بسم الله الرحمن الرحيم

وزارة البيئة

الرقم ٢/٥/١٣٩٧

التاريخ

الموافق ٢٠٢٥/٣/٥

معالي.....

عطوفة.....

سعادة.....

السادة.....

الموضوع: مسودة خطة عمل التبريد الوطنية

تحية طيبة وبعد،،

اشارة الى تنفيذ اولوية **تطوير التكييف والتبريد المستدام** ضمن **البرنامج التنفيذي لرؤية التحديث الاقتصادي**، أرفق لكم **مسودة خطة عمل التبريد الوطنية**، والتي تحدد إجراءات مفصلة وتدابير يجب اتخاذها من أجل وصول الأردن إلى أهداف التبريد المستدام وذلك لتلبية احتياجات التبريد المتزايدة في المملكة الاردنية الهاشمية استنادا **لاستراتيجية التبريد الوطنية في المملكة (NCS)**، والتي تم اعدادها لتعكس جميع النقاشات التي تمت بين الجمعية العلمية الملكية مع وزارة البيئة وممثلي الجهات الحكومية والمصنعين واصحاب المصلحة الرئيسيين.

راجيا التكرم بالايعاز للمعنيين لديكم **بمراجعة مسودة خطة العمل وتزويدنا بالملاحظات** ان وجدت من خلال الايميل التالي: **(Shorouq.baniata@moenv.gov.jo)** كحد اقصى **يوم الثلاثاء الموافق 2025/3/25** ليتم اخذها بعين الاعتبار قبل اعتماد خطة العمل الوطنية بصيغتها النهائية ونشرها حسب الاصول.

واقبلوا فائق الاحترام،،،

وزير البيئة

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1238

وزارة البيـــئة

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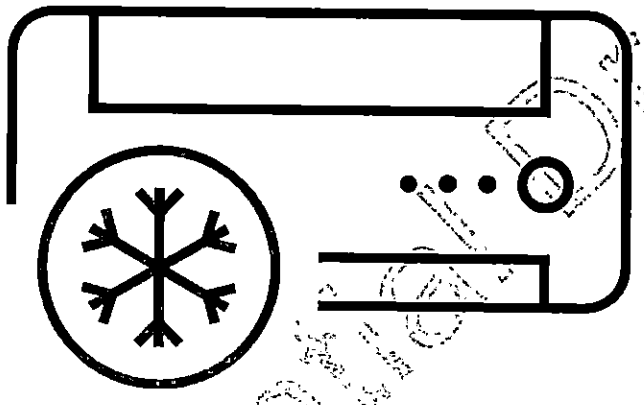

NATIONAL COOLING ACTION PLAN OF JORDAN

Priority interventions to address Jordan's growing cooling needs

NATIONAL COOLING ACTION PLAN OF JORDAN

Priority interventions to address Jordan's growing cooling needs

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based on a decision of the German Bundestag

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

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List of abbreviations

B2C	*business-to-consumer*
BAU	*business-as-usual scenario*
GHG	*Greenhouse Gas*
GWP	*Global Warming Potential*
HFC	*Hydrofluorocarbons*
HPMP	*Hydrochlorofluorocarbons*
IFI	*International Financial Institutions*
JEA	*Jordan Engineers Association*
KIP	*Kigali Implementation Plan*
KPI	*Key Performance Indicator*
Ktoe	*kilotonne of oil equivalent*
M&E	Monitoring and Evaluation
MAC	*Mobile Air Conditioning*
MENA	Middle East and North Africa
MEPS	*Minimum Energy Performance Standards*
MRV	*Monitoring, Reporting and Verification*
mtoe	*megatonne of oil equivalent*
NCAP	*National Cooling Action Plan*
NCS	*National Cooling Strategy*, National Cooling Strategy
NDC	*Nationally Determined Contributions*
NEEAP	*National Energy Efficiency Action Plan*
NOU	*National Ozone Unit*
PV	*Photovoltaik*
RAC	*Refrigeration and Air Conditioning*
S1	*Scenario 1*
S2	*Scenario 2*
SDG	*Sustainable Development Goals*

1. Introduction

1.1. Vision, mission and aim of the National Cooling Action Plan

The National Cooling Action Plan (NCAP) is an essential framework for addressing the rising demand for cooling while aligning with the decarbonization goals of the Kingdom of Jordan. As the population grows and temperatures rise due to climate change, cooling needs are expected to increase exponentially, especially in urban areas. The NCAP provides a comprehensive approach to balance these demands by promoting energy-efficient technologies and low-carbon cooling solutions. By integrating climate-friendly refrigerants and fostering innovation in cooling technology, **the NCAP will enable Jordan to reduce greenhouse gas emissions while promoting equitable access to affordable cooling for all.** The NCAP is the first document targeting both direct (HFC) and indirect (energy-related) emissions from cooling and thus fills an important gap in the regulatory landscape of Jordan. **The NCAP sets the Jordanian cooling sector on a future proof path and positions the country as a frontrunner in sustainable cooling in the MENA region.**

The NCAP seeks to drive implementation of measures that pave the way for sustainable cooling based on the strategic intervention areas identified in the **Jordanian National Cooling Strategy** (NCS), adopted in 2024. It establishes clear measures and priorities for transitioning to energy-efficient and sustainable cooling equipment and systems. It is a cross sectoral document that covers measures such as enhancing building designs for passive cooling, reducing the consumption and leakage of high GWP refrigerants, and promoting energy-efficient appliances directly contributing to the long-term sustainability of the sector. Additionally, the NCAP empowers sector stakeholders to adopt best practices in refrigerant management, appliance maintenance, and monitoring and enforcement. Lastly, the NCAP is the first document providing robust data on cooling demand, usage patterns, and emissions, which allows for evidence-based policymaking to address cooling challenges.

The NCAP plays a vital role in complementing and supporting existing strategies aimed at reducing emissions and enhancing energy efficiency. It is an **integrated document** which links and builds upon existing policies, plans, and targets concerning climate, energy, and economic development. The NCAP supports two pillars of the **Economic Modernisation Vision** for Jordan by fostering economic growth via innovation in the RAC sector and improving quality of life by providing access to affordable, reliable, and sustainable cooling to citizens, as well as the overarching target of the Economic Modernisation Vision to increase sustainability across the entire economy. The NCAP is also closely aligned with international agreements and policy targets such as a **31% greenhouse gas emission reduction by 2030** target under the **Paris Agreement Nationally Determined Contributions (NDCs)** and the **Kigali Implementation Plan** (KIP) directed towards phasing down the use of HFCs under the Montreal Protocol's Kigali Amendment. By reducing the carbon footprint of cooling solutions and enhancing the resilience of communities to heatwaves and other climate-related challenges, the NCAP supports national strategies for **adaptation and mitigation of climate change.** The NCAP thus delivers a cohesive approach that ensures cooling needs are addressed without compromising national and international environmental, economic, and social goals.

At the Jordanian country level, the NCAP fosters interministerial and intersectoral collaboration. Cooling spans sectors such as energy, health, urban development, production and environment. By providing a unified framework that **aligns objectives across Ministries** the NCAP allows the Kingdom of Jordan to tackle emissions from cooling more effectively. The NCAP seeks to strengthen regulation and enforcement around energy efficiency and refrigerant use in the cooling sector by introducing **robust governance frameworks to monitor and evaluate** the implementation of policy measures. On a market level, the NCAP is a forward looking and future proof plan to **create market readiness** for a fast and comprehensive uptake of sustainable cooling technologies across all sectors.

The implementation of a National Cooling Action Plan is a pivotal step in ensuring a successful decarbonisation of the cooling sector and ensuring the long-term impact and success of the proposed measures. The NCAP defines roles, responsibilities, and timelines for individual policy measures and found agreement on these through a collaborative process led by the **NCAP Steering Committee** headed by the **Jordanian Ministry of Environment** and developed with a **working group** comprising key stakeholders and decision makers from both the private

and public sector. The iterative and collaborative process by which the development of policy measures took place lays a strong foundation for effective implementation via the clear responsibilities and accountability assigned to the entities tasked with developing and executing the NCAP measures. Monitoring and reporting mechanisms are integral to this framework, providing a means to track progress, evaluate performance, and make necessary adjustments. This ensures that the NCAP remains **dynamic, responsive, and continuously aligned with evolving national priorities and capacities**.

1.2. Building on the National Cooling Strategy

The National Cooling Action Plan (NCAP) builds on the National Cooling Strategy (NCS) of Jordan published in May 2024 on the website of the Ministry of Environment. The NCS laid the groundwork and the strategic direction for the National Cooling Action Plan (NCAP), which outlines a comprehensive array of concrete measures aimed at addressing Jordan's increasing cooling demands while simultaneously reducing emissions from cooling systems. Further, the NCS set the guidance and **identified priority interventions** to address Jordan's growing cooling needs in the transition to more energy efficient technologies and environmentally friendly refrigerants.

Overview about the Jordanian NCS

The National Cooling Strategy envisions Jordan as a regional leader in mainstreaming sustainable cooling practices and technologies, building on the country's strong track record in pioneering climate action in the region. Sustainable cooling is integral to achieving Jordan's commitments under the Montreal Protocol and its Kigali Amendment, the Economic Modernisation Vision, the Nationally Determined Contributions (NDCs), and the Sustainable Development Goals (SDGs). The mission of the National Cooling Strategy is to guide the nation's transition to sustainable cooling, promoting the use of environmentally friendly, non-halogenated refrigerants. This strategy aims to ensure a better future for both present and future generations while supporting Jordan in meeting its environmental commitments and targets.

The National Cooling Strategy encompasses various cooling-related sectors, including stationary and mobile air conditioning, as well as domestic, commercial, industrial, and transportation refrigeration. It represents the initial phase of a comprehensive assessment of the cooling landscape, addressing socio-economic growth drivers for cooling demand, technological and market trends, and both international and national commitments and policies.

The following sections describe in brief the insights and outcomes of the NCS.

The energy sector and cooling demand

Jordan's energy sector is characterized by a high dependency on imported energy, with oil products and natural gas being the primary sources. In 2021, Jordan's total energy supply was 8.726 Ktoe, with 84% of this energy being imported. Oil products constituted 45% of the total energy supply, while natural gas accounted for 38%. Renewable energy sources, though growing, contributed 14% to the total energy mix.

Jordan's final energy consumption experienced a decline during the COVID-19 pandemic but rebounded to 6.2 million tonnes of oil equivalent (mtoe) in 2021. The transport sector remains the largest consumer of energy, followed by households, commercial sectors, and industry. The demand for cooling represents a significant portion of electricity consumption, driven by population growth, urbanization, and economic improvements.

Cooling accounts for a substantial portion of electricity use, and this demand is expected to increase due to the growing population and higher living standards. Many existing cooling systems in Jordan are energy inefficient, which presents opportunities for significant energy savings through the adoption of more efficient technologies.

Sub-sector	2017	2018	2019	2020	2021
Transportation	3431	3363	3074	2308	2677
Industrial	938	954	891	935	1017
Residential	1549	1483	1484	1487	1520
Commercial and other	950	981	1109	1045	1008
Total final energy consumption	6868	6761	6560	5774	6222

Table 1: Sub-sectoral final energy consumption distribution (Ktoe) 2017 - 2021

Drivers of cooling demand and impacts

The demand for cooling in Jordan is driven by several key factors, including population growth, economic development, urbanization, and rising temperatures. These factors, in turn, increase cooling needs across various sectors such as construction, healthcare, cold chains, mobility, and tourism. The following **Figure 1** provides an overview of these drivers. Details regarding each driver in the national context of Jordan can be found in the NCS.[1]

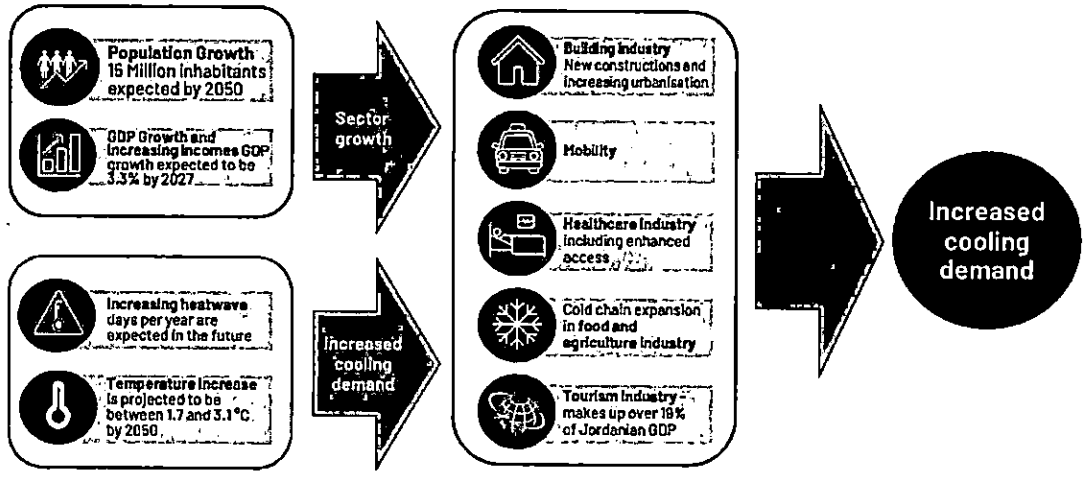

Figure 1: Drivers of cooling demand in Jordan

As highlighted by the drivers, cooling spans across many economic sectors and can have a significant impact on their performance and sustainable development. The NCAP can thus play an important role in improving economic, environmental and social outcomes across many sectors. Specifically:

- The **energy sector** benefits from the increased energy efficiency of cooling equipment which reduced total energy demand and can thus reduce the strain on electricity grids during peak times. Demand response measures in the cooling sector can deliver further benefits such as stabilizing the grid or the integration of renewables.
- The **healthcare sector** benefits from enhanced cold chain reliability, ensuring vaccines and medicines are stored and transported safely, reducing waste and spoilage. It also ensures that the thermal comfort of patients in clinics and hospitals can be maintained at a lower environmental cost.

[1] National Cooling Strategy of Jordan, 2024. https://moenv.gov.jo/EN/List/Strategic_Plan

- The **agriculture sector** benefits from energy efficient and reliable systems as food cold chains become more reliable, reducing food loss and improving food security.
- **Commercial businesses** such as supermarkets, hotels, and restaurants who have high cooling and refrigeration needs benefit from higher energy efficiency and improved maintenance of commercial systems as both can reduce their long-term operating costs.
- For businesses, such as **manufacturers of refrigeration units and SMEs** in the commercial refrigeration sector, the NCAP fosters innovation by promoting energy-efficient systems and natural refrigerants.
- **Jordanian households** benefit from more affordable and efficient cooling solutions, reducing electricity bills in a country where cooling accounts for a substantial share of residential energy use. Improved cooling access also benefits vulnerable populations and protects against heat stress.
- The **service sector** is strengthened as technicians are trained in handling future proof refrigerants and working with highly efficient and modern RAC equipment.

The policy landscape

Jordan's existing regulatory and institutional framework encompasses several regulations focused on energy efficiency and environmental protection affecting the RAC sector. The cross-sectoral nature of cooling means that various government bodies share the responsibility for regulating and promoting sustainable cooling solutions. The NCS identified how achieving sustainable cooling contributes to the existing economic, environmental, and social goals in Jordan. The NCAP builds on this and contributes to existing policies in the following ways:

- The NCAP aligns with the **National Economic Modernization Vision** by promoting sustainable industries and green technologies. Investing in energy-efficient cooling systems can stimulate economic growth, create jobs in green sectors, and reduce energy costs, thereby enhancing overall economic competitiveness and sustainability.
- The NCAP contributes to fulfilling Jordan's commitment to reducing greenhouse gas emissions under the **NDC** by targeting emissions reductions in the cooling sector. By promoting natural refrigerants with low-to-zero GWP, enhancing energy efficiency, and supporting renewable energy integration, the NCAP helps achieve the emission targets outlined in the NDC.
- The NCAP complements the National Energy Efficiency Action Plan (NEEAP) by specifically targeting the cooling sector, one of the largest energy consumers. Together, they create a comprehensive approach to reducing national energy consumption and enhancing efficiency standards.
- The NCAP and KIP work together to reduce the environmental impact of cooling and support sustainable development. Both aim to lower the use of HFCs and promote energy-efficient cooling. The NCAP takes a broad approach, while the KIP focuses on specific refrigerant goals and compliance with the Kigali Amendment to the Montreal Protocol. The KIP's goals are part of the NCAP's larger plan, which includes energy efficiency, sustainable development, and social equity. Together, they provide a comprehensive strategy for sustainable cooling, addressing both refrigerant management and wider energy and climate issues.

The NCS identified key challenges in the policy landscape, including the need for better coordination among institutions to streamline regulatory processes and the necessity of capacity building to strengthen the capabilities of these institutions. A focus on effective enforcement and monitoring of regulations were also recognized as essential to ensure compliance and promote sustainable cooling practices. The NCAP proposes measures that seeks to address these challenges.

The following figure provides an overview of the policy spheres in which existing strategies, plans, and policies are embedded and the space in which the NCAP will embed itself, linking and strengthening existing climate and energy policy.

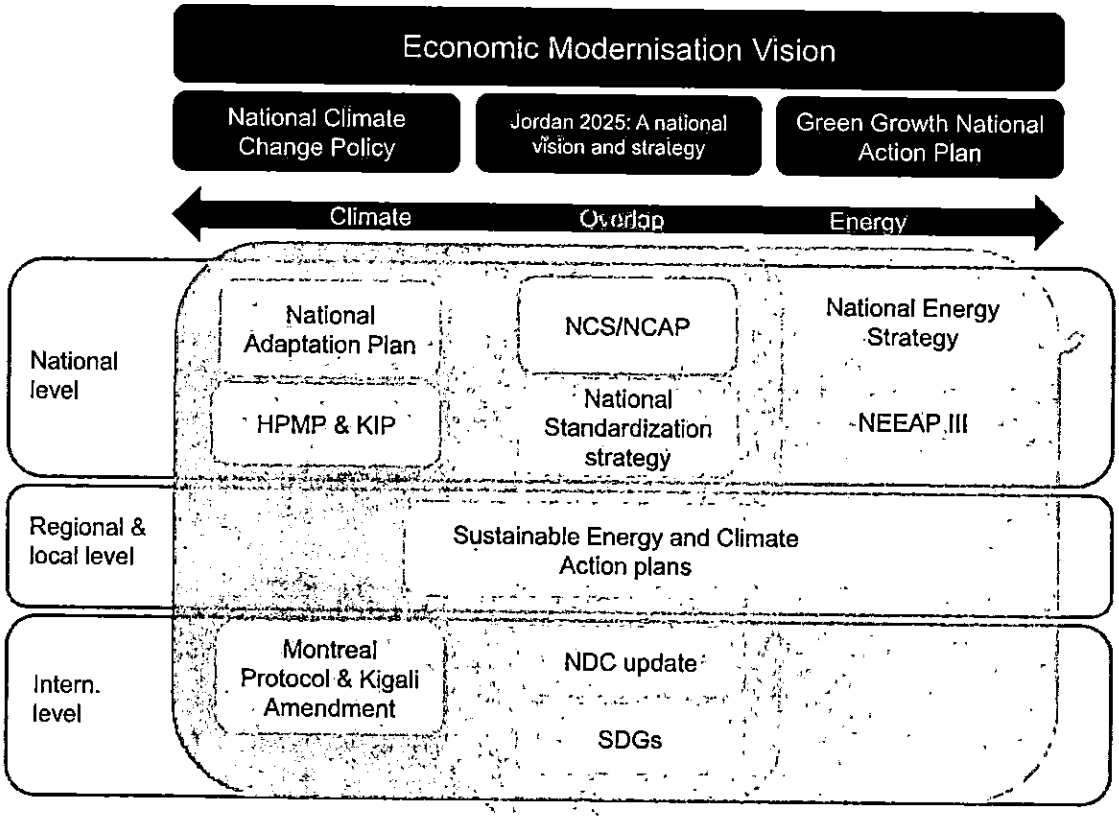

Figure 2: Energy and climate policy overview of Jordan

Strategic intervention areas

The NCS identified several key intervention areas, as visualised in the following graphic. These served as the basis for the NCAP measure development.

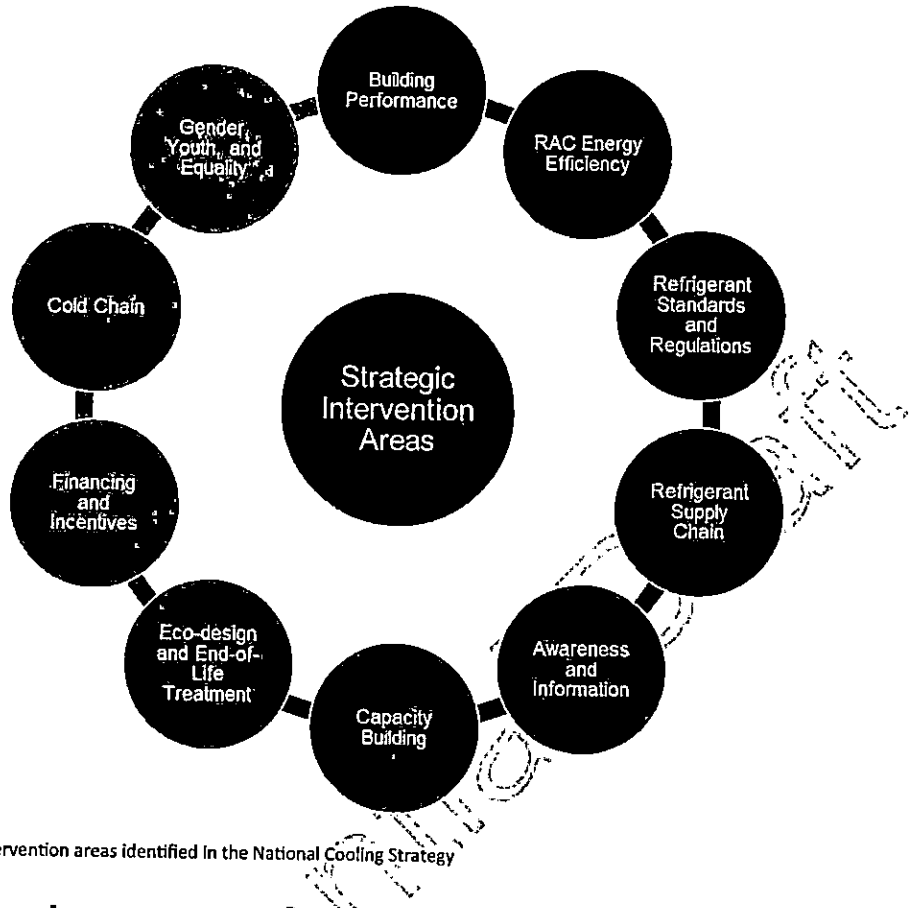

Figure 3: Strategic intervention areas identified in the National Cooling Strategy

2. Cooling sectors

The RAC market in Jordan is expected to expand at a compound annual growth rate between 3 and 4% 2025 and 2027[2], supported by growing installation in new and existing buildings and replacement of outdated systems. Despite this growth, the use of natural refrigerants will likely remain limited, constrained by safety concerns and costs. Jordan relies on imported refrigerants, with the conventional HFCs R410A and R134a being predominant. To meet national commitments under the Kigali Amendment, the government is advocating for sustainable cooling technologies and supporting the private sector's transition to natural refrigerants. Challenges persist in commercial and transport refrigeration, where inefficiencies contribute to high emissions, system failures and consequent food losses along the cold chain. Addressing these issues alongside refrigerant management is essential to achieving sustainable cooling solutions in Jordan.

2.1 Refrigerant supply chain

Fluorinated refrigerants, mainly HFCs, currently account for most of the market in Jordan as well as in all other MENA countries. Production of HFCs and other fluorinated refrigerants does not take place in Jordan, but the demand is addressed by imported quantities. Supply chains are well-established and conventional HFC refrigerants are easily available throughout the country.

In contrast, supply chains for alternatives to HFCs are not set-up to full extent yet. Natural refrigerants are mainly imported from Europe today[3] which leads to higher prices, sometimes delays in the delivery and lacking availability. Transportation of flammable refrigerants such as hydrocarbons is not allowed on cargo aircrafts but needs to be carried out via sea shipments or road transport. Therefore, assessment of potential suppliers in the region are to be envisaged. To cater for future needs of natural refrigerants, logistics and storage capacities for

[2] BSRIA, Splits Systems Middle East & Africa Air Conditioning 2023, Jordan

[3] Refrigerants import data covering the time period 2019-2023. Provided by national Customs authorities

are to be developed further, while meeting relevant safety requirements. For service and maintenance of existing equipment, recovery and reclamation of HFCs from end-of life equipment (see subsequent chapter) will gain importance due to the scheduled limitations of imports as the HFC phase down proceeds.

2.2. Refrigerant recovery, reclamation, destruction

Refrigerant emissions at end-of life of various types of RAC equipment account for a large share of direct emissions. As the HFC phase down proceeds, recovery and reclaim of refrigerants is gaining attention because recovered HFC quantities are not subject to quota restrictions.

Generally, recovery refers to the collection and storage of refrigerants from containers, products and equipment during maintenance or servicing or prior to the dismantling or disposal of the containers, products or equipment. Reclamation means that recovered refrigerants are processed in a dedicated facility using methods such as filtering, drying, non-condensable gas removal, and separation/distillation to ultimately reach the same quality as virgin refrigerants (AHRI 700 Standard, 2019). While the process is complex for multi-component refrigerant blends, it is easier for single-component refrigerants such as e.g. R134a. However, the separation and reclamation of mixed refrigerants require substantial investment and expertise.[4]

At the end of their lifetime, RAC systems are typically dismantled to spare parts for use in other systems. However, refrigerants are often released into the atmosphere rather than being safely disposed of. The lack of respective waste management regulations leads to significant emissions of refrigerant remaining in the equipment at end-of life during disposal.[5]

Key challenges to improve end-of-life management include a lack of awareness among those involved in the disposal process of refrigerants on safety measures, as well as the absence of monitoring and evaluation mechanisms. Additionally, there are insufficient logistics and facilities and resources to ensure the safe disposal of refrigerants. Major challenges for safe disposal also encompass the lack of storage space for used refrigerants and proper recovery and recycling equipment for refrigerant treatment among technicians. Also, there is limited public awareness about the dangers of unsafe disposal of old equipment. Finally, awareness among installers and technicians is lacking, and there are no mandatory regulations for safe disposal.[6]

According to the Kigali implementation plan for Jordan,[7] selected servicing workshops will be provided with recovery and recycling equipment to facilitate the proper handling and storage of refrigerants. Furthermore, trainings on proper use and maintenance of recovery and reclaim machines will be provided. Regular monitoring of the reclamation centre will ensure the efficient transfer of used and reclaimed refrigerant gases between the centre and the servicing workshops.

The refrigerant management activities in Jordan include:

- Support for the reclamation centre operation: safe handling of refrigerants will be included into trainings for technical personnel, the update of safety measures, and established area for safety measure and proper equipment.
- Storage facility for waste refrigerants: the reclamation centres will establish a central storage facility for the safe and secure storage of unusable recovered refrigerants that cannot be reclaimed. These quantities will ultimately become destroyed in dedicated facilities. Such facilities are however not available in Jordan at this stage as very high temperature incineration is required to safely destroy fluorinated compounds. Hence the destruction of obsolete refrigerants remains an area of further concern.

Incentivizing recovery include:

[4] UNEP. Best Practices for End of Life Refrigerant Management

[5] Cool Up, 2022. Cooling Sector Status Report Jordan

[6] Cool Up, 2022. Cooling Sector Status Report Jordan

[7] UNIDO, Kigali HFC Implementation plan (stage I, first tranche), 2023. https://downloads.unido.org/ot/33/05/33059267/2.%20Jordan%20-%20KIP%20Stage%20I,%20first%20tranche%20%E2%80%93%20project%20document.pdf

- Enhanced education and awareness raising regarding the environmental harm caused by refrigerant emissions and the benefits of recovery.
- Customized recovery solutions tailored to the specific needs of each customer segment.
- Specific incentives designed to promote improved recovery practices.
- Increased investment in reclamation and destruction technologies.[8]

Jordan faces challenges in end-of-life refrigerant management such as lack of access to lifecycle management infrastructure, lack of qualified technicians, lack of regulations and financial incentives. Overall, the recovery, reclamation, recycling and destruction scheme is not yet established in the country which leads to high servicing and end-of life emissions.

2.3. Space Cooling

2.3.1. Passive cooling

Passive cooling measures are an important tool and approach when it comes to reducing energy consumption for mechanical cooling, both for AC and refrigeration use. Passive cooling includes methods aimed both at reducing heat from entering, as well as removing heat from the building. Passive cooling can thus play an important role in reducing energy demand for cooling and contribute to the overall energy efficiency of the building. There are many actions that can be taken to enable passive cooling, some are low-cost interventions which can be implemented regardless of the building type, others are more suited to new buildings as they architectural design adaptations which should be implemented during construction. The Jordanian green building code already includes a number of criteria for enhancing energy efficiency that fall under passive cooling measures, such as building orientation, thermal insulation, shading devices, and natural ventilation.[9]

The most common and easily implementable passive cooling method is via **window shading**, also called solar control. Shading reduces the amount of solar radiation that reached as building's interior, thus lowering indoor temperatures and in turn reducing the need for mechanical cooling. Usually, blinds or shades will be placed in in front of windows to block direct sunlight during peak hours. However, also natural solutions such as strategically planted trees can achieve the desired effect. Shading can be either fixed or adjustable, allowing for flexibility in response to seasonal changed in sun angle and intensity. A study by Abbass et al. (2023) found that window shading reduces indoor temperatures by 2.6–3.3°C in existing buildings in Amman. In Jordan, the population is used to combatting intense solar radiation and high temperatures, thus shading, especially of windows is already a widespread common practice.

Next to window shading, **roof shading** is another option to reduce the amount of solar radiation and thus the heat absorption of the building. Roof shading can be achieved in a number of ways from simply adding structures like pergolas or shade sails to the roof, to more complex solutions such as using reflective roofing materials or installing green roofs.

The amount of heat entering a building is also affected by the level of **insulation**. Better insulation reduces a building's heat transfer, meaning it will stay cooler inside when outside temperatures are high, and vice versa. The reduced heat transfer means a reduced reliance on mechanical cooling when outside temperatures are high, it also means that a mechanically cooled room will retain its lower temperature for longer.

Natural ventilation allows for air circulation and a cooling effect without any mechanical systems. It leverages natural forces like wind and thermal buoyancy to circulate fresh air through a building by strategically placing vents and windows throughout a building. There are two main approaches for natural ventilation: cross ventilation and stack ventilation. Cross ventilation is achieved by placing openings on opposite sides of a space, allowing air to flow through and expel warm air. Stack ventilation involves low openings through which cool air

[8] UNEP, A-gas. Best Practices for End-of-Life Refrigerant Management. https://ozone.unep.org/system/files/documents/4.%20A-gas%20-%20Best%20Practice%20Ref%20Mgt_V2.1_0.pdf

[9] Awadallah, Tala & Habet, S & Mahasneh, A. (2011). Green Building Guideline of Jordan.

can enter, this cool air pushes up the warmer air which is let out through high openings. This creates a natural upward air movement.

2.3.2. Active space cooling

Active or mechanical space cooling can be broadly separated into two categories. Central systems where several transmission units are served by a central cold production unit and decentralized systems, where every transmission unit is served by one cold production unit.

Jordan has a strong local manufacturing sector for AC units, 50% of all units sold are manufactured in Jordan, while the other 50% are imported.[10] The most important domestic and international players are Petra Engineering Industries Com., Middle East Electric Industries Com Ltd., Abu Haltam Group for investments, National Refrigeration Com, National Integrated Industrial Complex, Zahran and Partners, Ramco Air Conditioning, Panasonic, Daikin, Carrier, Trane, Samsung, Gree, LG, Daewoo, and Akai. Jordan also boasts a healthy AC servicing sector, with over 400 workshops that provide maintenance and repairs to RAC equipment.[11]

In terms of market share, single split systems are the most common across the Jordanian building stock as they are the easiest and cheapest to install and thus serve the overwhelming share of the residential segment. Key difference between decentralised and centralised systems is that decentralised systems can be added more easily to existing buildings, thus they offer more flexibility to homeowners or tenants to respond to external effects such as rising temperatures or rising incomes. Centralised systems are more complex to install in the existing building stock as they often require planning during the construction phase of a building.

Decentralised systems

Decentralised systems are by far the most widespread in Jordan as they are the most common AC technology in the residential segment, which constitutes the largest building segment, while also being the most common technology in office and retail spaces. AC sales, particularly single split unit sales are growing in Jordan, as modules become increasingly affordable, the population grows, and temperatures rise. Decentralised units also mean that households can easily increase the number of rooms cooled by adding a new module, thus adapting to changing means and needs. Increasing electricity prices are also a key in driving consumers to upgrade or exchange their older equipment for new equipment with higher energy efficiency sooner than they may have previously.

Centralised systems

Central systems are where several transmission units are served by a central cold production unit. They are most installed in larger buildings such as hospitals, malls, or hotels. They can offer higher efficiency, as they can take advantage of economies of scale as the energy usage and cost can be lower per unit of cooling capacity when compared to decentralized systems. In Jordan, packaged systems (e.g. rooftop) in particular, have a major market share in the retail building segment and are also installed in hotels and the office and healthcare building segments.

2.4. Mobile Air Conditioning

In 2022, mobile AC systems contributed approximately 11% of Jordan's total direct emissions, while the vehicle registration data shows that Jordan had about 1.8 million licensed vehicles that year. The prevalence of air-conditioned vehicles has increased substantially, from an average of 62% in the 2000-2009 period to more than 80% in recent years. Passenger cars account around 1,4 million units (2022) with 86% of them being air-conditioned. The sole refrigerant used in all operational and new mobile air conditioning units in R134a. As Jordan does not manufacture automobiles, vans, or other large vehicles domestically, it relies entirely on imports to meet the increasing demand for vehicles.[12] According to current trend, the number of passenger cars will grow

[10] Cool Up, 2022. Cooling Sector Status Report Jordan

[11] Cool Up, 2022. Cooling Sector Status Report Jordan

[12] National Cooling Strategy of Jordan, 2024

of 500,000 vehicles every 5 years. Jordan's public transportation system currently consists of about 1,400 buses, nearly 4,000 minibuses, and more than 4,000 service (shared) taxis, alongside over 16,000 traditional taxis (World Bank, 2022). Looking at future projections, if current trends persist, the number of public transport vehicles in Jordan is expected to grow to over 200,000 by 2046. While air conditioning in vehicles other than cars is not common today, global trends indicate increasing market uptake also in other means of transport.

Mobile AC systems generally have high average annual leakage rates due to vibrations of the vehicles during movement as well as damages caused by accidents. In the model assumptions, an estimated average of 30% is used, leading to annual emissions exceeding 300 kilotons of CO2 equivalent. The leakage rates can however be lowered by providing specific trainings to car servicing workshops, which have not been addressed by any capacity building measures in Montreal Protocol activities so far. This is because HCFCs have never been used in this application so that HPMPs were not considering the MAC sector.

2.5. Cold Chain

Cold chain infrastructure is designed to maintain the quality and safety of temperature-sensitive products throughout their journey from production to consumption, referring to a temperature-controlled supply chain that preserves and extends the shelf life of perishable goods. It is essential for industries such as food and beverages, pharmaceuticals, and chemicals, where maintaining specific temperature ranges is crucial for product integrity.

Components of cold chain Infrastructure include:

- **Warehousing and Storage:** Specialized facilities equipped with refrigeration systems to store perishable goods at controlled temperatures.
- **Transportation:** This includes refrigerated trucks, ships, and aircraft designed to maintain specific temperature conditions during transit.
- **Monitoring and Control Systems:** Advanced technology, including sensors and AI-powered systems, to provide real-time data on temperature conditions.
- **Packaging:** Specialized solutions like insulated containers and coolants to protect products from temperature fluctuations during transportation.
- **Distribution Networks:** A system of distributors and suppliers ensuring products reach their destination while maintaining required temperature conditions.

These components of the cold chain infrastructure are visualized in **Figure 4:** Cold chain technology brief commercial, professional, and domestic refrigeration

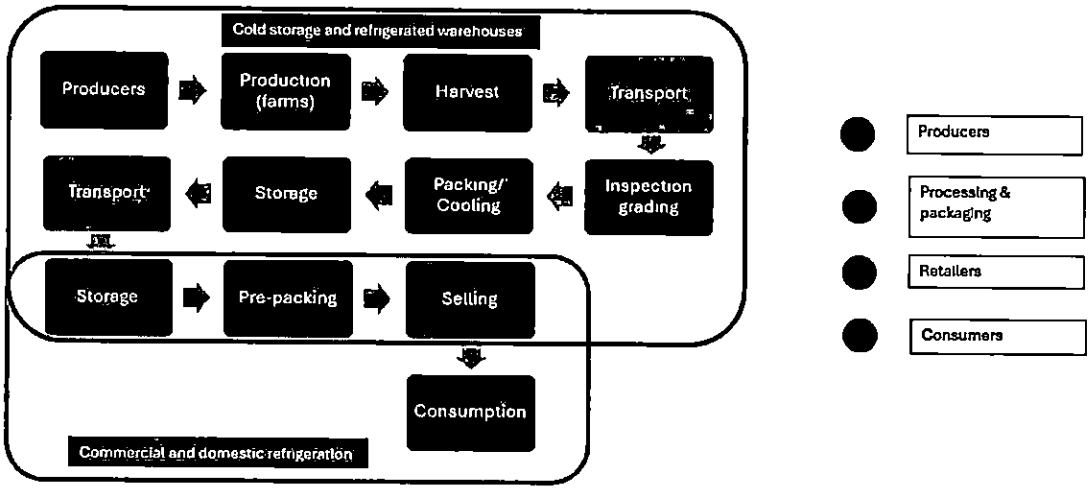

Figure 4: Cold chain technology brief commercial, professional, and domestic refrigeration[13]

The food cold chain starts at the agricultural farms, where temperature-sensitive products begin their journey through a carefully controlled environment. From these origins, specialized refrigerated transport vehicles (vans and trucks) convey the goods to centralized distribution hubs – refrigerated storages and warehouses. These industrial refrigeration facilities serve as critical waypoints, offering temperature-regulated storage and efficient sorting capabilities. Subsequently, the products are dispatched to various retail outlets, which are a part of the commercial refrigeration sector. Here, advanced cooling systems maintain optimal conditions until the products reach their final consumer at home or in commercial establishments like canteens or restaurants. This network of temperature-controlled environments ensures the integrity and safety of goods throughout their entire supply chain journey, from farm to table.

Establishing a cold chain, which would use energy-efficient and climate-friendly cooling solutions supports the important mission of reducing food-loss.

2.5.1. Commercial refrigeration

The main technological categories in commercial refrigeration are stand-alone systems, condensing units, and centralized systems. The market is primarily driven by supermarkets, followed by hotels and restaurants. Approximately 95,000 units were installed nationwide in 2020 14. From a technological standpoint, stand-alone equipment comprises 65% of the market, condensing units account for 30%, and centralized systems make up the remainder. About 85% of condensing and centralized systems are locally manufactured, although they utilize imported compressors15.

Standalone refrigeration systems, such as chest freezers, are primarily utilized for small refrigeration needs, typically in small and medium-sized freezers found in small supermarkets. These standalone reach-in refrigerators and freezers are often provided at no cost by food and beverage industries. Quick-service restaurants predominantly rely on standalone units.

Condensing units are generally installed in medium to large supermarkets and hypermarkets. They are widely used in large restaurants, hotels, and establishments with central kitchens supporting multiple branches. These units are also used in smaller cold stores due to their lower initial costs. Centralized refrigeration plants are preferred in large cold storage facilities because they offer higher efficiency compared to condensing systems.

[13] Cool Up, based on Guilpart E., Curlin J. S., Clark E. "Cold Chain Technology Brief: Refrigeration in food production and processing." (2018). https://iifir.org/en/fridoc/cold-chain-technology-brief-refrigeration-in-food-production-and-142038

[14] Data derived from the GCI model (Green Cooling Initiative, "Global greenhouse gases emissions from the RAC Sector"). The model calculates the number of systems in use via an indicator (number of system per capita: 0.0114).

[15] Cool Up primary data collection: Expert interviews

The rising population results in a greater demand for temperature-sensitive medications, such as vaccines, necessitating an expansion of the medical cold chain. This includes enhancing commercial refrigeration systems in healthcare facilities.

The commercial refrigeration sector is rapidly growing, driven by population demand, economic feasibility, technological advancements, and energy efficiency. However, this sector also faces challenges that originate earlier in the supply chain.

The leakage rate for commercial refrigeration ranges from 20% to 40% 16, with stand-alone systems having the lowest rates as they are factory-built. Additionally, the lack of end-of-life management leads to 100% refrigerant emissions during disposal[17] accounting for 15% of total annual RAC emissions.[18] Commercial refrigeration requires frequent maintenance checks, as poor upkeep leads to higher refrigerant leakage and decreased equipment efficiency. Supermarket owners often report insufficient regular or professional maintenance for commercial refrigeration systems, depending instead on the sales company's maintenance and replacement plans.[19]

2.5.2. Transport refrigeration

Transportation of temperature-sensitive products plays a vital role for food safety. For countries with severe climate conditions this specifically affects food supply such agricultural products, diary, and meat. Besides, growing demand on medical cold chain leads to increased needs in refrigeration for medical products transportation, e.g. vaccines.

Logistics of supply includes delivery by refrigerated trucks and vans depending on the needs and distances. In Jordan, over 70% of refrigerated vehicles are vans, and the rest is trucks.[20] According to the technicians working in this sector, around 70% of this number is assembled locally and 30% imported with pre-charged refrigerants.[21]

Up to 2008, the marked was fully saturated with R22 refrigerant in the transport sector. From this year on, R404A and R134a began penetrating the market, and their current coverage is estimated to be 40% each as of 2020.[22]

Estimated leakage rate in transport refrigeration range at 30% for vans and 20% for trucks.[23] Service practices face difficulties due to technicians' limited knowledge, leading to poor procedures for leakage checks, repairs, and end-of-life management. Road accidents and enhanced vibrations during movement also contribute to emissions release.

Natural refrigerants are currently hardly used in refrigerated road transport at all.

2.5.3. Industrial refrigeration

Industrial refrigeration is used in processing, packaging and storage of raw materials and final products in food and beverages, pharmaceuticals, petrochemicals, and bioprocesses. Industrial refrigeration systems are much larger in size and cooling capacity compared to commercial or residential systems. They are designed to cool vast spaces like warehouses, processing plants, distribution centres, and storages.

2.5.4. Domestic refrigeration

Domestic refrigeration represents the last step in the cold chain and refers mainly to private households.

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[16] Cool Up primary data collection: Expert interviews

[17] Cool Up primary data collection: Expert interviews

[18] National Cooling Strategy of Jordan, 2024

[19] Cool Up, 2022. Cooling Sector Status Report Jordan

[20] Data extract provided by the Ministry of Transport as part of the data collection process

[21] Data extract provided by the Ministry of Transport as part of the data collection process

[22] Estimation based on Cool Up primary data collection, 2024

[23] Estimation based on Cool Up primary data collection, 2024

Due to the significant number of operational refrigerators in the country, expected to rise from 2.3 million in 2022, and the prevalence of inefficient appliances in Jordan, the market is poised for growth. Jordan hosts approximately 29 companies24 that manufacture a variety of domestic (and commercial - standalone) refrigerators, including household appliances, display cabinets, and cold rooms.

Domestic refrigeration is used in households for storage of food and drinks and includes refrigerators and freezers. Domestic refrigeration is greatly vulnerable to existing servicing practices in Jordan. Evidence confirms that equipment owners often receive services from poorly qualified personnel. The direct business-to-consumer (B2C) interactions make it nearly impossible to regulate informal service providers under current regulations. This issue is becoming sharper as flammable natural refrigerants are being introduced for domestic use.

3. Definition of scenarios

Three scenarios were defined and represent increasing ambition levels of the measures included.

3.1. Business as Usual (BAU)

The business-as-usual scenario (BAU) takes into account currently available technologies and market trends, as well as existing legislation and government programs that may have an effect on the energy efficiency of cooling equipment and the refrigerants used. Given that the Government of Jordan is committed to the implementation of the Kigali Amendment, the BAU scenario is designed to meet the Kigali Amendment control limits for HFCs. Energy efficiency of appliances is assumed to increase slightly over time in line with expected improvements in technology. In the BAU scenario it is assumed that this development is not accelerated by any targeted policy interventions. The same applies for the refrigerant transition to natural refrigerants, the lack of targeted policy interventions means the market will first transition to intermediate GWP refrigerants before a transition to natural refrigerants. Building energy efficiency is also based on current values and only a slight improvement of energy efficiency is considered.

3.2. Scenario 1

Scenario 1 considers measures that have been proposed but are not in place yet, specifically measures where the implementation details, timeline, and or final approval are not yet determined. Thus, scenario 1 includes measures proposed in other strategies or action plans such as the NEEAP. On top of these several measures proposed as part of this NCAP are also considered. For the model only the measures with a direct impact on appliance or building energy efficiency or on direct emissions due to refrigerant type or handling are considered. The measures are considered as a package, and the effects of each individual measure are not calculated in isolation. **Table 2:** Overview of measures and impacts considered in modelling scenarios**Table 2** shows which measures are considered, the assumptions underlying them and how they impact the model results.

Regarding the refrigerant transition, the model assumed the new Regulation (EU) 2024/573 addressing F-gases in the EU will be transposed in Jordan, with special attention concerning the feasibility of its implementation in the context of the country needs and characteristics. As such, prohibitions concerning the use of F-gases in existing equipment as well as 'placing on the market bans' for cooling equipment in Jordan have been transposed from the EU model to the context of Jordan.

3.3. Scenario 2

Scenario 2 builds on scenario 1 by including additional innovative and ambitious measures which are currently not in discussion but are proposed here as they are supposed to have a significant impact. In Scenario 2 sustainable cooling technologies are included if these are technically feasible, even if - from a financial point of view – investment costs might be higher compared to systems currently sold on the market. Financial incentive mechanisms are considered in scenario 2 which stimulate the uptake of sustainable cooling technologies.

[24] National Cooling Strategy of Jordan, 2024

Furthermore, a complete phase out of F-gases in new equipment from 2034 onwards is implemented in the model.

Table 2: Overview of measures and impacts considered in modelling scenarios

Measure	Assumption	Impact in model	Scenario 1	Scenario 2
Improve enforcement of existing green building codes	from 2027: due to improved enforcement of current building code the new buildings compliance rate will be increased from 20 % to 80 %; from 2030 the building code is tightened by to reduce the cooling demand by further 20 %	The energy efficiency of new buildings is increased and thus the cooling demand decreases.	X	X
Require a strict adherence to green building codes in new public buildings and retrofit old ones not in compliance	From 2030 the cooling demand of public building stock (share 5 %) is decrease to newbuild-average	The cooling demand for the share of public buildings decreases significantly	X	X
Issue MEPS for sectors not currently covered and update existing MEPS	MEPS will cover all cooling appliance categories and will be aligned with EU MEPS. A different level of tightening is assumed between scenarios 1 and 2	The average energy efficiency of new appliances will increase as the worst performing ones are removed from the market	X	X
Adopt energy efficiency labelling for sectors not currently covered and update existing labels and energy classes	2030: assumption 3 % overall efficiency increase for new appliances	Overall increase in efficiency of new appliances as consumer behaviour changes	X	X
Organise end-of-life treatment and disposal to reduce end-of-life leakage and manage e-waste	2030: 90% of refrigerant quantities handled are emitted to air. Improvement of this factor is modelled in S1 (80% in 2050) and S2 (50% in 2050)	Annual emission rates from operation as well from decommissioning of equipment are elevated	X	X
Develop a tax rebate schemes for energy efficient and climate friendly cooling appliances and refrigerants	2030: A tax rebate on highly efficient appliances is introduced. This leads to 20% of new products being one efficiency class higher	Annual indirect emissions from cooling equipment is reduced.	X	X
Smart meters with external control functions must be installed in all buildings to allow for demand response and load shifting	The emission factor of RAC usage is reduced as they match renewable energy generation profiles.	2050 RAC emission factor is assumed to be reduced by 20% (stepwise reduction from 2030 to 2050)	X	X

Mandatory PV and Battery storage in new buildings from 2030 and in existing buildings from 2040	The emission factor of RAC usage is reduced as they match renewable energy generation profiles.	In 2050 RAC emission factor is assumed to be 0 (stepwise reduction from 2030 to 2050)	X

4. Cooling demand and related emissions up to 2050

For each scenario, the modelling results are illustrated for the development of total emissions and broken down into direct and indirect emissions.

4.1. BAU scenario

Total emissions (direct + indirect)

According to the model the cooling sector is responsible for around 5% of total GHG emissions in Jordan.[25]

As laid out in chapter **Error! Reference source not found.**, the cooling sector in Jordan is expected to continue to grow, an assumption which is backed up by the model. For example, the number of AC-systems is expected to triple by 2050. However, due to technology improvements in energy efficiency, a shrinking grid emission factor, and a switch to natural refrigerants already taking place, total emissions under a BAU scenario are still expected to fall by 37%. This reduction, considering an increase in the number of cooling appliances, shows that technological preconditions for a decarbonisation of the cooling sector are already in place.

The model shows that under BAU, up until 2050, direct emissions gain in relative importance increasing their share from 39% to 53%. This is because we assume that increases in energy efficiency are more likely to occur without any immediate policy actions, while the use of natural refrigerants will not. Thus, the majority of the 37% GHG emissions savings comes from a reduction in indirect emission from the cooling sector.

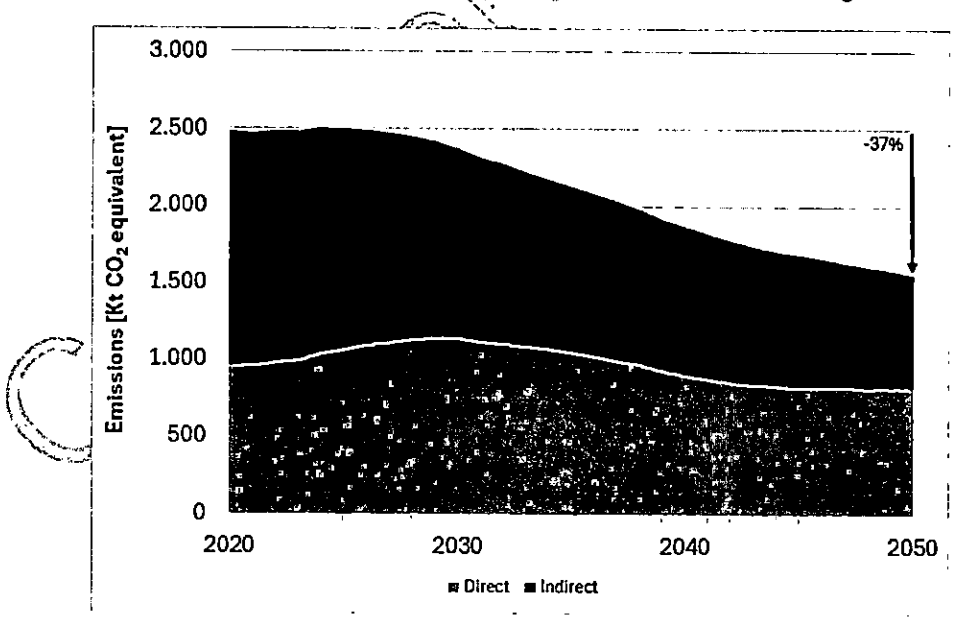

Figure 5: Total emissions (direct + indirect) 2020-2050 in the BAU scenario

When looking at total emission across different sectors, as depicted in **Figure 5** we see that total emissions from stationary AC systems remain relatively constant until 2050, this is because, while efficiency is increasing and thus indirect emission are decreasing, the increase in number of systems and level of direct emissions cancels

[25] Our World in Data, Jordan: CO2 Country Profile. 2024. https://ourworldindata.org/co2/country/jordan

out the efficiency gains. A similar picture can be observed for commercial refrigeration where emissions decrease slightly but remain at a relatively constant level until 2050. The largest reduction in emissions stems from the mobile AC sector.

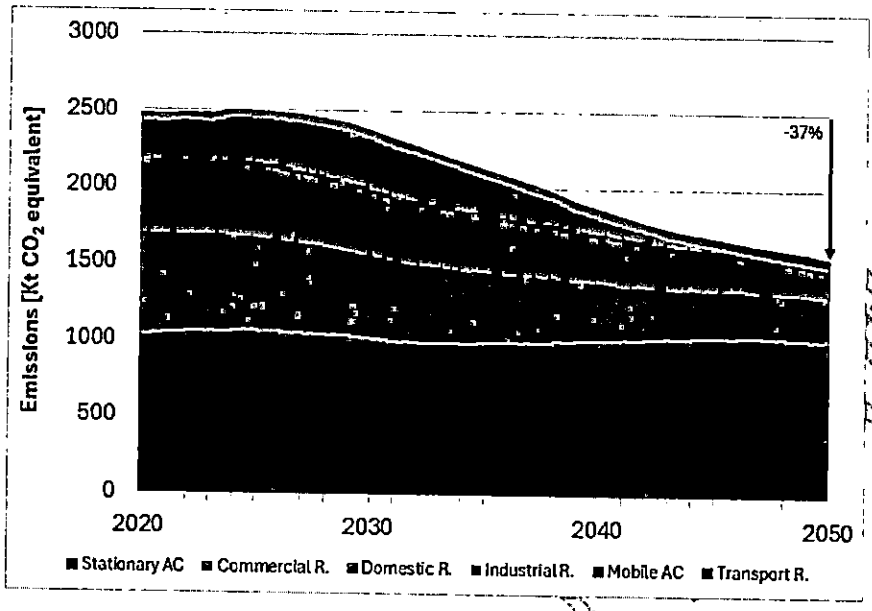

Figure 6: Total emissions (direct + indirect) 2020-2050 in the BAU scenario (broken down by sub-sector)

Indirect emissions

Indirect emissions are expected to decrease by 52% under a BAU scenario. This is mainly due to expected improvements in the general technology used (increase in efficiency) as well as a significant reduction in the grid emission factor, which is reduced by more than half from *459 g/kWh in 2020 to 184 g/kWh by 2050.* Thus, the reduction in indirect emissions under a BAU scenario is very heavily affected by general energy policy and the decarbonisation of the grid via increasing installation of renewable energy generation capacity. Due to the reduced emission factor and increased efficiency, a decrease in indirect emission can be observed across all sectors, in the stationary AC sector however, this reduction is smallest as the reduction in indirect emissions are offset by the strong increase in the number of appliances. Thus, the share of indirect emissions from stationary AC increases from 42% in 2020 to 57% in 2050.

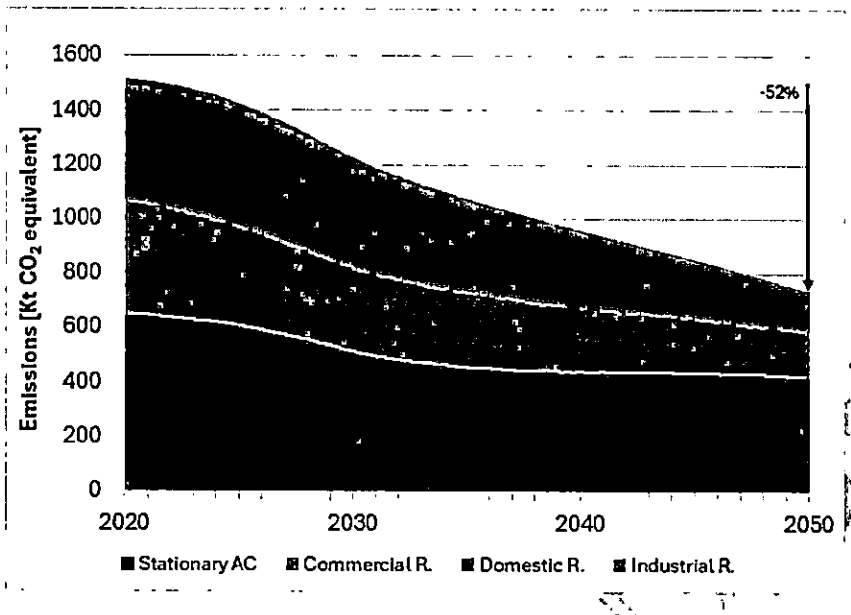

Figure 7: Indirect emissions 2020-2050 in the BAU scenario (broken down by sub-sector)

Direct emissions

Direct emissions projected for 2050 decrease by 14% compared to 2020. **Figure 8** shows the evolution of direct emissions from 2020 – 2050, broken down by cooling sub-sectors.

The decrease is mainly due to elimination of refrigerant emissions from mobile AC (mainly passenger cars). Noting that the technology is available and (although to a low extent) already sold on the Jordanian market, transition to low GWP refrigerants in mobile air-conditioning is assumed to take place as of today in the BAU scenario. Here it needs to be emphasised that a Jordanian Regulation addressing mobile air-conditioning systems (passenger cars and light commercial vehicles) still would need to be established, preferably following the example of the EU.

Stationary AC emissions increase from 40% in 2020 to 72% in 2050. Emissions from stationary AC systems primarily stem from single split AC units (74% of total direct cooling emissions), although even in the BAU 20% natural refrigerants for single split sales in 2050. Commercial Refrigeration is the second most relevant sector in 2050 (15% of total).

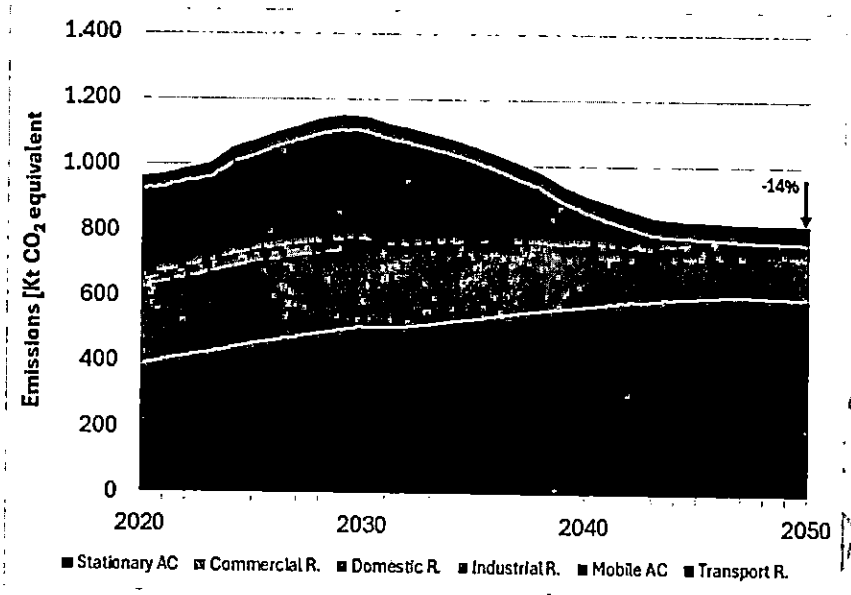

Figure 8: Direct emissions 2020-2050 in the BAU scenario (broken down by sub-sector)

4.2. Mitigation scenarios 1 und 2

Indirect emissions

Compared to today's emission levels from the cooling sector, 66% of emissions could be saved in our policy scenario 1, while 100% of indirect emissions would be saved in scenario 2 by 2050. Compared to the BAU the savings increase by 12% and 46% in the S1 and S2 respectively.

In scenario 1 we assume a tightening of the MEPS in line with the updated EU ones, as well as a continuous increase in the MEPS from 2030 to 2050. We also assume stronger enforcement of the current building code, as well as financial incentives which target increased efficiency of both buildings and appliances. While these measures have an important impact, with improvements of MEPS contributing to 4% of the and improvement in buildings efficiency contributing 7% of the savings in scenario 1, the biggest emission savings are achieved via demand response measures. In the model, demand response measures under scenario 1 contribute to 20% of the indirect emission savings.

Scenario 2 considers further improvements in MEPS and building efficiency as well as higher levels of financing, this results in indirect emissions dropping faster in the short term as there is less energy demand for cooling. The largest difference however between scenario 1 and 2 is that in scenario 2 ambitious demand response measures result in a full decarbonisation of the cooling sector, as the emission factor of the energy used by cooling equipment drops down to zero. This is achieved either by obligations for 100 % renewable cooling compatibility (smart controls + (ice) storages + onsite PV) or the introduction of attractive flexible el. tariffs (by CO2-tax) by 2030 for systems in new buildings and by 2040 for all cooling systems.

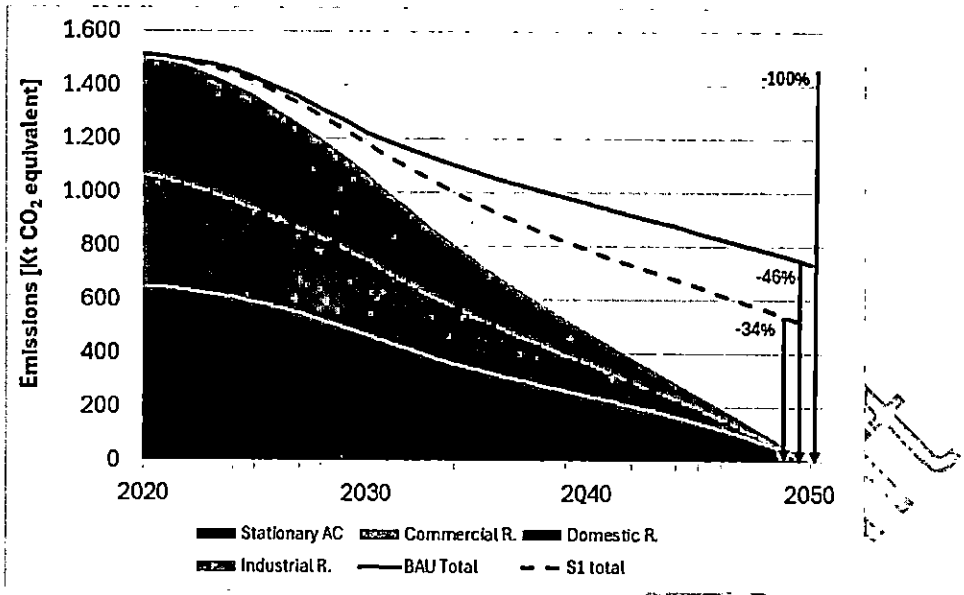

Figure 9: Indirect emissions 2020-2050, from BAU (black solid line), S1 (dashed line) and S2 (broken down by sub-sector)

Direct emissions

Concerning direct emissions in scenario 1, 90% of emissions could be reduced when comparing 2050 against 2020. In more detail, 74% of total emissions were projected to be mitigated through addressing stationary air-conditioning. Specifically, almost 60% of total emissions saved could be attributed to decentral single split AC. As second most relevant sub-sector, 22% of total emissions saved can be attributed to measures and policies addressing commercial refrigeration, specifically condensing units & centralised systems.

In scenario 2, 2050 emissions were 98% lower compared to BAU, illustrating the considerable impact of early action on high GWP refrigerants, and increasing the market share of natural refrigerants in the wide array of cooling systems.

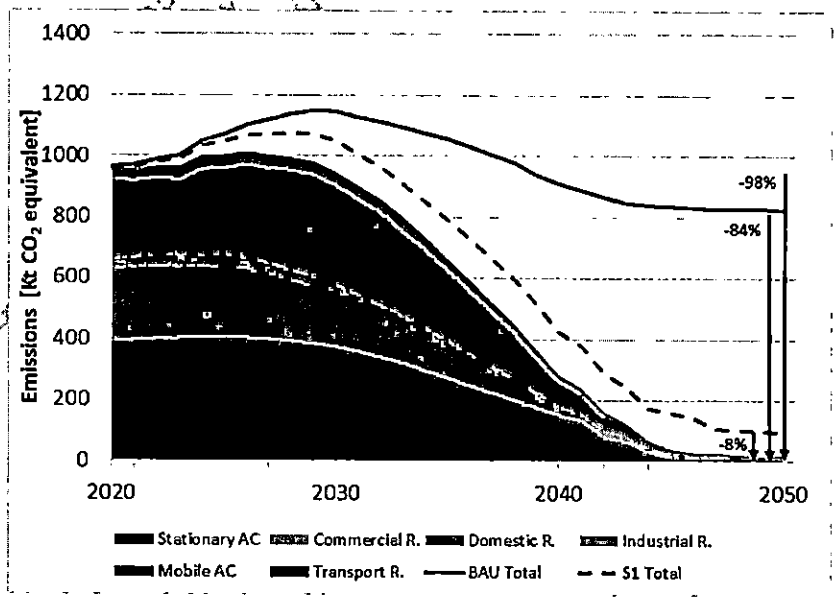

Figure 10: Direct emissions 2020-2050, from BAU (black solid line), S1 (dashed line) and S2 (broken down by sub-sector)

Total emissions (direct + indirect)

The BAU scenario is based on existing measures and policies in place and projects a decrease of total emissions by 36% in the period from 2020 to 2050.

Scenario 1 shows additional 40% reduction compared to the BAU, ending in total of 76% emission reductions from 2020 to 2050. Sector emission decreases are mostly evenly distributed over time. Scenario 2 decreases emissions further with additional 23% reduction on top of the S1, resulting in almost zero emissions in 2050 with 99% reduction compared to 2020. The remaining emissions in 2050 are mostly direct emissions from few remaining equipment units.

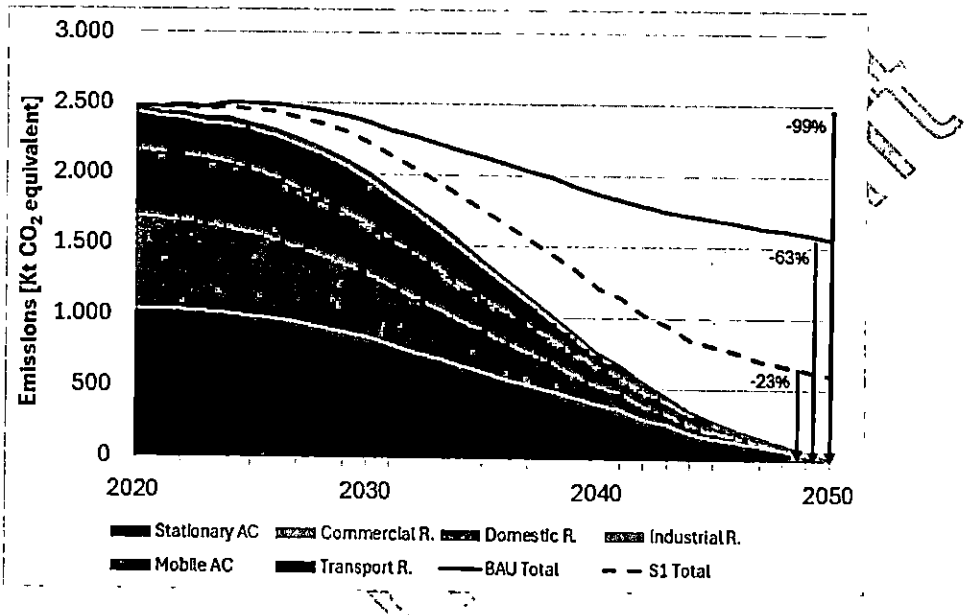

Figure 11: Total emissions 2020-2050, from BAU (black solid line), S1 (dashed line) and S2 (broken down by sub-sector)

4.3. Conclusions

To sum up, the modelling shows that there is an extremely high potential for decarbonisation of the cooling sector with ambitious policy measures. Scenario 2 shows a path to achieving an almost complete decarbonisation of the cooling sector by 2050 through a combination of measures aimed at reducing direct and indirect emissions. Both for direct and indirect emissions, the model provides a guide for which policy measures can have the most impact when it comes to the decarbonisation of the cooling sector. For direct emission, growth of HFCs and emissions from various sectors (specifically, stationary AC and commercial refrigeration) need to be regulated.

Measures are to be designed to reach the following objectives:

1. Avoiding leakages of F-gases (containment and recovery measures).
2. Developing a clear phase out/down roadmap showing transition schedules for refrigerant use in different sectors to implement the HFC phase-down.
3. Formulating prohibitions for the use and placing on the market and use of high-GWP refrigerants to steer implementation of the HFC phase-down further.
4. Raise awareness and enhance capacity building to address emissions from refrigerant handling.

For indirect emissions the largest emission savings can be achieved via demand response and energy efficiency measures, specifically:

1. Start developing a smart grid that is ready for smart cooling appliances which can react to signals from the grid.

2. Develop (ice) storages + onsite PV in buildings to enable carbon neutral cooling systems.

3. Continually improve MEPS and labels to ensure new products entering the market are highly energy efficient.

4. Continually improve building efficiency to reduce cooling demand by improving insulation and passive cooling measures.

When looking into the model for guidance on policy measures it is important to remember that a holistic approach must be taken to ensure the success of policy measures. The measures considered in the modelled scenarios are dependent on supporting measures such as monitoring, awareness raising, capacity building, and adequate targeted financing. While the impacts of these supporting measures cannot be easily translated to a model, they ensure the successful implementation of the measures by shaping the environment and creating the necessary preconditions for the other measures to reach their full decarbonization potential.

Chapter 5 lays out the detailed recommendations for a full decarbonization of the cooling sector.

5. Policy Measures and Actions

Based on the modelling results 4 and close collaboration within the NCAP working group and steering committee, a set of measures were developed to achieve the goals of the NCAP, namely, **to reduce greenhouse gas emissions while promoting equitable access to affordable cooling for all.** The measures were grouped along the strategic intervention areas that have been identified in the NCS (see Chapter 0) and lay out the path for Jordan to transition to sustainable cooling across sectors.

The measures target the entire spectrum of cooling related emissions. Energy efficiency is addressed at both the building and the equipment level. The refrigerant transition is addressed via comprehensive phase down and ban schedules. Market transition and readiness are ensured by the proposal for targeted financing schemes as well as capacity building in policy and finance circles, and most importantly at the technician level.

The measure development and prioritization took place with the following high priority aims in mind, all with the **overall aim of reducing direct and indirect emissions from cooling.**

- Achieving a reduction in cooling load via passive cooling measures in buildings and energy efficient RAC equipment.
- Accelerating the uptake of natural refrigerants and quickly phasing out refrigerants with the highest GWP levels.
- Building capacity and skills in the RAC service sector to ensure safe handling of natural refrigerants and improving maintenance to reduce refrigerant leaks.
- Raising awareness around the use of natural refrigerants and energy efficiency in cooling equipment.
- Reducing leakage rates and waste via improved life cycle and end-of-life management.
- Financing and incentivising the sustainable cooling transition via government and private sector financial instruments.

Each specific policy measure and action is described in a high level of detail on an individual measure card (in Annex). A proposal regarding the responsible entity for the implementation of each policy measure has been included in the measure card and first discussions with the entities in question took place during the NCAP development process. The structure of the measure cards and the chosen level of detail was thus developed with the following three aims in mind:

1. Provide an initial understanding of the measure and suggest implementation steps and priorities for the responsible institution.

2. Highlight synergies between NCAP measures and existing or other proposed policies with the aim of fostering collaboration on common goals.

3. Lay the foundation of a formal monitoring and evaluation system to track the implementation and impacts of individual measures.

The proposed policy measures and actions are prioritized into short-, medium- and long-term measures.

- Short-term (2025 – 2027) measures are considered high priority measures of which the implementation should begin immediately after the adoption of the NCAP document. These measures address acute barriers that currently hinder the short-term uptake of sustainable cooling measures as well as targeting low hanging fruits, i.e. aspects of cooling associated with the highest emissions thus immediately delivering emission reductions. In some cases, short-term measures aim to strengthen or support existing measures such as the ones in the NEEAP or KIP. Where this is the case, the link is mentioned in the measure card.

- Medium-term (2028 – 2033) measures have a lower priority than short-term measures however are still considered essential in decarbonising the cooling sector. In some cases, medium term measures are dependent or build on short term measures thus cannot be implemented immediately, or they require more detailed assessments and preparation. In other cases, the measures are dependent on the increasing market maturity of sustainable cooling technologies and thus cannot be implemented immediately.

- Long term (2033 – 2040) measures are those seen as important to fully decarbonise the cooling sector in the long term, however their implementation is not immediately feasible. The need for long term measures will be reevaluated depending on the success of preceding measures as well as general market developments.

The measure cards with full details are found in the Annex Policy measure cards.

6. Outlook: Implementation of NCAP measures

The chapter explains the process of implementing NCAP measures, underlines the role of a monitoring framework and addresses finance aspects for the implementation of NCAP measures.

6.1. Implementation and monitoring framework

The National Cooling Action Plan is a short-, mid- and long-term framework to implement measures with the aim of increasing sustainable cooling in Jordan. **The first phase of the NCAP will last three years**, after which a comprehensive evaluation (end of 2027) will follow. To track the progress of the NCAP implementation and its impact, **yearly monitoring reports** will be prepared. Input for these will come from the **responsible entities** and **monitoring steering committee**. Regular monitoring and evaluation of the NCAP will allow for adaptation of the implementation plan or the ambition level of certain measures in response to technological, social, political, or economic changes, while also ensuring transparency for all relevant stakeholders and the wider public.

The NCAP suggests measures in different strategic intervention areas covering a variety of topics. For the effective coordination and implementation, it is indispensable to put an effective monitoring, reporting and verification (MRV) framework in place. The different stakeholders in relevant ministries, government departments, industry sector, finance sector and all other related stakeholders need to collaborate actively.

It has been decided after consultation with the Ministry of Environment to set up a **monitoring steering committee** chaired by the Ministry of Environment/NOU and formed by relevant entities. It should monitor the progress made on the implementation of the NCAP by performing the following key tasks:

- Sharing the Key Performance Indicators and data needs with the responsible entities
- Reviewing the measures outcomes and ensure alignment with the objectives
- Reporting the progress made on the NCAP measures for the Ministry of Environment

Other members included in the NCAP should have the following key roles and responsibilities:

Ministry of Environment: The Ministry is the primary owner of the NCAP and will be responsible on the following:

- Preparing progress reports on the implementation of the National Cooling Action Plan for submission to the Prime Ministry as needed.
- Coordinating and leading the steering committee meetings
- Monitoring and supervising the implementation of the National Cooling Action Plan in collaboration with regulatory authorities, along with achieved indicators, to ensure alignment of outcomes with the country's goals and vision, in line with the Economic Modernization Vision.

Responsible Entity: Responsible for supporting the implementation of the actions proposed in the NCAP by performing the following:

- Listing all initiatives and actions related to the measure
- Reporting the outcomes of the initiative and projects to the monitoring steering entities
- Implementing the action plan activities in coordination with supporting entities.
- Participating in the steering committee (For the selected entities)

- Each responsible entity should also follow up and monitor the action implementation and report the progress to the monitoring steering committee and the Ministry of Environment.

Stakeholders Involved: Contributing to the overall process of the implementation and monitoring

- Supporting the implementing entities
- Contributing to the implementation process
- Supporting the monitoring by providing data and participating in the meetings

The Ministry of Environment and the relevant responsible entities will determine the need for changes to any of the measures based on the monitoring reports and the recommendations provided by the steering committee. The yearly reports produced by the steering committee will include an assessment of whether the implementation of the NCAP measures is on track and is likely to meet the goals set out in the NCAP. Should the assessment conclude that the NCAP measures will miss the goals set out, the Steering Committee may propose changes to existing measures or propose additional measures. The final decision on necessary changes to the measures proposed under the NCAP lies with the Ministry of Environment.

By the end of 2027 a larger impact assessment and process evaluation will be conducted by the Ministry of Environment to evaluate the progress and outcomes of the NCAP measures. The impact assessment will specifically focus on the direct and indirect emission reductions achieved as well as qualitative indicators such as developments in the service sector labour force, or other important market developments. The process evaluation will analyse if the structure around the NCAP implementation is effective, including if stakeholders are sufficiently tied into the process. Lastly, the report will also determine the necessity for an update to the NCAP, including proposals for potential changes.

Figure 12 shows the governance structure for implementing the NCAP. **Table 3:** Monitoring and evaluation table shows an example for a monitoring and evaluation template that could be used by the monitoring responsible entities to report on the progress of the measures.

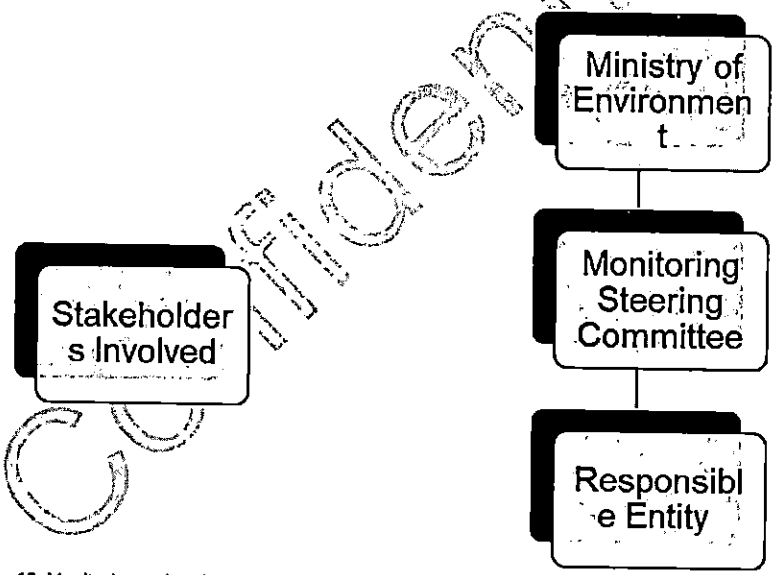

Figure 12: Monitoring and evaluation structure of the NCAP

Table 3: Monitoring and evaluation table

Strategic intervention area	Measure ID	Measure title	Implementing responsible entity	Monitoring responsible entity	Performance indicators	Data collection methodology per indicator	Data source	Actual achieved target	Progress

6.2. Implementation process

While the detailed guidance to organise measure finance will be described in a guidance document in 2025, the general process of establishing NCAP measures be the following:

1. Establishment of working groups
   - Objective: Create specialized working groups for each measure, led by the responsible entity.
   - Action steps:
     - Identify and select experts and stakeholders for each working group.
     - Define roles and responsibilities within each group.
     - Set up a schedule for regular meetings and progress tracking.
2. Assessment of needs and potential costs
   - Objective: Evaluate the needs and estimated costs for each measure.
   - Action steps:
     - Conduct market analysis to identify demand and cost implications.
     - Estimate financial requirements for each measure.
     - Determine the types of financial sources needed (e.g., grants, loans, subsidies).
3. Assessment of available government funds
   - Objective: Identify government funding sources that could support the measures.
   - Action steps:
     - Review current government budgets and allocations.
     - Engage with relevant government departments to explore funding possibilities.
     - Document any potential government grants or subsidies.
4. Review of available funds from donors and IFIs
   - Objective: Identify potential funding from international donors and International Financial Institutions (IFIs).
   - Action steps:
     - Compile a list of international donors and IFIs with an interest in environmental and energy-efficient projects.
     - Review their funding criteria and application processes.
     - Initiate preliminary discussions to gauge interest.
5. Updating of the measure concept notes
   - Objective: Update the concept notes for each measure.
   - Action steps:
     - Review and update the measure cards presented in Policy measure cards of this document
     - Include detailed cost estimates and potential financial returns.
6. Review of legislation updates needed
   - Objectives: Reflecting the measures in the local legislation
   - Action steps:
     - Review of existing relevant legislation
     - Defining the updates needed
     - Processing the legislation changes following the typical process
7. Attracting local finance sources, donors, and IFIs

- Objective: Present the concept notes to attract funding.
- Action steps:
  - Organize workshops and presentations to showcase the concept notes.
  - Engage with local financial institutions to explore co-funding opportunities.
  - Foster partnerships with donors and IFIs through direct meetings and proposals.

8. Establishment of an action plan
   - Objective: Create a detailed action plan with interested finance sources.
   - Action steps:
     - Collaborate with funding sources to outline a timeline and milestones.
     - Define roles and responsibilities for implementation and monitoring.
     - Ensure alignment of the action plan with funding requirements.
9. Creation of measure finance sources
   - Objective: Secure and establish financial sources for each measure.
   - Action steps:
     - Formalize agreements with donors, IFIs, and local finance sources.
     - Set up dedicated accounts or financial structures to manage the funds.
     - Ensure transparency and accountability in fund management.
10. Implementation of the measure
    - Objective: Execute the measures to achieve the intended outcomes.
    - Action steps:
      - Monitor progress through regular reporting and evaluations.
      - Adjust strategies as needed based on feedback and results.

For the financing of NCAP measures, close cooperation with banks is crucial to foster development of financing instruments for green products. The Central Bank of Jordan and the funds available for energy and transport will be particularly significant for providing investment in sustainable cooling technologies.

For certain NCAP measures, support is available from international donors. Most relevant for the cooling sector and related policies is the Multilateral Fund to the Montreal Protocol which supports signatory countries to the Protocol and its amendments. In general, MLF projects relate to the HCFC phase-out management plans (HPMPs), Kigali HFC implementation plans, enabling activities for early ratification of the Kigali Amendment, institutional strengthening, energy efficiency projects as well as national inventories of quantities of used or unwanted ODS including a plan for the collection, transport and disposal of such substances.

In addition, certain market-based mechanisms might be suitable to generate funding for NCAP measures. These include taxes or levies, for example import levies based on energy consumption of appliances and their labels or import levies based on the GWP of refrigerant charges in the appliances. However, feasibility and enforcement of such schemes need to be assessed in detail and with respect to the country-specific situation. Furthermore, carbon credit programmes represent a mechanism to finance a take-back system for recovered refrigerants and/or obsolete equipment.

Annex

6.3. Policy measure cards

A.3.1. Awareness, Information and Gender

Measure name	**A. Implement awareness campaigns for various sectors to share the benefits of natural refrigerant and energy efficiency of the RAC technologies.** **B. Raise awareness on the use of f-gas free insulation foams.**
Sector	All Sectors
Project timeline	Long term (After 2033)
Responsible agency	Ministry of Environment
Stakeholders involved	• All engineers and designers in all ministries • Ministry of Industry and Trade • Royal Scientific Society • Jordan Standards and Meteorology Organization.
Target group	• Government agencies, • local authorities, • private sector entities, • civil society organizations, • suppliers, end users, designers, • educational institutions, • INGOs & donors.
Measure objective	The aim of this measure is to raise awareness about f-gas-free insulation foams, which can further improve energy efficiency. By educating stakeholders on these alternatives, the measure aims to accelerate the transition to cleaner technologies and materials, contributing to both climate action and energy efficiency goals. Provide a market transformation to the natural refrigerants and energy efficiency of the RAC technologies to achieve Jordan's commitments to the Kigali amendment.
Status quo related to the measure & related existing policies and measures	Stakeholders from industries and environmental agencies identified the sector's reliance on hydrofluorocarbons (HFCs) and f-gases as a significant contributor to climate change. While there have been advancements in energy-efficient RAC technologies and some adoption of natural refrigerants, uptake remains limited due to lack of awareness and technical knowledge. Current awareness efforts are insufficient to drive widespread adoption. Stakeholders stressed the need for targeted campaigns to demonstrate cost benefits and environmental impact, especially for businesses and consumers. Improved awareness on the use of f-gas-free insulation foams can further complement this shift by enhancing energy efficiency and reducing dependence on harmful chemicals.
Description of the measure	The measure focuses on raising awareness of the emerging global trend in utilizing natural refrigerant technologies, highlighting their energy-saving and environmental benefits. It seeks to eliminate ambiguity around these advancements and underscores their critical role in achieving sustainability targets. Additionally, the measure provides manufacturers with clear guidance, assisting them in developing strategic plans to transition to these new technologies. Through targeted awareness sessions for various stakeholder groups, it will address key topics related to the promotion of sustainable cooling solutions and foster a collaborative shift towards more eco-friendly practices.
Guiding implementation steps	1. Organize 3 regular awareness sessions annually targeting policy, finance, and industry stakeholders. 2. Tailor each session to the targeted group focus on highlighting the cost savings of energy-efficient systems and the environmental benefits of

	natural refrigerants, latest technology development and best practices in various sectors, policy regulations adopted locally and internationally, F-gas free foams, and awareness on energy labelling. 3. Equip the refrigerant suppliers with the necessary tools and brochures to raise awareness among end-users 4. Publicly display the energy efficiency of buildings via posters and labels. 5. 2. Where relevant display energy efficiency and natural refrigerants use of cooling appliances used in public buildings.
Measure expected results	Significant reductions in greenhouse gas (GHG) emissions from the RAC sector, contributing to climate mitigation efforts. By increasing the adoption of natural refrigerants and f-gas-free insulation foams, the measure is expected to lower the sector's reliance on HFCs, which have global warming potentials (GWPs) thousands of times higher than carbon dioxide. Additionally, promoting f-gas-free insulation foams will enhance energy efficiency in buildings and appliances, further reducing energy consumption and associated emissions. Stakeholders, including manufacturers and consumers, will benefit from long-term cost savings through energy-efficient technologies while contributing to national targets for reducing GHG emissions under climate agreements such as the Kigali Amendment to the Montreal Protocol. The overall expected result is a measurable decrease in GHG emissions and improved sustainability in the RAC sector.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Awareness Levels measured in awareness surveys and campaign reach. • Number of Awareness Campaigns. • Number of targeted people.
Data needs and measurement methodology	Data required for monitoring: • Survey data on awareness levels among different stakeholders • Data from campaign implementors
Monitoring responsibility	Monitoring steering committee

Measure name	**Create a one-stop-shop (platform) for information on energy efficiency and refrigerant emissions**
Sub-measures	Create an accessible database for the new systems using natural refrigerants entering the market
Sector	All Sectors
Project timeline	Short term (2025-2027)
Responsible agency	Ministry of Digital Economy and Entrepreneurship
Stakeholders involved	• Ministry of Digital Economy and Entrepreneurship • Ministry of Energy and Mineral Resources, • Ministry of Environment, • Ministry of Industry and Trade, • Royal Scientific Society, • Jordan Standards and Meteorology Organization
Target group	• Suppliers, • End users, • Designers, • Educational institutions, • INGOs & donors
Measure Objective	The aim of this measure is to establish a national benchmark platform to identify and promote energy-saving opportunities across various sectors, with a specific focus on advanced refrigeration and air conditioning (RAC) technologies that utilize natural refrigerants. This platform will serve as a comprehensive resource, empowering end users to make well-informed decisions when selecting energy-

	efficient equipment or undertaking building renovations. By offering insights into sector-specific energy-saving options and innovative, sustainable technologies, the platform aims to reduce energy consumption, lower operational costs, and significantly decrease carbon emissions—ultimately driving a positive environmental impact and supporting national sustainability goals.
Status quo related to the measure & related existing policies and measures	There is no available platform in the current situation, the initial data in the platform can be fed from other platforms used in the customs, JSMO and MoEnv.
Description of the measure	The measure aims to promote energy efficiency and maximize energy savings by equipping end users with information on highly efficient technologies and best practices. By increasing awareness of life cycle costs and the energy-saving potential of high-efficiency options compared to lower-efficiency alternatives, end users will be empowered to make more sustainable choices. The platform will address the following key areas: 1. A list of EE appliances (E consumption & GHG/CO2 emission fuels, refrigerants) 2. Passive design techniques for both new and existing building 3. A list of qualified & certified technicians who are capable to deal with natural refrigerants technologies. 4. A list of pilot project/ success stories (with numbers and measures)
Guiding implementation steps	1. Create an accessible database for the new systems using natural refrigerants entering the market to allow the consumer to easily compare the performance and impact of different technologies 2. Develop a list of passive cooling measures for residential households. This should include the expected costs of each measure and the expected impact. 3. Develop a list of renovation measures with information on expected costs, expected savings, and amortization periods to facilitate renovations in private and commercial buildings. 4. Provide a roadmap to improving EE for building owners 5. 5. Develop an online data base for qualified technicians capable to deal with RAC systems using natural refrigerants
Measure expected results	Provide a comprehensive set of data in all needed information for the RAC system and technicians.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of the platform visitors
Data needs and measurement methodology	Data required for monitoring: • Traffic data
Monitoring Responsibility	Monitoring steering committee

Measure name	**Empowering Women and Youth in Sustainable RAC Initiatives**
Sub-measures	A. Empowering Women and Youth in Sustainable RAC Initiatives. B. Developing networks and a platform in sustainable cooling.
Sector	All Sectors
Project timeline	Medium term (2028-2033)
Responsible agency	Ministry of Environment
Stakeholders involved	• Royal Scientific Society, • Vocational Training Centres and accredited training providers by TVSDC
Target group	• Women and youth in government agencies,

	• local authorities, • private sector entities, • and civil society organizations.
Measure objective	The aim of this measure is to empower women and youth by providing them with the skills, resources, and opportunities to participate in and lead sustainable RAC initiatives, promoting diversity and inclusivity in the green economy.
Status quo related to the measure & related existing policies and measures	The measure is designed to promote gender equity and youth participation in the RAC sector by integrating them into sustainable, environmentally friendly initiatives. Stakeholders highlighted the underrepresentation of women and youth in this field, despite their potential to drive innovation and contribute to climate solutions. Currently, the RAC sector is male-dominated and lacks sufficient programs tailored to engage these key demographic groups. Although some vocational training and awareness campaigns exist, they often fail to focus on sustainable technologies or target women and young people. This measure is needed to address these gaps by providing targeted training, mentorship, and opportunities in the growing green economy.
Description of the measure	The focus areas of the measure include: (A) promoting gender equality and youth inclusion in the sustainable RAC workforce. (B) providing training, resources, and mentorship opportunities in green RAC technologies, such as natural refrigerants and energy-efficient systems. The problem this measure addresses is the lack of inclusion and participation of women and youth in the RAC sector, particularly in sustainable and green technologies. This exclusion limits diversity in the workforce and restricts opportunities for innovation and growth in the sector. This measure addresses the problem by: 1. Offering targeted training programs in green RAC technologies, focusing on skills development for women and youth. 2. Creating mentorship programs to connect participants with industry leaders. 3. Establishing inclusive policies and partnerships with educational institutions and industry to ensure gender equity and youth engagement in sustainable RAC initiatives. 4. Creating networks in sustainable cooling
Guiding implementation steps	1. Train women and youth on Sustainable RAC technologies. 2. Promote participation of women and youth in activities within the RAC sector (technical education). 3. Promote women's participation in the decision-making process related to updating policies or amending regulations and provide opportunities in the servicing sector. 4. Create Networks in Sustainable Cooling
Measure expected results	• Increased Participation of Women and Youth: Enhanced representation of these groups in the RAC sector, specifically in sustainable and energy-efficient technologies. • Skills Development: Training programs will equip women and youth with technical skills in natural refrigerants, energy-efficient RAC systems, and sustainable practices, helping them contribute to climate action. • Social Equity: Empowering underrepresented groups fosters social inclusion and economic growth, aligning with broader Sustainable Development Goals (SDGs) such as gender equality and decent work. • 4. Increased experience and knowledge exchange through Networks in sustainable cooling
Monitoring and evaluation	

KPIs	• Number of women and youth attended the trainings and events for the RAC topics. • Skills development in green RAC technologies measured by the number of individuals certified in green RAC technologies, such as natural refrigerants. • Gender and youth inclusion measured by the proportion of women and youth placed in leadership or technical roles in the sustainable RAC sector. • Established network in sustainable cooling TVSDC is responsible to send an annual report to the Ministry of Environment on the number of conducted activities and no. Of beneficiaries related to capacity building activities.
Data needs and measurement methodology	Data required for monitoring: • Primary data from training organisers
Monitoring responsibility	Monitoring steering committee

Measure name	**Implement a pilot project to showcase the effectiveness of natural refrigerants in the RAC systems.**
Sub-measures	A. Implement a pilot project to showcase the effectiveness of natural refrigerants in the RAC systems. B. Showcase public buildings as frontrunners.
Sector	All Sectors
Project timeline	Short term (2025-2027)
Responsible agency	Ministry of Environment
Stakeholders involved	• Royal Scientific Society, • Jordan Standards and Meteorology Organization, • Manufacturers and suppliers, • Public and Private sector.
Target group	• Government agencies, • local authorities, • private sector entities, • civil society organizations.
Measure objective	The aim of this measure is to accelerate the adoption of natural refrigerants in RAC systems by implementing pilot projects in public buildings. These projects will demonstrate the environmental and economic benefits of using natural refrigerants and energy-efficient technologies, making public buildings frontrunners in the shift toward sustainable cooling solutions.
Status quo related to the measure & related existing policies and measures	The measure aims to demonstrate the practical benefits of natural refrigerants in RAC systems through pilot projects, particularly in public buildings. Stakeholders emphasized the need for visible examples to accelerate the adoption of eco-friendly technologies. Although energy-efficient RAC technologies exist, they are underutilized due to perceived risks, lack of technical knowledge, and high upfront costs. Public buildings, which often have high visibility and are government-funded, can serve as frontrunners in showcasing the effectiveness of natural refrigerants. By addressing concerns related to reliability, performance, and cost-effectiveness, the pilot project will help scale up adoption across industries and commercial sectors. Improvements are needed in scaling and replicating existing successful technologies and making them accessible to the broader market.
Description of the measure	The measure addresses the slow uptake of environmentally friendly alternatives to HFC-based systems, due to doubts about their real-world effectiveness and cost efficiency. This measure addresses the problem by providing tangible, high-profile examples of successful implementation in public buildings, showing different stakeholders that natural refrigerants offer both environmental and economic benefits. The

	pilot projects will reduce uncertainties by offering data on energy savings, emissions reductions, and performance over time.
Guiding implementation steps	Submeasure A 1. Develop a TOR outlining the demo project's scope, goals, roles, timeline, and performance metrics. 2. Publish the call for proposal with detailed guidelines and eligibility criteria to receive qualified applicants. 3. Conduct a transparent tender process with an evaluation framework based on technical, cost, and sustainability criteria. 4. Select the winning bids, finalize contracts, and establish clear terms, deliverables, and milestones. 5. Install the systems according to plan, ensuring adherence to efficiency, safety, and regulatory standards. 6. Oversee commissioning, conduct performance testing, and train personnel for optimal equipment operation. 7. Continuously track and analyze energy savings and performance metrics to validate project impact. Submeasure B 1. Publicly display the energy efficiency of buildings via posters and labels. 2. Where relevant display energy efficiency and natural refrigerants use of cooling appliances used in public buildings.
Measure expected results	• Increased adoption of natural refrigerants: The pilot project will demonstrate their viability, driving higher adoption rates across the public and private sectors. • Mitigation of GHG emissions. • Energy savings: Public buildings adopting energy-efficient RAC technologies will likely report reduced energy consumption, serving as a model for others. • Enhanced public awareness: By positioning public buildings as frontrunners, this measure will raise awareness among decision-makers and the public, further driving demand for sustainable cooling solutions.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Reduction in GHG Emissions reduced by the pilot project. • Energy savings achieved in the pilot project (measured in kWh). • Growth in the sales of natural refrigerant technologies
Data needs and measurement methodology	Data required for monitoring: • Energy consumption and emissions data from pilot project • RAC sales data
Monitoring responsibility	Monitoring steering committee

A.3.2. Building Performance Standards

Measure name	***Develop an energy performance certificate (EPC) (rating system) for buildings***
Sub-measures	Adopt the EPC by the relevant Authority
Sector	Building Sector
Project timeline	Short-term (2025-2027)
Responsible agency	JNBC is the primary responsible entity
Stakeholders involved	• Ministry of Public Works and Housing

	• Royal Scientific Society • Jordan Engineers Association • Amman Greater Municipality and other municipalities in Jordan • Jordan Contractors Association • Projects' developers, designers and owners
Target group	• The Building Sector includes public buildings, commercial buildings and residential buildings.
Measure objective	The aim of this measure is to increase the adoption of EE/RE measures in the built environment and indicate the energy performance of a building or a building unit, calculated according to a methodology complying with the common general framework adopted at the national level.
Status quo related to the measure & related existing policies and measures	Jordan has released several regulations, directives, and policy tools that regulate energy efficiency in the building sector. The Ministry of Energy and Mineral Resources (MEMR) has issued an updated Master Strategy for the Energy Sector 2020-2030. It aims to ensure a sustainable energy supply, diversify the national energy mix, rely more on domestic energy sources, enhance energy security, and reduce energy costs. The strategy calls for a target of a 9% reduction in energy consumption by 2030. Implementing an Energy Performance Certificate (EPC) system would play a crucial role in increasing energy efficiency practices across buildings, directly supporting Jordan's national energy goals. The EPC system would drive the adoption of energy-saving technologies, foster accountability, and encourage both new and existing buildings to meet higher energy performance standards. Due to the absence of essential regulations and incentives in Jordan to promote the Energy Performance Certificate, all relevant stakeholders must collaborate closely to address this issue.
Description of the measure	The Energy Performance Certificate serves as an evaluation process that measures the energy efficiency of a building. It provides a rating scale from A to G, with A representing the most efficient energy performance and G the least efficient. This assessment includes several factors, such as the effectiveness of insulation, the types of heating and cooling systems in place, and the incorporation of renewable energy technologies. EPC will become voluntary for the new and existing residential and commercial buildings. It will help facilities' owners, buyers, and operators understand their building's energy performance and identify opportunities for energy savings. The EPC normally includes: **Rating:** A scale from (most efficient) to (least efficient), indicating the building's overall energy performance. **Details of energy consumption:** It describes energy use for heating, cooling, lighting, and other systems. **Validity Period:** The duration for which the EPC is valid. Most countries that adopt EPC give around 10 years validity.
Guiding implementation steps	1. Develop the concept, addressing the methodology for the EPC process and financial windows to enhance adoption. 2. Adoption and establish Legal Framework and Mandates: The EPC shall be adopted by the entity responsible for its implementation, which, in the case of Jordan, is the JNBC. This step is important to ensure that the framework is effectively integrated into the relevant processes. 3. Identify certification processes: this includes identification of tools/software that will be used for building evaluation. The assessment process includes certifying assessors who will evaluate the building's energy performance. 4. Identification of rating grades. 5. Certification documentation which starts from the design phase of the building and passes through the entire construction process of the building.

	6. Training and capacity building for assessors and inspectors. 7. Awareness campaign targeting the public to promote the importance of EPC. 8. Monitoring and Enforcement, looking for potential improvements.
Measure expected results	• Economic and energy savings as a result of improved energy performance of buildings. • Reduced carbon emissions, which helps the government to achieve its commitments toward climate change. • new job opportunities in the building sector. • Increased awareness among the public on the importance of improving the energy performance of buildings. • Helps update buildings' energy performance baseline.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Adoption of a legal framework for EPC • the number of certified buildings,
Data needs and measurement methodology	Data required for monitoring: • EPC official announcements • Number of buildings applied to the new scheme • Number of accredited buildings
Monitoring responsibility	Monitoring steering committee

Measure name	**Development of a district cooling code**
Sector	Building Sector
Project timeline	Medium-term (After 2028 - 2033)
Responsible agency	JNBC is the primary responsible entity in cooperation with the Royal Scientific Society.
Stakeholders involved	• Ministry of Public Works and Housing • Jordan Engineers Association • Amman Greater Municipality and other municipalities in Jordan • Projects developers, designers, and owners • Royal Scientific Society. • Ministry of local administration • Aqaba Special Economic Zone Authority • Ministry of Investment
Target group	Building Sector including public buildings, commercial buildings and residential buildings.
Measure/project Objective	The main aim of this measure is to develop a district cooling code that includes a comprehensive set of guidelines and standards to ensure the efficient, safe, and sustainable implementation of district cooling systems.
Status quo related to the measure & related existing policies/measures	Jordan always looking to enhance relevant building standards and regulations that comply with international norms, regulations, and standards as well as ensure a comfortable living environment. Over the past decade, Jordan has developed and updated several codes for buildings reaching out more than 51 codes. As district cooling gains significant interest internationally due to its tremendous benefits in reducing associated energy costs compared to traditional cooling systems, it is now imperative that Jordan thoroughly consider the opportunity to adopt this technology. To avoid the random spread of this

	technology, adequate standards and regulations must be established to ensure the safe and sustainable deployment of district cooling. This measure is planned in the 3rd NEEAP and still in the alignment process, and not adopted yet
Description of the measure	A district cooling code is a set of standards and instructions that govern the planning, design, installation, operation, and maintenance of district cooling systems. These rules are intended to guarantee that district cooling systems are efficient, safe, reliable, and sustainable.
Implementation steps	Key steps to develop a district cooling code may involve the following: 1. Define the objectives of the district cooling code, such as improving energy efficiency, reducing greenhouse gas emissions, and ensuring system reliability. 2. Determine the scope, including the types of buildings and areas covered by the code. 3. Analyze existing local, national, and international standards related to district cooling. 4. Conduct consultations and workshops to gather input and build consensus on the code's requirements. 5. Drafting Technical Requirements including technical standards for the design, installation, operation, and maintenance of district cooling systems as well as e specifications for central plants, distribution networks, building connections, and metering systems. 6. Establish safety protocols for the construction and operation of district cooling systems. 7. Develop a framework for monitoring compliance with the code, including regular inspections and reporting requirements.
Measure expected results	• A document that incorporates all required standards and information related to district cooling.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of studies on the potential of district cooling
Data needs and measurement methodology	Data required for monitoring: • Officially published district cooling code
Monitoring responsibility	Monitoring steering committee

Measure name	***Enforcement of existing building codes and regulations***
Sub-measures	Develop monitoring and verification mechanisms to ensure proper implementation of building codes and regulations
Sector	Building Sector
Project timeline	*Short-term (2026-2028)*
Responsible agency	Jordan National Building Council is the primary responsible entity for monitoring the implementation of national codes.
Stakeholders involved	• *Ministry of Public works and Housing* • Jordan Engineers Association • Amman Greater Municipality and other municipalities in Jordan • Jordan Contractors Association • Projects' developers, designers and owners
Target group	• Building Sector including public buildings, commercial buildings and residential buildings.
Measure objective	The primary aim of this measure is to verify and confirm that all the necessary building code requirements are being fully adhered to and implemented

	throughout the entire construction phase of the building. Adhering to building codes requirements will lead to: • Ensuring that all structures are constructed using high-quality materials and in compliance with safety standards to guarantee their safety and reliability for the long term. • Improving the energy performance of the building by ensuring that minimum energy performance standards of the building are met. • Reduce energy-related costs of the building and improve the economic value of the building. • Open new job opportunities where some interventions need specific attention during installation such as insulation, mechanical ventilation, distribution of cooling and heating load. • Carbon emission reduction which contributes to the government's obligations toward climate change as stated in Jordan's NDC.
Status quo related to the measure & related existing policies and measures	There are over 51 national codes in Jordan issued by the Jordan National Building Council (JNBC). The implementation of these codes is mandatory and falls under the responsibility of JNBC. The Jordan Engineers Association (JEA) is also responsible for verifying the compliance of building designs and drawings with the building codes according to its internal regulations. Project developers and designers must adhere to the building codes to obtain approval from JEA for their designs before commencing their work. Currently, there is no governmental inspection or verification scheme/mechanism for the implementation of the approved designs and drawings (based on the buildings codes) on site or after commencing the works. Neither JEA nor the municipalities have the legal authority to inspect the buildings in the construction phase for implementing the codes and, thus, the inspection of the codes is not their responsibility. The Jordan National Buildings' law was modified in June 2018 to emphasize the inspection process for implementing national codes and regulations in ongoing projects, as well as the coordination among authorities and institutions for inspections.
Description of the measure	The measure focuses on the proper implementation of the building codes to enhance the monitoring and inspection onsite. By developing a clear mechanism that assigns responsibility for a specialized unit to provide the technical verification for onsite installation of building elements including energy efficient solutions.
Guiding implementation steps	1. Develop a concept for improvements of inspection and supporting measures such as awareness raising campaigns, incentive programs, dissemination activities. 2. Establish a unit/department at JNBC for following up the enforcement of building codes. This unit may develop all needed instructions and guidelines that help relevant stakeholders complying with codes. 3. Establish an expert committee to support the unit at JNBC in their role by providing technical assistance, providing advice and proposing solutions to overcome the challenges that may hinder the implementation. 4. Establish legal framework: Municipalities and JEA shall be delegated by JNBC to have the legal authority to inspect the implementation of the Jordanian codes in new buildings. This can be accomplished by modifying the internal regulations/instructions and regulation to focus on the inspection in their scope of work. 5. Establish a national register to follow up on the applications and the certified buildings based on the requirements
Measure expected results (mitigation potential if relevant)	• Economic and energy savings as a result of improved energy performance of buildings. • Reduced carbon emissions, which helps the government to achieve its commitments toward climate change. • new job opportunities.

	• Increased awareness among the public on the importance of improving the energy performance of buildings by complying with codes.
Monitoring and verification	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Publication of relevant guidance materials by new JNBC Jordan National Building Council unit. • Regulatory changes are adopted to empower JEA and municipalities to perform inspections of new buildings and control application of relevant building codes. • Increased the number of buildings complying with codes, • Number of new job created to perform the inspection and supervision
Data needs and measurement methodology	• Legal framework published for the new instructions • Number of dissemination and awareness events • Members representatives participating in the new unit/ department • Number of the technical committee experts' meetings, • Number of annual inspections and supervisions for the new constructions • Number of new job opportunities
Monitoring responsibility	Monitoring steering committee

Measure name	**Study the potential for district Cooling**
Sub-measures	Commission studies on potential location(s) and technology for energy efficient district cooling grids
Sector	Building Sector
Project timeline	Medium-term (After 2028 - 2033)
Responsible agency	Jordan National Building Council
Stakeholders involved	• Ministry of Public works and Housing • Jordan Engineers Association (JEA) • Amman Greater Municipality and other municipalities in Jordan • Jordan Contractors Association • Projects' developers, designers, and owners • NEPCO and Electricity Distribution Companies
Target group	• Building Sector including public buildings, commercial buildings, and residential buildings.
Measure objective	The main aim of this measure is to assess the potential of introducing district cooling to Jordan and identifying potential zones and technologies to ensure the presence of cooling demand for different building types.
Status quo related to the measure & related existing policies and measures	District cooling refers to the centralized generation and distribution of cooling energy. An underground insulated pipeline delivers chilled water to business, industrial, and residential buildings to cool the inside air. Specially constructed devices in each building then use this water to cool the air traveling through the building's air conditioning system. District cooling systems may replace any form of air conditioning system, although they typically compete with air-cooled reciprocating chiller systems used in large buildings that require a lot of power. In Jordan, air-conditioning reciprocating chiller systems often operate in a tough environment that includes severe heat, salty humidity, and windborne sand. Over time, performance, efficiency, and reliability deteriorate, resulting in high maintenance costs and, ultimately, equipment replacement. Currently, district cooling is not well utilized in the building sector in Jordan. There are only two district cooling projects in the country, Al Abdali district cooling in Amman, and Ayla Oasis resort in Al Aqaba. District cooling adoption is

	hindered by several factors including but not limited to the absence of clear regulations and standards, the high estimated cost of installation, and a lack of information about potential demand.
Description of the measure	The building sector is considered an intensive energy consumer as it uses more than 60% of the total electricity consumption in Jordan. This is in addition to the consumption of other energy sources such as diesel, LPG, and kerosene, while cooling and heating demand represent the largest contributors in this domain. Furthermore, due to the high energy consumption the building sector is responsible for a significant amount of greenhouse gas emissions. Therefore, it is important to address this emission source. Using district cooling in some zones is one of the actions that might significantly contribute to lowering building energy consumption, particularly the cooling demand. A comprehensive assessment is needed to identify the potential zones of utilizing district cooling.
Guiding implementation steps	Conducting an assessment for district cooling potential involves several key steps but not limited to the following: 1. Data Collection and Analysis: o Climate Data: Gather information on temperature, humidity, and seasonal variations to understand cooling needs. o Energy Consumption Data: Analyze current energy usage patterns, especially for cooling, in residential, commercial, and industrial sectors. o Building Stock Data: Collect data on building types, sizes, and ages to estimate cooling demand. 2. Demand Mapping: o Identify high-density areas with significant cooling needs, such as commercial districts, industrial zones, and large residential complexes. o Use Geographic Information Systems (GIS) to map potential demand clusters. 3. Identify Technical Feasibility: o Assess the availability of water sources and existing infrastructure that can be leveraged for district cooling. o Assess technical options for district cooling grids o Evaluate potential sites for central cooling plants and distribution networks 4. Economic Analysis: o Estimate the capital and operational costs of district cooling systems. o Conduct a cost-benefit analysis to compare district cooling with conventional cooling methods. o Explore financing options and potential subsidies or incentives. 5. Regulatory and Policy Framework: o Review existing regulations and policies related to energy, environment, and urban planning. o Identify gaps and propose necessary regulatory changes to support district cooling adoption. 6. Stakeholder Engagement: o Involve key stakeholders, including government agencies, utility companies, real estate developers, and the public. o Conduct workshops and consultations to gather input and build consensus. 7. Awareness and Capacity Building:

	○ Develop and awareness campaign plan to educate stakeholders about the benefits of district cooling. ○ Assess the required training and capacity-building programs for professionals involved in the planning, design, and operation of district cooling systems.
Measure expected results	A comprehensive report that includes but is not limited to the following: • Demand mapping for district cooling zones including weather conditions analysis. • Potential technologies, costs and related energy savings. • Identified zones for district cooling. • Suggestions for a potential legal framework including incentives policy. • Plans for awareness and training.
Monitoring and evaluation	
KPIs	• The key performance indicators necessary for monitoring and evaluation of the measure are:Recommended locations for the district cooling technology • An assessment report outlining economic, social, and environmental potential for district cooling
Data needs and measurement methodology	Data required for monitoring: • Results of technology and economic analysis; potential return on investment, cost-effectiveness, and other factors related to financial analysis. • The potential of energy savings in (%) or (KWh) compared to the traditional cooling systems of the potential sites identified. • Potential of carbon reduction quantity in tons eq CO2.
Monitoring responsibility	Monitoring steering committee

A.3.3. Capacity Building

Measure name	**Provide training programs for different stakeholders in RAC sector**
Sub-measures	• Provide training programs for the banking sector. • Provide training programs for the policy sector. • Provide training programs for custom staffs in charge of monitoring product imports. • Provide training for building contractors. • Provide training programs for the technicians in the RAC sector. • Provide training programs for the informal market service providers
Sector	Cross-sector
Project timeline	Short-term (2025-2027)
Responsible agency	• Royal Scientific Society
Stakeholders involved	• Technical Vocational and Skills Development Commission • Vocational Training Corporation • Central Bank of Jordan • Association of banks • Ministry of Environment • Ministry of Energy and Mineral Resources • Ministry of Industry and Trade, • Jordan Chamber of Industry • Jordan Engineers Association • *Civil Defence* • *Ministry of Interior* • *Department of Statistics*
Target group	• Banking sector

	• Policy sector • Custom staffs • Building contractors • Installer/ technician working in the RAC sector
Measure objective	The aim of this measure is to enhance the knowledge and skills of stakeholders and technicians directly involved in installation and maintenance activities. By ensuring safe handling practices, the action promotes the adoption of sustainable cooling technologies, thereby contributing to a positive environmental impact. By offering tailored training programs for various categories of targeted stakeholders, this measure accomplishes the following objectives: 1. Raise awareness in the banking sector about emerging technologies, facilitating access to financing opportunities. 2. Secure support for adopting necessary regulations and policies to align with international plans and commitments. 3. Ensure enforcement of efficiency and climate regulations, both during and beyond customs checkpoints, in alignment with the HPMP. 4. Promote awareness of green building practices and sustainable design. 5. Equip technicians with the knowledge needed for the safe handling of sustainable cooling technologies.
Status quo related to the measure & related existing policies and measures	The concept of sustainable cooling is relatively new, and there exists a significant knowledge gap among financial institutions, policymakers, and manufacturers regarding the necessary transformation. To address this, comprehensive and targeted training should be provided to stakeholders across all sectors. Special attention must be given to technicians involved in installation and maintenance, as they hold direct responsibility for the safe handling of these technologies. Current curricula for technicians do not reflect current needs for safe handling and need to be improved and developed further to establish a certification scheme. Requirements for natural refrigerants application are not considered under the current version, and there is no dedicated training provided so far. The servicing sector experiences poor practices for leakage prevention and recovery which leads to high direct emissions.
Description of the measure	The measure aims to enhance the capabilities of various stakeholders in the RAC (Refrigeration and Air Conditioning) sector, taking into account the unique needs and considerations of each targeted group. Training will be delivered repeatedly, focusing on specific areas to effectively raise awareness and build expertise. The Cool Up program has provided tailored training sessions for various stakeholder groups, including technicians, policymakers, and financial institutions. To ensure the long-term impact and effectiveness of these initiatives, it is essential to not only continue and expand these activities but also to involve new stakeholder groups directly impacted by emerging natural refrigerant technologies. Each training module should be customized to address the unique needs of its target audience, with a focus on technical competencies, regulatory frameworks, and compliance requirements specific to their roles and responsibilities.
Guiding implementation steps	1. Assess training needs and knowledge gaps, especially for MAC and transport sectors (which were not addressed by MLF-funded activities in the past). 2. Design training modules for natural refrigerants tailored to the target groups. 3. Approve training materials and licensing exam requirements with VTC and Ministry of Environment. 4. Establish an evaluation scheme.

	5. Start register of certified technicians and raise awareness about the register.
Measure expected results	• Upscale adoption of sustainable cooling policies and regulations. • Providing green financing opportunities for sustainable cooling technologies. • Control over natural refrigerants imports and exports. • Updated minimum requirement standards and safety measures for natural refrigerants handling. • Improved servicing practices.
Monitoring and verification	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Training modules are developed per stakeholder group • Number of trainings provided per stakeholder group • Number of stakeholders trained • Curricula update - conducted occupational analysis, updated occupational standards, finalized curricula document, developed training programmes, developed license exams • Natural refrigerants handling is included into minimum requirements standard
Data needs and measurement methodology	Data required for monitoring: • Name, titles, and contact information of the trainees • A breakdown of trained participants per stakeholder group. • Trainings outlines and key topics • Trainings dates, locations and formats • Reviews performed and updates on the modules • Training Evaluations outcomes • Specific requirements for handling natural refrigerants, outlining skills, knowledge, and safety protocols.
Monitoring responsibility	Monitoring steering committee

Measure name	**Equip technicians with the necessary skills to deal with the natural refrigerants**
Sub-measures	Update the certification scheme for include new requirements for natural refrigerant
Sector	Refrigeration and Air Conditioning (RAC) Sector
Project timeline	Short-term (2025 – 2027)
Responsible agency	Royal Scientific Society (RSS)
Stakeholders involved	• RSS (Royal Scientific Society) • Accredited training providers (for alignment in curriculum development) • TVSDC (for vocational and technical support) • RAC industry stakeholders • Educational institutions • Civil Defence • Department of Statistics • Ministry of Environment/ Waste management department
Target group	• Technicians working in domestic and commercial RAC sectors • Training centres and vocational institutions • Certification bodies
Measure/project Objective	The aim of this measure is to enhance the skills and standards of technicians working in the RAC sector in Jordan, ensuring alignment with international standards and introducing topics such as natural refrigerants. This scheme aims to contribute to climate goals by supporting the adoption of environmentally friendly practices, particularly through the use of natural refrigerants, while also

	promoting economic and social benefits by enhancing job competency in the sector.
Status quo related to the measure & related existing policies/measures	Currently, the occupational standards for technicians in the RAC sector require updates to incorporate best practices and modern technologies, particularly concerning natural refrigerants. The MOV-HET program has laid some groundwork, but further enhancements are necessary to ensure alignment with international standards. There is a need for a comprehensive certification program to ensure technicians are qualified to work with both traditional and environmentally friendly refrigerants, which aligns with global climate and energy efficiency goals. It is highly important to address the waste management topic to ensure safe handling of RAC systems at the end of its life.
Description of the measure	This measure involves the development and implementation of a certification scheme for technicians working in the RAC sector in Jordan. Key focus areas include updating occupational standards, developing curricula, creating training materials, establishing a robust examination process, and managing RAC systems waste. The inclusion of natural refrigerants in the certification process is crucial for aligning with Jordan's National Cooling Action Plan and international environmental goals. The scheme also addresses gaps in current training and standards, ensuring that technicians are equipped with the necessary skills to meet market demands and environmental requirements.
Guiding implementation steps	1. Review & Update Standards: The Royal Scientific Society will review and update the occupational standards for technicians in both domestic and commercial air conditioning, leveraging the support of the MOV-HET program. 2. Curriculum Development: Development of new curricula tailored to the needs of the domestic and commercial sectors, including air conditioning and refrigeration. 3. Training Materials: Create comprehensive training materials to support the curriculum and ensure technicians receive practical and theoretical knowledge. 4. Exam Bank: Prepare a bank of exam questions to be used for certification exams. 5. Natural Refrigerants Inclusion: Incorporate topics related to natural refrigerants into the updated occupational standards and curriculum. 6. Pilot and Rollout: Pilot the certification scheme in key regions, adjust based on feedback, and then proceed with full implementation. 7. Stakeholder Consultation: Engage with relevant industry and government stakeholders to ensure the scheme meets local needs and aligns with national policies.
Measure expected results (mitigation potential if relevant)	• Improved competency and certification of technicians in the RAC sector. • Wider adoption of natural refrigerants, leading to a reduction in greenhouse gas emissions. • Alignment with Jordan's National Cooling Action Plan and international climate commitments. • Increased energy efficiency in the cooling sector.
Monitoring and evaluation	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of technicians certified under the updated standards. • Percentage of technicians trained in the use of natural refrigerants.
Data needs and measurement methodology	Data required for monitoring: • New occupational standards • Number of technicians qualified to deal with natural refrigerants
Monitoring responsibility	Monitoring steering committee

A.3.4. Cold Chain

Measure name	**Assessment of cold chain at the national level**
Sector	Cold chain sector
Project timeline	Short-term (2025-2027)
Responsible agency	Ministry of Environment
Stakeholders involved	• Ministry of Transport, • Department of Statistics, • Ministry of Finance, • Ministry of Agriculture • Ministry of Health • Ministry of Trade • Chamber of Commerce and Industry
Target group	• Small and Medium Enterprises, • Commercial sector, Logistic companies, Transport companies, Suppliers, Storage facilities/warehouses providers • Agricultural unions/labour unions • Greater Amman Municipality
Measure objective	The aim of this measure is to ensure that temperature-sensitive products remain potent and safe throughout the entire supply chain. By evaluating storage conditions, equipment functionality, and handling practices across the country, authorities can identify and address any weaknesses that could compromise products' quality.
Status quo related to the measure & related existing policies and measures	There is currently no comprehensive nationwide cold chain assessment that evaluates all aspects of the cooling system, including storage facilities, transportation, and economic impacts.
Description of the measure	The assessment aims to determine the amount of food, commodities, blood, etc. lost due to spoilage and waste and the associated costs to businesses and the country overall (technology and gap analysis). Assessment involves evaluating multiple aspects over the supply chain and provides a holistic view of the current state of the cold chain, identifies areas for improvement, and offers actionable insights for enhancing efficiency, reducing waste, and promoting sustainability. The outcomes include comprehensive options for enhancing the cold chain such as rural vs urban environment, regional aspects, technology options to improve reliability, energy efficiency.
Guiding Implementation steps	1. Analyse infrastructure on existing cold storage facilities, transportation systems, and monitoring technologies 2. Monitor the vehicles operating in the supply chain and check its efficiency to deliver the food and medical products 3. Study vaccine temperature monitoring through sensors and the Internet of Things 4. Collect data on temperature monitoring, compliance with safety standards, and product integrity 5. Determine the amount of food, commodities, blood, etc. lost due to spoilage and waste and the associated costs to businesses and the country overall 6. Evaluate processes and review operational protocols for handling, storing, and transporting temperature-sensitive products. 7. Evaluate funding opportunities for SMEs and engage stakeholders
Measure expected results	• Enhanced effectiveness and increased reliability of the cold chain • Optimized cooling infrastructure • Reduced loss of temperature-sensitive products significantly • Ensured that perishable goods such as food and pharmaceuticals are maintained at optimal temperatures throughout the supply chain • Ensured support of public health by safe distribution of essential products • Minimized waste and financial losses
Monitoring and verification	

KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Conducted and published assessment of cold chain at the national level • Cold chain compliance rate including a percentage of cold chain facilities meeting established safety and performance standards • Temperature variance incidents including a number of reported incidents of temperature breaches during transport and storage • Infrastructure utilization rate showing a percentage of cold storage capacity actively utilized across the country • Response time for issues to address and rectify cold chain incidents or failures • Comprehensive options for enhancing the cold chain such as rural vs urban environment, regional aspects, technology options to improve reliability, energy efficiency are determined • Vaccine temperature monitoring options provided through sensors and the Internet of Things • Recommendations for enhancing efficiency, reducing waste, and promoting sustainability are provided • Funding opportunities for SMEs are evaluated • Stakeholder satisfaction score regarding the effectiveness and reliability of the cold chain
Data needs and measurement methodology	Data required for monitoring • Infrastructure inventory including a comprehensive list of cold storage facilities, transport vehicles, and monitoring equipment. • Temperature monitoring data providing historical data on temperature control from monitoring systems used in transport and storage. • Incident reports showing the records of temperature breaches, product spoilage, and related incidents. • Stakeholder feedback including surveys and interviews with key stakeholders to assess satisfaction and gather insights. • Regulatory compliance reports including documentation from inspections and audits of cold chain operations.
Monitoring responsibility	Monitoring steering committee

A.3.5. Demand Response

Measure name	**Introduction of a (voluntary) smart grid ready cooling certification of cooling systems**
Sub-measures	Introduction of a consumer facing label identifying smart grid ready cooling appliances. Studying the potential of demand response in the cooling sector.
Sector	Domestic and commercial AC
Project timeline	Short term measure (2025-2027) – as it lays the foundation for more ambitious demand response measures in the future
Responsible agency	Ministry of Energy and Mineral Resources (MEMR) Energy and Minerals Regulatory Commission (EMRC)
Stakeholders involved	• Domestic RAC equipment manufacturers • The TSO (NEPCO) • The DSOs (JEPCO, EDCO, IDECO) • Energy providers • Regional RAC equipment manufacturers and manufacturers associations
Target group	• Equipment manufacturers (domestic and commercial AC) • Energy providers and DSOs • AC equipment owner and users (domestic and commercial)
Measure objective	The aim of the measure is to prepare the market, via a smart-grid-ready label, for increased grid-flexibility via demand side management of AC loads in order to reduce the emission factor of energy used for cooling. The introduction of smart-

	grid ready devices (and the proper labelling of these) is an important step in preparing the market as it increases consumer awareness.
Status quo related to the measure & related existing policies and measures	Smart grid ready cooling appliances are those capable of being controlled externally and able to respond e.g. to price signal from the electricity grid to enable high shares of renewable energies. Different interventions are possible here. • A simple binary switch to set the device into predefined operating conditions (e.g. on => load storages, off => de-load storages, and standard operation) • An advanced non-binary control which allows to a dynamic adaptation to the (prognosed) grid requirements Currently, no such label exists for AC, however an increasing number of appliances around the world are designed to be "smart" and grid ready. A prominent example of this is the SG (smart grid) ready label used for heat pumps in Germany. The goal of introducing such a measure is to consume electricity for cooling during times when the share of renewables in the grid is high and reducing demand when the share is low, this effectively lowers the emission factor of the energy used for cooling. The emission factor of the energy grid in Jordan in 2020 was *459 gCO_2/kWh*. While this is already declining and expected to continue to do so as renewable energy and natural gas play an increasing role in Jordan's energy generation, demand response measures can ensure the cooling sector is decarbonized more quickly. For demand response to effectively take place two preconditions are necessary. Firstly, by introducing dynamic electricity tariffs which send price signals to consumers and allow them to respond to these. Dynamic electricity tariffs can incentivise consumers to consume energy (in this case via cooling) when energy prices are low (i.e. when supply is high) and to reduce consumption when prices are high (i.e. when supply is limited). Currently, at the household level, no dynamic tariffs are available. Electricity prices for households are cross-subsidised from industry and large consumers to keep tariffs for low-income households at affordable levels, this means household consumers pay a fixed low price and are unresponsive to price signals from the electricity market.[26] Secondly, consumers must be equipped with smart meters, which measure consumption in (or close to) real-time in order for dynamic electricity tariffs to be implemented. Under the Jordan Energy Sector Strategy (ESS) a target was set to reach a 100% rollout by 2022, however in 2021 on 10% had been achieved.[27] Smart AC unit are able to receive signals from the smart meter and respond to these. This autonomous control could be beneficial for the consumer, as it capitalizes on low energy prices when available, for the grid, as times of high supply are matched by high demand, and for the environment, as more of the available renewable energy is used as well as the smoothing out of demand peaks which reduce the dispatch of fossil fuel run peaking plants.
Description of the measure	The measure builds on the requirement to increase the demand response to decarbonize electricity grid in Jordan. A smart grid ready label will increase consumer awareness for futureproof AC technologies which will be able to save costs and emissions by exploiting dynamic pricing. Currently AC systems have no ability to response on demand as neither the incentives nor the technology to enable it are in place. A label will begin to create a market environment where demand response with AC systems is more common.

[26] IRENA, "Renewables Readiness Assessment: The Hashemite Kingdom of Jordan", 2021. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Feb/IRENA_RRA_Jordan_2021.pdf

[27] EDAMA, Smart Meters Rollout in Jordan Opportunities Challenges and Recommendations, 2022. https://edama.jo/wp-content/uploads/2022/10/Smart-Meters-Rollout-in-Jordan-Opportunities-Challenges-and-Recommendations-English-1.pdf

Implementation steps	1. Through a collaborative process, led by the RAC manufacturers, but also including the TSOs, DSOs, energy providers, and the regulating authority, the Energy and Minerals Regulatory Commission (EMRC) shall determine and define the requirements for a smart-ready cooling appliance. These findings shall be translated into a certification. As currently nowhere a smart grid ready label for AC system exists, an international cooperation with other MENA countries (Egypt, Lebanon and Türkiye) is recommended to increase the impact and share the workload. 2. Definition of a SG ready AC label and a corresponding certification method. 3. Implementation by AC equipment manufacturers, which can mark their suitable equipment to be SG ready. 4. An information/marketing campaign may accompany this to ensure end-users understand what smart-grid ready means and how they can benefit from such an appliance. 5. Promote regional cooperation and standardization by organizing working groups with other regional manufacturers and manufacturers associations with the aim of creating a common SG-ready label for the region.
Measure expected results	The expected result of the measure is that there are clear technical parameters and control features that qualify an AC device as smart grid ready. These are adopted as an industry standard and communicated via a label to end consumers. This will increase the uptake of such appliances and increase market preparedness for the necessary increase in demand response.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and verification of the measure are: • The existence of a certification scheme for smart-ready AC appliances. • The number of smart grid ready AC appliances sold (adoption rate) • Consumer recognition of the smart grid ready label.
Data needs and measurement methodology	Data required for monitoring: • The adoption rate of smart grid ready AC appliances (measured by the share of smart grid ready AC appliances of the total sales volume) • Consumer recognition (measured via a survey).
Monitoring responsibility	Monitoring steering committee

A.3.6. Eco-Design and End-of-Life Management

Measure name	**Organise end-of-life treatment and disposal to reduce end-of-life leakage and manage e-waste**
Sector	Cross-sector
Project timeline	Medium-term (2028-2033)
Responsible agency	Ministry of Environment
Stakeholders involved	• Department of Statistics • Ministry of Industry and Trade • Ministry of Environment
Target group	• RAC equipment retailers • RAC service providers • End-users (households and commercial entities) • Waste management companies • Refrigerant suppliers • Local authorities
Measure objective	The aim of this measure is to implement systematic end-of-life treatment and disposal processes while minimizing the environmental impact of refrigerants released substances to the atmosphere during servicing, maintenance and at the equipment end-of-life. Further, to establish recovery and reclaim of refrigerants and to avoid imports of virgin materials. Additionally, to contribute to compliance

	with the HFC phase-down by providing reclaimed refrigerant quantities to the market and contribute to a circular economy for electronics.
Status quo related to the measure & related existing policies and measures	UNESCWA reports that e-waste dumping is the most common method of disposal among Jordanian households, highlighting a broader challenge in the country's waste management practices. Similarly, the country faces significant gaps in the end-of-life treatment of appliances. Much like unsorted solid and e-waste, the majority of RAC appliances are not collected and treated in dedicated facilities so that any refrigerants contained are vented during dismantling which causes high amounts of direct emissions. While some private recycling facilities have been established in Jordan, their current capacity is insufficient to meet the growing number of end-of life appliances.
Description of the measure	Organizing end-of-life treatment and disposal of e-waste primarily focuses on environmental protection, resource recovery, and public health with the majority of components in electronics can be recycled and reused. This measure focuses on assessment of the status of refrigerant RRRD in the country, while also identifying potential barriers to the effective implementation of the KIP and HPMP. Conducting this assessment is crucial to ensure that all actions taken are comprehensive and well-coordinated, avoiding gaps in implementation. Furthermore, a national F-gas Regulation would provide a unified framework for prohibiting their emissions to air, managing refrigerants, addressing their environmental impact from their placing on the market to disposal ensuring the most effective approach to regulating the full lifecycle of refrigerants and appliances. The proposed measures, whether implemented individually or as part of a national F-gas regulatory framework, are designed to complement this overarching goal. By creating a comprehensive scheme for refrigerant handling and management, this measure seeks to streamline practices for both service providers and end-users, ensuring consistency across the industry and enhancing environmental outcomes. Ultimately, integrating these measures into a broader F-gas regulation would ensure a more robust and sustainable approach to refrigerant management in Jordan.
Guiding implementation steps	1. Conduct an assessment of RRRD scheme status in Jordan, including an assessment of existing refrigerant banks (point 1 above) 2. Develop a comprehensive e-waste management policy and refrigerant lifecycle management plan (regulation or regulatory elements for recovery, reclaiming and collecting refrigerants) 3. Create an inventory system to track and monitor activities performed on cooling systems and, the refrigerant charge contained, at their end-of-life 4. Establish collecting points and partner with certified e-waste recyclers 5. Develop regulatory measure(s) for the treatment of end-of-life appliances and recovery, reclaim and destruction of used refrigerants : Establish a pathway for collection of end-of life appliances and their dismantling, treatment facilities for reclaim and destruction of recovered refrigerants, set-out requirements for equipment operators, service companies, RAC technicians, e-waste collectors and waste treatment facilities. Define responsibilities and targets. 6. Equipment operators are obligated to: a. Ensure that refrigerant recovery and reclaim/disposal are performed by certified technicians in the case of larger equipment. b. Ensure that end-of life appliances are collected by dedicated waste collectors to be treated in recycling plant. 7. Municipalities and RAC distributors are obligated to: a. Ensure collection, storage and transportation of end-of life appliances and organise delivery to a dedicated recycling plant. 8. Waste treatment companies are obligated to: a. Ensure proper treatment of end-of life RAC equipment (recovery and destruction of refrigerant and foam, metal scrapping).

Measure expected results	• Assessed and organized end-of-life treatment and disposal scheme • Regulated circularity of RAC equipment • Reduced leakage from e-waste significantly • Increased rates of recycling and resource recovery from electronic devices • Enhanced public awareness and participation in responsible e-waste disposal practices.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Conducted assessment of status of RRRD based on action in HPMP and KIP and current practices • Established RRRD system with increase in number of RAC appliance collection points, number of collected end-of life appliances and refrigerant recovery and reclaim quantities • Current number of: • RAC collection points in the country, • Collected end-of life appliances, • Refrigerant recovery, reclaim and destruction quantities
Data needs and measurement methodology	Data required for monitoring: • E-waste generation data providing statistics on the volume and types of e-waste generated annually across various sectors. • Collection and processing data providing records of e-waste collected and processed by certified facilities. • Survey results including data from public awareness surveys to gauge knowledge and behaviour regarding e-waste disposal. • Incident reports documenting the illegal dumping incidents and their environmental impacts. • Facility compliance reports including inspection results from regulatory bodies to ensure treatment facilities are adhering to standards.
Monitoring responsibility	Monitoring steering committee

Measure name	**Establish new and improve existing waste facilities, allocate a centre point for collecting old RAC equipment and increase awareness of proper RAC disposal.**
Sector	RAC Sector
Project timeline	Short term (2025-2027)
Responsible agency	Ministry of Environment, Civil Defence, and Energy and Mineral Regulatory Commission
Stakeholders involved	• Municipalities • Ministry of Local Administration • Equipment manufacturers
Target group	• Municipalities • Equipment manufacturers • RAC equipment retailers • RAC service providers • End-users (households)
Measure objective	The aim of this measure is to increase proper disposal and recycling rates of e-waste (especially RAC equipment), thereby reducing dumping. Additionally, to reduce direct emissions by ensuring refrigerant and foam recovery from end-of-life RAC appliances and to improve end-of-life processing and recycling of RAC equipment and refrigerants.
Status quo related to the measure & related existing policies and measures	Recycling rates of air conditioners and kitchen equipment (which covers domestic refrigeration) remain low in the Kingdom of Jordan. According to a survey conducted by UNESCWA of over 15,000 households in 2019, almost 60% of respondents indicated that they dumped their old AC equipment, with only around 5% stating that they deliver it for recycling. For kitchen equipment just under 45%

	dumped their equipment with around 8% delivering it to a recycling point.[1] For both equipment categories the remaining share of equipment was either given to others or sold. The currently available public collection containers for old equipment are limited and not easily accessible to the entire population. Returning old equipment is also voluntary without any incentive to do so, thus citizens with limited access to collection points are unlikely to return equipment for recycling. At collection points, any cooling equipment should be segregated from the other e-waste, as these should be handled in a way that allows for refrigerant recovery. This also requires clear instructions for both the people dropping off equipment, as well as the staff working at collection points. An improvement and expansion of the e-waste collection and sorting infrastructure would build upon and be embedded in the following national laws and strategies: • National Strategy for Jordanian Waste Management 2015-2034 • Waste Sector Green Growth Action National Action Plan 2021-2025 • The Waste Management Framework Law No.16 of 2020
Description of the measure	The measure focuses on the reduction of e-waste that is dumped and thereby not properly recycled. It aims to increase the number of e-waste collection and disposal points with a special focus on RAC equipment in order to reduce e-waste and end-of-life refrigerant leakage through improved processing and recycling.
Guiding implementation steps	1. Establish new and improve existing waste facilities for the end-of life treatment of obsolete RAC appliances e data on e-waste disposal to a. Identify where the greatest need for more collection infrastructure exists b. Assess waste stream for end-of life RAC appliances and related logistics c. Assess whether existing e-waste collection and disposal points are properly equipped to handle RAC equipment d. Identify technology upgrades and related investment needs 2. Establish centre points for collection of obsolete RAC equipment 3. Spread awareness among end-users on proper disposal of RAC equipment 4. Develop information material and engage directly with end-users via information campaigns 5. Provide capacity building to disposal and e-waste collection workers on the handling of RAC equipment 6. Strengthen cooperation between the public and private sector, creating collaboration between equipment manufacturers, retailers, installers, waste and recycling companies, and the municipalities in charge of e-waste collection
Measure expected results	• Reduced absolute number and the share of RAC equipment that is dumped or otherwise not properly disposed of and recycled • Reduced direct emissions from refrigerant leakage at end of life through better disposal and increased recycling rates
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Legislation setting out clear procedures for the management of end-of life RAC appliances are in place. • Number of collection points and facilities for the safe end-of life management of RAC appliances exist throughout the country and are fully operational. • Share of e-waste disposal by method (dumped, recycled, granted to other, sold, other). UNESCWA survey results can be used as a baseline. • Direct emissions (savings) from refrigerants at end-of-life.

Data needs and measurement methodology	Data required for monitoring • Data from collection points • Saved direct emissions calculated using data from collection points on refrigerants that are recycled or destroyed, based on their GWP values • Share of e-waste disposal method collected via a consumer survey
Monitoring responsibility	Monitoring steering committee

Measure name	**Build on the adopted EU Directive 2009/125/EC establishing a framework for the setting of eco-design requirements for energy-related products, adopted in Jordan in 2012, and transpose the EU eco-design regulations for RAC equipment into Jordanian law.**
Sub-measures	Conduct a prep-study on implementing eco-design regulations in the RAC sector and a feasibility study on transposing the EU Eco-design for Sustainable Products Regulation from July 2024
Sector	Domestic and commercial RAC equipment
Project timeline	Short term (2025 – 2017)
Responsible agency	Jordan Standards and Metrology Organisation
Stakeholders involved	• Ministry of Environment • Ministry of Industry and Trade
Target group	• Equipment manufacturers, incl. importers
Measure Objective	The aim of the measure is to accelerate the transposition of the EU eco-design regulations for RAC equipment and thereby increase the circularity of RAC equipment, as well as the safety and reliability. Following eco-design regulation ensures that RAC products are more durable, recyclable, and repairable. The EU currently has eco-design and labelling regulations for the following RAC product groups: • Fridges and freezers • Commercial refrigerators • Professional refrigerated storage cabinets • Air conditioners and comfort fans • Air heating and cooling products Alignment with EU eco-design product regulations is also an important step in strengthening the export market for RAC equipment towards the EU.
Status quo related to the measure & related existing policies and measures	Jordan has transposed EU Directive 2009/125/EC establishing a framework for the setting of eco-design requirements for energy-related products in 2012. Thus, the legal basis for adopting eco-design regulations including all relevant definitions and scope is already adopted into law. Some preliminary work on eco-design regulation for RAC products has been conducted by the UNDP under the GEF Project: Energy Efficiency Standards and Labelling in Jordan. Some of the specific requirements laid out under the eco-design regulation, such as minimum energy performance standards for certain RAC appliances, are already adopted in Jordanian law. Adopting the eco-design standards would thus further enhance the sustainability of RAC equipment in Jordan. The Ecodesign for Sustainable Products Regulation, adopted into EU law in July 2024, aims to further improve the circularity, energy performance and other environmental sustainability aspects of products. Delegated acts will update existing product eco-design regulations, including those on RAC equipment. These updates should be monitored and transposed to Jordanian law with as little delay as possible.
Description of the measure	The measure aims to transpose the EU eco-design regulations for various product categories of RAC equipment into Jordanian law.

	EU eco-design regulations lay out two types of requirements which must be met in order for a product to be sold on the market, specific and generic requirements. Specific requirements are "when exact values are measured, and a limit is given". For example, maximum energy consumption, or minimum quantities of recycled material to be used in production."[1] Generic requirements do not set limit values, but rather take the shape of guidelines, for example on how the product must be constructed, used, or disposed of. Specifically, when it comes to the design of the products, the requirements commonly call for a design that promotes circularity, meaning the products are durable, recyclable, repairable, and that components are recoverable.
Guiding implementation steps	1. Analyse the EU eco-design product regulations and determine which aspects are not already regulated under Jordanian law. a. Include key stakeholders such as local manufacturers in a consultation process. 2. Draft study on the implementation of eco-design regulation in the RAC sector in Jordan. 3. Draft technical regulations transposing the EU eco-design product regulations to Jordanian law. 4. Adopt the technical regulations via the legislative process.
Measure expected results	• Improves circular economy by regulating specific aspects of product design to ensure they are repairable, recyclable, and durable.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of eco-design regulations adopted, regulating RAC equipment. • Repair and recycling rates of old equipment
Data needs and measurement methodology	Data required for monitoring: • Repair and recycling rates are measured by collecting data from repair shops and recycling centers. A survey of households can also be conducted.
Monitoring responsibility	Monitoring steering committee

A.3.7. Finance

Measure name	**Enabling import of high-efficient natural refrigerant cooling components for manufacturers and finished goods with tariff incentives**
Sub-measures	Develop a tax rebate schemes or customs exemptions for natural refrigerant RAC technologies, components, and refrigerants
Sector	Industrial, Trade sectors
Project timeline	Short-term (2025-2027)
Responsible agency	• Ministry of Finance Jordan • Tax Department • Customs Department • Jordan Standards and Metrology Organization (JSMO)
Stakeholders involved	• Industrial, Trade sectors • Chamber of Industry • Jordan Chamber of Commerce
Target group	• Private sector entities such as Manufactures and Whole Sellers • Beneficiaries – end users

Measure objective	The aim of this measure is to increase market penetration of sustainable cooling technologies and reduce energy consumption. Additionally, the CO_{2e} emission should be reduced
Status quo related to the measure & related existing policies and measures	Currently there are customs exceptions on selected renewable energy technologies and selected energy efficiency technologies (that partly might cover sustainable cooling solutions but is not the major target).
Description of the measure	Tax/customs rebate for the sustainable cooling solutions will increase the affordability of these solutions against the business-as-usual solutions which will in return lead to increased use of the sustainable cooling solutions. The rebates will lead to: • Cost reduction of raw materials used for producing natural refrigerant RAC systems. • Cost reduction of finished goods that supports natural refrigerant RAC systems.
Guiding implementation steps	1. Stakeholders' meetings to decide on the process and list the technologies that need to benefit from the taxes and customs 2. Prepare a concept note with suggestions 3. Provide successful examples from other countries 4. Meet the governmental stakeholders to discuss recommendations and take their input and areas of support i.e taxes, customs. 5. Obtain official approvals then to be implemented by law.
Measure expected results	• Increased demand on high-efficient natural refrigerant RAC systems • Increase in local manufacturing of high-efficient natural refrigerant RAC systems
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Increase/Size of local production of high-efficient natural refrigerant RAC systems • Increase of import of high-efficient natural refrigerant RAC systems • Import of natural refrigerants • Increase/Size of import of natural refrigerants • Energy savings by end users • Emissions reduction
Data needs and measurement methodology	Data required for monitoring: • Production numbers from domestic manufacturers • RAC equipment import data from customs • Refrigerant import data from customs • End user energy consumption
Monitoring responsibility	Monitoring steering committee

Measure name	**Financing incentives for high-efficient natural refrigerant RAC systems**
Sub-measures	Developing financial cooling products with subsidized interest rates, or cash back incentives. The finance providers would be Commercial banks, Islamic Banks, Micro finance, Leasing companies, SMEs lending companies. The financial products can be along with the guarantee of JLGC. The financial cooling products will target the following challenges: • Low penetration of sustainable cooling solutions on the market • Limitations in access to finance by SMEs • Limitations in access to finance by women led businesses
Sector	Banking
Project timeline	Medium-term (2028-2033)
Responsible agency	Central bank of Jordan Ministry of Finance

Stakeholders involved	• Multilateral Development Banks (EBRD, EIB, others to be defined in due course) • International donors (EU, GIZ, GCF, others to be defined in due course) • Central bank of Jordan • Banks (commercial & Islamic) • Microfinance companies • Leasing Companies • SMEs lending companies
Target group	• Private sector entities (SMEs and other) • Individuals • End users, who request to purchase or replace the RAC systems in the household and commercial sector
Measure objective	The aim of this measure is to provide affordable sustainable cooling solutions to end users and finance covering the sustainable cooling solutions.
Status quo related to the measure & related existing policies and measures	The CBJ provides a subsidized fund (with low interest rates) to different economic sectors such as: industrial, tourism, agriculture, renewable energy, information technology, transportation, health, technical and vocational education, and engineering consulting. The fund is used to finance fixed assets and working capital as a term loan with competitive interest rates. The CBJ fund is lent to Jordanian banks at an interest rate of 0.5%–1% Banks on-lend the funding to eligible clients at a CBJ-capped rate between 2.5% and 4%, depending on the location of the client. Loans have a 10-year tenor and a 2-year grace period, with a maximum single loan size of JOD 3 million and JOD 4 million for transportation and energy sectors, respectively. These loans can be guaranteed by a third party called the Jordan Loan Guarantee Cooperation, which works with banks, leasing companies, and MFIs to provide guarantee coverages between 70% and 85% for the SMEs clients. This fund goal is to increase access to finance and stimulate the economy. It does not have any technology specific targets. CBJ has already extended the fund few times. The EBRD GEFF (Green Economy Financing Facility program) with a USD 90 million facility lend to local financial institutions in the form of a credit for on-lending to SME private sector borrowers and individuals for sustainable energy and resource efficiency investments. The aim is to finance and advise private sector businesses to improve competitiveness and increase profitability, through high performance technologies and practices. The GEFF covers cooling projects under the green finance. GEFF provides cash back between 10% or 15% as cash back incentive to the end user. The current partner financial institutions are BAE, CAB, HBTF, MFW, Tamweelcom. JREEEF cover the interest on SMEs (investing in RE and EE) loans from selected banks in Jordan. This fund does not have economy wide access.
Description of the measure	Encourage affordable finance from all financial institutions not only banks by providing cash incentives, or affordable interest rates. In order to include the majority of borrowers the incentives have to be from all financial institutions and for commercial and Islamic products: • Banks (commercial & Islamic) • Microfinance companies • Leasing Companies • SMEs lending companies
Guiding implementation steps	• Meeting the Central bank of Jordan to agree on financial cooling products with subsidized interest rates • Attract international funds • Attract international donors • Meeting Banks, Micro Finance Institutions, Leasing companies and SMEs lending companies • Support the FIs in designing the sustainable cooling financial products • Raising awareness and marketing campaigns in regards to the available finance.

	• Introducing the sustainable cooling technologies as a green finance technology to align with green finance strategy published by CBJ
Measure expected results	• Increase in lending for sustainable cooling solutions • Increased demand on natural refrigerant RAC systems
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Size of finance for sustainable cooling solutions • Energy savings by end users • Reduced CO2e emissions • Increased demand on high-efficient natural refrigerant RAC systems
Data needs and measurement methodology	The key performance indicators necessary for monitoring and evaluation of the measure are: • Bank data on number and size of loans provided for sustainable cooling solutions • End user energy consumption
Monitoring responsibility	Monitoring steering committee

Measure name	**Grants for high-efficient natural refrigerant RAC systems**
Sub-measures	Grants for sustainable cooling technologies, natural refrigerant RAC systems) for end users - individuals, SMEs or corporates (Demand side) and grants to manufacturers (supply side)
Sector	Public/private
Project timeline	Medium-term (2028-2033)
Responsible agency	Ministry of Planning & International Cooperation (MOPIC) Central bank of Jordan
Stakeholders involved	• Government (Ministry of Planning & International Cooperation (MOPIC), Central bank of Jordan) • NGOs • JEDCO (Jordan Enterprise Development Corporation) • Banks and Financial Institutions • Donors and MDBs
Target group	• Governmental sector, • Private sector entities, organizations, • Individuals, manufacturers
Measure objective	The aim of this measure is to increase the supply side (manufacturing) of high-efficient natural refrigerant RAC systems and the demand on high-efficient natural refrigerant RAC systems. Additionally, the energy consumption and the CO_{2e} emissions should be reduced.
Status quo related to the measure & related existing policies and measures	EBRD GEFF programme offers financing (loans) to households and commercial sectors (MSMEs) on commercial terms with a 10% - 15% grant. GEFF is available through the following partner financial institutions: CAB, BAE, Housing Bank, MFW, Tamweelcom.
Description of the measure	Provide grants for replacing old and installing new systems with high-efficient natural refrigerant RAC systems Provide Grants for new systems with high-efficient natural refrigerant RAC systems Provide Grants for project developments and investments in the natural refrigerant RAC systems, for example grants for producers & manufacturers The availability of grants will increase both the demand side and the supply side. Grants to serve manufacturers & end users either individuals or entities.
Guiding implementation steps	1. Reach out to different donor such as EU, KfW, GIZ, EIB, EBRD 2. Design grant program 3. Provide support to the government in setting up the grant program

	4. Communicate with relevant stakeholders 5. Awareness raising amongst the target group 6. Select the suitable vendors, Manufacturers and arrange special agreements, vendors also to be local to encourage local products.
Measure expected results (mitigation potential if relevant)	• Increased in the demand of high-efficient natural refrigerant RAC systems • Increased in the supply of high-efficient natural refrigerant RAC systems
Monitoring and evaluation	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Size of grants provided for sustainable cooling solutions • Increased production of sustainable cooling solutions • Energy savings by end users • CO2 emissions reduction • Increased demand on high-efficient natural refrigerant RAC systems
Data needs and measurement methodology	Data required for monitoring: • Bank data on number and size of loans provided for sustainable cooling solutions • End user energy consumption • Domestic manufacturer data on production numbers
Monitoring responsibility	Monitoring steering committee

Project name or Measure	**Green Public Procurement Concept**
Sub-measures	Update the Green Public Procurement (GPP) concept to include natural refrigerants technologies and give it higher priority
Sector	Governmental sector/ Procurement Department Local Manufacturers
Project timeline	Long term (after 2033)
Responsible agency	The Jordan Standards and Metrology Organization (JSMO) Procurement Department
Stakeholders involved	• The Jordan Standards and Metrology Organization (JSMO) • Procurement department • Manufacturers
Target group	• Jordan Industrial Sector
Measure objective	The aim of this measure is to motivate private entities to enter tenders with high-efficient natural refrigerant RAC systems and to increase installation in sustainable cooling technologies to public institutions.
Status quo related to the measure & related existing policies and measures	There are current priorities in tenders for local manufacturer. The aim to have higher priorities for sustainable cooling technologies
Description of the measure	Update the Green Public Procurement (GPP) concept to include high-efficient natural refrigerants technologies. Here there are two advantages: First prioritize local companies that provides sustainable cooling technologies Second encourages public authorities to consider environmental and sustainability criteria when purchasing goods and services
Guiding implementation steps	1. Incorporating green criteria into the procurement methodologies that would recognize the energy efficiency of cooling systems as well as use of natural refrigerants. 2. Engagement of the government to update the policies and engaging local authorities to use the updated policies. 3. Provide case studies to current projects to show the local authorities that it makes financial sense to invest in highly efficient, natural refrigerant based technologies. 4. Capacity building to educate procurement officers and decision-makers on green public procurement principles.

	5. Develop guidelines / handbook for the procurement officers and technical experts to follow the rules. 6. Implement the sustainable cooling also to public buildings 7. Establish a proper monitoring and reporting approach.
Measure expected results	• Increased use of high-efficient natural refrigerant cooling technologies by public institutions • Increased awareness • Stimulating the market of high-efficient natural refrigerant cooling technologies by increasing demand on natural refrigerant cooling technologies
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of high-efficient natural refrigerant cooling projects implemented by the government • Energy savings for governmental projects who choose natural refrigerant cooling technologies. • CO2e emissions reduction
Data needs and measurement methodology	Data required for monitoring: • Government data on cooling projects funded and implemented • Energy consumption data from cooling in public projects
Monitoring responsibility	Monitoring steering committee

A.3.8. RAC Minimum Energy Performance Standards and Labelling

Project name or Measure	Issue MEPS for sectors not currently covered and update existing MEPS
Sub-measures	Issue MEPs and Energy Labelling for the Commercial Air Conditioning systems
Sector	Commercial and Industrial sectors
Project timeline	Short-term (2025-2027)
Responsible agency	Jordan Standards and Meteorology Organization (JSMO)
Stakeholders involved	• Ministry of Energy and Mineral Resources (MEMR), • Ministry of Industry and Trade (MIT), • Ministry of Finance (MoF), • Ministry of Environment (MoEnv), • Chamber of Industry, • Customs department, • Royal Scientific Society
Target group	• Suppliers (importers), • End users, • Central Air conditioning manufacturers
Measure objective	The aim of this measure is to implement MEPs and Energy Labelling program for commercial Air Conditioning and to Enhance the energy performance of the commercial Air conditioning systems which will result in reduced energy consumption, less operational costs, and minimized environmental impact. Additionally, a clear and consistent framework for manufacturers and suppliers to follow to regulate import and manufacturing operations should be established and a clear and accessible information to consumers about the energy efficiency and performance of appliances, equipment, and other products should be provided.
Status quo related to the measure & related existing policies and measures	In Jordan, Minimum Energy Performance Standards (MEPs) and energy labelling have been applied to residential refrigeration and air conditioning systems in accordance with EU regulations adopted and transposed in Jordan. However, there is an urgent need to regulate the commercial AC units by introducing MEPs tailored to Jordan's specific climate and circumstances. Energy labels to guide customers' purchase decision should also be developed. A gap analysis has been

	conducted by JSMO and supported by Cool Up to assess the current needs and identify future actions required to develop these MEPs effectively. This measure is planned in the NEEAP and still in the alignment process, and not adopted yet
Description of the measure	The project's foundation is rooted in the establishment of comprehensive legal and regulatory frameworks. This involves developing regulations that define the Minimum Energy Performance Standards (MEPS) that commercial air conditioning systems must meet to enter the market. Simultaneously, detailed plans and mechanisms shall be developed to ensure the successful implementation of these standards. This includes the introduction of labeling schemes and eco-design requirements, which guide manufacturers and consumers towards more energy-efficient and environmentally friendly choices. By integrating these components, the project aims to create a robust system that promotes sustainability and compliance across the commercial air conditioning sector.
Guiding implementation steps	1. Perform initial market assessment to review the existing regulations, technologies, and key stakeholders to clearly identify the needs. 2. Conduct brainstorming sessions with key stakeholders to thoroughly discuss International best practices and collaboratively determine the optimal standards to adopt. 3. Create preliminary legislation that formally incorporates the Minimum Energy Performance Standards (MEPS) and related regulatory requirements into law. 4. Develop labeling schemes that clearly indicate the energy performance of commercial air conditioning systems, helping consumers make informed choices. 5. Regularly monitor the market to ensure that all commercial air conditioning systems comply with the MEPS, review and update the MEPS and energy labelling to reflect technological advancements.
Measure expected results (mitigation potential if relevant)	• Enhanced energy efficiency • Reduced environmental impact • Improved System Performance and Reliability • Cost Savings for Businesses results in increased competitiveness • Enhanced Consumer Awareness
Monitoring and verification	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Measuring the number of units complying with the MEPs • Quantifying Energy savings and emission reduction achieved • Consumer awareness level The monitoring process should include comprehensive surveys designed to accurately quantify and assess the impact of the regulation.
Data needs and measurement methodology	Data required for monitoring • Results of the initial market assessment • Breakdown of the systems complying with the MEPs • Information on the number of compliant units sold or imported in the market to assess the adoption rate. • Document outlining the MEPs and labelling schemes • Energy saving and emission reduction through compliance with MEPs • Survey results measuring consumer knowledge of MEPs
Monitoring responsibility	Monitoring steering committee

Project name or Measure	**Issue MEPS for sectors not currently covered and update existing MEPS**
Sub-measures	**Issue MEPs and Energy Labelling for the commercial refrigeration systems**
Sector	**Commercial and Industrial sectors**

Project timeline	Medium-term (2028-2033)
Responsible agency	Jordan Standards and Meteorology Organization (JSMO)
Stakeholders involved	• Ministry of Energy and Mineral Resources (MEMR), • Ministry of Industry and Trade (MIT), • Ministry of Finance (MoF), • Ministry of Environment (MoEnv), • Chamber of Industry, • Customs department, • Royal Scientific Society • Jordan Engineers Association • Private Sector
Target group	• Suppliers (importers), • End users, • Commercial refrigeration manufacturers
Measure objective	The aim of this measure is to implement a MEPs and Energy Labelling program for commercial Refrigeration systems and enhance the energy performance of the commercial refrigeration systems which will result in reduced energy consumption, less operational costs, and minimized environmental impact. Additionally, it establishes a clear and consistent framework for manufacturers and suppliers to follow to regulate import and manufacturing operations
Status quo related to the measure & related existing policies and measures	In Jordan, Minimum Energy Performance Standards (MEPs) and Energy Labelling have been applied to residential refrigeration and air conditioning systems in accordance with EU regulations. However, there is an urgent need to regulate the commercial sector by introducing MEPs tailored to Jordan's specific climate and circumstances and energy labelling to guide the customers purchase decision. A gap analysis has been conducted to assess the current needs and identify future actions required to develop these MEPs effectively. This measure is planned in the 3rd-NEEAP and still in the alignment process, and not adopted yet
Description of the measure	The project's foundation is rooted in the establishment of comprehensive legal and regulatory frameworks. This involves developing regulations that define the Minimum Energy Performance Standards (MEPS) and energy labelling that commercial refrigeration systems must meet to enter the market. Simultaneously, detailed plans and mechanisms are developed to ensure the successful implementation of these standards. This includes the introduction of labeling schemes and eco-design requirements, which guide manufacturers and consumers towards more energy-efficient and environmentally friendly choices. By integrating these components, the project aims to create a robust system that promotes sustainability and compliance across the commercial refrigeration sector.
Guiding implementation steps	1. Perform initial market assessment to review the existing regulations, technologies, and key stakeholders to clearly identify the needs. 2. Conduct brainstorming sessions with key stakeholders to thoroughly discuss international best practices and collaboratively determine the optimal standards to adopt. 3. Create preliminary legislation that formally incorporates the Minimum Energy Performance Standards (MEPS) and related regulatory requirements into law. 4. Develop labeling schemes that clearly indicate the energy performance of commercial refrigeration systems, helping consumers make informed choices. 5. Regularly monitor the market to ensure that all commercial refrigeration systems comply with the MEPS, review and update the MEPS and regulatory frameworks to reflect technological advancements.
Measure expected results	• Enhanced energy efficiency • Reduced environmental impact • Improved System Performance and Reliability

	• Cost Savings for Businesses results in increased competitiveness • Enhanced Consumer Awareness
Monitoring and verification	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Measuring the number of units complying with the MEPs • Quantifying the Energy savings and emission reduction achieved • Consumer awareness level The monitoring process should include comprehensive surveys designed to accurately quantify and assess the impact of the regulation.
Data needs and measurement methodology	Data required for monitoring: • Results of the initial market assessment • Breakdown of the systems complying with the MEPs • Information on the number of compliant units sold or imported in the market to assess the adoption rate. • Document outlining the MEPs and labelling schemes • Energy saving and emission reduction through compliance with MEPs • Survey results measuring consumer knowledge of MEPs
Monitoring responsibility	Monitoring steering committee

Project name or Measure	**Strengthen the MEPs Technical Committee by Enhancing Capacity for Updating the RAC Standards**
Sub-measures	Educate Technical Committee on Standards
Sector	Cross sector
Project timeline	Medium-term (2028-2033)
Responsible agency	Jordan Standards and Meteorology Organization (JSMO)
Stakeholders involved	• Ministry of Energy and Mineral Resources (MEMR), • Ministry of Industry and Trade (MIT), • Vocational Training Centre • Ministry of Environment (MoEnv), • Chamber of Industry, • Customs department, • Royal Scientific Society, • Technical and Vocational Skills Development Commission. • Education Institutions
Target group	• Members of the technical committee
Measure objective	The aim of this measure is to strengthen the technical committee by equipping them with the latest knowledge and expertise to effectively assess and integrate emerging technologies. This approach will ensure a deeper understanding and more efficient updates to MEPs and regulations, ultimately enhancing overall performance and advancing progress.
Status quo related to the measure & related existing policies and measures	The technical committee is tasked with regularly reviewing and updating the MEPs to ensure they align with the latest advancements. By evaluating cutting-edge technologies, they recommend improvements to the current regulations. As the RAC sector evolves, the committee must adapt to new concepts and technologies, focusing on integrating natural refrigerants and adhering to the latest upgrades. Through training and knowledge transfer, the committee will be better equipped to understand these advancements effectively and implement changes and updates to rules and regulations where relevant. This proactive approach ensures that the regulations remain relevant, and that the RAC sector continues to advance sustainably and efficiently, while also meeting environmental and industry standards.

Description of the measure	This measure prioritizes awareness of the latest developments in RAC systems while enhancing the technical committee's capacity to manage new updates and emerging concepts. This proactive approach will ensure the regulations remain relevant, ensuring that the RAC sector advances sustainably and efficiently while consistently meeting environmental and industry standards.
Guiding implementation steps	1. Conduct a training needs assessment by evaluating the current knowledge and skill levels of the technical committee. Compare these findings with the desired level of expertise to identify knowledge gaps, and tailor the training programs to effectively bridge these gaps. Collaborate with vocational training centers and specialized training providers to design, develop, and deliver tailored training programs that meet the specific needs of the technical committee. 2. Implement scheduled annual training sessions, or conduct training as needed, in response to the release of new technologies in the market. This ensures that the technical committee remains consistently updated and equipped to address emerging innovations.
Measure expected results (mitigation potential if relevant)	• Increased knowledge and expertise of the technical committee regarding the latest technologies and market trends. • Ensuring the capacity of the technical committee to continuously update the regulations affecting the cooling sector.
Monitoring and evaluation	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of knowledge sharing sessions and training • Number of members completed the training • Technology maturity assessment • Frequency of regulations update
Data needs and measurement methodology	Data required for monitoring: • Records of members enrolled in the committee • A draft outlining the results of the capacity and skills assessment • Annual plans for the training and knowledge sessions • Trainings outlines, dates and locations • List of Participants • An evaluation form with key recommendation and potential topics for improvement
Monitoring responsibility	Monitoring steering committee

Measure name	**Update inspection procedures for maintenance workshops and manufacturers**
Sector	Cross sector
Project timeline	Short term (2025-2027)
Responsible agency	Ministry of Labour
Stakeholders involved	• Ministry of Energy and Mineral Resources (MEMR), • Ministry of Industry and Trade (MIT), • Ministry of Finance (MoF), • Ministry of Environment (MoEnv), • Chambers of Industry, • Royal Scientific Society, • Technical and Vocational Skills Development Commission, • Vocational Training Centre.
Target group	• Informal service providers, • End users, • Suppliers (importers), • Air Conditioning and Refrigeration manufacturers.

Measure objective	This measure aims to establish a deeper understanding of the demand within the informal market and establish more effective regulations. By reassessing accreditation, licensing requirements, inspecting service delivery, and work procedures, the measure aims to: • Monitor and regulate the informal service providers to ensure safe handling of RAC systems including new natural refrigerant systems for end users. • Minimize environmental impact by enforcing regulations on the proper management of RAC technologies. • Raise awareness among workshop owners about emerging technologies and their implementation.
Status quo related to the measure & related existing policies and measures	A lack of control and monitoring over procedures in workshops has led to numerous improper practices that have a negative impact on the environment and end users. Inspection and monitoring of the informal market are crucial to ensure compliance with the best practices.
Description of the measure	The measure focuses on regulating the informal market by inspecting the procedures and services within the RAC sector. This approach ensures the safe handling and proper disposal of appliances and refrigerants at the end of their life cycle. Additionally, it aims to increase awareness among end users and service providers, equipping them with the knowledge and skills to safely manage and adopt new technologies.
Guiding implementation steps	1. Review the existing inspection procedures and regulations to identify gaps and opportunities for improvement, working collaboratively with relevant stakeholders to develop actionable recommendations. 2. Regulatory monitor the activities done in the RAC sector and address improper practices. 3. Collaborate with workshop owners to assess their needs and identify ways to facilitate and support their activities in the market.
Measure expected results	• Safe handling of RAC systems, including sustainable practices for installation, maintenance, and disposal of both appliances and refrigerants with a focus on natural refrigerants • Less environmental impact from refrigerant leakage • Higher energy efficiency through proper maintenance of appliances • Increased awareness and competence among workshop technicians.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Gap analysis report for the inspection procedures and regulations. • List of the informal workshops and their compliance status. • Document listing installation and maintenance issues.
Data needs and measurement methodology	Data required for monitoring: • Number of yearly accidents related to the RAC sector (if any), • Number of workshops inspected per year, • percentage of workshops adhering to safe handling and sustainable practices as per updated guidelines.
Monitoring responsibility	Monitoring steering committee

Measure name	**Enhance Testing Infrastructure and Workforce for RAC Equipment**
Sub-measures	Upgrade existing testing facility for residential/Establish a new testing facilities for commercial appliances
Sector	Cross Sector
Project timeline	Short term (2025-2027)
Responsible agency	Royal Scientific Society

	Jordan Standard and Meteorology Organization (JSMO)
Stakeholders involved	• Ministry of Industry and Trade, • Jordan Chamber of Industry • Ministry of Environment
Target group	• Suppliers (importers), • End users, • Refrigeration and Air Conditioning manufacturers
Measure/project Objective	The aim of this measure is to ensure compliance to the most recent standards and regulations trough testing the imported and manufactured RAC systems. Additionally, the existing laboratory for testing residential systems should be upgraded by equipping it with the necessary tools to effectively assess modern technologies, including RAC systems using natural refrigerants. A dedicated laboratory specifically designed to test commercial and industrial systems should be established.
Status quo related to the measure & related existing policies/measures	In Jordan, the Royal Scientific Society hosts the country's only accredited laboratory for testing household appliances. This facility is equipped with essential tools to accurately measure appliance performance. However, a thorough evaluation of the current tools and methodologies is necessary to ensure they remain aligned with the latest technological advancements. Additionally, there is an urgent need to establish a new laboratory dedicated to testing commercial and industrial systems, as no such facility currently exists.
Description of the measure	The primary problem addressed by the measure is the inadequacy of existing testing facilities in Jordan. The measure aims to ensure a strict adherence to the Minimum Energy Performance Standards (MEPs) in Jordan. It also highlights the current gap in testing capabilities, particularly the absence of a specialized laboratory for commercial and industrial systems. This deficiency may lead to a lack of transparency and inaccurate performance assessments. To address this, supporting the existing laboratory and establishing a new facility equipped with state-of-the-art measurement techniques and tools for commercial and industrial systems would significantly improve compliance and guarantee high-performance standards.
Guiding implementation steps	1. Assess the need for improvements in the existing laboratory by thoroughly reviewing the current tools and testing methods, and comparing them against global best practices to identify opportunities for upgrading the lab's capabilities. 2. Establish a dedicated laboratory for commercial and industrial systems, providing the infrastructure needed for rigorous testing and ensuring compliance with energy performance standards, thereby addressing the current gap in testing capabilities. 3. Evaluate the need for training inspectors on new testing methods and tools and equip them with the essential knowledge and expertise. 4. Complete the required accreditation process to formally authorize the new laboratory for future inspection and testing activities of commercial refrigeration and air conditioning systems.
Measure expected results	• Enhanced Testing Capabilities • Increased Compliance of RAC equipment with MEPS • Improved Energy Efficiency of RAC equipment • Reduced Environmental Impact of RAC equipment • Increased systems reliability of RAC equipment
Monitoring and evaluation	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of tests performed for the Commercial and Industrial systems • Number of systems and appliances that adhere to the MEPs • Consumer awareness level • Defect Detection Rate

	The monitoring process should include comprehensive surveys designed to accurately quantify and assess the impact of the regulation.
Data needs and measurement methodology	Data required for monitoring • Analysis results for the current laboratories addressing the needs for improvement • Layout of the inspection laboratory including tools and equipment inventory • Types of the systems inspected and information about the tests outcomes • Number and details of the training performed for the staff (If any)
Monitoring responsibility	Monitoring steering committee

Project name or Measure	**Establish a database for licensed technicians working in Natural refrigerants**
Sector	Cross sector
Project timeline	Medium term (2028-2033)
Responsible agency	Technical and Vocational Skills Development Commission
Stakeholders involved	• Vocational Training Centre, • Ministry of Industry and Trade (MIT), • Ministry of Digital Economy and Entrepreneurship • Private sector • Jordan Engineers Association • Civil Defence • Ministry of Environment (MoEnv), • Royal Scientific Society,
Target group	• End users, • RAC Technicians, • Training providers
Measure objective	The aim of the measure is to promote the adoption of sustainable cooling systems by enabling the end users to identify qualified technicians skilled in the safe installation and maintenance of systems utilizing natural refrigerant technologies. Additionally, it assists the government in regulating the market effectively and facilitates a safe transition to more environmentally friendly technologies.
Status quo related to the measure & related existing policies and measures	As the government advances its plans to promote sustainable cooling, there is an urgent need to identify technicians who are proficient in handling various types of natural refrigerants, each with their unique characteristics. Efforts are underway to assess technicians across different specializations and consolidate their information into a single, accessible platform for end users. Additionally, it is crucial to include RAC technicians from diverse perspectives to ensure safe handling and easy accessibility for end users.
Description of the measure	The measure focuses on enhancing the adoption of sustainable cooling systems by ensuring the availability of qualified technicians skilled in natural refrigerant technologies. It addresses the problem of inadequate technician proficiency and the lack of accessible information for end users regarding safe installation and maintenance practices. By consolidating data on technicians into a comprehensive platform and including diverse RAC specialists, the measure improves market regulation and facilitates a seamless transition to environmentally friendly technologies, ultimately promoting safety and efficiency in the cooling sector.
Guiding implementation steps	1. Review and continuously update the technician's data base including their specialization in collaboration with the vocational training center and other training providers 2. Leverage the database to update the platform with information on individuals possessing varying levels of expertise in handling natural refrigerants. 3. Develop and launch the platform for the end-users.

	4. Promote the launch of the platform and emphasize its significance in comprehensively covering activities within the RAC sector.
Measure expected results	• Safe handling of sustainable RAC systems • Enhanced oversight and regulation of the RAC service sector • Increased adoption of sustainable cooling systems • Increased efficiency in the cooling sector • Enhanced labor market control
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Number of accesses to the platform by end users • Number of sustainable RAC systems installed • Changes in energy consumption before and after the adoption • Number of registered technicians
Data needs and measurement methodology	Data required for monitoring: • Technicians contacts, their specialization, and location • Number of requests made by the end-users through the platform • Rate of the service provided
Monitoring responsibility	Monitoring steering committee

Project name or Measure	**Update the existing MEPs and Energy Labelling in the Residential sector**
Sector	Residential Sector
Project timeline	Medium term (2028-2033)
Responsible agency	Jordan Standards and Meteorology Organization (JSMO)
Stakeholders involved	• Ministry of Energy and Mineral Resources (MEMR), • Ministry of Industry and Trade (MIT), • Ministry of Finance (MoF), • Ministry of Environment (MoEnv), • Chamber of Industry, • Customs department, • Royal Scientific Society • Private Sector • Jordan National Building Council • Greater Amman Municipality • Ministry of Labor
Target group	• Suppliers (importers), • End users, • Air Conditioning and Refrigeration manufacturers
Measure objective	The aim of this measure is to revise the Minimum Energy Performance Standards (MEPs) and Energy Labelling for the residential sector to incorporate the latest advancements and innovations in refrigeration and air conditioning (RAC) technologies and improve the energy performance of the Refrigeration and Air conditioning systems which will result in reduced energy consumption, less operational costs, and minimized environmental impact. Additionally, a clear and consistent framework for manufacturers and suppliers to follow to regulate import and manufacturing operations should be established and energy costs for residents should be minimized and the systems reliability and durability should be increased.
Status quo related to the measure & related existing policies and measures	In Jordan, Minimum Energy Performance Standards (MEPs) and Energy Labelling are applied to residential refrigeration and air conditioning systems in alignment with European Union regulations. These standards are reviewed and updated annually to incorporate the latest technological advancements, ensuring that the systems remain efficient, environmentally friendly, and in step with global best practices.

	This measure is planned in the 3rd NEEAP and still in the alignment process, and not adopted yet
Description of the measure	Conduct a comprehensive assessment of the current MEPs and Labelling for residential RAC (Refrigeration and Air Conditioning) systems to benchmark them against global standards and technologies. This evaluation, carried out annually by a dedicated technical committee, aims to promote the adoption of energy-efficient technologies that utilize natural refrigerants. The committee reviews the latest global best practices and issues recommended modifications targeting various technical aspects. These recommendations guide manufacturers and consumers toward more energy-efficient and environmentally friendly choices. By integrating these components, the project seeks to establish a robust system that drives sustainability and compliance across the residential refrigeration sector.
Guiding implementation steps	1. Perform initial review for the latest updates on the technical specifications of the refrigeration and air conditioning used in household sector and compare these with adopted standards in Jordan 2. Recommend key improvements and standards to be adopted and applied for the RAC appliances in the residential sector. 3. Present and review the recommendations with the technical committee to obtain approval for incorporating the proposed standards into the MEPs and Labelling. 4. Formally announce issuing the new standards. . 5. Regularly monitor market to ensure that all commercial refrigeration systems comply with the MEPS and Labelling, review and update the MEPS and regulatory frameworks to reflect technological advancements.
Measure expected results	• Enhanced energy efficiency • Reduced environmental impact • Improved System Performance and Reliability • Enhanced Consumer Awareness • Aligned with International standards
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Measuring the compliance rate • Quantifying Energy savings and emission reduction achieved • Consumer awareness level The monitoring process should be supported by the JSMO enforcement procedures to ensure compliance and planned results.
Data needs and measurement methodology	Data required for monitoring: • A clear set of standards or regulations that define compliance. • Consumer surveys to assess awareness of sustainable RAC systems. • Pre-installation and post adoption energy usage and emissions data.
Monitoring responsibility	Monitoring steering committee

A.3.9. Refrigerant Standards and Regulations

Measure name	**Develop a national F-gas regulation**
Sector	Cross-sector
Project timeline	Mid-term (2028-2033)
Responsible agency	Ministry of Environment
Stakeholders involved	• Ministry of Industry and Trade • Department of Statistics
Target group	• Manufacturers and importers of equipment and systems • Importers and distributors of refrigerants • Servicing sector • End-users

Measure objective	The aim of this measure is to develop National F-gas regulation which is a basis for successful KIP implementation. It seeks to establish a comprehensive regulatory framework for the management and reduction of fluorinated greenhouse gases (F-gases) to mitigate their impact on climate change. The regulation aims to combine relevant regulations and restrictions for refrigerants' applications (e.g. minimum requirements for refrigerant handling over lifecycle, RRRD scheme, personnel qualification).
Status quo related to the measure & related existing policies and measures	Jordan currently has no regulations on F-gases, which has to be improved to follow the Kigali phase-down schedule. Some areas such as safe handling of refrigerants, improved service practices, and minimum requirements for personnel are also not sufficiently covered by existing regulations.
Description of the measure	The regulation establishes a framework for gradually phasing down HFCs. It sets quantitative limits for the marketing of HFCs. This phased approach allows industries to adapt while significantly decreasing the environmental impact. The legislation builds on the licensing system and establishes a quota scheme. Application-specific bans for HFC use are set out to steer the phase-out. Further measures included in the regulation refer to containment and leakage control, recovery and reclaim, technician training and certification, labelling and an electronic reporting scheme for HFC import/ export/ reclaim/ destruction (bulk and equipment).
Guiding implementation steps	1. Review existing legislation, including internationally 2. Form stakeholder groups for consultations and inform them about transition to HFC alternatives 3. Establish a roadmap for HFC phase-down and identify application specific bans 4. Draft legal text and include key components of the national F-gas regulation: 5. Emission limits and setting legally binding limits on the permissible levels of F-gas emissions from various sources 6. Reporting and monitoring requiring industries to report F-gas usage and emissions, ensuring transparency and accountability 7. Phasedown schedule to implementing a gradual reduction in the use of high-GWP F-gases, transitioning to more environmentally friendly alternatives 8. Incentives for alternatives to promote research and development of low-GWP alternatives and providing financial incentives for their adoption 9. Receive approval from the Ministry of Environment 10. Design and implement a RAC equipment replacement program
Measure expected results	• Drafted comprehensive F-gas regulation, taken up in legislative procedures and adopted • Prepared Government entities are for implementation and enforcement • Informed relevant target groups are and aware of the requirements • Established Electronic reporting system for mandatory reporting by companies • Reduced F-gas emissions contributing to climate change mitigation significantly • Increased adoption of safe, environmentally friendly alternatives • Enhanced public awareness and industry compliance with regulations
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Emission reduction targets including a percentage reduction in F-gas emissions relative to baseline levels over specified time frames • Compliance rate of industries complying with reporting requirements and emission limits • Adoption rate of alternatives showing an increase in the use of low-GWP alternatives in relevant sectors

	• Public awareness level measured through surveys assessing knowledge and understanding of F-gas regulations and alternatives • Establishment of an Electronic reporting system for mandatory reporting by companies • Industry innovation index showing a number of patents and new technologies developed for F-gas alternatives
Data needs and measurement methodology	Data required for monitoring: • Annual level of domestic HFC consumption: Data on relevant parameters (mainly imports) for reporting under the domestic F-gas regulation, also to comply with reporting requirements under Article 7 of the Montreal Protocol • F-gas emission inventory including comprehensive data on F-gas emissions by sector, including sources and quantities used • Reporting compliance data with the records of industry compliance with reporting and emission limits • Research and development outputs on investments and advancements in low-GWP technologies and alternatives • Public awareness surveys providing feedback from surveys to assess public understanding and attitudes towards F-gas regulation • Market analysis reports on the market share and growth of low-GWP alternatives
Monitoring responsibility	Monitoring steering committee

Measure name	**Develop programmes to reduce refrigerant leakage**
Sector	**Cross-sector**
Project timeline	Short-term (2025-2027)
Responsible agency	Ministry of Environment
Stakeholders involved	• Jordan Chamber of Industry Ministry of Trade and Industry • Training institutions
Target group	• Commercial sector • Transport companies • Qualified personnel
Measure objective	The aim of this measure is developing programmes to significantly reduce the percentage of leakage rate.
Status quo related to the measure & related existing policies and measures	Current service practices are insufficient in Jordan with a great amount of refrigerant being ventilated during operation.
Description of the measure	Refrigerant leakage reduction also covers practices for containment and partly recovery. Designed systems minimize refrigerant charge as well as use of high-quality components can help contain refrigerants. Established procedures for the recovery and recycling of refrigerants during servicing or at the end of the equipment's life include using reclaimers and adhering to regulations that mandate the recovery of refrigerants to prevent emissions (under F-gas regulation). Can be regulated through a national F-gas Regulation or as a separate rule or as a soft measure such as training.
Guiding Implementation steps	1. Develop guidance for technicians to perform leak checks at existing equipment, repair without emissions, recover refrigerants without emissions, document interventions. 2. Develop and implementing standard Leak Detection and Repair (LDAR) protocols for regular monitoring, detection, and repair of leaks 3. Adjust training requirements and curricula to include related practices and set-out mandatory training & certification requirements. 4. Oblige equipment owners to have their RAC equipment checked regularly by trained (certified) technicians.

	5. Provide proper training to technicians on leak prevention, detection, and proper handling practices. 6. If not covered by the F-gas Regulation: Draft and approve a regulation for refrigerant discharge prevention with the Ministry of Environment
Measure expected results	• Reduced refrigerant leakage, contributing to climate change mitigation efforts significantly. • Enhanced operational efficiency and cost savings for businesses. • Increased awareness and responsible practices among technicians and the public.
Monitoring and evaluation	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Leakage rates are continuously declining year to year • A ban to prevent the discharge of refrigerant gases to the atmosphere when servicing industrial vapour compression equipment and Mobile ACs is established • Mandatory leak checks and documentation are established and included into training materials • Leak detection rate: percentage of refrigeration systems regularly monitored for leaks. • Reduction in refrigerant loss providing measured decrease in the volume of refrigerants lost due to leaks annually. • Technician training participation with a number of technicians trained and certified in leak detection and maintenance practices. • Upgrade adoption rate: percentage of businesses that upgrade to leak-resistant technologies and low-GWP refrigerants. • Public awareness metrics in increased public knowledge about refrigerant leakage and its environmental impact, measured through surveys
Data needs and measurement methodology	Data required for monitoring: • Refrigerant usage data including a comprehensive data on the types and quantities of refrigerants used in various sectors. • Leakage reports with detected leaks, including volumes and associated costs. • Training program records • Market analysis of technologies providing information on the adoption rates of leak-resistant and low-GWP refrigerant technologies. • Public awareness surveys providing feedback from surveys assessing understanding and behavior regarding refrigerant use and leakage
Monitoring responsibility	Monitoring steering committee

Measure name	**Develop safety standards for natural refrigerants**
Sector	Cross-sector
Project timeline	Short-term (2025-2027)
Responsible agency	The Jordan Standards and Methodology Organisation
Stakeholders involved	• Ministry of Labour • JSMO • Civil defence department • JCL • Ministry of Industry and Trade • TVSDC • VTC • Public and private training centres
Target group	• Technicians • End users

	• GMP
Measure objective	The aim of this measure is developing guidance to ensure health and safety of workers and consumers in line with international standardisation
Status quo related to the measure & related existing policies and measures	The recently adopted National Cooling Strategy does not contain specific measures for the transition to natural refrigerants. Although Jordan is obligated to enforce wider application of the natural refrigerants under KIP.
Description of the measure	The National Safety Standards for Natural Refrigerants initiative focuses on creating a robust framework of safety regulations and guidelines to govern the use of natural refrigerants (e.g., ammonia, carbon dioxide, hydrocarbons). Natural refrigerants are available but limited in use in Jordan as of now. They are planned to be upscaled under the national Kigali Implementation Plan and NCS. Current safety standards do not refer to natural refrigerants specifically.
Guiding Implementation steps	1. Complete Risk assessment protocols for assessing the risks associated with the use of natural refrigerants in various applications. 2. Develop Training and certification programs for technicians and operators on safe handling, maintenance, and emergency response related to natural refrigerants. 3. Adopt Regulatory framework with clear regulations outlining safe installation, operation, and maintenance practices for systems using natural refrigerants, also based on the best practices internationally. 4. Establish monitoring and compliance mechanisms for regular inspections and compliance checks to ensure adherence to safety standards. 5. Approve standards.
Measure expected results	• Enhanced safety for workers and technicians handling natural refrigerants. • Increased compliance with safety standards and reduced incident rates. • Greater public awareness and acceptance of natural refrigerants as sustainable alternatives.
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Compliance rate showing percentage of facilities using natural refrigerants that meet established safety standards. • Training participation rate including the number of technicians trained and certified in the safe handling of natural refrigerants. • Incident rate of reported incidents or accidents involving natural refrigerants before and after the implementation of safety standards. • Risk assessment completion rate with percentage of installations that have undergone risk assessments according to established protocols. • Public awareness metrics showing an increase in public knowledge regarding natural refrigerants and their safety, measured through surveys.
Data needs and measurement methodology	Data required for monitoring • Accident reports including data on incidents involving natural refrigerants, including causes and outcomes. • Training program records providing information on participation rates in safety training and certification programs. • Compliance inspection reports presenting documentation from inspections assessing adherence to safety standards. • Risk assessment records summarizing data on completed risk assessments for installations using natural refrigerants. • Public awareness surveys - feedback from surveys evaluating understanding of natural refrigerants and associated safety practices.
Monitoring responsibility	Monitoring steering committee

Measure name	**Establish a system of taxation of refrigerants by GWP**
Sector	Cross-sector

Project timeline	Long-term (After 2033)
Responsible agency	Ministry of Finance
Stakeholders involved	• Ministry of Environment • Jordan Customs • Ministry of Planning
Target group	• Importers • Distributors • Service companies • End-users
Measure objective	The aim of this measure is to establish polluter-pays-principle: Cut imports and use of HFCs by increasing tax to promote the use of alternatives. Additionally, to use revenues for reclaim/destruction of obsolete refrigerants.
Status quo related to the measure & related existing policies and measures	Jordan has currently no taxation system for refrigerants in place. However, it has approved related obligations under KIP and HPMP.
Description of the measure	The deposit-refund scheme focuses on preventing emissions of refrigerants and ensuring proper training and certification of personnel and companies. Based on the example of EU countries (e.g. Spain, Denmark), a tax scheme shall be developed to putting highest taxes on high-GWP refrigerants. Measure serves to avoid windfall-profits for HFC importers and to finance reclaim/destruction of obsolete F-gas refrigerants. Tax structure design establishing a tiered taxation system where the tax rate increases with the GWP of the refrigerant, incentivizing the use of low-GWP options. Additionally, compliance monitoring for tracking the purchase and use of refrigerants to ensure proper taxation and compliance. Revenue allocation for designating tax revenues for funding research, development, and promotion of low-GWP refrigerants and technologies. It also addresses public awareness campaigns to inform stakeholders about the taxation system, its benefits, and the importance of using low-GWP refrigerants.
Guiding implementation steps	1. Detail concept, assess enforcement needs and enforcement costs to decide on practicality of this measure. Consider risks such as growth of the illegal trade, safety aspects. 2. Restrict purchase of refrigerants to service companies. 3. Set end-user fees for refrigerant charges, with portions allocated to service companies and facilities (funding of secretariat, infrastructure for reclamation and destruction, refund). 4. Establish refunds to service companies that are returning used refrigerants to the facilities. Depending on the purity of the recovered refrigerant, the amount reimbursed to the company will be reimbursed. 5. Establish reclamation and destruction of used refrigerants. The price sold to service companies from reclaimed gases is significantly less than newly purchased ones
Measure expected results	• Reduced the use of high-GWP refrigerants and increased adoption of low-GWP alternatives significantly • Enhanced revenue generation to support green technology initiatives and reclaim/destruction of refrigerants • Established greater public awareness and acceptance of environmentally friendly refrigerants
Monitoring and verification	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • HS codes for refrigerants are issued • A share of revenues is invested into funds for R&D and RRRD activities • Tax revenue generated with an amount of revenue generated from the taxation of refrigerants based on GWP • Reduction in high-GWP refrigerant usage showing a percentage decrease in the use of refrigerants with high GWP since the implementation of the tax

	• Adoption rate of low-GWP alternatives providing an increase in the market share of low-GWP refrigerants and technologies. • Compliance rate in percentage of businesses accurately reporting and paying the GWP-based tax • Public awareness metrics showing an increase in stakeholder awareness regarding the tax system and the importance of using low-GWP refrigerants
Data needs and measurement methodology	Data required for monitoring: • Refrigerant usage data presenting comprehensive data on the types and quantities of refrigerants used across industries • Tax revenue reports with documentation of revenue generated from the GWP-based taxation • Market analysis reports on market trends and the adoption of low-GWP refrigerants • Compliance records showing data on compliance rates among businesses regarding the taxation system • Public awareness surveys with feedback from surveys assessing stakeholder understanding of the tax system and refrigerant options • Refrigerants' import data • Number of returned refrigerants to the facilities/service companies • Price of refrigerants provided by service companies vs. import price
Monitoring responsibility	Monitoring steering committee

A.3.10. Refrigerant Supply Chain

Measure name	**Develop Comprehensive Safety and Handling Guidelines for Natural Refrigerants across the whole life cycle**
Sector	RAC sector
Project timeline	Short-term
Responsible agency	Ministry of Environment
Stakeholders involved	• Refrigerant importers and distributors • Jordan Customs • Authorities involved in transportation of flammable/ hazardous substances
Target group	• Refrigerant importers • Local authorities • Service companies
Measure objective	The aim of this measure is to support import and safe distribution of natural refrigerants
Status quo related to the measure & related existing policies and measures	Currently only small quantities of natural refrigerants are used in the country which are mainly imported by specific distributors. The currently existing regulation does not contain specific measures regarding natural refrigerants. Although Jordan is obligated to enforce wider application of the natural refrigerants under KIP.
Description of the measure	Natural refrigerants are expected to take the major share of the market under KIP. This measure aims to facilitate the import and distribution of HFC alternatives, thereby supporting global initiatives to reduce greenhouse gas emissions. The guidelines are designed to provide comprehensive standards for safe refrigerant handling throughout the entire life cycle: from importation to destruction. By establishing these safety guidelines for natural refrigerants, the risk of severe accidents for technicians and end-users can be significantly reduced, ultimately fostering a safer and more environmentally responsible industry.
Guiding implementation steps	1. Assess the supply chains and special storage needs for natural refrigerants within the country in cooperation with the stakeholders. 2. Estimate current use of natural refrigerants based on import data and existing studies. 3. Research a list of distributors currently offering natural refrigerants.

	4. Review the current procedures for importing, shipping, and storing HFC refrigerants as well as storage requirements and draft amendments for natural refrigerants on the basis of KIP work. 5. Assess Life cycle conducted from production to disposal to identify potential hazards and safety protocols at each stage. 6. Develop Safety protocol for installation, operation, maintenance, and emergency response specific to each type of natural refrigerant. 7. Integrate guidelines into training programmes for RACHP sector 8. Complete Monitoring and compliance.
Measure expected results	• Enhanced safety for workers handling natural refrigerants • Increased compliance with safety standards and reduced incident rates • Improved public awareness and acceptance of natural refrigerants as sustainable alternatives
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Safety and Handling Guidelines for Natural Refrigerants are developed and implemented • Storage requirements are reviewed by the customs • Training participation rate • Compliance rate including a percentage of facilities adhering to the established safety and handling guidelines • Incident rate showing a number of reported incidents or accidents involving natural refrigerants before and after implementation of guidelines • Risk assessment completion rate of facilities that conduct regular risk assessments related to natural refrigerants. • Public awareness metrics showing an increase in public understanding of natural refrigerants and their safe handling, measured through surveys
Data needs and measurement methodology	Data required for monitoring: • Incident reports of accidents or near-misses involving natural refrigerants. • Training program records showing participation rates in safety and handling training programs • Compliance inspection reports from inspections assessing adherence to safety guidelines • Risk assessment records with data on completed risk assessments for facilities using natural refrigerants • Public awareness surveys evaluating stakeholder understanding of natural refrigerants • Quantity of imported refrigerants • Requirements for handling of refrigerants
Monitoring responsibility	Monitoring steering committee

Measure name	**Establish mandatory equipment logbooks (under the F-gas regulation)**
Sector	Cross-sector
Project timeline	Medium term (2028-2033)
Responsible agency	Ministry of Environment
Stakeholders involved	• Ministry of Environment • Ministry of Trade and Industry • MODEE (IT Ministry) • Training institutions • Department of Statistics • Civil defense department (concerning safety aspects) • RSS
Target group	• Commercial sector

	• Transport companies • Qualified personnel
Measure objective	The aim of this measure is to collect data for monitoring and enforcement of all measures relating to the use, containment, recovery and end-of life treatment of refrigeration and air conditioning equipment. Also, it seeks to enhance equipment management, ensure safety compliance, and improve operational efficiency across all departments.
Status quo related to the measure & related existing policies and measures	Currently no records on equipment installation, operation, repair, maintenance, servicing and end-of life are available in Jordan. Examples: Certain EU countries (e.g. Poland, Italy), Türkiye
Description of the measure	Implementing mandatory logbooks supports monitoring and control of operating equipment and related emissions and creates awareness at end-users and service companies for refrigerant consumption and energy efficiency. It requires mandatory equipment logbooks for all departments to maintain detailed records of equipment usage, maintenance, and performance. Each logbook will serve as a comprehensive documentation tool that captures vital information such as: • Usage details: date, time, and purpose of equipment use, including operator information. • Maintenance records: scheduled maintenance activities, repairs conducted, and parts replaced, along with dates and responsible personnel. • Performance monitoring: any anomalies, issues reported, and corrective actions taken to address them. This standardized approach ensures that all equipment is regularly monitored, facilitating proactive maintenance and reducing the risk of unexpected failures. By mandating logbook entries, the organization will foster a culture of accountability and safety, ensuring that all personnel are aware of the importance of equipment upkeep. Can be regulated through a national F-gas Regulation or as a separate rule.
Guiding implementation steps	1. Develop standardized logbook templates that include fields for usage, maintenance dates, user details, and any issues reported. 2. Conduct training sessions for all relevant staff on the importance of maintaining logbooks and how to properly fill them out 3. Schedule periodic audits to ensure compliance with logbook maintenance and accuracy. 4. Establish feedback mechanism establishing a process for users to provide feedback on the logbook system for continuous improvement
Measure expected results	• Enhanced safety and compliance across all equipment operations • Improved equipment reliability and performance metrics • Increased accountability and streamlined operational processes
Monitoring and evaluation	
KPIs	The key performance indicators necessary for monitoring and evaluation of the measure are: • Establishment of a collection of electronic logbooks on activities performed on RAC equipment • Logbook completion rate including a percentage of equipment logbooks completed and maintained accurately • Incident rate showing a number of safety incidents related to equipment usage before and after logbook implementation. • Downtime reduction in equipment downtime due to proactive maintenance • Audit compliance rate with a percentage of successful audits regarding logbook adherence and accuracy • Maintenance cost savings showing reduction in maintenance costs over time as a result of improved tracking and management
Data needs and measurement methodology	Data required for monitoring: • Logbook entries showing the frequency and completeness of logbook entries for each piece of equipment

	• Maintenance records including details of all maintenance and repair activities, including dates and costs • Usage data showing the hours of operation and purpose of usage for each equipment type • Incident reports providing data on any incidents or accidents involving equipment • Audit findings showing the results from periodic audits assessing logbook compliance
Monitoring responsibility	Monitoring steering committee

Measure name	**Perform a market study of natural refrigerants**
Sector	Industry sector
Project timeline	Short-term (2025-2027)
Responsible agency	Ministry of Environment
Stakeholders involved	• Department of Statistics, • Ministry of Trade and Industry • Importers, distributors • Civil defense department (safety aspects)
Target group	• Commercial sector, • Suppliers
Measure objective	The aim of this measure is to conduct a baseline study on the market and refrigerants' distribution among supply chains.
Status quo related to the measure & related existing policies and measures	Market studies were conducted under NCS and NCAP preparations. However, natural refrigerants were not targeted specifically.
Description of the measure	Market study aims to provide a detailed market study of natural refrigerants to understand their current usage, market dynamics, barriers to adoption, and potential for growth in various sectors.
Guiding Implementation steps	1. Identify local suppliers 2. Project future demand of natural refrigerants in the market 3. Identify how supply chains should be enhanced, in particular concerning storage for flammable and toxic gases. 4. Provide a mapping of national distribution of natural refrigerants 5. Conduct a market analysis, assessing the current market landscape for natural refrigerants, including demand, supply, and key players in the industry. 6. Identify the barriers to adoption and obstacles that hinder the widespread adoption of natural refrigerants, such as regulatory challenges, technological limitations, and market perceptions. 7. Provide potential applications where natural refrigerants can be effectively utilized, including refrigeration, air conditioning, and heat pumps. 8. Forecast future trends and technologies that could influence the market for natural refrigerants 9. Provide recommendations for supply chain improvement
Measure expected results (mitigation potential if relevant)	• Provided a comprehensive overview of the current distribution of suppliers and refrigerants' availability • Enhanced stakeholder awareness of natural refrigerants and their benefits • Provided recommendations for policies and strategies to support the growth of natural refrigerants and supply chain improvement
Monitoring and verification	
KPIs (quantification of impact)	The key performance indicators necessary for monitoring and evaluation of the measure are: • Completion of market study with timely completion of the market study report and dissemination to stakeholders

	• Stakeholder engagement including the number of stakeholders consulted during the study, including manufacturers, end-users, and policymakers • Identification of barriers as a number of barriers to adoption identified and documented in the report. • Market growth projections with forecasted growth rates for natural refrigerants in various applications over the next 5-10 years. • Public awareness metrics showing an increase in awareness and understanding of natural refrigerants among targeted stakeholder groups, measured through follow-up surveys. Easy access information on where to purchase natural refrigerants and logistics in place ; the majority of national suppliers are listed • Guidelines for the market enhancement are provided
Data needs and measurement methodology	Data required for monitoring: • Market data with quantitative and qualitative data on the current market size, trends, and forecasts for natural refrigerants • Stakeholder feedback to show the input from manufacturers, industry experts, and end-users regarding their experiences and perceptions of natural refrigerants • Regulatory information and data on existing regulations affecting the use of natural refrigerants in different regions • Technological developments and information on advancements in natural refrigerant technologies and applications • Environmental impact data and analysis of the environmental benefits associated with the use of natural refrigerants compared to conventional options
Monitoring responsibility	Monitoring steering committee

A.4. Methodology

A.4.1. Data collection for modelling

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

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

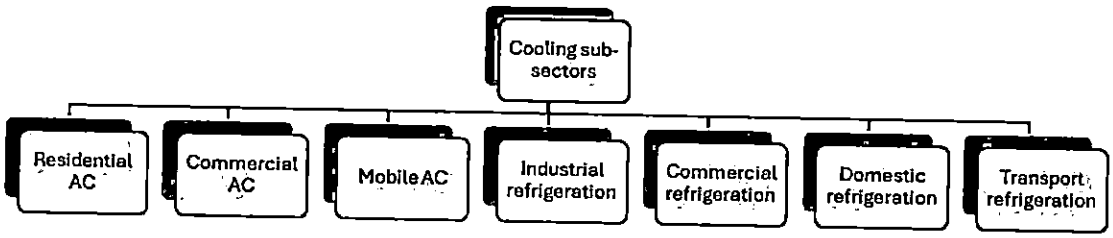

Figure 13: Overview of RAC subsectors

Data collection framework

Data collection has been carried out to provide an overview of historic and current trends as well as projections of future market characteristics about the cooling landscape in Jordan.
The data used for the modelling shown in this report was collected from various primary and secondary sources. Current and historical data are based, where available, on factual data from the sources listed in Figure X.

Projections are estimated based on statistical data, economic growth projections, information from trade associations, manufacturers, importers, etc.

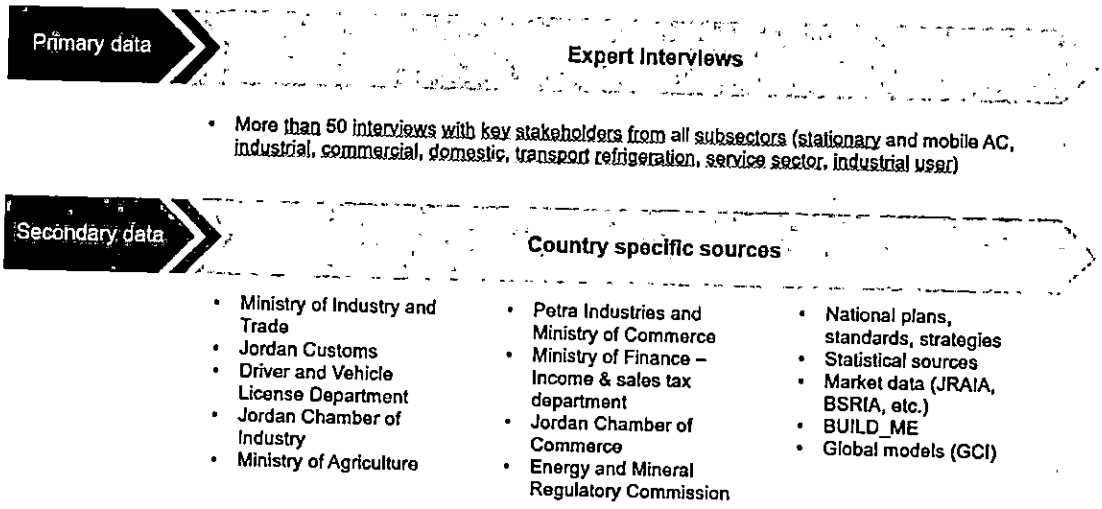

Figure 14: Data sources and references

Expert interviews

The bottom-up data collection process from stakeholder selection towards the compilation of the final data set followed a 6-step sequence outlined below:

The bottom-up data collection process from stakeholder selection towards the compilation of the final data set followed a 6-step sequence outlined below:

1. Identify data needs for modelling of the subsectors
2. Develop questionnaires tailored to the data needs per sub-sector. The questionnaires were provided to selected stakeholders prior to the interviews. For the interviews, questionnaires were designed, tailored to the stakeholders and adjusted to the business logic and equipment type of the corresponding sub-sector.
3. Identify stakeholders and determine market coverage: For each subsector concerned, several stakeholders were selected. The stakeholder selection aimed at covering a minimum 80 percent of the market share of current and historic sales per sub-sector concerned.
4. Conduct interviews: During a period of four months data from stakeholders were collected and, in case of gaps or questions, discussed with the stakeholders in a follow-up interview via telephone or via email.
5. Data processing and quality assessment: Expert confirmation of data was collected for verification, outliers and data gaps were discussed and addressed using secondary data.
6. Develop final comprehensive dataset ready to use in the model (also for documentation purposes)

Primary data was collected through expert interviews with relevant stakeholders, which are mainly technology providers, importers, equipment operators. If possible, site visits were also conducted. Interviews with 14 stakeholders were conducted while more than 50 stakeholders promised to deliver required data in the period from March to May 2024. Governmental entities that provided data are listed in **Table 4**.

Data from governmental data sources

Data from government-run sources was gathered from existing studies, reports, and customs data, which outline the national context. The national assessments aim to provide a strategic overview of the contribution of cooling and refrigeration applications within the national context. This includes data on the total volume of manufacturing and imports, as well as, where available, information on energy consumption for all installed systems and the energy efficiency standards (MEPS) applied, particularly in the domestic and commercial

refrigeration sectors.

These resources were contributed by Ministry of Environment, Chamber of Industry and Energy and Environmental Sustainability Unit, Department of Transport, NERC (RSS) and Customs department.

Country-level data

Multiple secondary (country-level) data sources were used.

A market assessment of the status quo of the cooling sector in Jordan and the current state of technologies used was published by Cool Up in March 2022. Paving the way for further assessment work, the Cooling Sector status report was laying the foundation for understanding upscaling potential of sustainable cooling technologies in the country and served as a comprehensive data source for the NCAP modelling. Additionally, data on HFC inventory/ODS Alternative Survey[28] has been used.

Cool Up also used the market reports from Building Services Research and Information Association – BSRIA for different years to obtain information the sales of different AC technologies including forecast up to 2028.

Additional secondary data was obtained from further data sets such as registry extracts and databases, listed in **Figure 14:** Data sources and references

Measures applied to address data gaps

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

Secondary data was also used to complement the primary data in case of data gaps. For example, for data gaps or in case existing data points appeared to be unplausible, triangulation against secondary data allowed to assess the level of validity of data points (e.g. market shares of the identified types). In more detail, data gaps were closed by using information from global studies such as those from the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA), Technical and Economic Assessment Panel of the Montreal Protocol - Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee (TEAP/RTOC), by using data from a global model developed by the Green Cooling Initiative (GCI), and by using expert knowledge from interviews.
Specific data sources and values used for the modelling (e.g. equipment parameters such as the energy efficiency) are provided in the corresponding mitigation scenario tables in Chapter X.

A.4.2. Calculation approach

The calculation model is an excel based bottom-up calculation tool that delivers annual energy demand and the annual equivalent CO_{2eq} emissions for cooling sector for Jordan between 2020 and 2050. The input for the model is based on various data sources.

The model determines the direct and indirect equivalent CO_{2eq} emissions. The model uses status quo data for the base year 2020 and calculates projections up to 2050. Input data were derived from various available data sources, including surveys, statistics, and expert judgements of Cool Up and national experts for the parameters where data was not available.

The purpose of the models is to provide an impression about the potential future development of the cooling sector emissions under consideration of the most probable sets of NCAP actions/measures and/or other circumstances.

The model calculates three scenarios, which consider different sets of potential NCAP measures. The scenarios have been defined by Cool up and aligned with NOU and Ministry of Environment.

The model uses parameters that are assumed to be the same in all three scenarios, such as building stock development, sales and stock data of technologies and lifetime of systems. Furthermore, it uses parameters that are different in the three scenarios such as efficiency of systems, share of refrigerant used, annual leakage, end of life leakage (at disposal), CO_2-factor of electricity grid mix for cooling, thermal quality of the building stock.

[28] UNIDO, HFC Inventory of Jordan,
https://www.ccacoalition.org/sites/default/files/resources//Jordan_HFC%20Inventory_%20Final%20Report_140306.pdf

The model calculates output parameters that include projections until 2050 for energy demand, indirect CO_{2eq} emissions in the sectors as well as direct CO_{2eq} emissions from annual and end-of-life leakages. Different system types (e.g. 4 AC types for AC) are distinguished. One BAU scenario and two mitigation scenarios (Mitigation Scenario 1 and Mitigation Scenario 2) are modelled.

A.4.3. Stakeholder consultation process

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

Stakeholder identification and grouping

Stakeholders were identified in comprehensive selection using an integrated approach, which referred to engaging all relevant groups and individuals whose expertise, interests, and responsibilities are essential to the success of the NCAP. This ensured inclusivity and collaboration across sectors and disciplines and created well-rounded, actionable solutions considering technical, social, environmental, and economic dimensions.

The integrated approach includes cross-sectoral representation such as government, industry, academia, civil society, and the private sector. It ensures multi-level collaboration for policies to align with local needs and country commitments. Iterative feedback loops provide mechanisms for regular input and revision, allowing stakeholders to adapt their contributions as strategies evolve.

A structures integrated framework was developed. The process started with stakeholder mapping and analysis, including identification of all potential stakeholder groups and assessing their roles, influence, and interests. Next, integrated platforms for engagement included collaborative action planning were established , such as regular stakeholder meetings and written communication. Finally, all stakeholders contributed to balanced decision-making by shaping policies based on their unique insights and addressing conflicting interests.

The stakeholders were identified and grouped during the National Cooling Strategy development. The Steering Committee and the Working Group were formed.

Steering Committee	Working Group
Government Bodies: Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Industry and Technology, Ministry of Trade and Supply, Jordan Chamber of Industry, Jordan Chamber of Trade, Amman Chamber of Commerce, Jordan Customs Department, Ministry of Agriculture, National Ozone Unit, Ministry of Public Works & Housing (MPWH), Ministry of Labour, Ministry of Health, Ministry of Planning and International Cooperation, UNIDO, Jordan Army, Jordan Standardisation and Meteorological Organisation (JSMO), Greater Amman Municipality, Jordan National Building Council, German Embassy Amman, MIT/MEMR, Energy and Minerals Regulatory Commission (EMRC), Vocational Training Cooperation (VTC), Technical and Vocational Skills Development Commission (TVSDC), Department of Statistics, Drivers and Motor Vehicles Licensing Department	**Industry sector and suppliers:** Petra Industries, Petra Engineering, Baqeea Construction Contractors, Daikin, York, NIIC, Haidar Murad and Sons Group, Arab. Technical Group, Elia F. Saba Trading Est., Abdin Industrial Est., M.Abu Haltam Group, Abu Zahra Group, Nicola Nassar & Sons Ca., Samsung Electronics, Kawar Energy Co, Jordan Export Association, Jordan Engineers Association, PHC Privatization Holding Company, National integrated industrial Complex, Mohammed Tahseen Baalbaki & Partners Company, Naim Dahdal & Sons Co., Badr Marine Repairs and Services CO., Mellinium Energy Industries, Arab Technical Group (ATG), Energy International Corporation, Ayla Oasis. AHRI, Mohammed Tahseen Baalbaki & Partners Company, E-Tafkeek, Exeed Electronics, MEHNA for Engineering Solutions and Machine Manufacturing
Financial Institutes: Central Bank of Jordan, Jordan Environment Fund, Jordan Renewable Energy and	**Research Institute:** RSS (environment center, air studies division, Constructions and Sustainable

Energy Efficiency Fund (JREEEF), EU financing programmes, BLOM Bank, Jordan Islamic Bank, Association of Banks of Jordan, Jordan Ahli Bank, Capital Bank of Jordan, Cairo-Amman Bank, Jordan Loan Guarantee Corporation, Bank al Etihad, Jordan Enterprise Development Corporation (JEDCO), Sales and Income Tax Dept., EIB, EBRD, Awar Trading Company, Jordan Kuwait Bank, Safwa Islamic Bank, Housing Bank

Buildings Center, Water, Environment & Climate Change Centre), UNDP, GIZ Jordan, National Energy Research Center (NERC), Jordan University of Science and Technology, Amman Arab University, Al Albayt University, Princess Sumaya University for Technology, Jadara University, Arab Open University Amman, Al Hussein Technical University, Hashemite University, Amman Ahliyya University, German Jordan University, Jordanian-Korean Institute, Natural Agriculture Research Center

Independent technical experts: Bemco (consulting), finance and valuation experts, Green Building Association, Greentech, izzat Marji group, Jordan District Energy, M&I MEP Consulting, YAS Contracting - Construction Company, ETA-max Energy & Environmental Solutions, BDO Jordan (Samman & Co.), Abdali District Cooling Project, Darweesh Bsessi Company, Civil Defense, NDC partnership, Manaseer Group, Careers of Gold, ADAA

Stakeholder engagement methods

Throughout the process, the stakeholders were engaged via constant communication with the NCAP developing team. Initial roundtables provided a broad overview of the NCAP objectives, outlined critical points, and served as a starting point for gathering high-level insights from key stakeholders. They set the foundation for further in-depth engagement by identifying priority areas and facilitating initial discussions among participants.

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

The Technical Working Group further refined the plan by focusing on specialized areas, such as energy efficiency standards and refrigerant regulations. The group ensured that the recommendations are well-informed and actionable.

Finally, the Steering Committee meetings and feedback sessions were held to present findings and initial recommendations, creating a platform for stakeholders to review, discuss, and provide feedback on the NCAP draft. These sessions facilitated dialogue and allowed stakeholders to validate the plan, ensuring their perspectives are reflected before the NCAP is finalized.

Incorporation of stakeholder views

Stakeholder feedback is categorized to balance diverse needs and ensure that industry interests, regulatory feasibility, and public needs are balanced. Conflicting viewpoints, such as economic considerations versus environmental impact, are mediated through a collaborative approach. A summary of stakeholder feedback was incorporated into recommendations (measure cards), detailing which suggestions were adopted and why, and shared further with involved parties to ensure transparency. The NCAP undergoes several iterations, with stakeholder views incorporated progressively, and key decisions, such as prioritizing certain technologies or focusing on specific refrigerants needs, are refined based on iterative input.

Outcomes and benefits

The engagement process provided a broad-based support for NCAP implementation and helped set up adapted and practical policy recommendations. Engaging stakeholders increases awareness of climate-friendly cooling issues and builds capacity among public, private, and civil groups to contribute to sustainable cooling solutions.

6.5. Input data for modelling (ÖkoR)

A.5.1. List of institutions involved in the collection of secondary data

Table 4: List of institutions involved in the collection of secondary data

Institution	Received data	Comments
Ministry of Environment	Implementation of the Montreal Protocol: Jordan Report	Includes data about the total refrigerant materials in Jordan as well as detailed information about selected companies
Customs Department	Refrigerant data on imports	Provided data according to the HS Code for different items
Chamber of Industry	- Reports about the number of establishments for each industrial sub sector - Analysis report about cooling application in the energy audit reports from the industries - Report on the amount of productions for each sector for estimated the cooling capacity needed for each sector	NA
Department of Transport	Data about numbers of refrigerated containers	NA
NERC / RSS	- Expert review of the collected data through list of meetings - Previous reports from Cool Up project includes: Cooling Sector Prospects Study Jordan, Cooling Sector Status Report Jordan, - Snapshots reports about Jordan's figures.	Data used to fill gaps for technology suppliers for industrial refrigeration systems.

A.5.2. Technical parameters

The following table provides information on the different technical parameters for the considered AC and commercial refrigeration systems throughout the study.

Table 5: Technical parameters for considered AC and commercial refrigeration systems.

System	Capacity [kW][29]	Unit energy consumption [UEC]*	Initial refrigerant charge size [kg][30]	Lifetime [Years][31]
Air-conditioning				
Decentral AC (residential)	5	n/a	1	10
Central AC (Multisplit, VRF)	20	n/a	13	10
Central AC (Dx-AHU)	120	n/a	24	10
Chillers (including transmissions system losses)	240	n/a	80	20
Commercial refrigeration				
Standalone refrigerators & freezers (plug-in)	n/a	3,000**	0.2	12
Condensing systems	n/a	18,500**	7	12
Central systems	n/a	375,000**	120	15
Industrial refrigeration				
Central systems (dx)	250	650,000	575	12
Industrial chillers	390	870,000	538	16
Domestic refrigeration				
Domestic refrigerators	n/a	426 (year 2020)	0,09	15
Transport refrigeration				
Refrigerated vans	n/a	n/a	2	10
Refrigerated trucks	n/a	n/a	7,5	10
Mobile air-conditioning				
Passenger car AC	n/a	n/a	0,5	13

* Unit energy consumption is the amount of electricity that an electric utility customer use and is typically measured in kilowatt hours (kWh)

** Source: Cool Coalition Model

[29] Cool Up primary data (2024)

[30] As simplification an average refrigerant charge size has been assumed, independent from the type of refrigerant. As systems with natural refrigerants or other (ultra) low GWP refrigerants typically have lower charge sizes the overall error by this assumption is small compared to other uncertainties

[31] Cool Up primary data (2024)

A.5.3. I.4 Refrigerant mix

The following tables provide information on the current refrigerant mix in the existing stock for the considered technology groups as well as the new shares development over the decades and for the BAU and each of the modelled Mitigation Scenarios 1 and 2.[32]

Table 3: Refrigerant mix of new sold systems in the BAU

Refrigerant mix of new sold systems in BAU				
Sector	Refrigerant mix			
	R22	HFCs with high GWP*	HFCs with intermediate GWP**	Natural refrigerants
		2020		
AC except chillers	0%	89%	11%	0%
Chillers	0%	100%	0%	0%
Standalone refrigerators & freezers (plug-in)	0%	99%	0%	1%
Condensing units and central systems	0%	100%	0%	0%
		2030		
AC except chillers	0%	60%	40%	0%
Chillers	0%	69%	28%	3%
Standalone refrigerators & freezers (plug-in)	0%	80%	0%	20%
Condensing units and central systems	0%	77%	0%	23%
		2040		
AC except chillers	0%	45%	53%	2%
Chillers	0%	35%	60%	5%
Standalone refrigerators & freezers (plug-in)	0%	61%	0%	39%
Condensing units and central systems	0%	77%	0%	23%
		2050		
AC except chillers	0%	11%	82%	7%
Chillers	0%	5%	85%	10%
Standalone refrigerators & freezers (plug-in)	0%	61%	0%	39%
Condensing units and central systems	0%	70%	0%	30%

* including e.g. R410A, R134a, Rseveral, etc.

** Including R32 and R513A

[32] Refrigerant mixes shown for 2020 are directly taken from data collection. For future refrigerant mixes, indications from data collection were double-checked against own expert assumptions.

Table 6: Refrigerant mix of new sold systems in Mitigation Scenario 1

Refrigerant mix of new sold systems in Mitigation Scenario 1				
Sector	Refrigerant mix			
	R22	HFCs with high GWP*	HFCs with intermediate GWP**	Natural refrigerants
	2020			
AC except chillers	0%	89%	11%	0%
Chillers	0%	20%	80%	0%
Standalone refrigerators & freezers (plug-in)	0%	99%	0%	1%
Condensing units and central systems	0%	100%	0%	0%
	2030			
AC except chillers	0%	40%	57%	3%
Chillers	0%	50%	45%	5%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	30%	0%	70%
	2040			
AC except chillers	0%	0%	0%	100%
Chillers	0%	0%	45%	55%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	0%	0%	100%
	2050			
AC except chillers	0%	0%	0%	100%
Chillers	0%	0%	20%	80%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	0%	0%	100%

* including e.g. R410A, R134a, R407C, R404A, etc.
** including R32 and R513A

Table 7: Refrigerant mix of new sold systems in mitigation Scenario 2

Refrigerant mix of new sold systems Mitigation Scenario 2				
Sector	Refrigerant mix			
	R22	HFCs with high GWP*	HFCs with intermediate GWP**	Natural refrigerants
	2020			

AC except chillers	0%	89%	11%	0%
Chillers	0%	100%	0%	0%
Standalone refrigerators & freezers (plug-in)	0%	99%	0%	1%
Condensing units and central systems	0%	100%	0%	0%
	2030			
AC except chillers	0%	40%	57%	3%
Chillers	0%	50%	45%	5%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	30%	0%	70%
	2040			
AC except chillers	0%	0%	0%	100%
Chillers	0%	0%	0%	100%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	0%	0%	100%
	2050			
AC except chillers	0%	0%	0%	100%
Chillers	0%	0%	0%	100%
Standalone refrigerators & freezers (plug-in)	0%	0%	0%	100%
Condensing units and central systems	0%	0%	0%	100%

* Including e.g. R410A, R134a, R407C, R404A; etc.
** Including R32 and R513A

A.5.4. Leakage rates

The following table provides information on the assumed leakage per technology group considered throughout this study for each of the modelled scenarios.

Table 6: Assumed leakage rates for considered cooling applications across sub-sectors and mitigation scenarios.

System	Leakage rates across all modelled scenarios
	2020 - 2050
Air-conditioning	
Decentral AC (single split)	10%
Central AC (Multisplit, VRF)*	8%
Central AC (Dx-AHU)	8%
Chillers*	10%
Commercial refrigeration	

Central systems	20%
Condensing units	18%
Standalone	4%
Industrial refrigeration	
Centralised systems (dx)	105%
Industrial chillers	40%
Domestic refrigeration	2%
Transport Refrigeration	30%
Mobile AC	30%

Notes: (*) Data for BAU and MS1 taken from EKOMVET database. MS2 data calculated considering improvements from refrigerant handling during maintenance and servicing.

A.5.5. End of life

The following table provides information on the assumed shares of end-of-life emissions and their future development per technology group considered throughout this study for each of the modelled prospects.

Table 8: End of life refrigerant emission rates for cooling sub-sectors across technology groups and mitigation scenarios

System	Base year[80]	Business-as -usual		Mitigation Scenario 1		Mitigation Scenario 2	
	2020	2030	2050	2030	2050	2030	2050
All RAC sub-sectors	80%	80%	80%	80%	80%	80%	50%

Table 9: End of life refrigerant emission rates for Commercial refrigeration systems across technology groups and mitigation scenarios

System	Base year	Business-as-usual		Mitigation Scenario 1		Mitigation Scenario 2	
	2020	2030	2050	2030	2050	2030	2050
Central systems	90%	90%	80%	90%	80%	90%	50%
Condensing units	90%	90%	80%	90%	80%	90%	50%
Standalone	90%	90%	80%	90%	80%	90%	50%

A.5.6. Systems efficiency

AC systems[33]

[33] As simplification an average efficiency per system has been assumed, independent from the type of refrigerant. Systems with natural refrigerants or other (ultra)low GWP refrigerants nowadays have typically have higher efficiencies than conventional systems with HFCs

The following table provides information on the assumed efficiency levels and their future development per AC system type considered throughout this study for each of the modelled prospects.

Table 10: Assumed efficiency level (whole system average seasonal efficiency at local climate (Reference: Istanbul)) [7]

System type	SEER						
	Installed systems	New systems					
		2030			2050		
		BAU	Mitigation Scenario 1	Mitigation Scenario 2	BAU	Mitigation Scenario 1	Mitigation Scenario 2
Decentral AC (residential)	4.5	7.1	7.5	8.1	8.1	8.3	8.8
Central AC (Multisplit, VRF)	4.5	7.1	7.5	8.1	8.1	8.3	8.8
Central AC (Dx-AHU)	3.6	6.5	6.8	7.2	7.1	7.3	7.6
Chillers (including transmissions system losses)	3.6	6.5	6.8	7.2	7.1	7.3	7.6

Commercial refrigeration

The following table provides information on the assumed annual efficiency improvement levels for all commercial refrigeration systems considered throughout this study for each of the modelled prospects.

Table 11: Assumed annual efficiency improvement levels for commercial refrigeration technologies across mitigation scenarios

System type	Unit	Business-as-usual (BAU)	Mitigation Scenario 1	Mitigation Scenario 2
Central systems	Annual improvement in %	0.8%	1.21%	1.76%
Condensing systems	Annual improvement in %	1.1%	1.51%	2.06%
Standalone	Annual improvement in %	1.1%	1.51%	2.06%

A.5.7. Building efficiency

The energy efficiency of buildings in the model is calculated via the cooling full load hours of the AC systems. As the energy efficiency of buildings is increased, AC units need to operate for less hours in order to achieve and maintain the same level of thermal comfort. The base year 2020 is the same across all mitigation scenarios.

Table 12: AC unit yearly full load hours across technologies and mitigation scenarios[9]

System type	Full load hours (h/a)		
	BAU	Mitigation Scenario 1	Mitigation Scenario 2

	2020	2030	2050	2030	2050	2030	2050
Decentral AC (residential)	1231	1219	1204	1182	1100	1159	1053
Central AC (Multisplit, VRF)	1495	1480	1464	1436	1336	1408	1279
Central AC (Dx-AHU)	1510	1510	1510	1510	1510	1510	1510
Chillers	1510	1510	1510	1510	1510	1510	1510

A.5.8. Emission factors

The following table provides information on the CO_{2eq} emissions factor for electricity generation (electricity used for cooling) from 2020 up to 2050 for the BAU and the mitigation scenarios.

The current emissions factor is provided by the Department of Energy Efficiency and Environment.[10] Future cooling emission factors for the BAU scenario are expected to improve due to the increased use of natural energy resources and for the different mitigation scenarios expected to improve due different demand response measures in the mitigation scenarios (see Figure 13).

Table 13: Emission factor electricity for cooling in g CO_{2eq} /kWh

	2020	2030	2050
BAU	458.5	338.1	183.9
Mitigation Scenario 1	458.5	338.1	147.12
Mitigation Scenario 2	458.5	338.1	0

A.5.9. Proposed prohibitions concerning placing on the market for Mitigation Scenario 1

Table 14: Proposed prohibitions concerning placing on the market for Mitigation Scenario 1

Product and equipment		Date of Prohibition
STATIONARY REFRIGERATION		
(2) Domestic refrigerators and freezers:	(a) that contain HFCs with GWP of 150 or more;	1 January 2027
	(b) that contain fluorinated greenhouse gases, except if required to meet safety requirements at the site of operation.	1 January 2027
(3) Refrigerators and freezers for commercial use (self-contained equipment):	(a) that contain HFCs with GWP of 2 500 or more;	1 January 2027
	(b) that contain HFCs with GWP of 150 or more;	1 January 2029
	(c) that contain other fluorinated greenhouse gases with a GWP of 150 or more.	1 January 2029
(4) Any self-contained refrigeration equipment, except chillers, that contains fluorinated greenhouse gases with a GWP of 150 or more, except if required to meet safety requirements at the site of operation.		1 January 2029
(5) Refrigeration equipment, except chillers and equipment covered in points (4) and (6), that	(a) HFCs with GWP of 2 500 or more except equipment intended for application designed to cool products to temperatures below – 50 °C;	1 January 2027

contains, or whose functioning relies upon:		
	(b) fluorinated greenhouse gases with a GWP of 2 500 or more, except equipment intended for application designed to cool products to temperatures below – 50 °C;	1 January 2027
	(c) fluorinated greenhouse gases with a GWP of 150 or more, except if required to meet safety requirements at the site of operation.	1 January 2031
(6) Multipack centralised refrigeration systems for commercial use with a rated capacity of 40 kW or more that contain, or whose functioning relies upon, fluorinated greenhouse gases listed in Annex I with GWP of 150 or more, except in the primary refrigerant circuit of cascade systems where fluorinated greenhouse gases with a GWP of less than 1 500 may be used.		1 January 2029
STATIONARY CHILLERS		
(7) Chillers that contain, or whose functioning relies upon:	(a) HFCs with GWP of 2 500 or more except equipment intended for application designed to cool products to temperatures below – 50 °C;	1 January 2027
	(b) fluorinated greenhouse gases with a GWP of 150 GWP or more for chillers up to and including a rated capacity of 12 kW, except if required to meet safety requirements at the site of operation;	1 January 2030
	(c) fluorinated greenhouse gases for chillers up to and including a rated capacity of 12 kW, except if required to meet safety requirements at the site of operation;	1 January 2035
	(d) fluorinated greenhouse gases with a GWP of 750 or more for chillers above 12 kW, except if required to meet safety requirements at the site of operation.	1 January 2032
STATIONARY AIR-CONDITIONING EQUIPMENT AND STATIONARY HEAT PUMPS		
(8) Self-contained air-conditioning equipment and heat pumps, except chillers, that:	(a) plug-in room air-conditioning equipment which is moveable between rooms by the end user that contains HFCs with GWP of 150 or more;	1 January 2027
	(b) plug-in room air-conditioning equipment, monoblock air-conditioning equipment, other self-contained air-conditioning equipment and self-contained heat pumps, with a maximum rated capacity of up to and including 12 kW that contain fluorinated greenhouse gases with a GWP of 150 or more, except if required to meet safety requirements. If safety requirements at the site of operation would not allow using fluorinated greenhouse gases with GWP of less than 150, the GWP limit is 750;	1 January 2030
	(c) plug-in room air-conditioning equipment, monoblock air-conditioning equipment, other self-contained air-conditioning equipment and self-contained heat pumps, with a maximum rated capacity of up to and including 12 kW that contain fluorinated greenhouse gases, except if required to meet safety requirements. If safety requirements at the site of operation would not allow using alternatives to fluorinated greenhouse gases, the GWP limit is 750;	1 January 2034
	(d) monoblock and other self-contained air-conditioning equipment and heat pumps, with a maximum rated capacity of more than 12 kW but not exceeding 50 kW that contains fluorinated greenhouse gases with a GWP of 150 or more, except if required to meet safety requirements. If safety requirements at the site of operation would not allow using fluorinated greenhouse gases with GWP of less than 150, the GWP limit is 750;	1 January 2030
	(e) other self-contained air-conditioning equipment and heat pumps that contain fluorinated greenhouse gases with GWP of 150 or more, except if required to meet safety requirements. If safety requirements at the site of operation would not allow using	1 January 2032

	fluorinated greenhouse gases with GWP of less than 150, the GWP limit is 750.	
(9) Split air-conditioning equipment and heat pumps (1):	(a) Single split systems, containing less than 3 kg of fluorinated greenhouse gases listed in Annex I, that contain, or whose functioning relies upon, fluorinated greenhouse gases listed in Annex I with GWP of 750 or more;	1 January 2027
	(b) Split air-to-water systems of a rated capacity up to and including 12 kW containing, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 150 or more, except if required to meet safety requirements at the site of operation;	1 January 2029
	(c) Split air-to-air systems of a rated capacity up to and including 12 kW containing, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 150 or more, except if required to meet safety requirements at the site of operation;	1 January 2033
	(d) Split systems of a rated capacity up to and including 12 kW containing, or whose functioning relies upon, fluorinated greenhouse gases, except if required to meet safety requirements at the site of operation;	1 January 2037
	(e) Split systems of a rated capacity of more than 12 kW containing, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 750 or more, except if required to meet safety requirements at the site of operation;	1 January 2036
	(f) Split systems of a rated capacity of more than 12 kW containing, or whose functioning relies upon, fluorinated greenhouse gases with GWP of 150 or more, except if required to meet safety requirements at the site of operation.	1 January 2040

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