systems can serve only one cooling load.

Türkiye also had the largest stock of commercial refrigeration units (in stock) in 2020, with 1.4 million units, followed by Egypt (1.1 million), Iran (987,000), and Algeria (514, 000). These four countries are projected to remain market leaders in 2050.[15]

Commercial refrigeration units (in stock) by country in 2020 and 2050

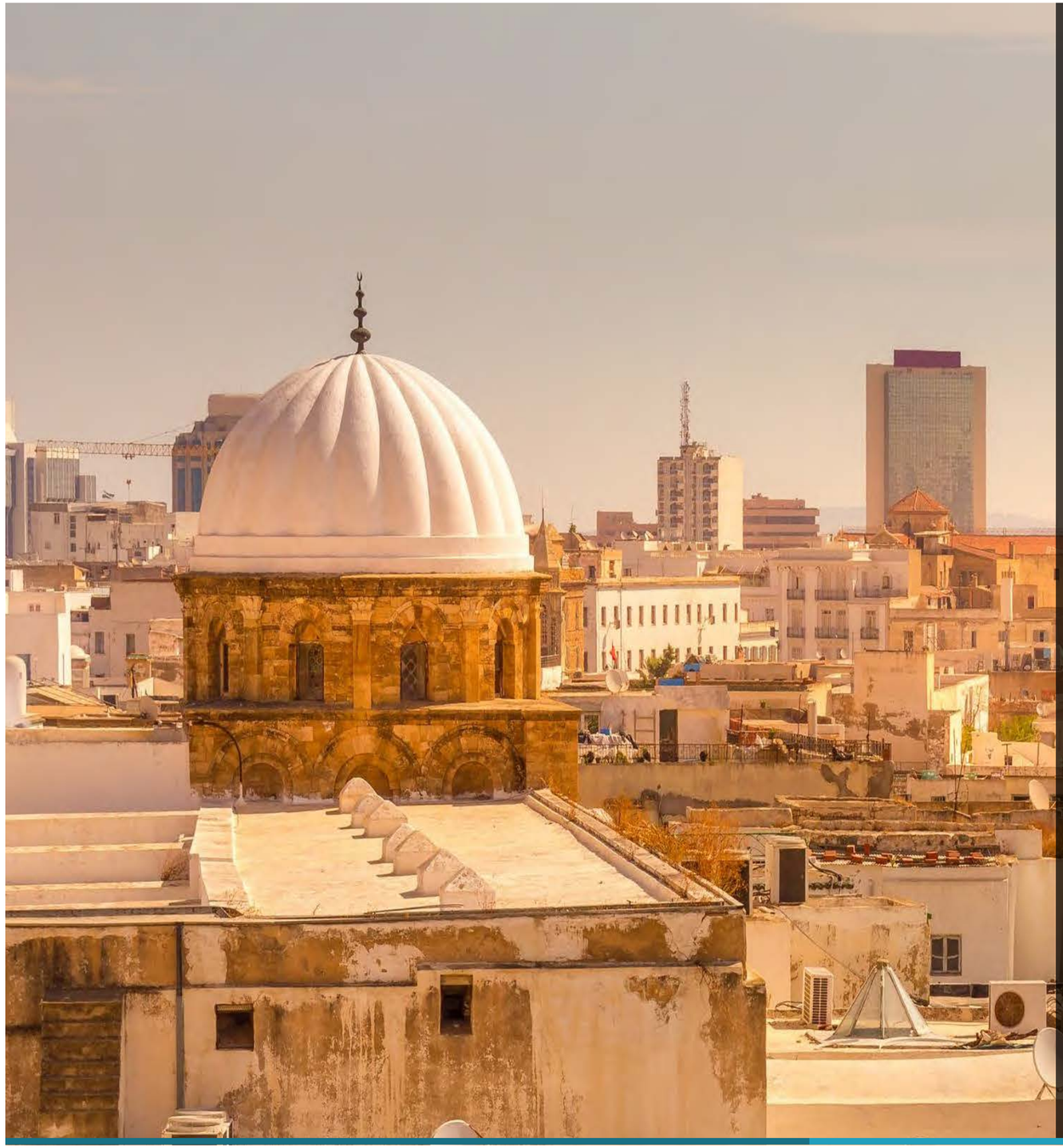


24.5%	**Türkiye**
18.7%	**Egypt**
17.3%	**Iran**
9.0%	Algeria
7.4%	Morocco
6.6%	Saudi Arabia
5.3%	Syria
2.4%	Tunisia
2.2%	UAE
1.7%	Jordan



23.1%	**Türkiye**
20.0%	**Egypt**
16.6%	**Iran**
9.0%	Algeria
7.1%	Morocco
6.6%	Saudi Arabia
6.0%	Syria
2.6%	UAE
2.2%	Tunisia
1.9%	Jordan

15 Green Cooling Initiative, "Global greenhouse gas emissions from the RAC sector." Data for Iraq not included.



Policy landscape

Governments and their policies play a vital role in supporting the transition to sustainable cooling solutions. Not only do governments make commitments on behalf of their public and private sectors, but they are also responsible for monitoring progress to ensure their pledges turn into actions that have the desired impact.

Whether it's phasing down the use of F-gases, improving the energy efficiency of buildings and RAC technologies, or deploying passive cooling solutions, there are several policy-based approaches being adopted by governments across MENA to accelerate the adoption of sustainable cooling solutions.

International protocols and agreements

The Montreal Protocol and its Kigali Amendment

The Montreal Protocol was adopted in 1987 in an effort to phase out the production and consumption of ozone depleting substances (ODS), such as chlorofluorocarbons (CFCs) and HCFCs, both of which are commonly used in RAC technologies.

Initially, more than 30 countries signed the Montreal Protocol and as of 2015, all UN Member States had ratified the agreement, making it the first treaty in the history of the UN to achieve universal adoption. *See Section 5.1 of this report to learn more about the success of the Montreal Protocol.*

As the world transitioned away from CFCs and HCFCs, HFCs became the go-to alternative for many in the RAC sector. While HFCs do not contribute to the depletion of the ozone layer, they are super-potent GHGs that can have extremely high global warming potential (GWP). The GWP of HFCs can be many thousands of times higher than CO_2.

Without action, HFC emissions alone could cause a global temperature increase of 0.35°C to 0.5°C by the end of the century.

In recognition of the impact HFCs have on our warming climate, the international community came together in 2016 to establish a plan of action. And so the Kigali Amendment to the Montreal Protocol was adopted.

Under the Kigali Amendment, which is a legally binding multilateral agreement, parties have committed to a staggered phasedown of HFCs. By mid-century, parties should have reduced the production and consumption of HFCs by at least 80%.

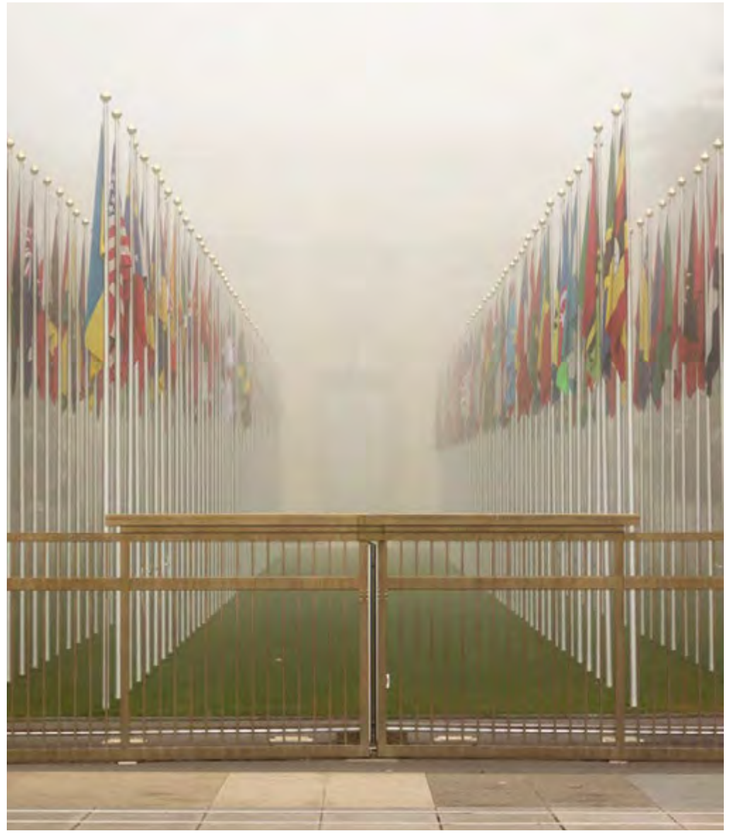
If fully implemented, the Kigali Amendment has the potential to avoid up to 0.4°C of global warming by 2100. In effect, the Kigali Amendment can contribute significantly to GHG emissions reduction targets, thus providing a crucial opportunity to meet the Paris Agreement's long-term goals.

Within the Kigali Amendment, there are different baseline years and phasedown schedules for different groups of countries: Article 5 and Non-Article 5. Within Article 5 parties, there are two further categories: Group 1[16] and Group 2[17] (see following graphics for Article 5 parties' phasedown schedule).

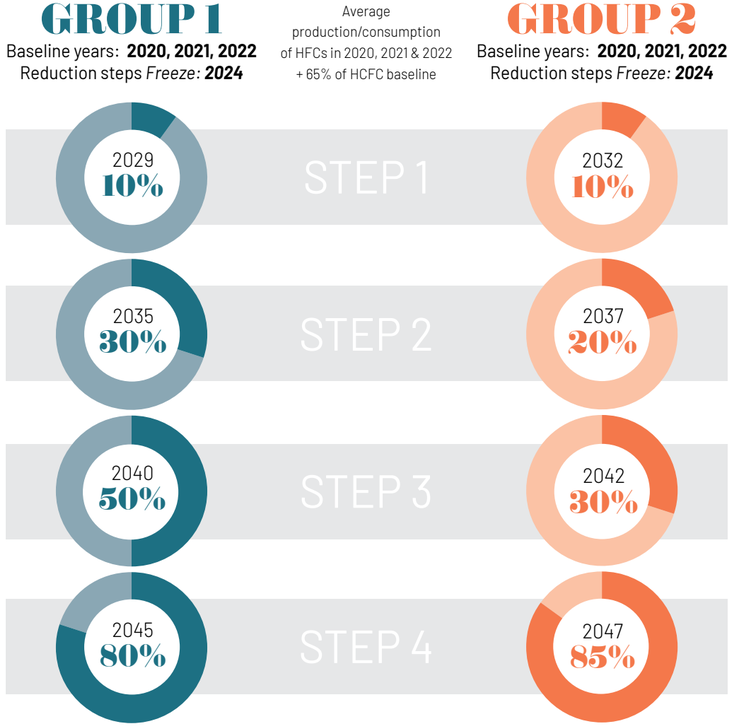
16 Article 5 - Group 1 includes Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, and Türkiye.

17 Article 5 - Group 2 includes Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE.

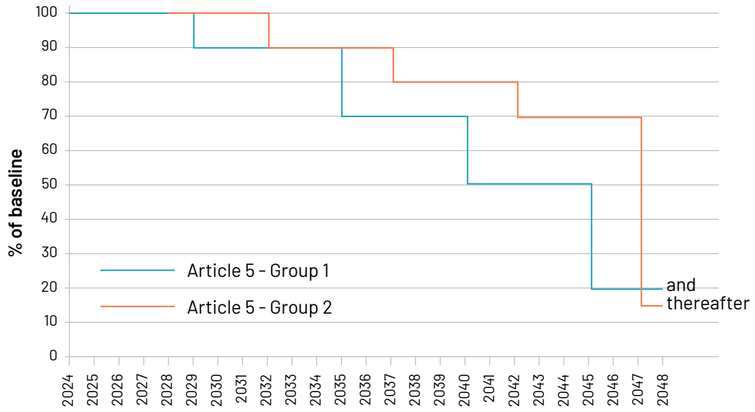
If fully implemented, the Kigali Amendment has the potential to avoid up to 0.4°C of global warming by 2100.



Parameters for HFC phase down in Article 5 Group 1 and Group 2 countries[18]



18 UN Environment Programme, "The Kigali Amendment to the Montreal Protocol: HFC Phase-down."



HFC phase-down schedules for Article 5 Group 1 and Group 2 countries

As of October 2023, 155 parties have ratified the Kigali Amendment globally.[19] Across the region, seven countries—Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia, and Türkiye—have ratified the Amendment, with Egypt having formalised ratification on 22 August, 2023. According to the UAE's NDC, it is also preparing to ratify the amendment.

The UAE's commitment was reconfirmed in September 2023 when the GCC countries—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE—expressed their intention to proceed with ratification.[20]

For developing countries in the region, the phasedown of HFCs from 2024 combined with obligations to phase out ODS by 2030 represents both opportunities and challenges for the sector's transition to sustainable alternatives.

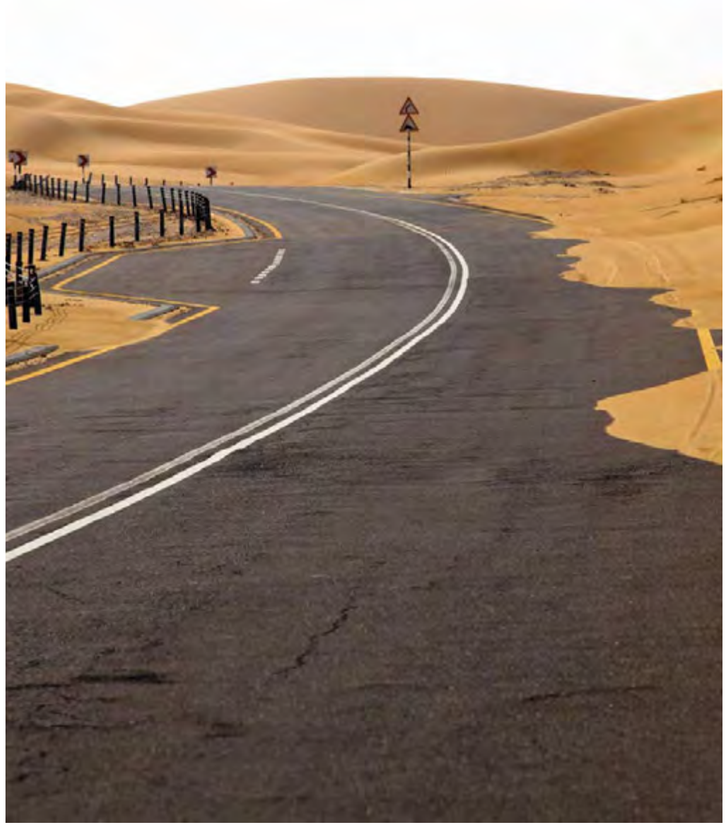
The Paris Agreement

Adopted by 196 parties at the 21st UN Climate Change Conference (COP21) in Paris in December 2015, the Paris Agreement aims to limit global warming to less than 2°C, preferably to 1.5°C, above pre-industrial levels.

19 Country Data: All ratifications, UNEP

20 Al Fahaam, "UAE commends consensus of GCC countries to ratify the Kigali Amendment to the Montreal Protocol."

Across the region, seven countries —Egypt, Jordan, Lebanon, Morocco, Syria, Tunisia, and Türkiye— have ratified the Kigali Amendment.



15 countries across the region have submitted an NDC.

To limit temperature rise, countries have committed to reduce GHG emissions and build resilience via mandatory plans known as nationally determined contributions (NDCs). Revised on a five-year cycle, NDCs are meant to "reflect an increasingly higher degree of ambition compared to the previous version."[21] Countries were required to submit their first NDC by 2020.

To date, 15 countries across the region have submitted an NDC.[22] Most recently, Egypt and Türkiye submitted revised versions of their first NDC in June 2022 and April 2023, respectively. The UAE submitted its second NDC in 2022 in response to the Glasgow Climate Pact's request for all parties to revisit and strengthen their NDC targets by the end of 2022.

Libya and Iran have yet to submit their first NDCs, although the latter has indicated that it intends to do so.

Of the 15 countries that have submitted an NDC, 12 have made some reference to their RAC sector, which is three more than previously reported[23]. Efforts include reducing HFCs, improving the energy efficiency of RAC technologies, investing in district cooling, and developing an NCAP. However, most targets connected to the cooling topic are minor impact areas and cluster around general topics like increasing the energy efficiency of technical building systems.

21 UN Climate Change, "The Paris Agreement."

22 Algeria (first - 2016), Bahrain (first, revised - 2021), Egypt (first, revised - 2022), Iraq (first, revised - 2021), Jordan (first, revised - 2021), Kuwait (first, revised - 2021), Lebanon (first, revised - 2021), Morocco (first, revised - 2021), Oman (second - 2021), Qatar (first, revised - 2021), Saudi Arabia (first, revised - 2021), Syria (first - 2018), Tunisia (first, revised - 2021), Turkiye (first, revised - 2023), UAE (second - 2022).

23 Cool Up, "MENA Region Cooling Status Report: Progress, Opportunities, and Insights | Issue 1."

Examples of cooling commitments in NDCs around the region

COUNTRY	NDC COOLING COMMITMENT
Egypt	• Enhance energy efficiency within the tourism sector through improved building envelope, efficient heating, ventilation and air conditioning (HVAC) systems, and guest behaviour change.
Iraq	• Change the specifications of electrical equipment used in the electricity sector to cope with the increasing temperatures
Jordan	• Promote the joint action on the Kigali Amendment and the Paris Agreement to achieve a significant reduction of high-GWP HFCs and encourage the efficient cooling technologies. • Pilot interventions to scale-up the sustainable use of cooling technologies with climate-friendly gases. • Introduce climate-responsive building techniques to reduce cooling-related energy demand.
Kuwait	• Use of district cooling systems in projects for new residential cities. • Establish rules for the efficiency of electrical appliances used in buildings, such as AC systems.
Lebanon	• Develop a National Cooling Plan.
Morocco	• Energy labels for refrigerators and AC • Act early on the reduction of HFCs and introduce climate-friendly, low-GWP solutions.
Oman	• Mandatory energy efficiency requirements for ACs. • Expand energy efficiency regulation to include refrigerators, refrigerator-freezers, and freezers.
Qatar	• District cooling • Energy labelling for all electronic devices, including ACs.
SaudiArabia	• Improve energy efficiency in targeted sectors including home appliances and AC units.
Tunisia	• Launch an HFC-reduction program, to comply with the objectives of the Kigali Amendment. • Launch the PROMOFRIGO and PROMOCLIM projects to tackle the HFC bank by recovering and destroying refrigerants in old equipment.
Türkiye	• Set goals to increase energy savings and use of renewable energy for heating and cooling by switching to central and district heating systems in mass housing complexes and large settlement units • Prepare National Cooling Action Plan covering sustainable and natural cooling technologies, as well as innovative financing solutions and higher energy efficiency cooling gases. • The Kigali Implementation Plan will be adopted as the National Strategy Document for the phasing down of HFCs and will enter into force in 2024. • Increase the use of energy-efficient household appliances.
UAE	• District cooling • Efficiency standards and labels for AC and refrigeration units.

Of the 15 countries that have submitted an NDC, 12 have made some reference to their RAC sector, which is three more than previously reported.

As global temperatures and GHG emissions levels continue to rise, committing to action on sustainable cooling in NDCs demonstrates a clear understanding of the opportunities it presents, both in terms of climate mitigation and adaptation. Globally, more than 100 countries have now included cooling-related efforts in their NDCs, up from just six in 2015.

Globally, more than 100 countries have now included cooling-related efforts in their NDCs, up from just six in 2015.

This positive trend indicates a clear shift in perception around the importance of sustainable cooling and the risk of inaction.

While not legally binding, countries are increasingly developing long-term strategies and making net-zero commitments.

To date, eight countries in the region have set net-zero goals, with Lebanon, Morocco, Oman, Tunisia, and the UAE committing to net zero by 2050; Türkiye committing to net zero by 2053; and Bahrain and Saudi Arabia committing to net zero by 2060.

Cooling is included in some of the region's long-term strategies. For example, Oman's net-zero strategy specifies a focus on improving the energy efficiency of AC units, implementing district cooling as a means of cooling existing buildings, and integrating passive cooling design into building standards.[24]

24 Oman, "The Sultanate of Oman's National Strategy for an Orderly Transition to Net Zero."

National plans and policies

National Cooling Action Plans

NCAPs provide a roadmap for a country's cooling needs and practices, with a focus on meeting these needs with sustainable solutions.

In recognition of cooling's cross-cutting nature, NCAPs integrate cooling-relevant policies that are often addressed separately—for example energy, climate, health, agriculture, housing, etc.—into one strategy to realise cumulative benefits.

NCAPs typically identify groups that are vulnerable due to a lack of cooling, promote the adoption and increased stringency of MEPS, support the phasedown of HFCs, and identify potential financial mechanisms for cooling. They can also include measures to support countries' efforts to achieve international climate and development goals such as the Kigali Amendment to the Montreal Protocol, the Paris Agreement, and the UN SDGs.

Cool Up is working with government and industry stakeholders in its four programmatic countries to support the development of NCAPs. The programme is also sharing its knowledge and expertise with others across the region to encourage other countries to follow suit.

To date, Lebanon is the only country in the region to have developed an NCAP, having launched its "Guidance for Integrating Efficient Cooling in National Policies in Lebanon"[25] in May 2021. Türkiye[26] and Jordan[27] are also in the process of developing NCAPs in close collaboration with the Cool Up programme.

Cool Up is working with government and industry stakeholders in its four programmatic countries to support the development of NCAPs.

Cool Up is working with government and industry stakeholders in its four partner countries; Egypt, jordan, Lebanon and Türkiye, to support the development and implementation of NCAPs.

25 UN Development Programme, "Guidance for Integrating Efficient Cooling in National Policies in Lebanon."

26 Cool Up, "Launch of National Cooling Action Plan in Türkiye."

27 Cool Up, "First draft of Jordan's National Cooling Strategy shared with stakeholders."

National F-gas regulation

Beyond the Montreal Protocol and its Kigali Amendment, some countries are choosing to implement their own national regulations on F-gases. For example, the EU F-gas Regulation, which is enforced across its 27 member states, and the United States' American Innovation and Manufacturing Act, set the HFC phasedown within the regional/national context.

Türkiye has fully harmonised its national F-gas regulation with the EU to ensure compliance with the bloc. Tunisia has plans for an "HFC use reduction program" and the UAE has announced it will be updating its regulatory framework to address F-gases, according to their respective NDCs.

Many countries in the region, such as Egypt, Jordan, Lebanon, and Türkiye, have HCFC Phaseout Management Plans (HPMP) in place to detail their national approach to reducing the use of HCFCs.

National Energy Efficiency Action Plans

National Energy Efficiency Action Plans (NEEAPs) detail a country's broad approach to long-term market transformation. Typically, they estimate national energy consumption and set out measures to improve energy efficiency. While NEEAPs are not cooling-specific, some include the RAC sector due to its high energy use.

The majority of the region's countries have a NEEAP, or a similar plan, either in place or under development. Some include cooling-specific targets, however the sector is largely given little to no attention. Most include reference to building-related or general energy efficiency goals, which would typically have a knock-on effect for the RAC sector.

Efficiency standards and labels

Minimum Energy Performance Standards (MEPS) specify the maximum amount of energy appliances—like an AC or refrigerator—can use. They are an important tool for improving energy efficiency, which in turn reduces energy consumption and GHG emissions.

MEPs create driving force the market towards more energy-efficient technologies and efficiency labels communicate an appliance's energy consumption with consumers, helping them to make more informed decisions when purchasing electronics.

To achieve net-zero emissions by 2050, the average efficiency rating of new AC units must be approaching best-available technologies by 2035.[28]

While many countries have developed efficiency standards and labels for domestic AC and refrigeration appliances, few have established such policies for commercial refrigeration equipment.[29]

Across MENA and Türkiye, most countries have some form of energy labelling and/or efficiency standard for RAC technologies. As of 2022, more than 73% of residential cooling in the Middle East was covered by MEPS, up from just 30% in 2010.[30] However, not all RAC technologies are covered by such policies and there is significant room for enhanced ambition in many countries. Examples of these policies can be found on the next page.

If countries across the region adopted more ambitious MEPS, by 2040, the region could reduce its annual energy consumption from room ACs and commercial refrigeration equipment by 13.8% and 17.8%, respectively. These energy savings would result in emissions reductions of around 82.6Mt of CO_2e and USD 5.4 billion (EUR 4.95 billion) in energy costs each year. Savings could increase significantly with more ambitious efforts.[31]

28 International Energy Agency, "Space Cooling."

29 United for Efficiency, "Unfreezing the savings potential of commercial refrigeration equipment."

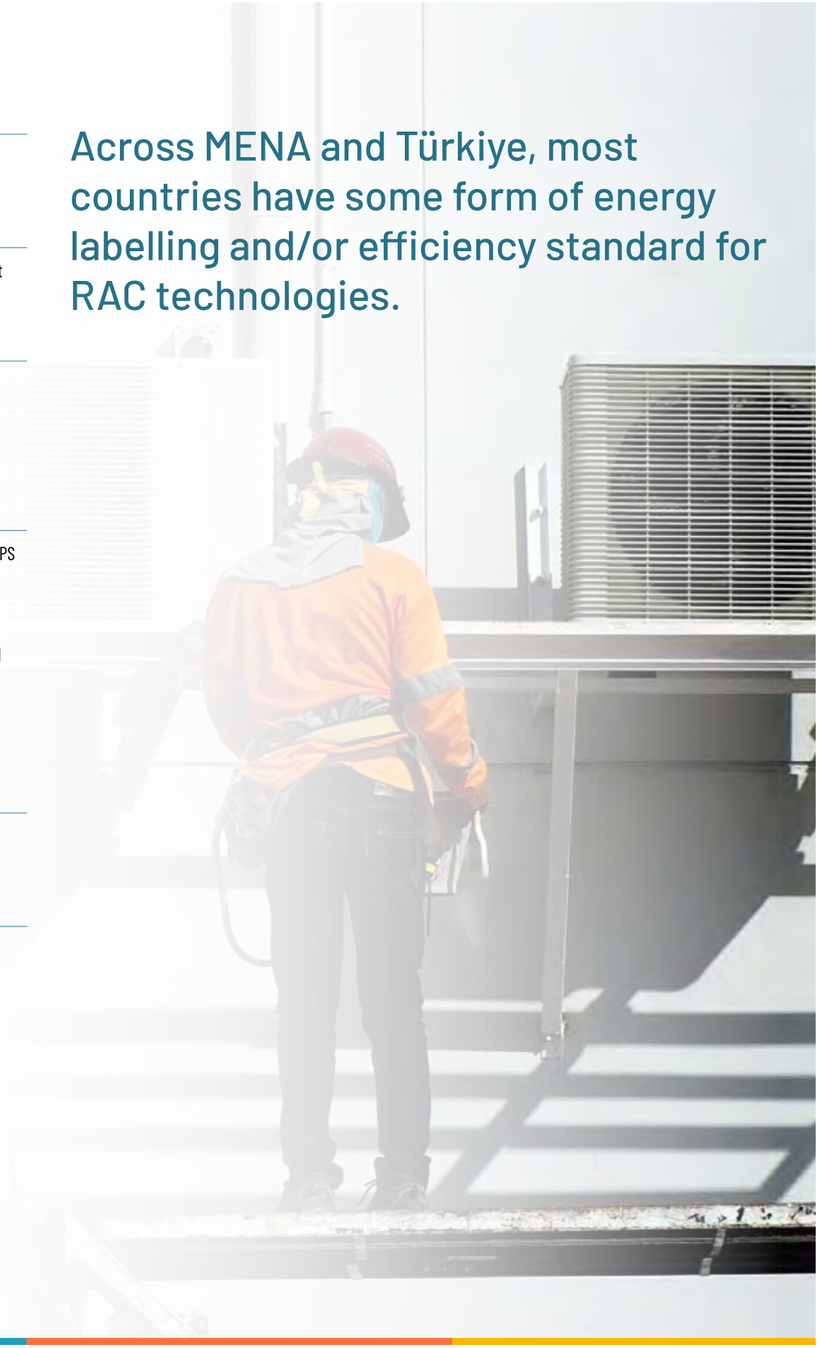
30 International Energy Agency, "Space Cooling."

31 United for Efficiency, "Country Savings Assessments."

Table 2: Examples of RAC efficiency standards and labels in place across MENA and Türkiye[32]

COUNTRY	REFRIGERATION	AIR CONDITIONING
Algeria[33]	• Mandatory comparative label and MEPS for domestic refrigeration appliances. • Adopted in 2010.	• Mandatory comparative label and MEPS for domestic ACs with a cooling capacity of less than 12 kW. • Adopted in 2010.
Bahrain	• n/a	• Mandatory comparative label and MEPS for a range of residential, commercial, and industrial AC applications. • Adopted in 2015 and revised in 2018.
Egypt	• Mandatory comparative label and MEPS for refrigerators, refrigerator-freezers, and freezers less than 480 volts. • Adopted in 2003 and revised in 2018.	• Mandatory comparative label for a variety of AC applications. • Adopted in 2003 and revised in 2018.
Iran[34]	• Mandatory comparative label and MEPS for domestic refrigeration appliances and commercial refrigerated display cabinets. • Adopted in 1998 and 2007, respectively, and revised in 2012.	• Mandatory comparative label for room ACs. • Adopted in 2009.
Jordan	• Mandatory comparative label and MEPS for domestic refrigeration appliances up to 1,500 litres storage volume. • Adopted in 2013 and revised in 2014.	• Mandatory MEPS for ACs with a cooling capacity of up to 12 kW and comfort fans with an input of 125 W. • Adopted in 2013 and revised in 2014. • Mandatory comparative label for ACs with a cooling capacity of up to 12 kW. • Adopted in 2012 and revised in 2013.
Morocco	• Mandatory comparative label for domestic refrigeration appliances. • Adopted in 2010 and revised in 2011. • Plans to implement MEPS for energy-efficient refrigerators, with the potential to avoid 4,818 GtCO2e between 2020 and 2030. [35]	• Mandatory comparative label and MEPS for domestic ACs. • Adopted in 2018. • MEPS for ACs could avoid 1,813 $GtCO_2e$ between 2020 and 2030.
Oman	• Mandatory comparative label and MEPS for refrigerators currently under development.	• Mandatory comparative label and MEPS for a range of AC appliances and equipment with a cooling capacity of up to 20 kW. • Adopted in 2019.
Qatar	• Mandatory comparative label and MEPS for domestic refrigeration appliances. • Adopted in 2016.	• Mandatory comparative label and MEPS for split unit ACs. • Adopted in 2016.
Saudi Arabia	• Mandatory comparative label and MEPS for refrigeration appliances. • Adopted in 2007 and revised in 2018.	• Mandatory comparative label and MEPS for a range of "small" ACs. • Adopted in 2013 and revised in 2018. • Mandatory MEPS for a range of "large" AC equipment. • Adopted in 2016.
Tunisia	• Mandatory "EU-style" comparative label and MEPS for refrigerators. • Adopted in 2004 and revised in 2009. • Mandatory MEPS for a range of commercial and industrial refrigeration equipment, including refrigerators, freezers, ice makers, vending machines and walk-in cold rooms. • Adopted in 2010 and revised in 2012.	• Mandatory "EU-style" comparative label and MEPS for ACs with a power consumption of less than 12 kW. • Adopted in 2004 and revised in 2009 and 2012. • Mandatory MEPS for a range of commercial and industrial AC equipment. • Adopted in 2010 and revised in 2012.
Türkiye[36]	• Mandatory comparative label and MEPS for domestic refrigeration appliances. • Adopted in 2009.	• Mandatory MEPS for room ACs. • Adopted in 2012.
UAE	• Mandatory comparative label and MEPS for domestic refrigeration appliances with a capacity of less than 1,500 litres. • Adopted in 2013 and revised in 2020.	• Mandatory comparative label and MEPS for residential and commercial ACs. • Adopted in 2011 and 2014, respectively, and revised in 2019.

Across MENA and Türkiye, most countries have some form of energy labelling and/or efficiency standard for RAC technologies.



32 CLASP "Policy Search" and International Energy Agency, "Policy database."

33 Government of Algeria, "Appliances for domestic use subject to specific energy efficiency rules and powered by electricity."

34 Iran has also introduced labels and MEPS for a wide range of other cooling technologies and components, including fans, fan coils, compressors, and air handling units.

35 Morocco, "National Determined Contribution - Updated."

36 United for Efficiency, "Energy Efficiency Policy Assessment for Residential Refrigerators: Turkey."

Building energy codes

Building energy codes dictate the energy performance of a building and provide clear guidance on its features with the aim of enhancing efficiency, reducing emissions, and ensuring resilience. From a cooling perspective, this means including standards that promote thermally-efficient building design to reduce AC demand.

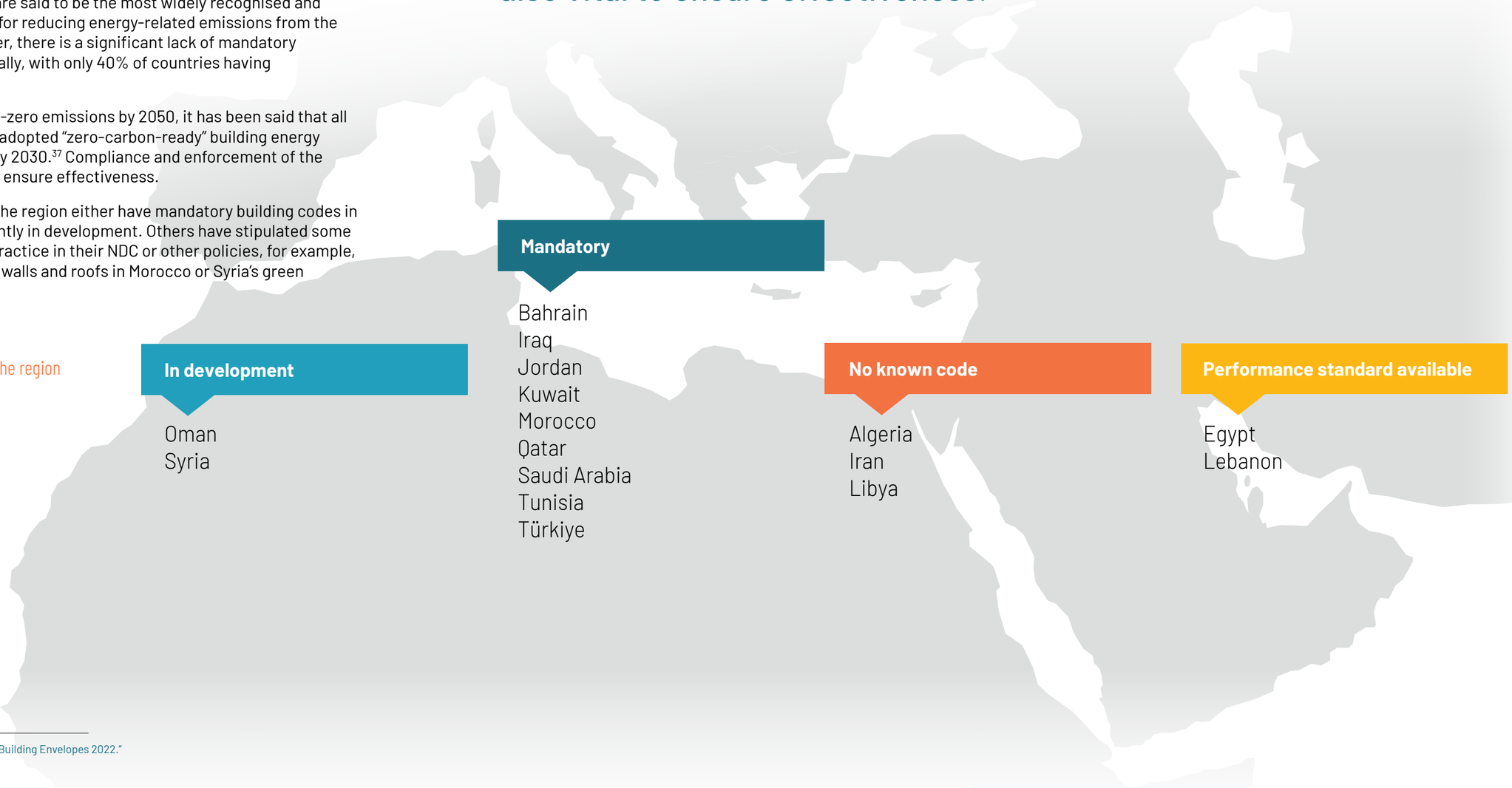
Building energy codes are said to be the most widely recognised and scalable policy actions for reducing energy-related emissions from the building sector. However, there is a significant lack of mandatory standards in place globally, with only 40% of countries having implemented them.

To stay aligned with net-zero emissions by 2050, it has been said that all countries need to have adopted "zero-carbon-ready" building energy codes for all buildings by 2030.[37] Compliance and enforcement of the policies are also vital to ensure effectiveness.

Most countries across the region either have mandatory building codes in place, or they are currently in development. Others have stipulated some sort of green building practice in their NDC or other policies, for example, the promotion of green walls and roofs in Morocco or Syria's green architecture guide.

To stay aligned with net-zero emissions by 2050, all countries need to have adopted "zero-carbon-ready" building energy codes for all buildings by 2030. Compliance and enforcement of the policies are also vital to ensure effectiveness.

Building energy codes in the region



37 International Energy Agency, "Building Envelopes 2022."

Financial landscape

As initial investment costs are generally considered to be a significant barrier to the adoption of sustainable cooling, access to financing is a must. Financial support is needed both for driving technological innovation and for ensuring the rapid and wide-spread deployment of solutions.

Financing sustainable cooling offers significant climate mitigation benefits through greater energy efficiency and the phase down of F-gases, both of which result in lower GHG emissions. It also provides resilience and adaptation benefits via improved access to thermal comfort in a warming world.

Due to the wide range of RAC technologies, end-uses, and sectors, financing options are equally varied, creating a complex landscape. Finance products can range from commercial loans and government tax incentives, to international development finance and innovative business models.

To date, there have been relatively few examples of financial mechanisms that demonstrate how to support the transition to sustainable cooling, including in MENA and Türkiye.

International finance

Financial support from the international community is necessary if MENA and Türkiye are to meet their climate and development goals, which includes its transition to sustainable cooling solutions. However, to date, the flow of climate finance to the region has been significantly limited, with less than 3% of global funding for climate initiatives from 2019 to 2020 being spent in the Middle East.[38] Similar levels of investment are seen for renewable energy finance in the region, with around 2.5% of funding going to MENA.[39]

Once finance reaches the region, the allocation of funds has historically been uneven, with the majority of international finance being dedicated to a few large-scale energy projects in a few countries.[40]

International financial institutions (IFIs), and particularly, development banks and bilateral donors, play a crucial role in financing sustainable development efforts in developing countries and transitional economies. Through financial support, these institutions aim to reduce poverty, improve living conditions, and promote regional cooperation. They have a long history of helping developing countries realise the benefits of international agreements like the Paris Agreement and the Kigali Amendment via the development and implementation of a range of national policies and programmes.

Such institutions tend to focus on specific areas of development and have dedicated funds to support this work. For example, in 2021, the Green Climate Fund (GCF) allocated USD 157 million (EUR 142 million) to help developing countries develop sustainable cooling solutions.[41]

Less than 3% of global funding for climate initiatives from 2019 to 2020 was spent in the Middle East.

38 Shehu Beetz et al, "Financing a Net-Zero Middle East."

39 IRENA, "Global landscape of renewable energy finance, 2023."

40 Overseas Development Institute, "Climate Finance Regional Briefing: Middle East and North Africa."

41 ESMAP, "World Bank Mobilizes USD$157 million for Clean Cooling from Green Climate Fund."

Financial support from the international community is necessary if MENA and Türkiye are to meet their climate and development goals, which includes its transition to sustainable cooling solutions.

The GCF has also recently approved USD 1.4 billion (EUR 1.3 billion) in funding to enhance climate resilience in the construction sector with a focus on energy-efficient building design and operation. The programme will be implemented in 11 countries, including Tunisia and Morocco.[42]

Alternatively, IFIs can have regional programmes that dedicate funding to support regional agendas. For example, the World Bank and the International Finance Corporation (IFC) have committed to invest USD 10 billion (EUR 9 billion) in climate-smart projects and policy reforms in MENA. The two organisations hope their investment could leverage an additional USD 2 billion (EUR 1.8 billion) in private sector financing.[43]

Additionally, a variety of donors, including France, Germany, the Netherlands, Sweden, and Japan, also channel their support to climate change mitigation and adaptation initiatives through the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), and multilateral climate funds, predominantly the Clean Technology Fund (CTF), and the GCF. The Islamic Development Bank and the African Development Bank (AfDB) also play key roles in the region.

On sustainable cooling specifically, development banks are said to recognise the need for greater collaboration on "transformational investments" in the sector. They have also committed to supporting governments that included cooling-related actions in their NDCs.[44]

42 Green Climate Fund, "FP194: Programme for Energy Efficiency in Buildings (PEEB) Cool."

43 World Bank Group, "Middle East & North Africa Climate Roadmap."

44 Cool Coalition, "Finance."

International philanthropic funding for sustainable cooling is also on the rise, however, it is still a relatively limited source of funding, with only USD 13 million (EUR 11.8 million) going to cooling-related projects each year between 2017 and 2021. Over the same period, USD 35 million (EUR 31.6 million) went to clean electricity annually. While philanthropic funding for climate change mitigation is growing, it accounts for a small fraction of overall philanthropic giving and more can be done to increase ambition.[45]

There are numerous development finance sources and programmes, we highlight only a selection of these in this report.

Tunisia - Pilot Program for Climate Resilience

The AfDB's Pilot Program for Climate Resilience (PPCR) aims to demonstrate how developing countries can integrate climate resilience into national development planning.[46]

The PPCR portfolio includes technical preparatory studies for the implementation of a sustainable district heating and cooling system at a medical facility in Tunis. According to the AfDB, the USD 1 million (EUR 900,000) project will help accelerate the clean energy transition and post-COVID 19 economic recovery.[47] The funding is going towards conducting the studies necessary to develop, implement, and operate the district heating and cooling system.

It is anticipated that the project will help to reduce the medical complex's GHG emissions by 40%, in addition to reduced energy bills, improved environmental performance, and the reduction of the use of chemicals on-site.

The Government of Tunisia is currently recruiting a consulting firm for the project, which is due to be completed in mid-2024.

45 ClimateWorks Foundation "Funding trends 2022: Climate change mitigation philanthropy."

46 African Development Bank Group, "Pilot Program for Climate Resilience."

47 African Development Bank Group, "Pilot Program for Climate Resilience : AfDB-PPCR Portfolio."

International philanthropic funding for sustainable cooling is also on the rise, however, it is still a relatively limited source of funding, with only USD 13 million (EUR 11.8 million) going to cooling-related projects each year between 2017 and 2021.

Jordan, Morocco, and Tunisia - NDC Support Facility

In 2020, it was announced that 10 countries—Jordan, Ethiopia, Cambodia, Viet Nam, Burkina Faso, Nigeria, Pakistan, Morocco, Chile, and Tunisia—would receive funding to improve access to sustainable cooling.[48]

Jordan's funded project included work on cooling-related mitigation efforts, the development of a cooling action plan, and pilot interventions in public schools.

Morocco focused more on the efficiency of RAC appliances, with plans to strengthen efficiency standards and develop policies to support its HFC phasedown.

Tunisia included work on passive cooling building design, updating national efficiency standards and labels, and developing financial mechanisms to encourage the uptake of sustainable domestic appliances.

While philanthropic funding for climate change mitigation is growing, it accounts for a small fraction of overall philanthropic giving and more can be done to increase ambition.

48 Kigali Cooling Efficiency Program, "How countries can enhance Nationally Determined Contributions in 2021 with climate-friendly cooling."

National finance

National-level finance is also needed to help drive the region's RAC markets towards sustainable technologies and solutions through mechanisms like loans, rebates, tax incentives, bulk procurement, on-bill financing, cooling-as-a-service (CaaS), and many others.

While around 42% of the climate finance distributed in MENA came from domestic sources between 2011 and 2020,[49] regional stakeholders need to significantly scale up their investments in climate mitigation and adaptation.

For example, it has been estimated that the region's Arab countries will need a minimum of USD 230 billion (EUR 207.9 billion) each year to support the achievement of the United Nations' SDGs.[50]

The 2008 financial crisis and the COVID 19 pandemic have stretched public funding in the region—and globally—however financial institutions in MENA control hundreds of billions of dollars in sovereign wealth funds (SWFs), which will play a crucial role in funding climate-related initiatives. As will public savings, existing plans for economic transformation, and private-sector funding.[51]

Alternative funding sources are starting to be explored in the region, with some countries establishing small-scale and voluntary carbon markets.

The development of green bonds is also on the rise in MENA, with stakeholders in a number of countries issuing bonds worth hundreds of millions of dollars to help fund sustainable projects. That said, the region represents an extremely small portion of the global green bonds market, presenting a valuable opportunity in the region.

Although the majority of climate finance is anticipated to be funded by the private sector, the region's governments are largely responsible for mobilising and channelling said finance, and ensuring it is channeled to the most impactful initiatives in a timely manner. This is an ongoing challenge and they must make sure the necessary tools and frameworks are in place to support efforts.[52]

Regional stakeholders need to significantly scale up their investments in climate mitigation and adaptation.

49 Naran et al, "Global Landscape of Climate Finance: A Decade of Data."

50 Arab Forum for Environment and Development, "Financing Sustainable Development in Arab Countries."

51 Ahmed, "How MENA countries are adapting to and mitigating climate change."

52 Bin Rashid, "Financing a green transition in the Middle East."

Future-proof cooling: Taking a leading role in international climate action

Global leadership in sustainable cooling

MENA and Türkiye have the potential to become global **leaders in sustainable cooling.**

There is a multitude of benefits that could be realised by leapfrogging from outdated appliances and equipment to next-generation technologies as regional cooling demand grows over the coming decades.

In addition to demonstrating global leadership, supporting the transition to sustainable cooling would help create skilled jobs, reduce energy demand, and increase independence from energy imports.

Taking a leading role in international climate action

MENA and Türkiye are exceptionally vulnerable to the impacts of climate change from heat stress and drought, to rising sea levels and food insecurity.

Transition to net-zero
The transition will require improvements in energy efficiency, a shift to renewable energy sources, and establishing alternative income sources as the world moves away from fossil fuels, which many economies in the region have relied upon for decades.

With Egypt hosting COP27 in 2022 and the UAE hosting COP28 in 2023, **the region is gaining attention on the international climate agenda.**

As the region moves to the front of the global climate discussion, all regional stakeholders are expected to demonstrate enhanced commitment to the cause with **effective collaboration and timely action.**

The region is also on the front lines when it comes to contributing to climate change with some of the highest per-capita emissions in the world. This is largely due to high urbanisation rates and a reliance on fossil fuels.

COP27 SHARM EL-SHEIKH EGYPT 2022

COP28 UAE

The UAE's COP28 Presidency announced cooling as a prominent feature at the 2023 climate change conference.

INTERVIEWS

"Cooling is essential to human health, food security, and economic productivity, and it is becoming more important as global mean temperatures increase and there are more extreme heat waves."

Xiaofang Zhou
Director of the Chemicals and Waste Hub at UNDP's Bureau for Policy and Programme Support

"Energy-efficient cooling systems can use up to 50% less energy than traditional systems, and natural refrigerants have a much lower GWP than F-gases. Additionally, passive cooling techniques, such as shading and natural ventilation, can reduce the need for mechanical cooling systems altogether"

Dr. Jauad El Kharraz
Executive Director at RCREEE

Climate threats and challenges in MENA and Türkiye

MENA and Türkiye are exceptionally vulnerable to the impacts of climate change. From heat stress and drought, to rising sea levels and food insecurity, the region is facing several climate-related threats.

The region is also on the front lines when it comes to contributing to climate change, with some of the highest per-capita emissions in the world.[53] This is largely due to high urbanisation rates and a reliance on fossil fuels. With populations in many countries across the region expected to double during the first half of the 21st century,[54] high per-capita emissions could prove to be catastrophic for regional and global emissions reductions efforts.

Stakeholders cannot ignore the multitude of benefits that could be realised by leapfrogging from outdated appliances and equipment to next-generation technologies as regional cooling demand grows over the coming decades.

The transition to net-zero will require improvements in energy efficiency, a shift to renewable energy sources, and establishing alternative income sources as the world moves away from fossil fuels, which many economies in the region have relied upon for decades. Regarding the RAC sector specifically, MENA and Türkiye also need to transition away from high-GWP refrigerants.

In addition to being important for the global climate mitigation agenda, MENA and Türkiye's sustainability efforts will also help limit the impacts of climate change within the region and build resilience among its communities and economies.

53 Our World in Data, "Greenhouse gas emissions."

54 UNICEF, "MENA Generation 2030."

As MENA moves to the front of the global climate discussion, all regional stakeholders are expected to demonstrate enhanced commitment to the cause with ambitious pledges, effective collaboration, and timely action.

With Egypt having hosted COP27 in 2022 and the UAE due to host COP28 in late 2023, all eyes are currently on the region.

As MENA moves to the front of the global climate discussion, all regional stakeholders are expected to demonstrate enhanced commitment to the cause with ambitious pledges, effective collaboration, and timely action.

While governments have a vital role to play with strong public policies and their enforcement, these efforts must be accompanied by strategic and impactful action from other stakeholders, particularly the private sector, which tends to be responsible for driving innovation. That said, companies in MENA are falling short on corporate ambition compared to businesses in other regions.

Meaningful impact will require global action from all stakeholder groups.

Global leadership in sustainable cooling

As the world works to phase out HCFCs under the Montreal Protocol, phase down HFCs under its Kigali Amendment, and cut GHG emissions under the Paris Agreement, as well as enhance cooling access, MENA and Türkiye have the potential to become global leaders in sustainable cooling.

Stakeholders cannot ignore the multitude of benefits that could be realised by leapfrogging from conventional appliances and equipment to next-generation technologies as regional cooling demand grows over the coming decades. It is also important to note that before turning to mechanical cooling, communities in MENA and Türkiye could benefit from returning to the region's roots by reviving traditional architectural styles, using locally sourced building materials, and working with ancient techniques of shading and tree-planting to provide natural, sustainable, and affordable cooling for residents.

In addition to demonstrating global leadership, supporting the transition to sustainable cooling would help create skilled jobs, reduce energy demand, and increase independence from energy imports. It would also significantly reduce subsequent investment costs by transitioning straight to future-proof solutions, such as natural refrigerant-based technologies, rather than finding a stop-gap with soon-to-be-obsolete HFC-based alternatives.

When it comes to the RAC sector, MENA and Türkiye face a unique set of challenges, from rising temperatures and varying levels of cooling access, to high per-capita GHG emissions and an inventory of ageing technologies. If countries within the region can successfully transition to sustainable cooling solutions, in spite of these challenges (among others), it will demonstrate what is possible and encourage other nations to follow suit.

Given the region's current position on the global stage, now is the time to enhance ambition and accelerate action on sustainable cooling.

Cool COP28

In recognition of sustainable cooling being critical for both global climate mitigation and adaptation efforts, the UAE's COP28 Presidency has announced that cooling will be a prominent feature at this year's climate change conference.[55] The topic will be a key theme that is highlighted as part of the conference's thematic program.

To catalyse international commitment on cooling ahead of COP28 and beyond, the UAE's COP28 Presidency is partnering with a number of organisations to develop the Global Cooling Pledge and a "Cool COP Menu of Actions." These two initiatives are designed to highlight the importance of sustainable cooling and stimulate global action on cooling, with a focus on nature-based solutions, super-efficient appliances, food and vaccine cold chains, district cooling, and NCAPs.

COP28 President Designate Dr. Sultan Al Jaber has urged all governments and other stakeholders to join the pledge ahead of this year's climate change conference.

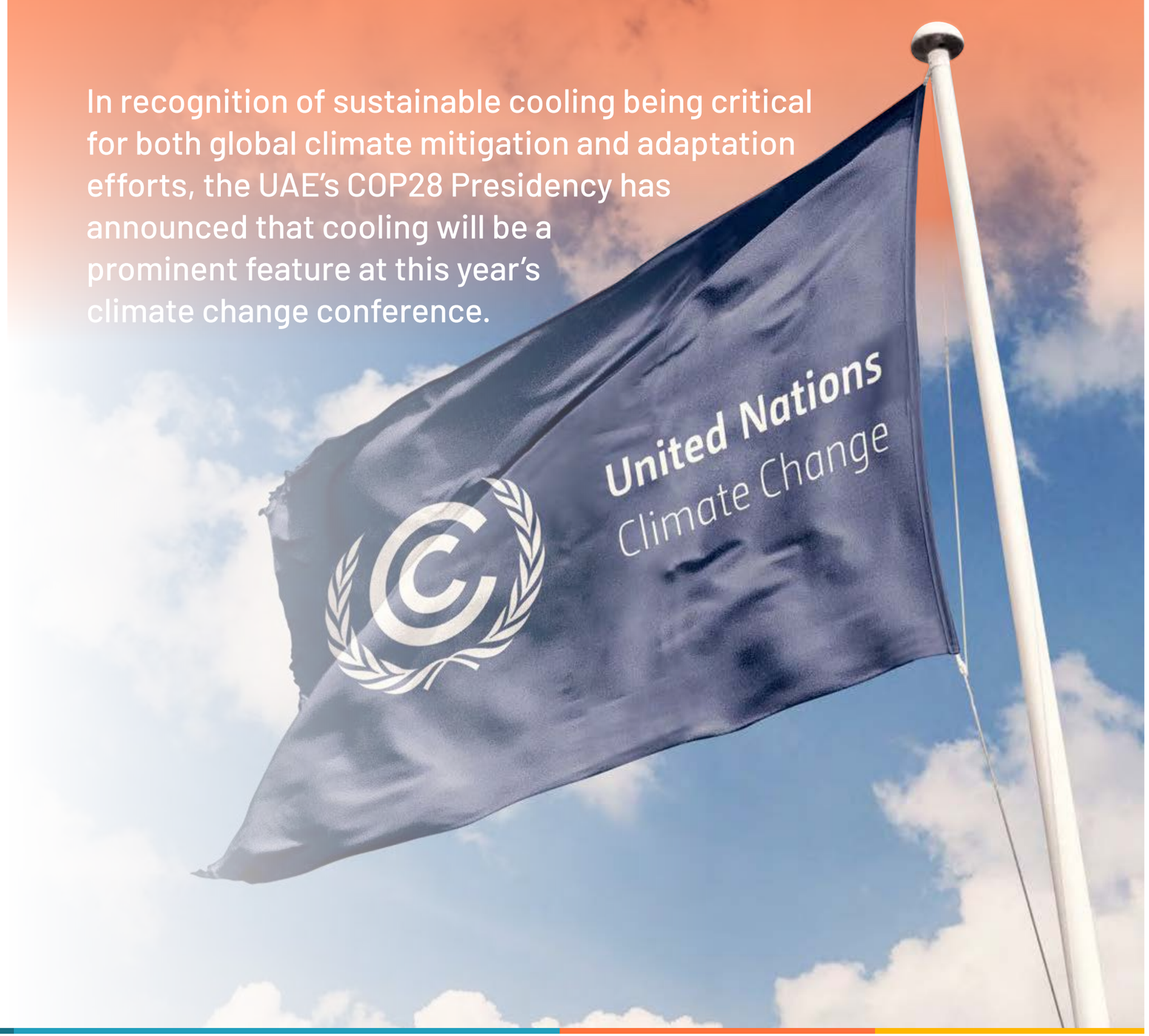
"We cannot expand cooling on a business-as-usual basis. Without strong policy action, emissions from the sector will rise 7%–10% from today. To solve this dilemma, we need a rapid transition to energy-efficient and climate-friendly cooling." - Dr. Sultan Al Jaber, COP28 President.[56]

Sustainable cooling will also be highlighted by a number of international and regional organisations at COP28, with several side events and pavilions featuring a range of cooling-related topics. This includes the This is Cool Challenge,[57] which features a Cool Up-sponsored prize for natural refrigerant-based sustainable cooling solutions, and Cool Up's participation in the "Montreal Protocol Advancing Climate Action" pavilion.

55 UN Environment Programme, "Partners announce new ambition on sustainable cooling for COP28."

56 COP28, "COP28 President Calls On All Countries to Join Global Cooling Pledge in the lead up to COP28

57 SEforALL, "Empowering Young Innovators Can Make Sustainable Cooling for All a Reality."



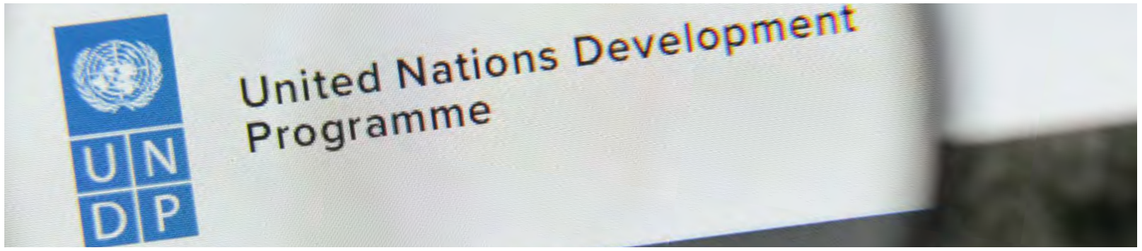
Interview: Xiaofang Zhou, United Nations Development Programme

The UN Development Programme's (UNDP) Chemicals and Waste Hub works to support developing countries in their management of chemicals and waste, implementation of international agreements, and transition towards a circular economy with sustainable production and consumption.

The Hub's initiatives help to protect human health, the ozone layer, and the climate by preventing pollution through the elimination of hundreds of hazardous chemicals, including ODS and high-GWP refrigerants. It has three decades of experience working in the cooling sector,[58] supporting governments and private sector organisations transition to environmentally- and climate-friendly cooling technologies and systems.

Cool Up met Xiaofang Zhou, Director of the Chemicals and Waste Hub at UNDP's Bureau for Policy and Programme Support, to learn more about to learn more about UNDP's work in the region.

58 UNDP, 'Sustainable cooling offer."



The MENA region is simultaneously one of the most challenging and the most promising areas for addressing the climate impact of cooling.

Cool Up:
How does UNDP view the MENA region's current contributions to and potential for addressing climate change and sustainability, particularly in the context of cooling technologies?

Xiaofang Zhou (UNDP):
The MENA region is simultaneously one of the most challenging and the most promising areas for addressing the climate impact of cooling. It is challenging due to the impact of crises and conflicts, which makes policy making more difficult, as well as the very high need for cooling, which is driven by high ambient temperatures.

Lebanon is an interesting example for the region. Its political and economic situations have been extremely challenging for several years now and compounded by the COVID 19 pandemic. In spite of these hurdles, the country continues to set a remarkable example in terms of implementing the Montreal Protocol, remaining one of the leaders in improved refrigerant management. It developed one of the most comprehensive and structured NCAPs to date—with the support of the Clean Cooling Collaborative and UNDP—which has inspired other countries to follow. On the other hand, however, Lebanon still does not have MEPS for cooling equipment so more work is needed.

Cool Up:
From UNDP's perspective, why is sustainable cooling a critical aspect of climate action, and how does it align with the broader SDGs?

Xiaofang Zhou (UNDP):
Cooling is essential to human health, food security, and economic productivity, and it is becoming more important as global mean temperatures increase and there are more extreme heat waves. However, cooling is currently estimated to consume 20% of the world's electricity and it is estimated that 14 billion cooling devices will be needed to meet the global demand by 2050. That is four times today's number. If unmanaged, this will result in increasing emissions from fossil-fuelled energy consumption and high-GWP refrigerants.

Through the 2019 Rome Declaration, parties to the Montreal Protocol stressed the importance of national action and international cooperation to promote the development of sustainable cold chains to reduce food loss. Many vaccines also require an unbroken cold chain, a challenge that was highlighted during the COVID 19 pandemic. As such, sustainable cooling is an essential part of sustainable development and climate action.

The climate impact of cooling can be mitigated by enhancing clean energy access, transitioning to low-GWP refrigerants, increasing the energy efficiency of cooling units, and integrating cooling and heating solutions with renewable energy.

The greatest potential for saving energy in cooling is through integrated system solutions such as district cooling, however, this potential is yet to be developed at scale. Integrated energy solutions for heating and cooling of buildings, coupled with renewable energy and waste heat can reduce energy consumption by up to 90% compared to stand-alone cooling units. Similar holistic approaches could be applied in the cold chain and energy intensive facilities such as shopping centres, large cold storage, food processors, hospitals, and hotels. The potential to decarbonise cooling through proper urban planning and systematic design is huge. At the same time, knowledge, technical, and financial gaps would need to be addressed in developing countries.

Cool Up:
In your opinion, what role can international partnerships and cooperation play in accelerating sustainable cooling initiatives in the MENA region?

Xiaofang Zhou (UNDP):
The Montreal Protocol has shown that international cooperation can help phase out the use of ODS at a reasonable financial cost to society and with immense benefits to human health and environment in the long run. However, to maximise the impact of sustainable cooling, we need to go beyond this level of cooperation.

What we notice is that the financial sector is still cautious to support end users' adoption of more sustainable cooling options. This prudent approach is understandable as more information is needed regarding the efficacy of the technologies, costs, the feasibility in MENA's specific climate, and the policy environment of each country, for example. Demonstration projects, including those implemented through the Cool Up programme, help to provide this type of information.

Our role is to help nurture partnerships with key stakeholders, particularly in the financial sector, to ensure they have access to the right information on the return on investment and are able to help fund the transition to low-GWP, energy-efficient technologies.

Cool Up:
Can you provide examples of how sustainable cooling contributes to broader environmental and socioeconomic improvements in the MENA region?

Xiaofang Zhou (UNDP):
I want to emphasise two examples here: cold chains and district cooling.

Strengthening cold chains in all countries across MENA will enhance food security and reduce the climate impact and economic cost of feeding the region's growing population. It can slash food loss and improve local farmers' access to regional or even international markets.

For district cooling, there are already numerous examples of efficient networks in the region, but there is potential for growth and improvement. As new cities and infrastructure are being developed in the MENA region, we should make sure that district cooling is consistently considered as an option during a project's conceptualisation stage.

The Montreal Protocol has shown that international cooperation can help phase out the use of ODS at a reasonable financial cost to society and with immense benefits to human health and environment in the long run.

One of the most promising areas for development is combining renewable energy production with cooling equipment.

Cool Up:
Looking ahead, what are UNDP's expectations for the MENA region's role in international climate action and sustainable cooling over the next decade?

Xiaofang Zhou (UNDP):
The MENA region has financial resources that can help further test the natural refrigerants solutions at scale, in very specific and demanding climatic conditions. This will be extremely beneficial to international climate action. One of the most promising areas for development is combining renewable energy production with cooling equipment.

Another key area is the management of refrigerant banks, i.e., the refrigerants that are in existing RAC equipment on the market. There are very large stores of refrigerants in the region, especially in comparison to the population of MENA countries and particularly in the Gulf region. We can work with key public and private stakeholders to devise the right incentives and management systems to ensure that these banks are not released into the atmosphere.

Again, a key enabler will be sustainable finance solutions. The conditions in the MENA region seem to be ripe to accompany the increase of private finance available for sustainable cooling projects.

To summarise, I would suggest these four pillars of action:

1. Refrigerant bank management - We should consider a long-term refrigerant bank management plan for the MENA region to promote best practices and reduce ODS and GHG emissions.
2. Low-GWP alternatives in the cold chain - This should be prioritised and worked on in combination with renewable energy solutions and digital tools.
3. District cooling systems using waste heat - This is a promising option for buildings in MENA. We recommend that municipalities consider consulting feasibility studies and consider the upfront investments of this solution.
4. Financial models for energy efficiency - This still needs to be elaborated further and could be tested and scaled up through programmes like Cool Up.

Cool Up:
Are there any upcoming projects or initiatives in the pipeline that our audience should be aware of?

Xiaofang Zhou (UNDP):
I would like to highlight two types of projects that will be supporting MENA's transition towards sustainable cooling: district cooling pilot projects and feasibility studies, and take-back programmes, in which old, inefficient cooling equipment can be replaced with new low-GWP, efficient alternatives at a reasonable financial cost.

Both these options have great potential to introduce natural refrigerant-based solutions to the market by encouraging importers to introduce more sustainable technology solutions. In the case of the take-back mechanisms, this can also help manage banks of refrigerants in a more environmentally-friendly manner. These two types of programmes have advanced beyond the pipeline development stage already.

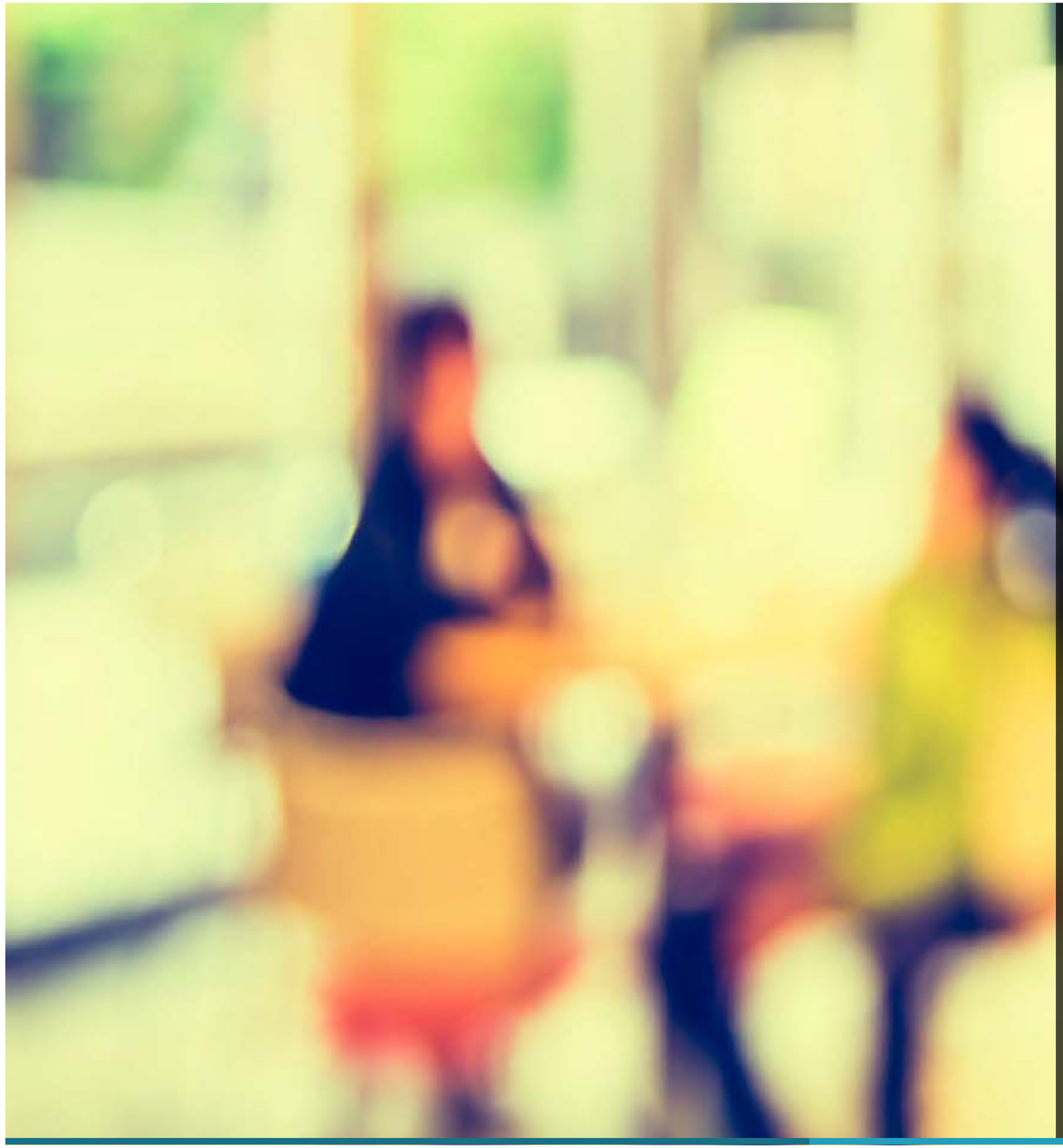
In terms of promising future projects, I would highlight the potential of digital solutions to optimise the use of cooling assets. Not only can they provide information about the performance of equipment in real-time, but they can also help to avoid refrigerant leaks during operation, facilitate maintenance, and drastically improve performance. With the size of the current market, and the projected growth, the climate benefits of better refrigerant management is significant. I also believe that many countries across the region have all the conditions assembled to allow for the quick deployment of such solutions. This is something that UNDP and its Cool Up partners will be promoting in the future.

Cool Up:
In conclusion, could you summarise the key takeaways regarding MENA's importance in global climate action and sustainable cooling leadership from the perspective of UNDP?

Xiaofang Zhou (UNDP):
The MENA region is already showing leadership in sustainable cooling. For example, the importance of cooling will, for the first time, be showcased during COP28, under the presidency of the UAE. It is the first time cooling has a specific focus on the agenda as December 5th will be the 'Cooling Day' at COP28.

The key takeaways are to continue to facilitate the dissemination of information about technologies; promote a life-cycle approach to refrigerant management; address capacity needs with policies like technical certification programmes; integrate sustainable cooling solutions into broader climate strategies, such as building NCAPs into NDCs; and most importantly, ensure the availability of sustainable financing for the most climate-friendly cooling solutions.

While there are still some barriers that need to be addressed, UNDP will play its role, in collaboration with its regional and international partners, to accelerate the adoption of sustainable cooling in the region.



Interview: Dr. Jauad El Kharraz, Regional Center for Renewable Energy and Energy Efficiency

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an intergovernmental organisation that works to support the adoption of renewable energy and energy efficiency practices and policies across the MENA region. It is a key regional player not only in the clean energy transition, but also in climate resilience and sustainable development.

To accelerate the region's energy transition, RCREEE engages in a number of activities, including supporting private sector investment, proposing innovative initiatives that deepen regional cooperation, and helping member states integrate energy efficiency measures into their NDCs.

Cool Up met with Dr. Jauad El Kharraz, Executive Director of RCREEE, to learn more about MENA's role in the global transition to sustainable cooling.

The transition to sustainable cooling is critical to meeting increasing cooling demand while also minimising environmental impact.

Cool Up:
Sustainable cooling has emerged as a critical component of climate strategies. Can you explain why this is the case and how it relates to broader climate goals?

Dr. Jauad El Kharraz (RCREEE):
Climate change is causing global temperatures to rise, making cooling—be that AC in buildings, refrigeration for food storage and transportation, or cooling for industrial processes—more important than ever before. As temperatures rise and heatwaves become more frequent and intense, the risk to human health, agriculture, and infrastructure increases.

Access to cooling, particularly in vulnerable regions, can help mitigate the adverse effects of extreme heat events and ensure the well-being of communities. It can also bring numerous economic, social, and health benefits. However, traditional cooling methods often rely on energy-intensive technologies that use climate-polluting refrigerants, which in turn exacerbates climate change.

The transition to sustainable cooling is critical to meeting increasing cooling demand while also minimising environmental impact. By promoting sustainable cooling practices, broader climate goals relating to mitigating climate change, improving energy efficiency, and building climate resilience can be effectively pursued.

Cool Up:
How does sustainable cooling specifically address the unique climate challenges of the MENA region while advancing its sustainable development objectives?

Dr. Jauad El Kharraz (RCREEE):
In hot climates like MENA's, cooling is a necessity but conventional approaches threaten the region's sustainable development objectives. However, Sustainable cooling technologies and practices can help to reduce the sector's energy consumption and GHG emissions.

Energy-efficient cooling systems can use up to 50% less energy than traditional systems, and natural refrigerants have a much lower GWP than F-gases. Additionally, passive cooling techniques, such as shading and natural ventilation, can reduce the need for mechanical cooling systems altogether.

Beyond reducing energy consumption, sustainable cooling helps the MENA region integrate renewable energy sources, conserve water resources, promote sustainable urban planning, and contribute to economic development.

Cooling has clear links to all 17 SDGs, and for this reason it is considered central to achieving the global goals. For example, cold chains are critical for ending hunger and malnutrition (SDG 2) and promoting health and well-being (SDG 3) through increasing access to affordable and nutritious produce as well as vaccines and medicines. Ensuring they are made up of energy-efficient and climate-friendly infrastructure is important to sustainable energy (SDG 7) and climate action (SDG 13).

By helping to advance sustainable development objectives, sustainable cooling ensures a more resilient and sustainable future.

Cool Up:
Beyond environmental benefits, what economic and social impacts can sustainable cooling solutions bring to the MENA region?

Dr. Jauad El Kharraz (RCREEE):
Sustainable cooling solutions can bring many economic and social benefits to the region. For example, they can lead to significant cost savings for individuals, businesses, and governments in the region thanks to reduced energy consumption. These savings can be seen in the form of reduced electricity bills, operational expenses, and long-term investments.

The adoption of sustainable cooling technologies can also create new skilled job opportunities in the MENA region, including in manufacturing, installation, maintenance, and operational capacities. In addition to boosting employment, this also contributes to a stronger economy.

In terms of social benefits, sustainable cooling solutions can improve the health and well-beingof citizens by reducing heat-related illnesses and deaths. They can also lead to improved learning and working environments and promote social inclusion by providing a better life for vulnerable populations.

Cool Up:
In your view, why is MENA gaining increasing importance in the context of international climate action, particularly in the area of sustainable cooling?

Dr. Jauad El Kharraz (RCREEE):
There are several factors at play here, but firstly I would highlight the region's high cooling demand. MENA is a climate change hotspot and experiences extremely high temperatures, which makes cooling a necessity for comfort, health, and productivity. The demand for AC and refrigeration is also expected to increase significantly in the coming years, driven by population growth, urbanisation, and economic development.

This growth could be extremely problematic due to the high energy consumption and GHG emissions associated with traditional cooling technologies, which can be inefficient and contain climate-harming refrigerants.

Transitioning to sustainable cooling in the region is crucial for reducing its energy consumption, mitigating emissions, and achieving climate goals. The region's abundant renewable energy resources, particularly solar power, could be leveraged to further reduce emissions. Sustainable cooling could also stimulate economic

Sustainable cooling solutions can bring many economic and social benefits to the region.

Cross-sector collaboration among governments, industries, and international organisations is essential for advancing sustainable cooling in the MENA region.

growth by creating jobs and fostering innovation in areas like energy efficiency, solar cooling, and green buildings design.

Given its vulnerability to the impacts of climate change, MENA's adoption of sustainable cooling solutions could be included in its adaptation strategy, which would open the door to adaptation funds available under UNFCCC.

Cool Up:
What are the distinctive contributions that the MENA region brings to the global climate action arena, and how have these evolved in recent years?

Dr. Jauad El Kharraz (RCREEE):
The region has made several distinctive contributions to the global climate action efforts to date, including expanding global renewable energy capacity, setting ambitious renewable energy targets, investing in innovative climate solutions, and facilitating international cooperation on climate.

The MENA region is rich in renewable energy resources, particularly solar and wind, and several countries are making significant investments in expanding their renewable energy capacity, which will have a meaningful impact on their climate mitigation efforts. Many countries have also set ambitious renewable energy targets, demonstrating a commitment to transitioning towards a low-carbon economy. For example, Morocco aims to generate 52% of its electricity from renewable sources by 2030.

The region has shown interest in innovative technologies in an effort to reduce GHG emissions. For example, countries like Saudi Arabia and the UAE have invested in carbon capture, usage, and storage (CCUS) projects, with the aim of decarbonising their industries. An emphasis on energy efficiency has also driven innovation in the field of sustainable cooling, particularly solar-powered cooling technologies. For example, solar-driven absorption chillers and desiccant cooling systems can reduce cooling-related electricity consumption and GHG emissions.

The MENA region has been active in international climate negotiations and diplomacy for many years, including hosting COP22 in Morocco in 2016, COP27 in Egypt in 2022, and COP28 in UAE in 2023. Countries across the region have also collaborated in many global and regional climate initiatives, such as the Industrial Deep Decarbonization Initiative (IDDI), the Arabian Gulf Green Deal, and the Arab Ministerial Declaration on Climate Change, promoting climate action and knowledge sharing.

The region's contributions have evolved over recent years in recognition of the urgency of addressing climate change and the opportunities presented by clean energy transition, demonstrating a clear shift towards a more sustainable and climate-resilient future.

Cool Up:
How critical is cross-sector collaboration among governments, industries, and international organisations for advancing sustainable cooling in the MENA region?

Dr. Jauad El Kharraz (RCREEE):
Cross-sector collaboration among governments, industries, and international organisations is essential for advancing sustainable cooling in the MENA region. It facilitates policy alignment, technology transfer, resource mobilisation, research and development, and the scaling up of successful initiatives.

For example, while governments play a key role in setting the policies and regulations that promote sustainable cooling, collaboration with other stakeholders allows governments to align their policies with industry best practices and international standards. In turn, this ensures a coordinated approach, avoiding conflicting regulations and creating a conducive environment for sustainable cooling solutions to thrive.

Industry players possess valuable expertise, technologies, and best practices in sustainable cooling and collaboration enables knowledge sharing and technology transfer. This can help overcome technological barriers and build local capacity to accelerate the adoption of sustainable solutions.

Similarly, international organisations can mobilise funding, offer technical assistance, and share knowledge. Collaboration here ensures that sustainable cooling projects have the financial and technical resources they need to be implemented, scaled-up, and replicated effectively.

Advancing sustainable cooling also requires continuous R&D efforts, which requires significant cross-sectoral collaboration for funding, knowledge exchange, and general support. This collaboration fosters innovation and encourages the development of new technologies.

By working together, governments, industries, and international organisations can learn from each other's experiences and support each other's efforts to accelerate the region's transition to sustainable cooling.

Cool Up:
Looking forward, what do you see as the key milestones and priorities for the MENA region in sustainable cooling and international climate action?

Dr. Jauad El Kharraz (RCREEE):
There are several key priorities for the MENA region in terms of action on cooling and climate, including policy development, technological innovation, renewable energy investments, water conservation, monitoring and reporting, and collaboration.

Developing and implementing policies and regulations that promote the adoption of sustainable cooling technologies and practices will be a crucial milestone. This includes setting energy efficiency standards, incentivising renewable energy integration, and promoting sustainable urban planning.

Developing and implementing policies and regulations that promote the adoption of sustainable cooling technologies and practices will be a crucial milestone.

Targets must then be followed by comprehensive policies and regulations that incentivise sustainable cooling practices and technologies.

Investing in innovative technologies and practices is another regional priority to ensure the adoption of sustainable cooling solutions. This can be achieved through knowledge transfer, technology partnerships, and training programs. The region also needs to increase investments in solar power infrastructure and grid integration, as well as incentivising renewable energy deployment, to ensure the use of renewables-based cooling solutions.

Water scarcity is a major challenge in MENA so prioritising water conservation in cooling processes and promoting sustainable water management practices is crucial. This could include the adoption of water-efficient cooling technologies and encouraging water recycling.

Establishing robust monitoring and reporting systems will be necessary to track progress and regularly assess the region's energy consumption.

Importantly, we need to increase cooperation and collaboration, both at the regional and global levels. If we are to address climate change effectively, we need to act collectively.

Cool Up:
What advice would you offer to MENA governments, industries, and organisations aiming to assume a leadership role in sustainable cooling and broader climate action?

Dr. Jauad El Kharraz (RCREEE):
For any stakeholder in MENA looking to assume a leadership role in the region's transition to sustainable cooling, I would recommend for them to first establish clear and ambitious goals that are aligned with international climate targets. This would send a strong signal of commitment and provide a framework for action.

Targets must then be followed by comprehensive policies and regulations that incentivise sustainable cooling practices and technologies. These policies must be supported by robust enforcement mechanisms and reporting frameworks to enhance accountability and allow for course correction if necessary.

I would also recommend allocating resources to support local research institutions, encourage innovation, and promote the development of homegrown solutions tailored to meet the region's specific needs. Investing in R&D can enhance technological capabilities and position the MENA region as a leader in sustainable cooling.

Fostering collaboration among different stakeholders—both regional and international—is also a must to maximise impact through knowledge sharing, technology transfer, and joint initiatives. We cannot solve the climate crisis alone.

It is also extremely important to raise awareness about the importance of sustainable cooling and broader climate action among the various stakeholders, including the public. Conducting capacity-building programs, training workshops, and educational campaigns to enhance understanding of and build expertise in sustainable cooling practices is also needed.

By following these recommendations, regional stakeholders can contribute to the region's sustainable development and resilience to climate change.

Cool Up:
In closing, are there any final messages or calls to action you'd like to convey to our audience concerning the MENA region's role in international climate action and sustainable cooling?

Dr. Jauad El Kharraz (RCREEE):
While MENA is facing some of the most severe impacts of climate change, the region also has the ability to overcome these challenges with the help of solutions like sustainable cooling.

MENA has the chance to place itself at the forefront of global efforts to combat climate change and the region's governments, industries, and organisations must work hand-in-hand to accelerate the transition to sustainable cooling. This is a critical opportunity for the region to lead the world in international climate action and create a more sustainable and liveable future for all.

Business smarts: Sustainable cooling for sustainable businesses

Sustainable cooling for sustainable businesses

By improving the energy efficiency of its RAC systems, a business can significantly reduce its energy consumption, indirect GHG emissions, and operational costs.

RAC systems in food retail businesses

60% electricity consumption is for refrigeration

In food retail, refrigeration systems alone can account for 30-60% of a business's electricity consumption.

40% carbon foot print emissions

Refrigerants can be responsible for up to 40% of a retailer's carbon footprint due to the high GWP of commonly-used gases.

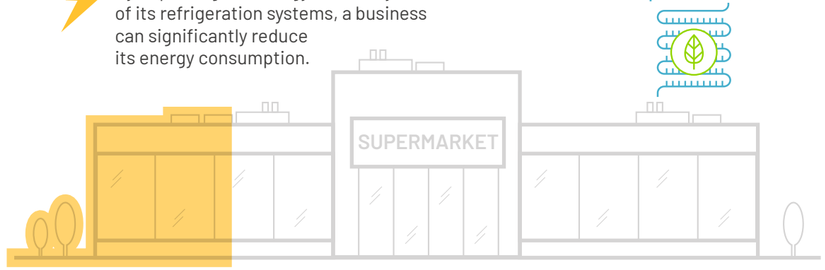
But, improving the energy efficiency

Reducing costs with increased energy efficiency

By improving the energy efficiency of its refrigeration systems, a business can significantly reduce its energy consumption.

Natural refrigerants

Transitioning to low-GWP refrigerants can reduce a business's direct GHG emissions and operational costs.



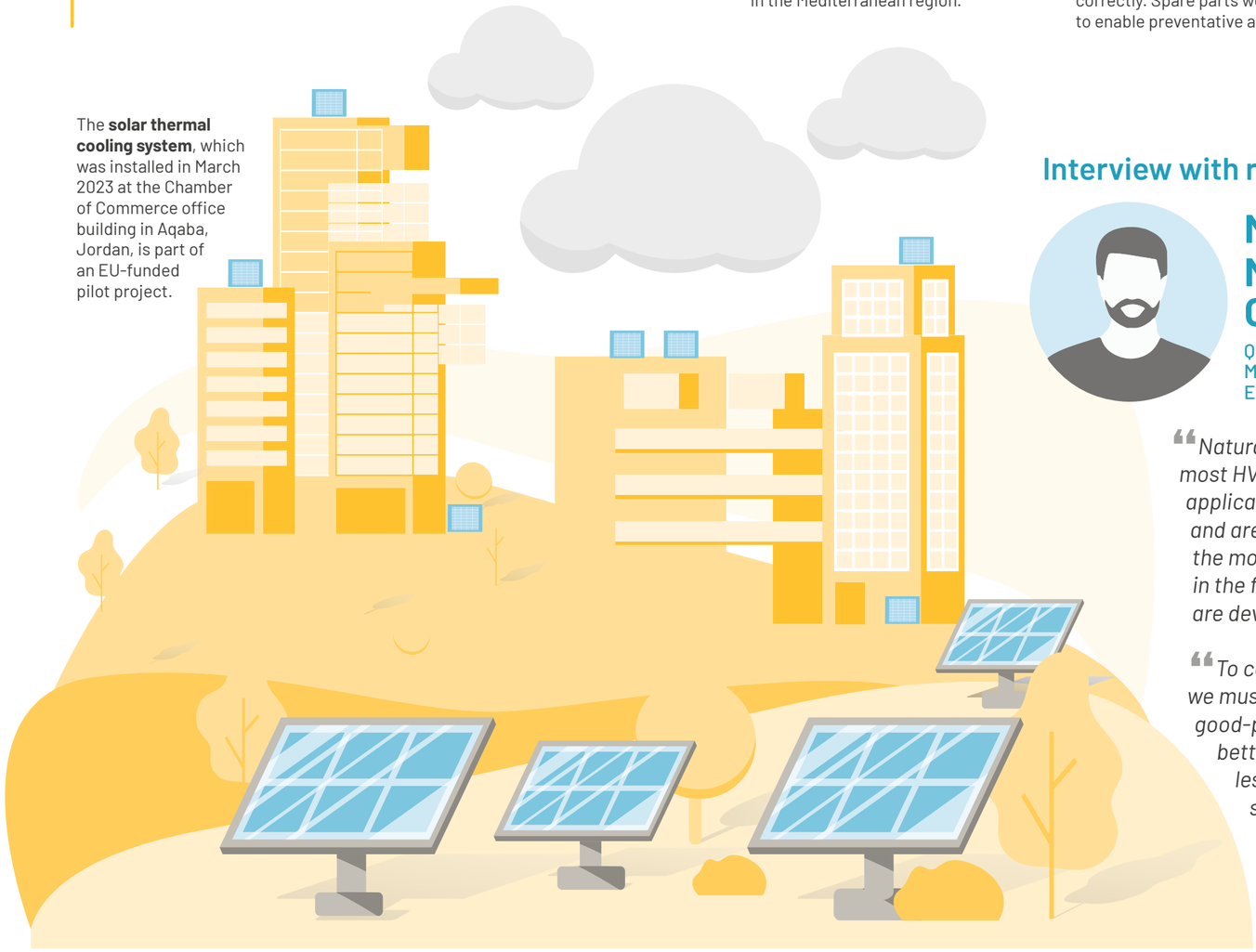
Regional spotlight: Promoting environmental sustainability with solar cooling

The adoption of solar thermal cooling supports Jordan's efforts to align its national standards and policies with EU regulation on F-gases, energy eficiency, and renewables.

The project aims to demonstrate how **solar thermal systems can be used to help reduce cooling-related energy consumption** and greenhouse gas emissions from office buildings in the Mediterranean region.

The project consisted of the **supply, installation, operation, and commissioning of the solar collectors and cooling system.** It also included a five-day training course for two technicians to ensure the system is managed and serviced correctly. Spare parts were also provided to enable preventative and corrective maintenance.

The **solar thermal cooling system**, which was installed in March 2023 at the Chamber of Commerce office building in Aqaba, Jordan, is part of an EU-funded pilot project.



Interview with regional expert

Mr. Mohammad Okour

QUALITY AND ENVIRONMENT MANAGER PETRA ENGINEERING INDUSTRIES

"Natural refrigerants can cover most HVAC and refrigeration applications and are expected to be the most economical option in the future as technologies are developed."

"To combat climate change, we must find ways to create good-paying jobs while building better buildings and installing less harmful technical systems."

In food retail, refrigeration systems alone can account for 30%-60% of a business's electricity consumption. When combined with other heating and cooling demands—for example, air conditioning and hot water production—a retailer's heating and RAC systems can make up a significant portion of their indirect, energy-related GHG emissions. In terms of direct emissions, refrigerants can be responsible for up to 40% of a retailer's carbon footprint due to the high GWP of commonly-used gases.[59] [60]

By improving the energy efficiency of its heating and RAC systems, a business can significantly reduce its energy consumption, which in turn realises numerous other benefits such as reduced indirect GHG emissions, reduced operational costs, and enhanced energy security.

Similarly, transitioning to low-GWP refrigerants—such as natural refrigerants—can not only reduce a business's direct GHG emissions, but it can also reduce operational costs thanks to lower refrigerant prices and reduce long-term capital expenditure due to the investment in future-proof technologies.

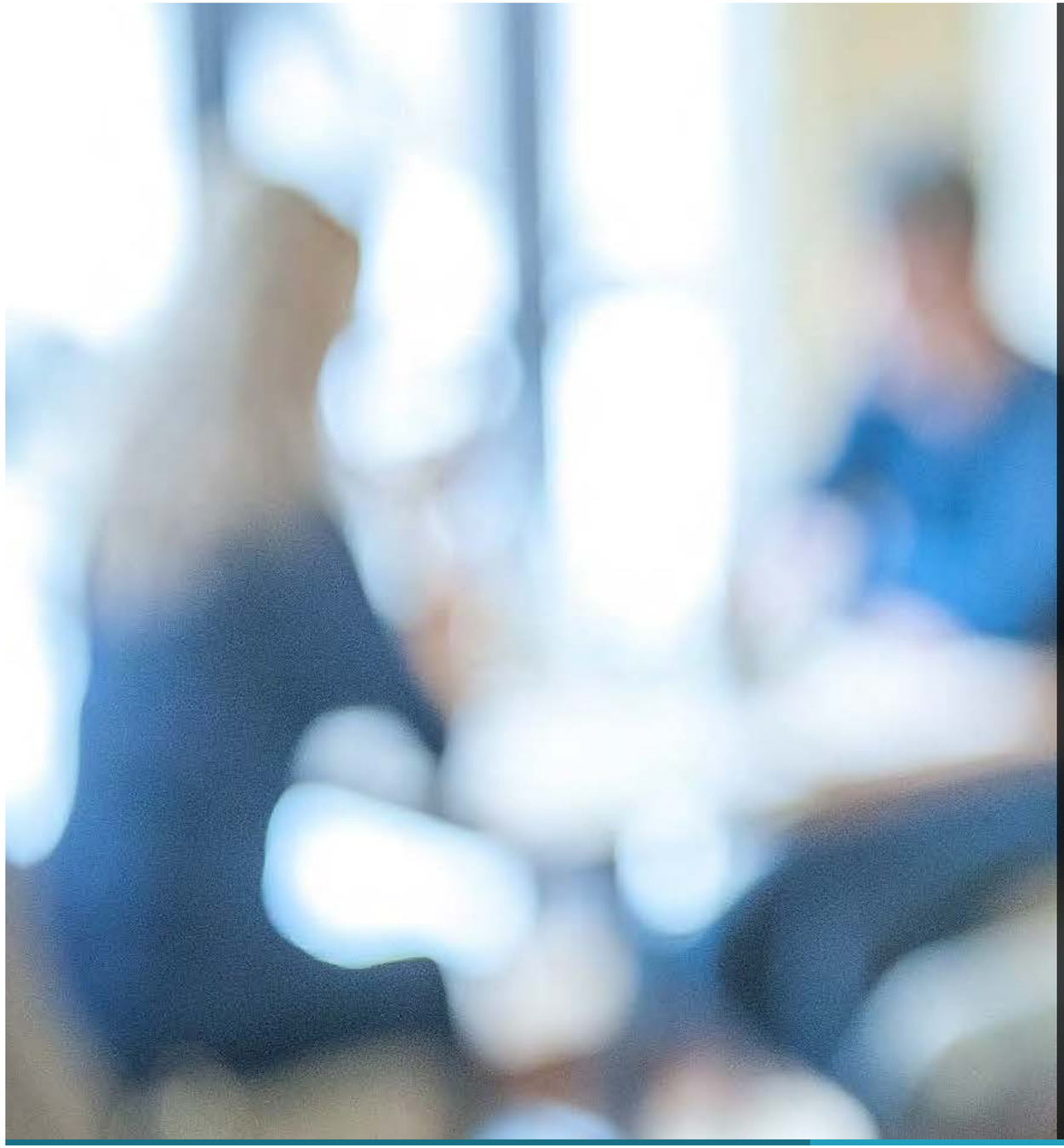
More generally, engaging in sustainable business practices is said to enhance brand reputation among customers and employees, and mitigate risks from the perspective of investors.[61]

Transitioning to low-GWP refrigerants —such as natural refrigerants— can not only reduce a business's direct GHG emissions, but it can also reduce operational costs thanks to lower refrigerant prices and reduce long-term capital expenditure due to the investment in future-proof technologies.

59 Energy consumption and conservation in food retailing (2011), Tassou et al.

60 Enhancing energy efficiency in supermarket refrigeration systems through a robust energy performance indicator (2016), Acha et al

61 Why you need sustainability in your business strategy (2019), Harvard Business School



Interview: Mohammad Okour, Petra Engineering Industries

Petra Engineering Industries is a Jordanian manufacturer of HVAC equipment and systems that has been involved in a number of projects piloting natural refrigerant-based technologies in the MENA region over the last decade. Petra's demonstration projects include the development and testing of an R290-based HVAC system for an industrial application in Saudi Arabia.

Cool Up met with Mohammad Okour, Petra's Quality and Environment Manager, to learn more about the pilot project and the company's plans for the future.

Petra designed and developed a prototype system that consisted of a packaged chiller and air handling unit (AHU) using natural refrigerant R290 (propane).

Cool Up:
Could you provide an overview of the sustainable cooling project in Saudi Arabia, including its key objectives and scope?

Mohammad Okour (Petra):
The pilot project in Saudi Arabia was an initiative of the United Nation Environment Programme (UNEP) and was funded by the World Bank. The aim of the project, which began in 2016, was to demonstrate the use of energy-efficient and climate-friendly air conditioning in the country.

For the project, Petra designed and developed a prototype system that consisted of a packaged chiller and air handling unit (AHU) using natural refrigerant R290 (propane). The demonstration included a 40 kW and a 100 kW system. For comparison, Petra also developed similar systems that used R32. At that time, nobody in the world was working on such equipment.

The performance of both systems would be tested and compared with a R410A-based system, which acted as the baseline.

According to our testing, both the R290 (propane) and R32 systems outperformed the R410A alternative in terms of cooling capacity and efficiency at a range of high ambient temperatures.

Cool Up:
How important was the energy efficiency of the system developed for the project?

Mohammad Okour (Petra):
Energy efficiency was one of the most important aspects of the pilot project and thanks to the high energy efficiency of Petra's standard product design, we did not need to make any big changes here. We were already exceeding the requirements of the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), for example, and local standards in Saudi Arabia.

At ambient temperatures of 35°C and 46°C, the R290 (propane) system Petra developed achieved a COP of 2.87 and 1.93, respectively. It's clear that natural refrigerants can perform well in high ambient temperatures.

Cool Up:
How has the sustainable cooling project positively impacted local stakeholders in Saudi Arabia?

Mohammad Okour (Petra):
This sustainable cooling project has had a very important effect for the local community in Saudi Arabia.

Beyond the energy and climate benefits of more sustainable cooling technologies, one of the main positive impacts of this project, and our work in general, is the development of skilled employment opportunities. For example, in Jordan, we have hired around 1,600 technical engineers and technicians, and we have plans to expand our operations even further. When dealing with new technology, there is also an opportunity to train a lot of technicians, and this is something Petra is doing in partnership with Cool Up.

Cool Up:
What were the main challenges you faced when implementing this project?

Mohammad Okour (Petra):
Seven years ago, when Petra started the pilot project, there were a lot of concerns around the safety of flammable refrigerants like R290 (propane) so a number of safety considerations and precautions had to be built into the design and manufacturing processes. These steps solved a lot of the problems and gave us and the systems we developed a competitive edge.

Other challenges we had to navigate were the availability of certified and compatible components, charge limitations—which is linked to flammability—and the higher costs associated with natural refrigerants. All of these were somewhat expected due to the immaturity of the market.

Cool Up:
Were there any notable lessons learned during the project in Saudi Arabia?

Mohammad Okour (Petra):
One of the most important lessons that we have learned is to establish whether there are any existing components that can be integrated into new technologies, because changing the entire design is very expensive and will be a real challenge for any manufacturer. Changing the design of a system changes everything from the documentation process and safety protocols, to the manufacturing process and the training of personnel. Having components that can directly replace old ones without a major change in the product design would be extremely beneficial. There is a need for a design competition to create better technologies using similar designs to previous systems.

It will come as no surprise but we also learned how important funding is for big demonstration projects like this. It is expensive to develop new technologies; it requires changing your designs, buying new components, changing your supply chain, and changing the manufacturing process. It's a lot.

It is also paramount to build safety considerations into the project from the very start.

Cool Up:
How important was collaboration in achieving the project's success?

Mohammad Okour (Petra):
Collaboration is key. Developing new technologies and demonstration projects is very expensive and we need organisations like UNEP to partner with to run successful pilots that can help show that natural refrigerants are a viable option for the MENA region.

When dealing with new technology, there is also an opportunity to train a lot of technicians, and this is something Petra is doing in partnership with Cool Up.

It is important to consider the local context in project design to ensure long-term success.

Cool Up:
Do you believe that the success of this cooling project can be replicated in other regions or industries?

Mohammad Okour (Petra):
Yes, it definitely can be replicated elsewhere. But I believe one project is not enough. I believe if natural refrigerants and new technologies are to be successfully adopted, there needs to be more than one or two demonstration projects. We need more demonstrations in different sectors and sometimes in different areas of the same country.

The pilot we ran in Saudi Arabia was for an industrial application, which will have extremely different needs compared to a commercial end user, for example. There is a big difference. If anybody asks whether we can do a big rooftop unit, our answer will be yes. This is what we did in Saudi Arabia; it is there and it's working successfully and safely. But people will want to see examples of systems working in different situations. It might be that we need three or maybe four demonstration projects to prove the concept.

I believe demonstration projects should be the number one activity when planning such work. It is also important for there to be demonstration projects around the world, even in countries like the United States and in Europe.

Cool Up:
What advice would you give to organisations looking to implement similar sustainable cooling solutions?

Mohammad Okour (Petra):
I would recommend that organisations are thorough during the planning and design phase of projects. It is vital that the concerns of a number of stakeholders are factored into planning, including system manufacturers, end users, funders, and national governments. It is also important to consider the local context in project design to ensure long-term success.

For example, in Jordan, funding is the most critical thing that everybody should think about. In Saudi Arabia, while still important, we found funding to be less influential.

Cool Up:
What inspired your organisation to initiate this cooling project?

Mohammad Okour (Petra):
Petra believes that natural refrigerants are the future and the company wants to take a leading role in the HVAC industry by developing energy-efficient and climate-friendly technologies that ensure a future for all.

Natural refrigerants like R290 (propane), R717 (ammonia), and R744 (CO_2) can cover most HVAC and refrigeration applications and are expected to be the most economical option in the future as technologies are developed.

To combat climate change, we must find ways to create good-paying jobs while building better buildings and installing less harmful technical systems.

Cool Up:
What are your organisation's future plans or initiatives to further enhance cooling sustainability in the region?

Mohammad Okour (Petra):
At Petra, we have an internal green strategy and part of this work is using the natural refrigerants. As one of the biggest HVAC manufacturers in the country, if Petra is able to succeed in adopting natural refrigerant technologies, it would be great for the company, for other local manufacturers, and for Jordan in general.

However, to help us drive this change, we also need to see a shift in the market from the demand side, as well as policy, as manufacturing tends to closely follow market requirements and demand.

Petra is ready to innovate and adopt new market requirements into its design and manufacturing processes. We are doing a lot of work in terms of engineering in our products, which more and more end users are demanding. Petra hopes to be leading this industry both domestically in Jordan and across the MENA region.

Cool Up:
How do you envision the evolution of sustainable cooling practices in the region?

Mohammad Okour (Petra):
I believe that across the MENA region and the world, everybody is now focussing on sustainability and sustainable refrigerants. Everybody is going there. While different countries and stakeholders are taking different routes, one day, sustainable refrigerants will be the only choice.

Eventually, what we see in the United States and in Europe, I expect to happen in MENA. For example, the Gulf states are now working on developing harmonised standards and Saudi Arabia is leading these efforts.

Cool Up:
Do you see a clear shift in the market towards natural refrigerants?

Mohammad Okour (Petra):
The market for natural refrigerants is still small but there is a clear shift to refrigerants with a low GWP, that is definitely a major focus in most markets.

In the end, I believe that everybody all over the world must make the shift and be ready to sell these solutions.

I believe that across the MENA region and the world, everybody is now focussing on sustainability and sustainable refrigerants.

Regional spotlight: Promoting environmental sustainability with solar cooling in Jordan

In an effort to reduce its energy consumption and GHG emissions, as well as to improve its RAC sector, Jordan is looking to solar thermal cooling as an energy-efficient and climate-friendly alternative to conventional cooling technologies.

The adoption of solar thermal cooling also supports Jordan's efforts to align its national standards and policies with EU regulation on F-gases, energy efficiency, and renewables.

Key facts

- Jordan is committed to reducing its GHG emissions in line with EU climate policy and global climate mitigation efforts.
- Jordan's updated F-gas regulation, which aligns with EU standards, opens the national market to energy-efficient solar thermal cooling technologies using natural refrigerants.
- A recent pilot project at the Aqaba Chamber of Commerce demonstrates the efficacy of solar thermal cooling to reduce energy demand and GHG emissions for commercial applications in Jordan.

With regards to refrigerants, Jordan has, through its new national F-gas regulation, implemented an ambitious phasedown schedule for HFCs.

Sustainable cooling in Jordan

Jordan's RAC market has largely been made up of energy-efficient cooling solutions since 2012, when the Jordan Standards and Metrology Organisation (JSMO) adopted the EU Ecodesign requirements for air conditioners and comfort fans.[62] Through the implementation of this regulation, Jordan aims to improve the energy performance of AC units and fans, which in turn reduces energy consumption.

With regards to refrigerants, Jordan has, through its new national F-gas regulation, implemented an ambitious phasedown schedule for HFCs. It has also introduced market bans that will support its efforts to reduce the emission of F-gases in line with international climate agreements like the Kigali Amendment, which Jordan ratified in 2019.

Solar thermal cooling systems can consist of either solar photovoltaics that power a heat pump or air conditioning system or solar collectors that connect to a thermally driven cooling unit, such as an absorption chiller. The market is still relatively niche; however, it is growing. As of 2022, there were over 2,000 solar thermal cooling systems installed globally,[63] up from 1,350 in 2015.[64]

In addition to requiring significantly less energy than conventional cooling technologies, solar thermal cooling – specifically solutions using absorption chillers – traditionally use natural refrigerants like ammonia (R717) and water (R718), resulting in an extremely low climate impact.

While around 70% of solar thermal cooling installations are in Europe, the technology is particularly well suited for countries with high ambient temperature and a high rate of solar radiation, like Jordan.[65]

Solar cooling pilot in Aqaba

The solar thermal cooling system, which was installed in March 2023 at the Chamber of Commerce office building in Aqaba, Jordan, is part of an EU-funded pilot project.

The project aims to demonstrate how solar thermal systems can be used to help reduce cooling-related energy consumption and GHG emissions from office buildings in the Mediterranean region. It also hopes to create a reference for future projects across MENA, raise awareness of such solutions, and build local technical expertise to enhance the adoption of solar cooling technologies.

The solar thermal cooling system at the Aqaba Chamber of Commerce consists of a 35 kW single-effect absorption chiller that uses lithium bromide (LiBr) and water as the working fluid instead of a traditional refrigerant. In addition to being climate-friendly, absorption chillers typically consume around 10% of the electricity needed for an electric chiller.[66] It also includes 148 m^2 of flat-plate solar collectors, two hot-water and one chilled-water storage tanks (1,500 L each), and a cooling tower.

The project consisted of the supply, installation, operation, and commissioning of the solar collectors and cooling system. It also included a five-day training course for two technicians to ensure the system is managed and serviced correctly. Spare parts were also provided to enable preventative and corrective maintenance.

During the pilot, the new system has been operating alongside the building's existing 344 kW-capacity HVAC system, which comprises two conventional vapour compression electric chillers. [67] It is anticipated that the solar thermal cooling system will cover around 20% of the office's cooling demand and reduce its annual emissions by approximately 4,190 kg of CO_2e, with a COP of around 0.5.

62 Commission Regulation (EU) No 206/2012

63 Weiss, "Solar Heat Worldwide 2023."

64 Weiss, "Solar Heat Worldwide 2017."

65 Green Cooling Initiative, "Installing solar cooling plants in Jordan: a practitioner's handbook."

66 Jordan Energy, Water and Environment, "JOCC Solar Thermal Cooling System Pilot Project."

67 Christodoulaki, "Performance Simulation and Monitoring Methodology of a Solar Cooling Installation in Aqaba, Jordan."

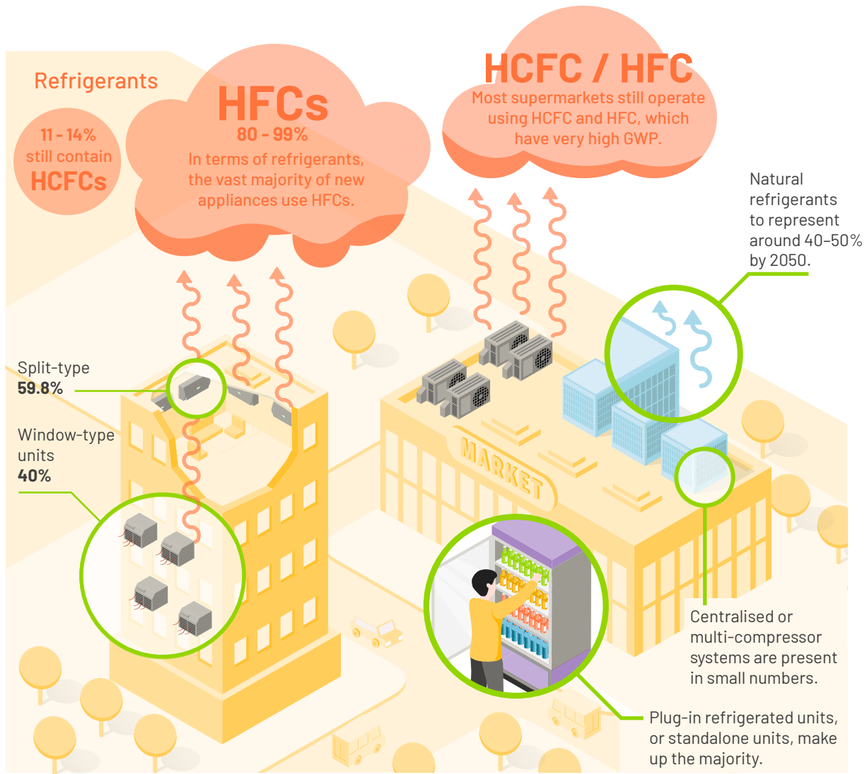
Shaping a cool tomorrow: Adopting sustainable RAC technologies in MENA and Türkiye

Adopting sustainable RAC technologies in MENA and Türkiye

Commonly-available technologies

Air conditioning
Over the last three years, there's been a markable shift in the region away from HCFCs.

Commercial refrigeration
Enhanced visual merchandising is driving an increased demand for refrigerated display cases.

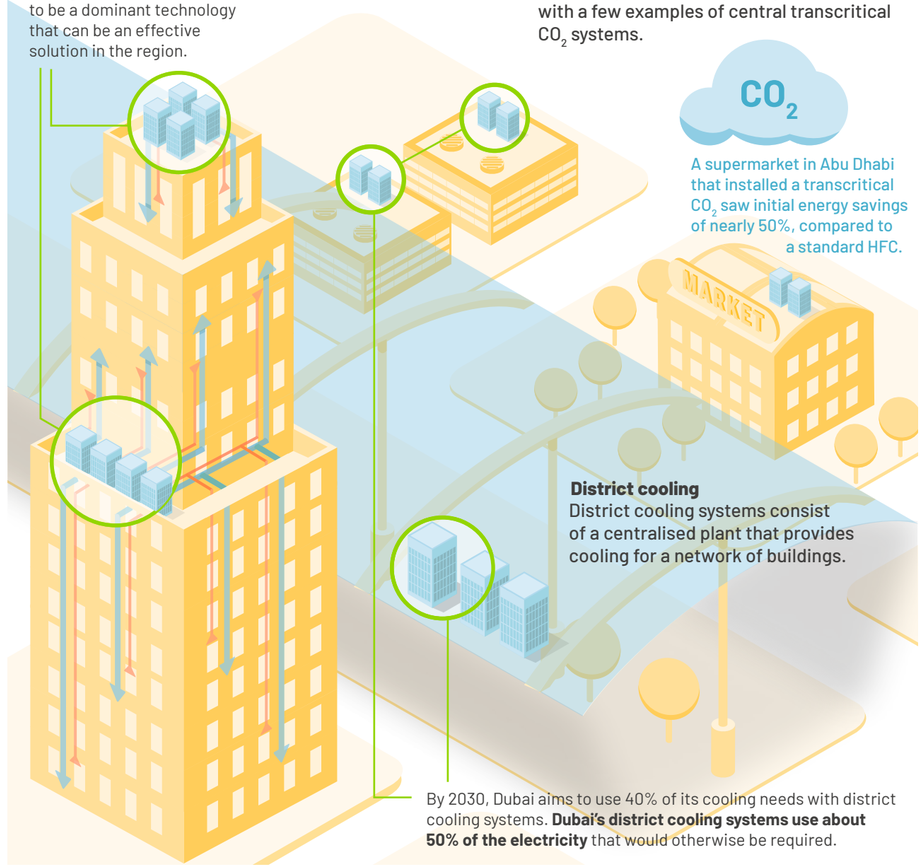


Best available technologies

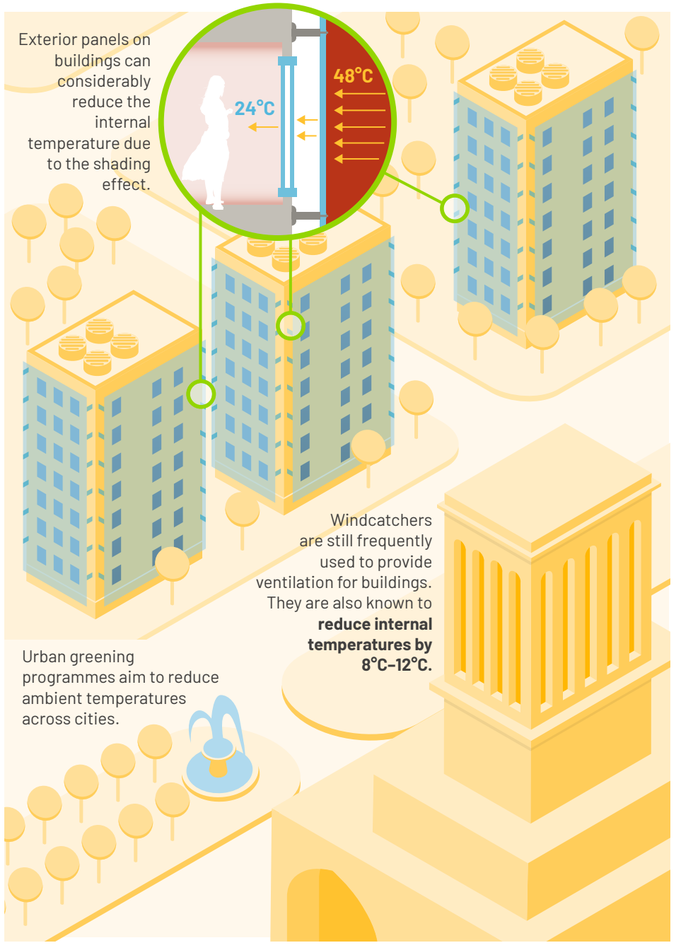
Air conditioning

VRF systems are considered to be a dominant technology that can be an effective solution in the region.

Commercial refrigeration
Regionally, sustainable refrigeration technologies are slowly being introduced, with a few examples of central transcritical CO_2 systems.

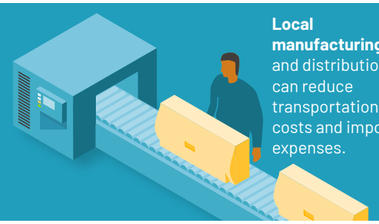


Passive cooling solutions



Developing a local and regional supply chain

Strengthening local and regional supply chains for sustainable cooling technologies can help overcome adoption barriers.



Local manufacturing and distribution can reduce transportation costs and import expenses.

Job creation and economic development are other benefits of a more localised supply chain.

In terms of refrigerants the vast majority of the refrigerants used across MENA and Türkiye, particularly F-gases, are imported.

REGIONAL SPOTLIGHT

Achieving environmental sustainability and industry excellence in Türkiye

Türkiye aims to enhance its environmental standards and ensure sustainable development.

Türkiye has become a significant manufacturing and export hub.

Turkiye is working to reduce its GHG emissions to comply with EU climate policy. It also updated its national F-gas regulation to align with EU standards.

Regional dynamics and varied adoption of RAC technologies in MENA and Türkiye

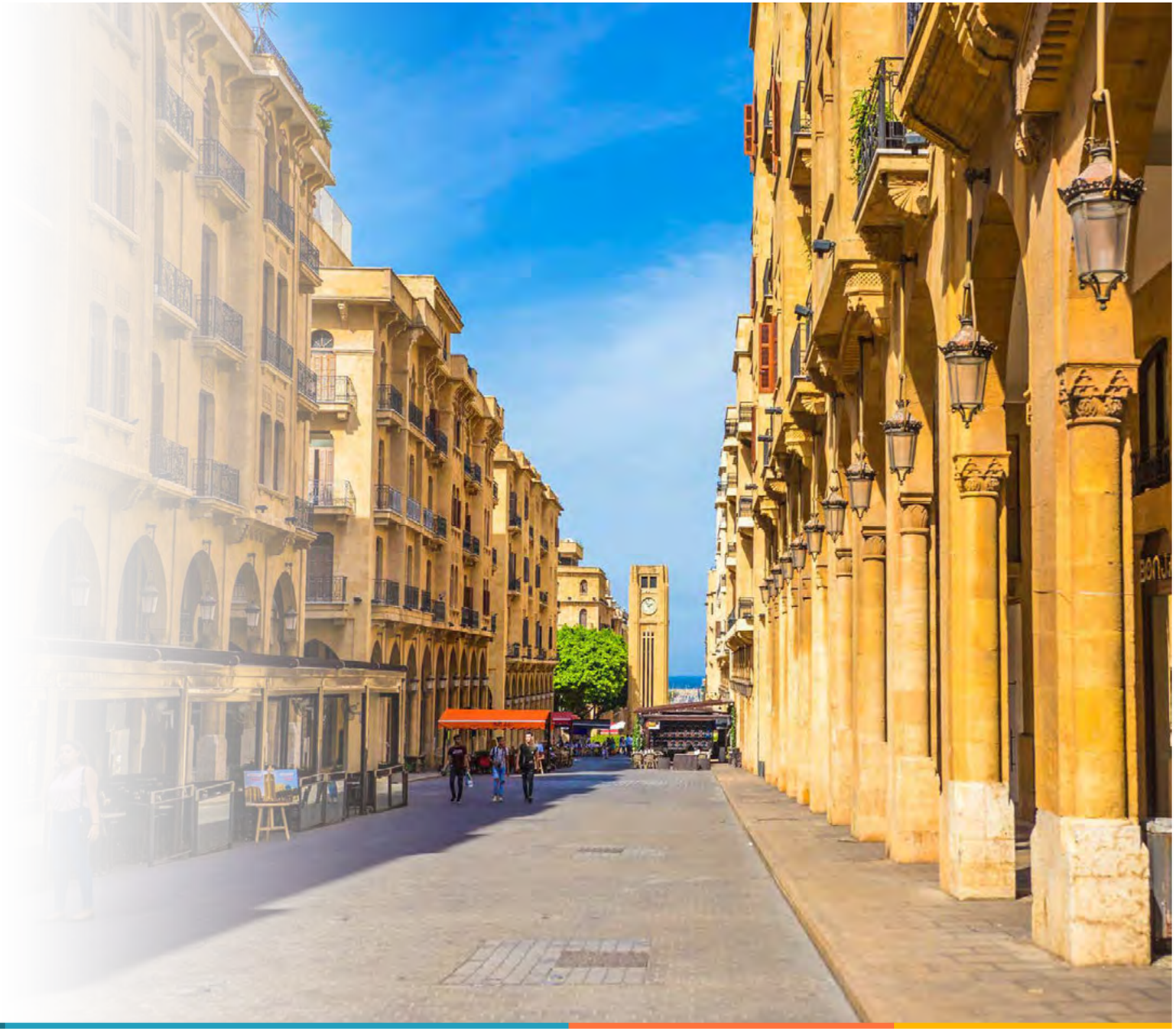
Most of the conventional RAC technologies available on the global market are also available in MENA and Türkiye, however the adoption rates of different technologies tend to vary from one country to the next.

For example, while district cooling could be an effective and efficient solution for many countries across the region, only a few countries—namely Egypt, Qatar, Saudi Arabia, and the UAE—have adopted it to date.[68] Similarly, countries with close trade links with Europe (e.g. Türkiye) are likely to have more high-efficiency, low-GWP appliances available on the market due to strict EU regulation.

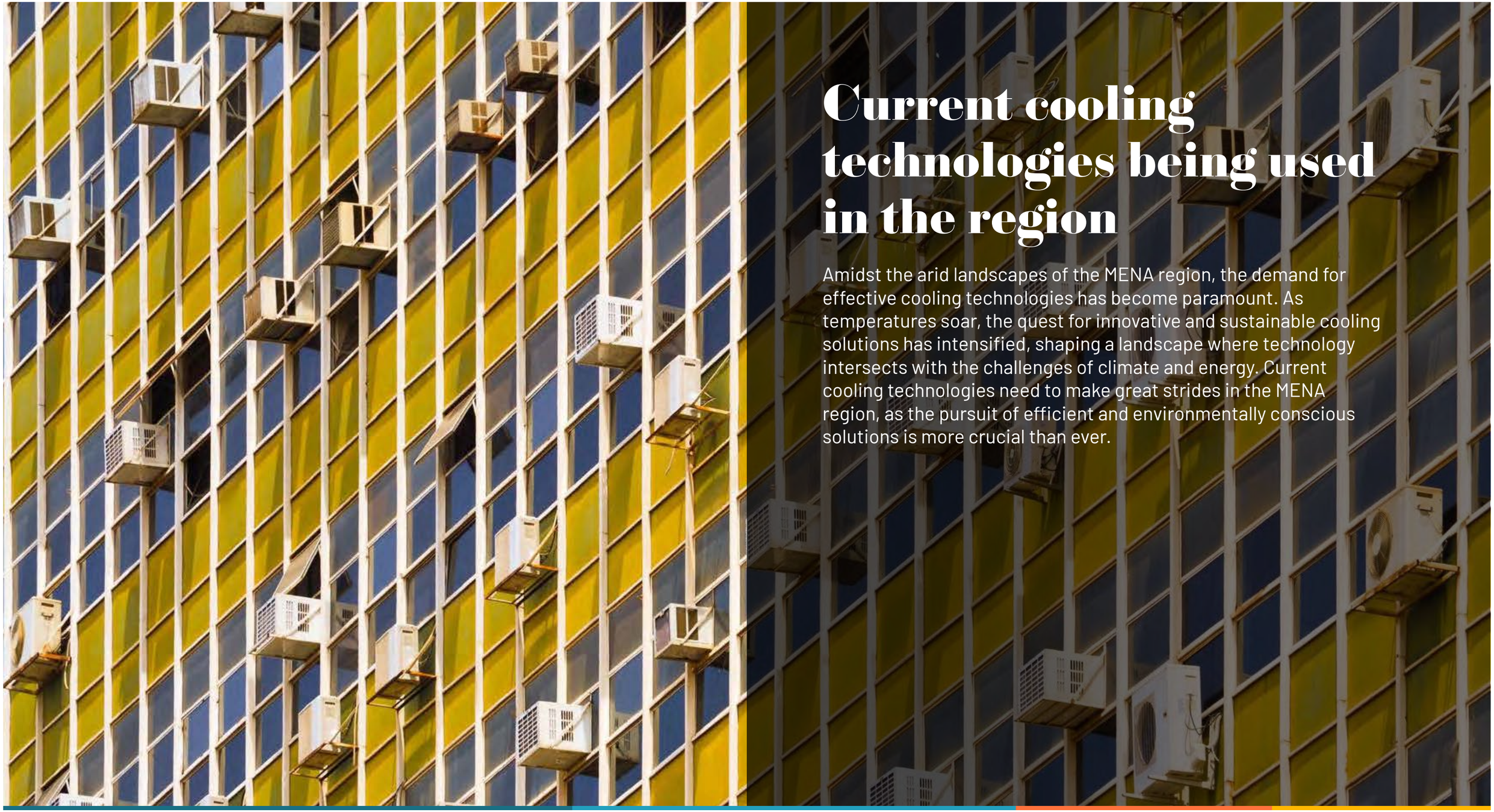
Regional variations in climate, building types, development levels, and other factors will also affect the appropriateness and adoption of different technologies and solutions.

As customer demands evolve to focus more on energy efficiency, sustainability, and reliability, equipment manufacturers are following suit and developing more advanced technologies. Innovation also helps stimulate continued market growth.

Regional variations in climate, building types, development levels, and other factors will also affect the appropriateness and adoption of different technologies and solutions.



68 Alotaibi, "District cooling in the Middle East & North Africa; history, current status, and future opportunities."



Current cooling technologies being used in the region

Amidst the arid landscapes of the MENA region, the demand for effective cooling technologies has become paramount. As temperatures soar, the quest for innovative and sustainable cooling solutions has intensified, shaping a landscape where technology intersects with the challenges of climate and energy. Current cooling technologies need to make great strides in the MENA region, as the pursuit of efficient and environmentally conscious solutions is more crucial than ever.

Commonly-available technologies

Air conditioning

In 2021, around 59.8% of the room ACs sold in the Middle East were single split-type units, while 40% were window-type units. A very small number of multi split-type units were also installed.[69]

This varies from country to country, however, with 70.5% of residential buildings in Saudi Arabia relying on window AC units, compared to 26% split-type and fan coil-based systems, 2.4% evaporative coolers, and just 1% central AC systems.[70] This reliance on window AC in Saudi Arabia is problematic due to their low energy efficiency compared to other systems.

With the exception of VRF systems, a very low percentage of AC units in the Middle East use inverter technology. Of the units sold in 2021, only 18% of packaged AC units and 19% of single split-type units used the energy efficient technology.

In terms of refrigerants, the vast majority of new appliances—80%–99%—use HFCs. In 2021, 11%–14% of the single split-type and packaged AC units sold in the Middle East still contained HCFCs and around 6% contained A2L refrigerants. Over the last three years, there's been a markable shift in the region away from HCFCs.[71]

Commercial refrigeration

The region's changing habits around food consumption is driving a surge in the demand for commercial refrigeration equipment, with a rapid expansion of supermarkets, hypermarkets, and restaurants. For example, in the UAE, the number of "organised" supermarkets increased by 60% between 2015 and 2018.[72] This trend is also encouraging smaller, more traditional food retailers to upgrade their infrastructure to compete.

The growing demand for frozen food and enhanced visual merchandising is driving an increased demand for refrigerated display cases.[73]

69 JRAIA, "Estimates of World Air Conditioner Demand."

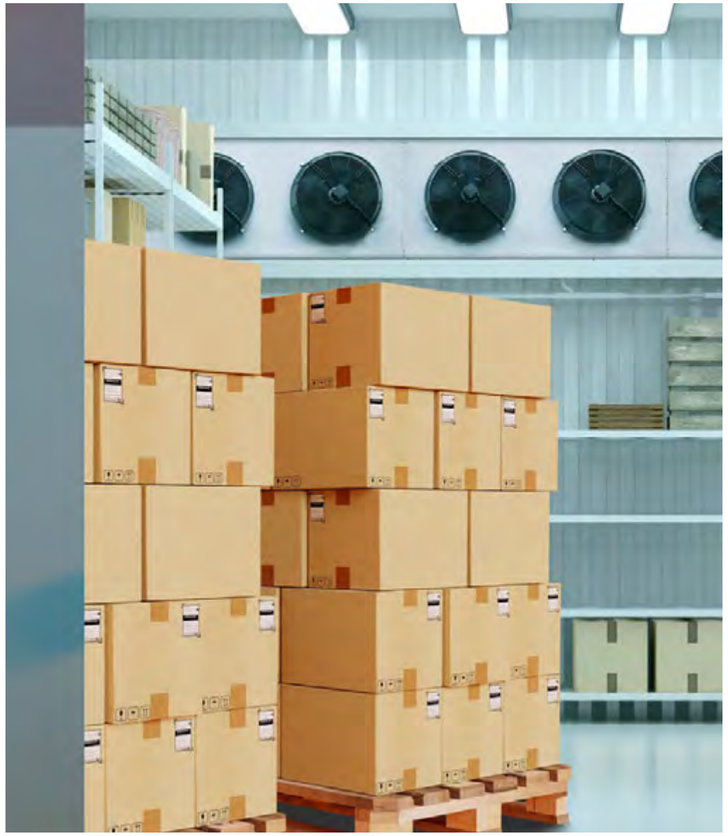
70 Krarti, "Transitioning to high efficiency air conditioning in Saudi Arabia."

71 JRAIA, "Estimates of World Air Conditioner Demand: Inverter rate & refrigerant use by type."

72 Sengupta, "Energy and advanced exergoeconomic analysis of a novel ejector-based CO2 refrigeration system and its optimization for supermarket application in warm climates."

73 PS Market Research, "Middle East and Africa (MEA) Commercial Refrigeration Equipment Market Overview."

The growing demand for frozen food and enhanced visual merchandising is driving an increased demand for refrigerated display cases.



While most markets are replacing HCFCs with HFCs, natural refrigerants — predominantly R290 (propane) — are also becoming more widely used."

In the four Cool Up programme countries—Egypt, Jordan, Lebanon, and Türkiye—plug-in refrigerated units (also called standalone units) make up the majority of the market. Condensing units are also commonly used across the region but at a much lower rate and centralised or multi-compressor systems are present in small numbers in certain markets.

With regard to refrigerants, most supermarkets in the region still operate using HCFC- and HFC- based refrigerants, which have very high GWP. The refrigerant mix in the region's commercial refrigeration sector varies from country to country, for example, as of 2020, about 80% of Egypt's existing equipment used HCFC R22, whereas in Jordan, Lebanon, and Türkiye, HFCs like R134a and R404A made up the majority of the market share.

Over the last three years, the region has been shifting away from HCFCs in new equipment. While most markets are replacing HCFCs with HFCs, natural refrigerants—predominantly R290 (propane)—are also becoming more widely used. If this trend continues, there is potential for natural refrigerants to represent around 20% of some countries' commercial refrigeration market by 2030 and 40%–50% by 2050.[74]

74 Cool Up, Cooling Sector Prospect Studies and Cooling Sector Status Reports

Best available technologies

Air conditioning

Regionally, there are a number of technologies available that can offer more efficient, climate-friendly space cooling, such as evaporative coolers, thermal storage, and modules centralised systems.

For example, a solar-powered ice storage system has been tested in the UAE and the study has shown significant energy savings and GHG emissions reductions compared to conventional cooling systems.[75] Additional studies looking into the efficacy of evaporative cooling in the MENA region have demonstrated substantial energy savings.[76] [77]

While the majority of these solutions have not been adopted at scale and are still considered niche, VRF systems are considered to be a dominant technology that can be an effective solution in the region. They can serve a wide range of space cooling applications from single- and multi-family houses to medium scale commercial applications, however it is worth noting that VRF systems do require comparably high charges of F-gas refrigerants, which can pose a significant environmental risk if not managed correctly.

Globally, there are a growing number of companies working to introduce R290 (propane)-based room AC units to the market.[78] [79] [80] Similarly, efforts are being made to commercialise room AC technologies that have five-times lower climate impact[81] than the conventional technologies currently available.[82]

75 Ghaith, "Performance and feasibility of utilizing solar powered ice storage system for space cooling applications."

76 Borodinecs, "Feasibility of Reducing Electricity Consumption of Air Conditioning Equipment by Condenser Direct Evaporative Cooling Technology. Example of Case Study in Dubai."

77 Kharrufa, "Evaluating an active low-energy cooling upgrade to the building envelope in the hot climates of the Middle East."

78 Green Cooling Initiative, "Midea sets benchmark for more climate protection with first R290 model on the German-European market."

79 Godrej, "R290 Eco-friendly Air Conditioners."

80 Trevisan, "Haier to Launch R290 Air-to-Air Split Heat Pump in Europe in 2023."

81 Global Cooling Prize, "Breakthrough, Climate-Friendly ACs: Winners of the Global Cooling Prize Announced."

82 Horowitz, "Introducing the Global Cooling Efficiency Accelerator."

Globally, there are a growing number of companies working to introduce R290 (propane)-based room AC units to the market.

District cooling

District cooling systems consist of a centralised plant that provides cooling for a network of buildings—be they residential, commercial, or industrial. They are significantly more efficient than traditional cooling technologies and typically offer greater flexibility in terms of balancing cooling load between different applications.

District cooling is well suited for major new urban developments, which are common in many countries across MENA, where the necessary infrastructure can be integrated in plans from the start. That said, there are also some examples of retrofit projects in the UAE.[83]

Dubai, for example, has established an extensive network of district cooling systems across the city. By 2030, the city aims to use the technology for all new developments in order to meet 40% of its cooling needs. Dubai's district cooling systems are said to use about 50% of the electricity that would otherwise be required.[84]

83 Alotaibi, "District cooling in the Middle East & North Africa; history, current status, and future opportunities."

84 UN Environment Programme, "District energy in cities: unlocking the potential of energy efficiency and renewable energy."

Commercial refrigeration

Regionally, sustainable refrigeration technologies are slowly being introduced, with a few examples of central transcritical CO_2 systems and hydrocarbon-based plug-ins being introduced in supermarkets.

In 2018, a supermarket in Amman, Jordan, became the first retail food store in the Middle East to install a transcritical CO_2 refrigeration system. The retrofit project has been found to reduce the supermarket's energy consumption by 20%–30%, compared to its previous R22-based system.[85] Similarly, a supermarket in Abu Dhabi that installed a transcritical CO_2 system in 2019 saw initial energy savings of nearly 50%, compared to a standard HFC-based alternative.[86]

In 2022, a supermarket in Dubai saw 40% energy savings thanks to its R290 (propane)-based plug-in refrigeration units with inverter technology.[87]

Globally, there are several examples of efficient, natural refrigerant-based commercial refrigeration systems and equipment.[88]

Passive cooling solutions

Prior to installing mechanical cooling technologies like ACs, passive cooling solutions should be deployed to help provide thermal comfort with reduced energy consumption. For example, passive cooling solutions could reduce the annual energy consumption of residential buildings in the UAE by more than 20%.[89]

There are a number of examples of how passive cooling can be integrated with building design and urban planning in MENA and Türkiye.

In Riyadh, Saudi Arabia, an urban greening programme aims to reduce ambient temperatures across the city with the planting of 7.5 million trees.[90]

Meanwhile, in downtown Doha, Qatar, a development is using high thermal mass buildings to offer better insulation, and in Abu Dhabi, external shading has effectively reduced indoor temperatures of a high-rise building.[91]

Improving the building envelope through better insulation can significantly reduce both peak and annual cooling demand. In Riyadh, better roof and wall insulation reduced a building's annual electricity demand by 25%.[92]

Windcatchers are still frequently used to provide ventilation for homes in Iran. They are also known to reduce internal temperatures by 8°C–12°C.[93] These architectural elements have also been included in the design of a university in Qatar to keep its buildings cool.[94]

Prior to installing mechanical cooling technologies like ACs, passive cooling solutions should be deployed to help provide thermal comfort with reduced energy consumption.

85 Climate & Clean Air Coalition, "Clean cooling technology in Jordan is a first for the Middle East."

86 Stausholm, "Transcritical System in Super-Warm Abu Dhabi Exceeds Energy Expectations."

87 Abdin Industries, "Project in partnership with Monoprix in opening their Dubai Hills branch."

88 Environmental Investigation Agency, "Cool Technologies Sustainable Cooling Database: Commercial Refrigeration."

89 Taleb, "Using passive cooling strategies to improve thermal performance and reduce energy consumption of residential buildings in U.A.E. buildings."

90 Cool Coalition, Not Passing on Passive Cooling."

91 Bardsley, "Beat the heat: Sustainable ways to make buildings in the Middle East cooler."

92 Krarti, "Transitioning to high efficiency air conditioning in Saudi Arabia: A benefit cost analysis for residential buildings."

93 Hambling, "Ancient windcatchers in Iran give architects cooling inspiration."

94 Deutsche Welle, "Planet A: How to cool our homes (even without ACs)."

Developing a local and regional supply chain

While sustainable cooling technologies exist and are being successfully implemented in other regions of the world, there are many reasons why they are yet to be adopted at scale across MENA and Türkiye. Barriers include higher upfront costs, a lack of industry capacity and experience, and concerns around safety and reliability.

Developing a stronger local and regional supply chain for sustainable cooling technologies can contribute significantly to overcoming these barriers to adoption. The impact of the COVID 19 pandemic on the global supply chain over the last three years has also highlighted to many the potential benefits of a more streamlined and localised supply chain.

For example, local manufacturing and distribution can reduce transportation costs and import expenses, which can then reduce the overall cost and delivery time of equipment. Even in instances when this approach results in slightly higher production costs, the reliability and resilience of local supply chains should not be underestimated.

Investing in local capacity building and knowledge sharing can help ensure demand for sustainable cooling is met in terms of installation and maintenance. Improving contractor and technician understanding of and familiarity with these technologies also means that industry best practices are adhered to and end user concerns around safety and reliability can be mitigated.

Other benefits of a more localised supply chain include job creation and economic development (which is particularly important for the region as economies transition away from fossil fuels), greater market resilience, and reduced climate impact from less transportation.

The recent shocks to the global supply chains, combined with the benefits of a local or regional supply chain has led to many supply-chain executives to consider regionalisation a priority.[95]

Most of the countries across the region are net importers of cooling appliances. However, over the last two decades, local manufacturing has increased significantly, with countries like the UAE,Türkiye, Saudi Arabia, and Jordan beginning to export AC units. The market share of locally manufactured units is expected to increase over time.[96]

Of the various corporations that dominate the region's HVAC market, only one is from MENA. The majority of the remaining AC market leaders are from the United States, Japan, China, or South Korea.[97] Similar names operate within the commercial refrigeration sector, although there are several more European players in the market.[98]

While the majority of MENA's suppliers are international companies, many have regional subsidiaries. This is also true with some component manufacturers.[99]

Investing in local capacity building and knowledge sharing can help ensure demand for sustainable cooling is met in terms of installation and maintenance.

95 Alicke, "How COVID-19 is reshaping supply chains."

96 Cool Up, "MENA Region Cooling Status Report: Progress, Opportunities, and Insights | Issue 1."

97 Oommen, "MENA HVAC market to grow "at significant rate" till 2026."

98 PS Market Research, "Middle East and Africa (MEA) Commercial Refrigeration Equipment Market Overview."

99 Castel, "Castel establishes Middle East subsidiary."

Over the last two decades, local manufacturing has increased significantly, with countries like the UAE,Türkiye, Saudi Arabia, and Jordan beginning to export AC units.

In some of the region's countries, locally manufactured equipment and components are available in certain sectors of the RAC market. For example, in Türkiye and Jordan, standalone commercial refrigeration units are locally manufactured thanks to locally produced components.[100] [101] Meanwhile, in Egypt, the AC market is dominated by local manufacturers that represent major international brands.[102]

In terms of refrigerants, the vast majority of the refrigerants used across MENA and Türkiye, particularly F-gases, are imported.[103]

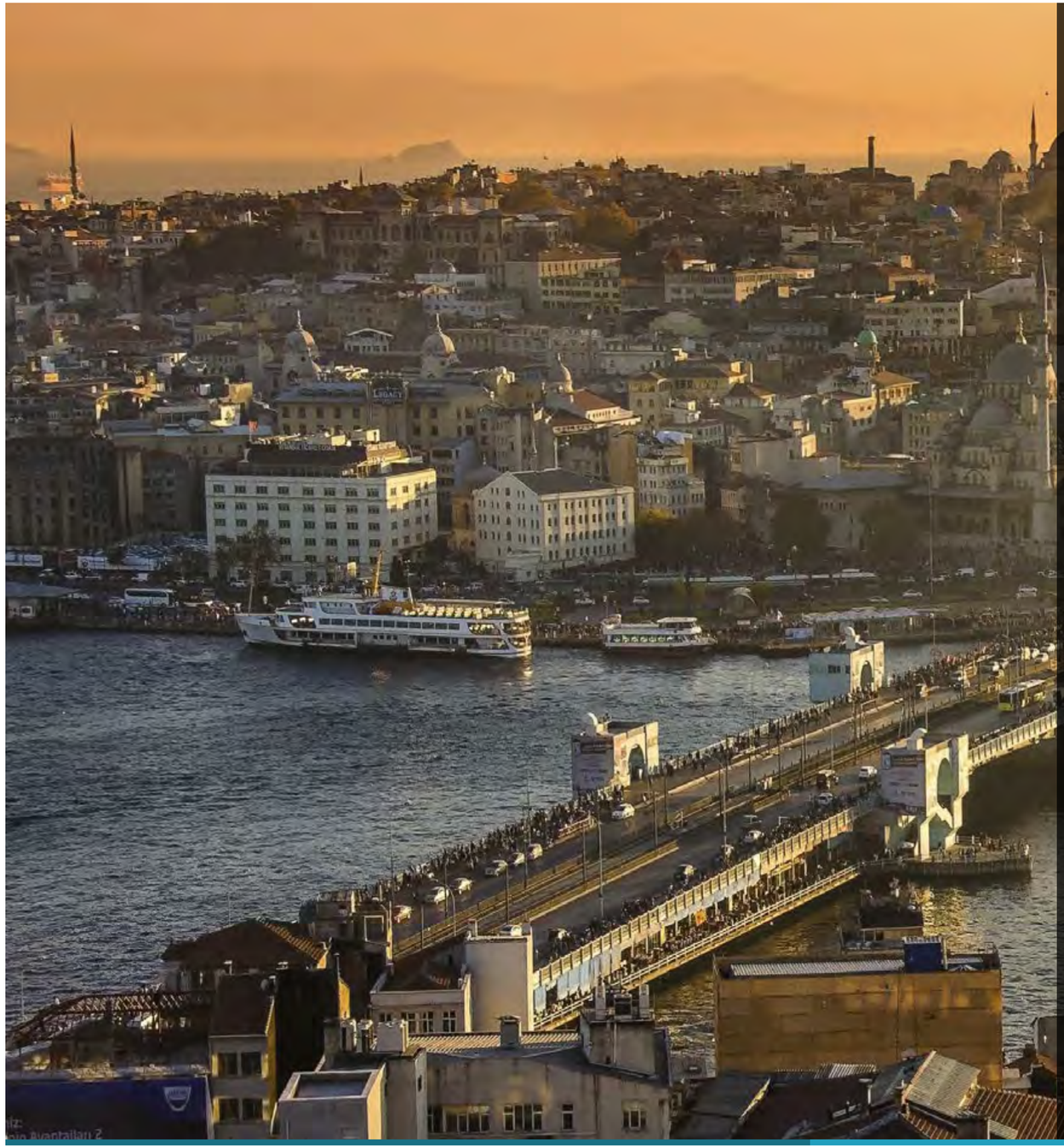
As the region's sustainable RAC market is still in its infancy, the skilled workforce is currently limited. However, as demand for sustainable AC and commercial refrigeration equipment and systems grows, governments, manufacturers, and other stakeholders will need to ensure that the necessary technicians are trained to install, service, and dispose of the existing and new technologies.

100 Cool Up, "Cooling Sector Status Report Türkiye."

101 Cool Up, "Cooling Sector Status Report Jordan."

102 Cool Up, "Cooling Sector Status Report Egypt."

103 Cool Up, Cooling Sector Status Reports.



Regional spotlight: Achieving environmental sustainability and industry excellence in Türkiye

Over recent years, Türkiye has set ambitious goals in pollution control, waste management, and combating climate change. By aligning with EU standards and regulations, Türkiye aims to enhance its environmental standards and ensure sustainable development.

As an important player in European, MENA, and Russian AC sectors, Türkiye's efforts to harmonise its market and product standards with the EU, have contributed to its increasing importance as a manufacturing and export hub of energy-efficient and climate-friendly cooling appliances.

Key facts

- Türkiye is actively working to reduce its GHG emissions, comply with EU climate policy legislation, and contribute to global efforts in mitigating climate change.
- Türkiye's open market and fair competition conditions, along with regulatory efforts, have harmonised product standards and updated the Turkish F-gas regulation to align with EU standards.
- Türkiye published its first F-gas regulation in 2018, followed by an update fully aligned with the EU's 517/2014 regulation in 2022.
- Thanks to its customs union with the EU and free trade agreements with Egypt, Jordan, and Lebanon, Türkiye has become a significant manufacturing and export hub.

Consumers benefit from high-quality, environmentally-friendly products and greater product choice.

"Türkiye's commitment to environmental sustainability and compliance with EU regulations have supported our efforts to position the country as a leader in the refrigeration industry, benefitting both our local industries and international trade relationships."

DOC. DR. DENIZ YILMAZ, R&D MANAGER - MECHANICAL ENGINEER, PHD., MSC. FRIGOBLOCK

Harmonised markets

Türkiye's recent adoption of the EU F-Gas Regulation demonstrates its commitment to environmental sustainability, product standardisation, cross-border trade facilitation, market access, and innovation.

By aligning its regulations with those of the EU, Türkiye contributes to the establishment of a harmonised RAC market that benefits both domestic industries and international trade relationships. Turkish manufacturers benefit from streamlined production and broader market access, while local businesses benefit from cost efficiency and market confidence, and consumers benefit from high-quality, environmentally-friendly products and greater product choice.

Through its new national F-gas regulation, Türkiye has implemented an ambitious phasedown schedule for HFCs and has introduced market bans that will allow the country to reduce the emission of F-gases in line with international climate agreements. Although Türkiye is not a member of the EU, following the EU F-gas Regulation will have a very positive impact on the country's trade capacities within the RAC sector.

Walking the talk

Frigoblock—a prominent player in the Turkish industrial refrigeration sector—specialises in designing and manufacturing RAC systems that align with the targets of the EU and Turkish F-gas regulation. The company embraced natural refrigerants like ammonia and CO_2 long before regulatory obligations required it to do so, and its systems are designed to minimise end users' carbon footprint.

Complying with the EU F-gas Regulations, not only enables Frigoblock to operate seamlessly in the EU market, but it also positions them as a model for other Turkish manufacturers striving to meet similar standards.

With a preference for CO_2 as a refrigerant—due to its environmental sustainability, energy efficiency, cost effectiveness, and versatility—Frigoblock has invested in the research and development (R&D) of CO_2-based RAC systems for the last 15 years. Not only has this supported its commercial efforts, it has also supported technological development in numerous academic settings.

At a time when CO_2 refrigeration systems were just beginning to be used, Frigoblock partnered with Marmara University to design and produce a CO_2-based cascade refrigeration system. The project was supported by Türkiye's Ministry of Industry and Technology. Immediately after this study concluded, a new project was initiated to support the introduction of CO_2 refrigeration systems in supermarkets.

Over the years, Frigoblock has encountered many challenges in its efforts to scale up the adoption of CO_2-based RAC technologies in Türkiye:

- ***Technical adaptation:*** Adapting Frigoblock's production line to accommodate natural refrigerants like CO_2 has required some technical adjustments due to their differing properties and operational requirements compared to traditional synthetic refrigerants. However, no major changes were required.
- ***Training and expertise:*** The successful adoption of natural refrigerants in Frigoblock required specialised knowledge and training for the company's engineering and technical teams.
- ***Market acceptance:*** Introducing new refrigerants can sometimes lead to hesitation from potential customers who may be unfamiliar with the benefits of these alternatives. Educating the market and building acceptance for natural refrigerants required a concerted effort.

To overcome these challenges, as well as wider market barriers like high upfront costs, limited stock, and long delivery times, Frigoblock believes additional regulatory support is needed to steer the market to more sustainable options like CO_2 and ammonia.

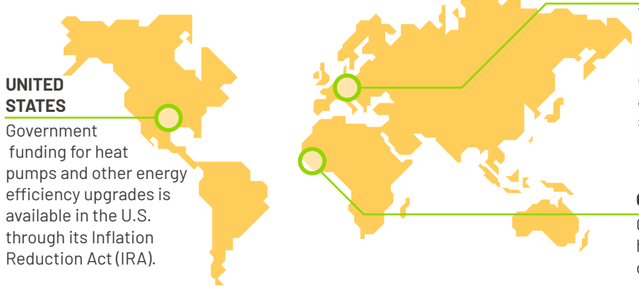
A cool view: Sustainable cooling strategies from around the world

A cool view

Sustainable cooling strategies from around the world

As regional stakeholders continue their work to scale up the adoption of sustainable cooling solutions, successful solutions from other regions could be applied —with adaptations to suit the local context— to support their efforts.

Financing sustainable cooling



UNITED STATES

Government funding for heat pumps and other energy efficiency upgrades is available in the U.S. through its Inflation Reduction Act (IRA).

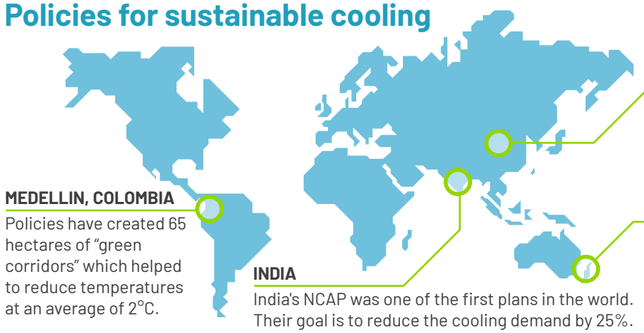
GERMANY

The German government's Federal Funding for Efficient Buildings programme offers subsidies for energy efficient heat pumps, with additional support granted for systems using natural refrigerants.

GHANA and SENEGAL

Consumer financing initiatives have helped people purchase a refrigerator or AC unit using a zero-interest loan.

Policies for sustainable cooling



MEDELLIN, COLOMBIA

Policies have created 65 hectares of "green corridors" which helped to reduce temperatures at an average of 2°C.

INDIA

India's NCAP was one of the first plans in the world. Their goal is to reduce the cooling demand by 25%.

CHINA

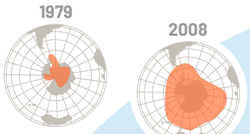
Ambitious MEPS have completely transformed China's domestic AC market from fixed-speed to variable-speed models.

NEW ZEALAND

In 2021, New Zealand introduced an update to its national building code. Amendments include requirements to reduce energy needs for heating and cooling.

The success of the Montreal Protocol

In the 1970s, scientists discovered a hole in the ozone layer, which was causing increased UV radiation levels and risk to human health and the environment.



1987

Countries came together to adopt the Montreal Protocol, which **regulates the production and consumption of nearly 100 man-made ozone-depleting chemicals.**

2007

Parties committed to an **accelerated phase-out of HCFCs,** parties agreed to phase out HCFCs until 2030.

2016

The protocol expanded further to include HFCs under its Kigali Amendment, which aims to phase down the production and consumption of HFCs by 85% by 2050.

The estimated impacts

MONTREAL PROTOCOL

It is estimated that the Montreal Protocol will help prevent up to 1°C of global warming by mid-century.

-1°C

KIGALI AMENDMENT

An additional 0.3-0.5°C temperature rise could be avoided by 2100 thanks to the Kigali Amendment.

-1,5°C

EU F-gas regulation for an accelerated HFC phase down

The EU has phased out ODS a decade ahead of its Montreal Protocol obligations, and taking action on HFCs two years before the Kigali Amendment was adopted.

EU

Under the Kigali Amendment, the European Union (as a Non-Article 5 party) is required to gradually **reduce its production and consumption of HFCs by 85% by 2036.**

HFC

In addition to limiting the amount of F-gases that can be placed on the market, the EU F-gas Regulation also bans the use of synthetic refrigerants in certain types of equipment where climate-friendly alternatives are available.

Türkiye's strong trade links with the EU have led the country to fully align its national F-gas regulations with the EU's.

If adopted, the revised F-gas regulations would further accelerate the EU's HFC phase down and set a new target of a 98% reduction by 2050.

If adopted, the EU's new F-gas Regulations would prevent the emission of 310 $MtCO_2e$ by 2050.

The EU's regulation confirms its position as a global leader on the F-gas phasedown and encourages others to take similar action.

As with many aspects of climate change, the cooling challenge is a global problem that requires global action.

While each country faces their own challenges when it comes to climate change and their own unique needs when it comes to cooling and refrigeration, there is a lot that can be learned from other countries and organisations. From ambitious policies and regulations, to innovative financing programs and business models, there are several examples of successful sustainable cooling strategies from around the world.

In MENA and Türkiye, countries are still in the early stages of the sustainable cooling transition. However, commitment is growing and existing projects and programmes are showing great potential. As regional stakeholders continue their work to scale up the adoption of sustainable cooling solutions, successful solutions from other regions could be applied–with adaptations to suit the local context–to support their efforts.

As regional stakeholders continue their work to scale up the adoption of sustainable cooling solutions, successful solutions from other regions could be applied—with adaptations to suit the local context—to support their efforts.

Policies for sustainable cooling

Effective governmental policies are a crucial part of global climate action. In relation to sustainable cooling, there are several examples of how policies have driven change and had a meaningful impact.

At the regional level, the European Union (EU)'s F-gas Regulation has been a highly effective tool for accelerating the phasedown of HFCs beyond the Kigali Amendment. (See Section 5.2. for more information on EU F-gas Regulation.)

At a national level, China's MEPS for room ACs have revolutionised its domestic AC market. In the space of just three years, the market has shifted away from inefficient, fixed-speed models and towards efficient, variable-speed alternatives, which use around 30% less energy. As of July 2022, fixed-speed ACs accounted for just 2% of China's domestic AC market, with the remaining 98% made up of variable-speed models.

In India, its NCAP was one of the first such plans in the world and aims to reduce cooling demand by 25%, refrigerant demand by 25-30%, and cooling-related energy demand by 40% by 2038. It is also focused on doubling farmers' income and reducing food waste through an improved cold chain. The plan has been praised for being comprehensive and ambitious, but also sensible and achievable.[104]

In 2021, New Zealand introduced an update to its national building code that aims to improve the energy efficiency of new homes and buildings. Amendments include requirements for better insulation to reduce energy needs for heating and cooling, and better monitoring of commercial heating, ventilation, and air conditioning (HVAC) systems.[105]

At the local level, Medellín, Colombia, has created 65 hectares of "green corridors" across the city since 2016. The new trees, plants, and other green spaces have helped to reduce temperatures across the city by an average of 2°C, as well as to deliver several other ecosystem services.[106]

Effective governmental policies are a crucial part of global climate action. In relation to sustainable cooling, there are several examples of how policies have driven change and had a meaningful impact.

104 UN Environment Programme, "India advances ground-breaking plan to keep planet and people cool."

105 New Zealand Government, "2021 Building Code update."

106 C40 Cities, "Cities100: Medellín's interconnected green corridors."

Financing sustainable cooling

Financing for sustainable cooling projects and initiatives come from a variety of sources, from governments and financial institutions, to the private sector and philanthropy.

The German government's Federal Funding for Efficient Buildings programme offers subsidies for energy efficient heat pumps, with additional money granted for systems using natural refrigerants.[107] Government funding for heat pumps and other energy efficiency upgrades is also available in the U.S. through its Inflation Reduction Act (IRA).[108]

Consumer financing programs backed by commercial banks and other financial entities can help offset the higher upfront costs of sustainable cooling appliances. For example, on-wage and on-bill programmes in Ghana and Senegal have helped thousands of individuals purchase an approved refrigerator or AC unit using a zero-interest loan, with repayments made via their salary or utility bills.[109]

Financing for sustainable cooling projects and initiatives come from a variety of sources, from governments and financial institutions, to the private sector and philanthropy.

107 German Federal Office for Economics and Exports, "Funding for efficient buildings - Systems for heat generation."

108 U.S. Department of Energy, "Inflation Reduction Act of 2022 - What it Means for You."

109 United for Efficiency, "Country and Regional Activities: Ghana and Senegal"

Private sector innovation through business models like refrigerant carbon financing or cooling-asa- service (CaaS) are helping expand access to sustainable cooling by improving its affordability, predominantly for commercial end users.

Private sector innovation through business models like refrigerant carbon financing[110] or cooling-as-a-service (CaaS)[111] are helping expand access to sustainable cooling by improving its affordability, predominantly for commercial end users.

Philanthropic funding has supported several sustainable cooling projects, for example, the Million Cool Roofs Challenge has supported the testing of different approaches and business models to scaling up reflective "cool roofs" in 10 new markets.[112]

110 North American Sustainable Refrigeration Council, "Groundbreaking Refrigerant Carbon Credit Pilot Program Rewards Grocers For Climate-Friendly Refrigerant Choices."

111 CaaS Initiative "CaaS implementation in a dairy factory completes its first-phase and already outperform expectations."

112 Clean Cooling Collaborative, "Million Cool Roofs Challenge: Local Champions for a Global Movement."

Montreal Protocol

In the 1970s, scientists discovered a hole in the ozone layer, which was causing increased UV radiation levels and risk to human health and the environment. They also found that CFCs and other ODS were responsible.

To combat the issue, countries came together in 1987 to adopt the Montreal Protocol on Substances that Deplete the Ozone Layer,[113] which regulates the production and consumption of nearly 100 man-made ozone-depleting chemicals.

Under the Montreal Protocol, all parties agreed to phase out the use of ODS in a stepwise manner. By the early 2000's, countries had successfully phased out CFCs and as of 2010, the production of the chemicals has been banned. As new scientific information became available and developments were made, the Montreal Protocol evolved. In 2007, parties committed to an accelerated phaseout of HCFCs, which are known for both their ozone depletion and high-GWP properties. Under this Montreal Agreement, non-Article 5 parties and Article 5 parties agreed to phase out HCFCs by 2020 and 2030, respectively.

In 2016, the protocol expanded further to include hydrofluorocarbons (HFCs) under its Kigali Amendment, which aims to phase down the production and consumption of HFCs by 85% by mid-century.

The Montreal protocol is one of the rare international agreements to have achieved universal ratification, and was the first to do so.

113 UN Environment Programme, "About the Montreal Protocol."

The Montreal Protocol's impacts

Without the Montreal Protocol, ozone depletion would have increased tenfold, resulting in millions of additional cases of skin cancer and eye cataracts, as well as other significant impacts. Similarly, CFC emissions would have led to 1.7°C of global warming by 2100.[114]

To date, countries have phased out almost 99% of ODS globally below 1990 levels, and with current policies, it is anticipated that the ozone layer will recover to 1980 values by around 2066 over the Antarctic, by 2045 over the Arctic, and by 2040 for the rest of the world.

It is estimated that the Montreal Protocol will help prevent up to 1°C of global warming by mid-century. An additional 0.3-0.5°C temperature rise could be avoided by 2100 thanks to the Kigali Amendment.[115]

The Montreal Protocol also contributes to several of the UN SDGs, including SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

"The Montreal Protocol is considered to be one of the most successful environmental agreements of all time. What the parties to the Protocol have managed to accomplish since 1987 is unprecedented, and it continues to provide an inspiring example of what international cooperation at its best can achieve." - UN Environment Programme.

"The Montreal Protocol shows what is possible when science, diplomacy, and business cooperate to implement international environmental agreements." - International Institute for Sustainable Development (IISD).[116]

What next for international action on F-gases?

Over the past 35 years, the Montreal Protocol has continuously evolved to cover new chemicals and accelerate phase down schedules. So what could come next?

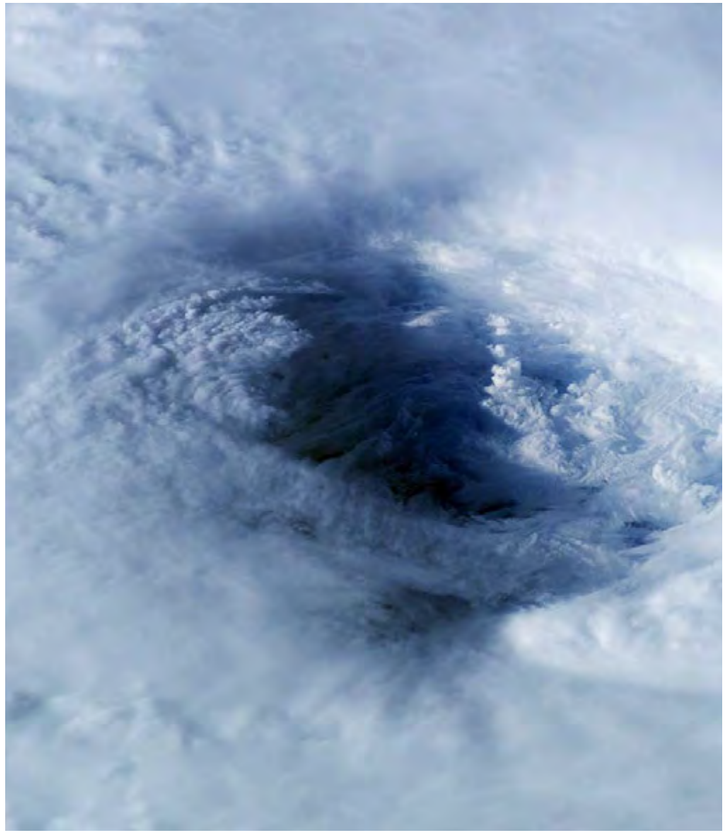
While the Montreal Protocol is celebrated for being one of the most impactful international treaties, there remain many opportunities to go even further. For example, refrigerant banks—the vast amounts of ODS and HFCs contained in old RAC equipment—are not currently covered by the agreement. If cooling appliances are not disposed of correctly, these refrigerants leak into the atmosphere and could result in the emission of 1.5 $GtCO_2e$ each year.[117]

Other opportunities include integrating work on energy efficiency with the HFC phasedown to double the climate benefits of the protocol and its amendments[118] and tackling the illegal trade of controlled substances.[119]

As we enter a period when, for the first time, Article 5 countries will be working simultaneously on the HCFC phaseout and the HFC phasedown, additional support could be given to help stakeholders leapfrog to future-proof solutions, such as natural refrigerants, bypassing HFCs altogether.

There is also growing debate around the use of hydrofluoroolefins (HFOs)—which are synthetic refrigerants with zero ozone depletion and low-GWP—as an alternative to HFCs. However, there is mounting evidence that HFOs pose potential dangers to human health and the environment.[120] Will the Montreal Protocol expand to cover these refrigerants one day too?

It is estimated that the Montreal Protocol will help prevent up to 1°C of global warming by mid-century. An additional 0.3-0.5°C temperature rise could be avoided by 2100 thanks to the Kigali Amendment.



114 Bates, "Protecting the Ozone Layer Also Protects Earth's Ability to Sequester Carbon."

115 World Meteorological Organization, "Scientific Assessment of Ozone Depletion: 2022 - Executive Summary."

116 Helfenstein, "Healing the Ozone Layer Through Diplomacy."

117 Climate and Ozone Protection Alliance, "ODS and HFC Banks Management."

118 UN Environment Programme, "Cooling Emissions and Policy Synthesis Report."

119 Environmental Investigation Agency, "Crime and Crime Again."

120 Environmental Investigation Agency, "New family of synthetic refrigerant gases poses potential dangers to human health and the environment."

EU F-gas Regulation for an accelerated HFC phasedown

The EU has long been a global leader on F-gases, having phased out ODS a decade ahead of its Montreal Protocol obligations and taken action on HFCs two years before the Kigali Amendment was adopted.

Through its ambitious F-Gas Regulation, which was first adopted in 2006 before being updated in 2014 to include HFCs and again in 2023 to raise ambition, the EU put itself on a phasedown schedule that has been ahead of the Kigali Amendment from the very start.[121]

Under the Kigali Amendment, the European Union (as a Non-Article 5 party) is required to gradually reduce its production and consumption of HFCs by 85% by 2036 below 2014 levels.122 However, the provisionally-agreed EU F-gas Regulation aims to achieve a 95% reduction in the use of HFCs by 2030 below 2015 levels, and a full phaseout by 2050. This progress marks the world's first HFC phaseout schedule.

121 European Commission "EU legislation to control F-gases."

122 UN Environment Programme, "The Kigali Amendment to the Montreal Protocol: HFC Phase-down."

In addition to limiting the amount of F-gases that can be placed on the market, the EU's regulation also bans the use of synthetic refrigerants in certain types of equipment where climate-friendly alternatives are available, and requires sufficient equipment servicing, maintenance, and end-of-life recovery to prevent refrigerant leaks.

For example, refrigerants with a GWP of higher than 150 will be banned in new small (<12kW) monobloc heat pumps and air conditioners from 2027. By 2032, all F-gases, regardless of GWP, will be banned in these appliances, which will discourage the adoption of HFOs. For split AC units and heat pumps, F-gases must be phased down by 2029 and phased out by 2035.

The revision also includes certain caveats and safeguards to ensure sufficient technological advancements and the success of other EU policies, such as heat pump deployment targets under REPowerEU.[123]

If successfully implemented, the revised F-gas regulation is anticipated to prevent the emission of around 300 $MtCO_2e$ by mid-century. An additional 200 $MtCO_2e$ will be avoided thanks to updated regulation on ODS.[124]

The availability of climate-friendly alternatives to F-gases makes its ambitious targets achievable and the regulation will help stimulate innovation within the RAC sector.

Beyond the EU

According to the European Commission, the EU's regulation confirms its position as a global leader on the F-gas phasedown and encourages others to take similar action. While the EU F-gas Regulation is enforced across the bloc's 27 member states, its impacts are indeed felt further afield.

For example, Türkiye's strong trade links with the EU have led the country to fully align its national F-gas regulations with the EU's to ensure harmonised product standards and compliance with regional legislation *(see Chapter 4.3 for more information)*. Similarly, the UK Government has committed to matching the ambition of the EU F-gas Regulation in its own regulatory review.[125]

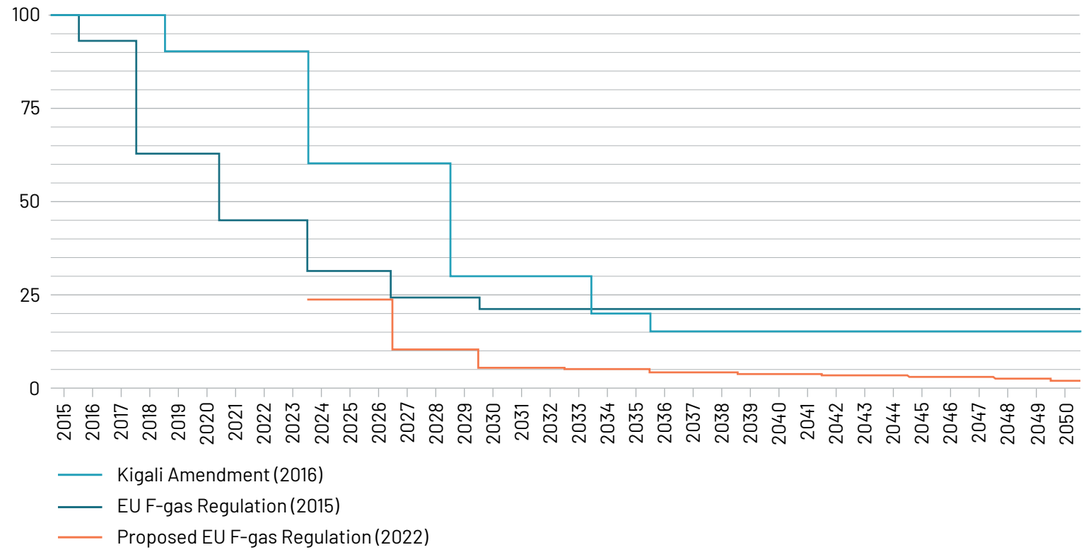
123 Council of the European Union, "Fluorinated gases and ozone-depleting substances: Council and Parliament reach agreement."

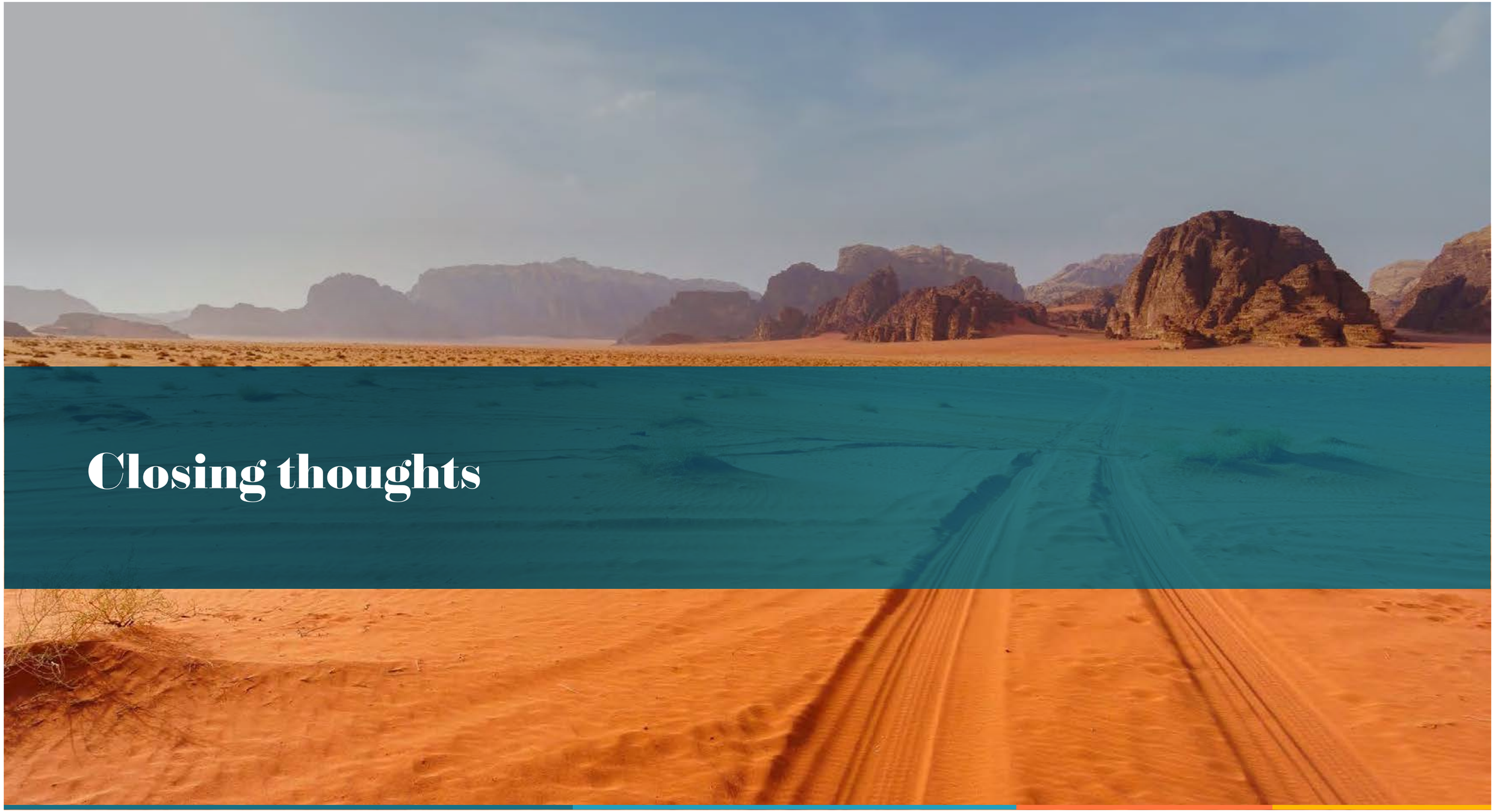
124 European Commission, "Commission welcomes agreement on new legislation to prevent 500 million tonnes of emissions from fluorinated gases and ozone depleting substances."

125 Environmental Investigation Agency, "Ambition of newly revised EU F-gas Regulation heralds a new era of climate innovation."

The EU's regulation confirms its position as a global leader on the F-gas phasedown and encourages others to take similar action.

The EU's phase down of HFCs





Closing thoughts

As governments in MENA and Türkiye are looking to reduce GHG emissions, while also building resilience to a changing climate, investing in sustainable cooling offers valuable climate mitigation and adaptation opportunities.

Furthermore, by leapfrogging from conventional equipment to future-proof RAC technologies that are energy-efficient, use natural refrigerants, and are compatible with renewable energy sources, they can avoid locking in excess GHG emissions—both direct and indirect—for decades to come.

While the interest in sustainable cooling is growing among regional stakeholders, more is needed to accelerate the transition and ensure maximum impact.

Governments must develop and implement ambitious policies that support the production and adoption of sustainable cooling solutions, such as MEPS, energy labels, building codes, and accelerated F-gas phasedown schedules. NCAPs are a particularly useful tool for creating a holistic overview of a country's cooling needs and how to meet them.

Financial institutions, be they national, regional, or global, must ensure the necessary finance is made available to drive technological innovation and deployment. This support could come in a variety of forms, including funding for demonstration projects, accessible loans for manufacturers to convert production lines, consumer finance programmes to make new technologies more affordable, or tax incentives to encourage early adoption.

Finally, manufacturers need to invest in R&D and convert their production lines to sustainable alternatives to meet the growing demand for future-proof technologies.

With several impending climate and development deadlines, including the Paris Agreement, the Kigali Amendment, and the SDGs, now is the time for stakeholders across MENA and Türkiye—and beyond—to act urgently and ambitiously on cooling.

Dr. Nesen Surmeli-Anac
Programme Manager, Cool Up programme

While the interest in sustainable cooling is growing among regional stakeholders, more is needed to accelerate the transition and ensure maximum impact.

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(implemented by SCOPE, a division of NETCOMPANY-INTRASOFT S.A.)

Date: December 2023

Publisher

Guidehouse Germany GmbH
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Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

Disclaimer:

Cool Up is part of the International Climate Initiative (IKI). Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection supports this initiative on the basis of a decision adopted by the German Bundestag.

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