



REGULATORY ANALYSIS LEBANON:

Analysis and recommendations for the regulatory and policy instruments governing the RAC sector

March 2022

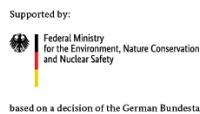


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Acronyms

AC	Air conditioning/conditioner
AFD	Agence Française de Développement
BAU	Business-as-Usual
BDL	Banque Du Liban
CFC	Chlorofluorocarbon
CH ₄	Carbon tetrahydride (Methane)
CO ₂	Carbon dioxide
COP	Conference of performance
CFC	Chlorofluorocarbon
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EEBC	Energy Efficiency Building Code
EER	Energy efficiency ratio
EIB	European Investment Bank
ESCO	Energy Service Company
ExCom	Executive Committee
F-gas	Fluorinated gases
GCF	Green Climate Fund
GEFF	Green Economy Financing Facility
GHG	Greenhouse gas
GWP	Global warming potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HPMP	HCFC Phaseout Management Plan
IBRD	International Bank for Reconstruction and Development
IEEHA	Italian Energy Efficient Home Appliances
IKI	Industrial Climate Initiative
IMF	International Monetary Fund
IRI	Industrial Research Institute
K-CEP	Kigali Cooling Efficiency Program
LCEC	Lebanese Center for Energy Conservation
LEPAP	Lebanon Pollution Abatement Project
LIBNOR	Lebanese Standard Institution
MENA	Middle East and North Africa
MEPS	Minimum energy performance standards
MEW	Ministry of Energy and Water
MLF	Multilateral Fund
MoE	Ministry of Environment
MP	Montreal Protocol
N ₂ O	Nitrous oxide (laughing gas)

NCP	National Cooling Plan
NCPL	National Cooling Plan for Lebanon
NDC	Nationally Determined Contributions
NEEAP	National Energy Efficiency Action Plan
NEEREA	National Energy Efficiency and Renewable Energy Action
NOU	National Ozone Unit
ODP	Ozone depletion potential
ODS	Ozone-depleting substances
PV	Photovoltaic
RAC	Refrigeration, Air Conditioning
RACHP	Refrigeration, air conditioning and heat pump equipment
RE	Renewable energy
SEER	Seasonal energy efficiency ratio
SME	Small and Medium-Sized Enterprises
TSBL	Thermal Standard for Buildings in Lebanon
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

1. Introduction

With energy demand expected to increase 50% by 2040,¹ Middle East and North Africa (MENA) countries are facing a range of climate-change related challenges. The region's energy challenges include rapidly growing populations, urbanisation, and a heavily strained energy infrastructure. Cooling in air conditioning (AC)-equipped households already represents a major source of energy consumption in the region. The use of cooling is expected to grow further since, with an improved standard of living, more households are using air conditioning (AC) systems. There is large potential for energy saving as many of the space cooling and refrigeration systems in use have a low energy efficiency. An additional climate impact from cooling comes from the refrigerants still used in many of today's air conditioners and refrigerators. Such refrigerants with a high global warming potential are 2,000 times more potent for the climate (direct greenhouse gas emissions) than carbon dioxide and natural refrigerant alternatives. Without further policy intervention, direct and indirect emissions from cooling and refrigeration may rise 90% above 2017 levels by 2050, creating a vicious feedback loop.

1.1. The Cool Up programme

The Cool Up programme promotes accelerated technological change and early implementation of the Kigali Amendment to the Montreal Protocol and Paris Agreement in Egypt, Jordan, Lebanon, and Türkiye. The programme focuses on enabling natural refrigerants and energy efficient solutions to mitigate the effects of rising cooling demand. The Cool Up approach is based on four pillars: reducing cooling demand, phasing down hydrofluorocarbons (HFCs), replacing and recycling inefficient equipment and refrigerants, and training and raising awareness.

The programme's cross-segment approach focuses on the residential and commercial AC (air conditioning) sector and on the commercial refrigeration sector.

The programme aims to develop lasting institutional capacity and increase the deployment of sustainable cooling technologies in the market. To enable a cooling market transformation towards sustainable cooling technologies, the Cool Up programme will:

- ▶ Enhance cross-sectoral dialogue between national actors to build ownership to support long-term impact.
- ▶ Develop policy actions to create a supportive regulatory environment.
- ▶ Develop financial mechanisms and funding structures to enable the cooling market transition.
- ▶ Support the commercial deployment and dissemination of existing and emerging technologies with natural refrigerants.
- ▶ Provide resources for capacity development on sustainable cooling in the four partner countries.

In Middle East and North Africa (MENA) countries, cooling constitutes a major source of energy consumption; it produces indirect greenhouse gas (GHG) emissions and contributes to ozone depletion and global warming. The Cool Up programme seeks to address this challenge in its partner countries by mitigating the adverse impacts of refrigerants through promoting accelerated technological change and facilitating early implementation of the Kigali Amendment and Paris Agreement.

The programme is divided into three pillars:

- ▶ Policy and regulation
- ▶ Technology and markets
- ▶ Financing and business models

¹ British Patrol, "BP Energy Outlook 2018 Edition"

This report focuses on the policy and regulation pillar. Policy and regulation are powerful stimuli to encourage the uptake of new technologies. In the policy and regulation workstream, the Cool Up programme supports its partner countries in leveraging policy stimuli and developing policy interventions closely linked to national policy goals, strategies, plans, and programmes as well as international processes. Cool Up works with partner countries to define roadmaps and regulatory measures to create a regulatory environment that requires reduced cooling demand and increased energy efficiency (EE) and supports sustainable cooling technologies that contribute to the phase down of hydrofluorocarbons (HFCs) and focus on natural refrigerants.

Building on a scan of policy instruments conducted for Cool Up's cooling sector status reports, the Cool Up programme developed an in-depth regulatory analysis, analysing the strengths and shortcomings in each partner country.

1.2. Aim and scope of this report

The main output of this report is to formulate policy recommendations towards phasing down HFCs, utilising natural refrigerants, and reducing cooling demand in Lebanon.

The analysis covers four categories of policy instruments:

- ▶ International protocols and commitments
- ▶ National plans and strategies
- ▶ Laws and bylaws relevant to the refrigeration, air conditioning (RAC) and building sector
- ▶ Standards and codes

The analysis examines the status of these instruments and investigates the degree to which they are implemented and complied with. The analysis also discusses which technical elements are covered by each policy instrument, examining if and how they contribute to enhancing EE in the RAC and heat pump sector, reducing cooling demand, phasing out ozone-depleting substances (ODS), phasing down HFCs, and promoting natural refrigerants. Data for the analysis was gathered by studying country-specific laws, regulations, standards and codes, input from the Cool Up cooling sector status reports, secondary literature, and interviews, bilateral meetings, and stakeholder discussions with national experts and policy stakeholders. The reports culminate in an action plan and roadmap to support each partner country in making policy and institutional changes to accelerate Kigali Agreement implementation. All identified measures have been discussed and agreed upon in conjunction with the National Ozone Unit (NOU) in each Cool Up partner country. Figure 1 provides an overview of the key implementing institutions across the sustainable cooling policy space in Lebanon.

<p>MEW Ministry of Energy and Water</p>	<ul style="list-style-type: none"> • Responsible for water, electricity, oil, minerals, mining and quarrying. Responsible of all plans related to energy efficiency and renewable energies.
<p>MoE Ministry of Environment</p>	<ul style="list-style-type: none"> • Responsible for the implementation of the Montreal Protocol activities and all its amendments in Lebanon. MoE is the national entity tasked to coordinate matters related to sustainable development, as well as responsible on all matters related to climate change (mitigation and adaptation, etc.) including working towards the adoption of low-carbon/emission technologies and policies
<p>LCEC Lebanese Center for Energy Conservation</p>	<ul style="list-style-type: none"> • Is the national energy agency for Lebanon. LCEC acts as the technical arm of the Lebanese Government and specifically the Ministry of Energy and Water in all issues related to energy efficiency and renewable energy.
<p>NOU National Ozone Unit</p>	<ul style="list-style-type: none"> • The NOU project implemented at the Ministry of Environment and managed by UNDP is in charge of the implementation of the Montreal Protocol activities in Lebanon.
<p>LIBNOR Lebanese Standard Institution</p>	<ul style="list-style-type: none"> • Lebanon's regulatory body issuing and adopting standards and potentially labels.
<p>IRI Industrial Research Institute</p>	<ul style="list-style-type: none"> • The Industrial Research Institute is a Lebanese institution for studies, industrial research, and scientific testing and analysis.

Figure 1 Key responsibilities among government stakeholders in Lebanon

2. Overview

2.1. Setting the scene

Lebanon is experiencing significant economic and political unrest, which has affected all markets and policy processes. A sustained economic crisis, ongoing since 2019 and further perpetuated by an explosion at the Port of Beirut in 2020, has worsened with the onset of the COVID-19 pandemic. Under current circumstances, there has been negative economic growth and few new construction activities in Lebanon, diminishing growth in the air conditioning (AC) and refrigeration markets.

The country has a Mediterranean climate with hot, dry summers that require cooling. Cooling degree days in Lebanon are two times higher than heating degree days and can exceed 1300 a year². In 2018, cooling energy consumption made up approximately 32% of total Lebanese electricity consumption, with the residential sector constituting 50% of total cooling consumption. Despite its recent economic challenges, Lebanon is expected to see a 75% increase in final energy consumption in buildings by 2030³. Cooling and dehumidification are the highest energy-consuming end uses in the Lebanese building sector.

2.2. Cooling market landscape

The Lebanese AC market is dominated by imports. Imported cooling products include whole split units and systems and detached parts that are typically assembled locally. Though the Lebanese air conditioning market declined between 2017 and 2020 due to the economic crisis, the market is expected to grow as soon as the economic situation stabilizes.

The main market drivers for sales have been economic growth (affordability), extreme weather conditions, and new construction activities before the economic downturn. The demand for different AC technologies is driven by installations in new buildings, new installations in existing buildings (to increase the share of air conditioned rooms), and the replacement of dysfunctional AC systems. In the new construction sector about 85% of all new apartments, 90% of new retail buildings and 95%--100% of other non-residential buildings such as hotel, office, and healthcare buildings have been installing AC systems (before the economic crisis). In existing residential buildings about 50% of the floor area is not air conditioned, yet there is substantial market growth potential for the cooling market in Lebanon once the economy starts growing again.

Currently installed equipment and new units installed have lower efficiency than the best available technology. There is a large potential for energy savings. AC systems installed in the building stock have an energy efficiency ratio (EER W/W) in the range of 2.0-2.8 (existing buildings). This is significantly below the efficiency of the technologies with the best available efficiency range in Lebanon. Comparing this to the best available efficiency on an international level, major increases in efficiency is possible, especially in the split system and central ducted segment.

The commercial refrigeration market is import-dominated with the most significant commercial refrigeration segments in corner stores, restaurants, and small and large supermarkets. Large brand name companies often provide equipment to stores and supermarkets. The market currently relies on the maintenance services of commercial refrigeration systems rather than the sales of new systems. The economic challenges have shifted large sectors to use more efficient equipment to reduce electricity consumption. In general, both the growth of the AC sector and the refrigeration sector are driven by new construction, economic growth, and increased population and urbanisation.

Currently Lebanon imports all refrigerants used in the cooling and refrigeration sectors. The predominant refrigerants used in the existing AC sector are R22 and R410A; in central systems R134a is also used. In new AC systems, the predominant refrigerant is R410A, also R32 is applied. In new central systems, apart from

² Sources: https://xp20.ashrae.org/standard169/169_2013_a_20201012.pdf, <https://meteonorm.com/en/>

³ Source: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Outlook_Lebanon_2020.pdf

R410A, R1234ze and a small amount of R600a is used. In the commercial refrigeration sector, the predominant refrigerants used in existing equipment are R22 and R134a. In new condensing commercial refrigeration systems, the predominant refrigerants are R404A and R134a, small amounts of R22 are still used in new systems. Although the market is dominated by high global warming potential refrigerants, some natural refrigerant solutions are currently being used in central chillers. However, the use of natural refrigerants at a commercial scale has not yet been introduced. Lebanon has the potential overcome these challenges and develop a natural refrigerant market by leveraging its work through the Cool Up program to expand technical knowledge, improve energy efficiency and sustainable cooling technology options, and build technical capacity that can be useful to stakeholders during and after the country's recovery.

In summary, the overall market for cooling equipment in Lebanon is expected to continue to grow once the economic crisis is overcome. A growth would require introducing sustainable cooling technologies and natural refrigerants early on as a direct replacement to prevent potential lock-in effects to harmful refrigerants. Perceived key challenges to the uptake of natural refrigerants include safety issues and associated costs.

2.3. Finance landscape

There are more than 45 commercial banks in Lebanon until 2020, of which about 16 banks are large and medium ones. Their share in total bank credit more than doubled to account for almost a third of total bank credit to the private sector. The sectoral distribution of bank credit underwent a radical structural change in the past decade. Personal loans granted mainly to finance all forms of consumer spending were multiplied by a factor of 7 in the period from 2000 to 2012 and by a factor of 11 in 2000 to 2018. Over the past two and a half years (July 2019 – December 2021), Lebanon has been facing several crises, including a) economic and financial crisis; b) Covid-19; and the explosion at the Port of Beirut (in August 2020). The economic crisis has had the largest negative impact. The banking sector has stopped lending and does not accept deposits (as banks adopted strict capital controls).

To stabilise the Country's economy, a specific economic, social and financial reform program has to be implemented, with broad challenges and demands and a base to pursue stable and sustainable prosperity. According to the International Monetary Fund (IMF), Lebanon's economy should include five strong points in order to transform specific policies to address the Country's economic and financial challenges, which include:

- ▶ Fiscal reforms to safeguard sustainable debt
- ▶ Fortify the restructuring, recovery, and confidence of the financial sector
- ▶ Reorganise the energy sector and public companies aiming to provide better services
- ▶ Reinforce banking frameworks to strengthen transparency and accountability
- ▶ Built-up a creditable exchange rate system.

Financing of the RAC value chain

Most commercial banks facilitate the financing of the RAC value chain in Lebanon. The Lebanese refrigeration and air conditioning (RAC) market is import-dominated and there is some local assembly and minor local manufacture. Most room air conditioning systems are split systems. The commercial refrigeration market depends on products from Italy, Turkey, Greece and Germany. Lebanon has no large-scale manufacturing base for room air conditioners and freezers. Lebanon has the most modern malls and supermarkets with retail outlets for various goods, including domestic appliances. Whereas distribution mainly includes warehousing and transportation. Commercial banks provide import finance as well as support SME units manufacturing (mainly assembling) commercial refrigeration systems. All financing is conventional corporate finance following balance sheet lending. Apart from financing new projects, banks also meet working capital needs. The financing of retail customers is through credit card finance or personal loans.

Green finance

NEEREA is implemented through all Lebanese commercial banks under the leadership and management of BDL. The technical support and capacity building activities are done by the LCEC to develop the know-how among all players. The Intermediate Circular 236 (Nov 25, 2010) allows the commercial banks to use their "Obligatory reserves" towards NEEREA mechanism to facilitate financing in green sectors. On the

other hand, the Green Economy Financing Facility (GEFF) is a program of EBRD that supports homeowners and businesses in investing in green technologies.

Opportunities for financing sustainable cooling technologies

The Cool Up programme evaluated financing approaches suitable for financing sustainable cooling options for each group of end-users in Lebanon. These were primarily integrated through the experience of local experts and international experience in energy efficiency financing, including vast literature on the subject.

Leasing and positive list are two prominent approaches that could be used for commercial end-users in Lebanon. Positive list is easy to implement mechanism for commercial banks that needs minimum training to loan officers. ESCO approach and bulk procurement could be used for public sector organisations. As regards, sources of finance commercial banks can play significant role.

In conclusion

The Cool Up programme needs to work closely with financing institutions/banks, end-users, technology providers and other stakeholders in Lebanon. Once technology selection is completed by the Cool Up programme, the next steps would include securing data from the stakeholders mentioned, to initiate feasibility studies of sustainable cooling technology options.

3. Methodology

Lebanon has progressed on the commitments relevant to the Montreal Protocol through the implementation of several relevant programs, laws, and other policy instruments such as codes and standards. In this report, the policy instruments governing the RAC and building sector in Lebanon are analysed to identify the key strengths and the key shortcomings towards the phase-down of HFCs, the utilization of natural refrigerants and the reduction of cooling demand. The regulatory analysis covers the four categories of policy instruments that hierarchically include the following categories:

- ▶ International Protocols and commitments
- ▶ National Plans and Strategies
- ▶ Laws and bylaws relevant to the RAC and building sector
- ▶ Standards and codes

Figure 2 explains the main steps of this analysis. The first step is to identify the existing policy instruments, secondly the assessment of these instruments, thirdly an initial list of policy recommendations. The initial list of recommendations will be then discussed with relevant stakeholders, mainly with NOU.

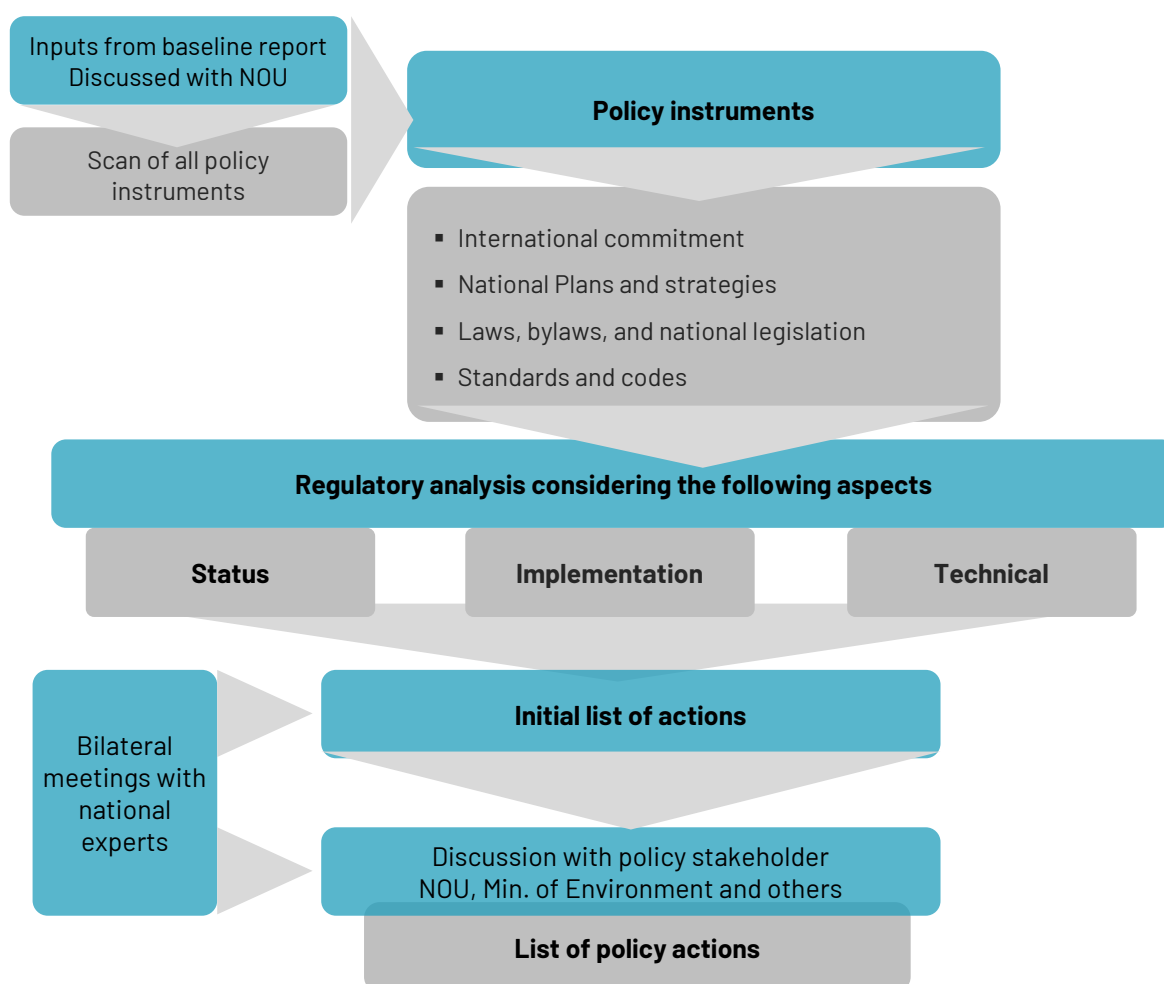


Figure 2 Methodology and working steps of the regulatory analysis in Lebanon

The regulatory analysis in this report covers three key aspects (see Table 1).

- ▶ Availability status of the policy instruments in Lebanon
- ▶ Implementation and compliance
- ▶ Provisions of the policy instruments in terms of the required and planned technical aspects

Table 1 Aspects of policy instruments analysis in Lebanon

A. Status	B. Implementation and compliance	C. Technical aspects
In place	High level of compliance/ implementation	EE of refrigeration, air conditioning, and heat pump (RACHP) equipment and systems
Planned	Medium level of compliance/ implementation	Reducing cooling demand
Not available	Low levels of compliance/ implementation	Phaseout of ODS
		Phasedown of HFCs
		Promoting natural refrigerants

The colour codes of the analysis

For the analysis of the policy instruments, a color code has been used in a table format to outline and scan the key strengths and define the gaps in policy instruments governing the RAC sector. Three shades of colors have used for this purpose as explained in Table 2. The white color has been used when the aspect in question is not applicable or not relevant.

Table 2 Colour codes

Color	Meaning
Advanced	Highlight the aspect that has been sufficiently addressed by the policy instrument.
Moderate	Describes the aspects that are partially mentioned and/or partially developed
Early	Depicts that there is gap that needs to be further investigated.
White	Not applicable

Table 3 explains the colour code applied for the different aspects of the policy analysis. For example, the first group of aspects that cover the status of the policy instruments, Table 3 explains the meaning of the three possible status including “in place”, “planned” and “not available”. The second group of aspects focuses on the implementation and enforcement of the policy instruments. In many cases, the codes and standards are well elaborated and include ambitious EE requirements and sufficient technical detail, but those codes and standards are intermittently implemented and not sufficiently enforced. While some laws, standards and codes are fully enforced with high or almost complete levels of compliance, some other laws and regulations are not well enforced due to a lack of compliance procedures or the complexity of implementing these policy instruments.

Table 3 Colour codes applied for the different aspects of the policy analysis

A. Status aspects	
In place	One of the following conditions applies: <ul style="list-style-type: none"> ▪ The policy instrument has been issued/adopted through a decision, law, or other legal procedures. ▪ The competent authority has officially announced the adaptation. ▪ The policy instrument has been published in the National Gazette.
Is planned	One of the following conditions applies: <ul style="list-style-type: none"> ▪ The adaptation/issuance process is ongoing. ▪ Has been officially announced to be under preparation. ▪ It has been suggested/proposed by the competent authority.
Is not available	No announcement/proposal/suggestion yet.

B. Compliance and Implementation aspects	
High level of compliance/ implementation	<p>One of the following conditions applies:</p> <ul style="list-style-type: none"> ▪ High levels of compliance (e.g., most of the appliances have an EE label). ▪ There is a monitoring/reporting mechanism in place. ▪ The implementation meets the planned targets (e.g., reduction of HCFC was successful).
Medium level of compliance/ implementation	<p>One of the following conditions applies:</p> <ul style="list-style-type: none"> ▪ Medium level of compliance. For example, there is no sufficient capacities to control compliance, and/or there are no clear compliance/implementation procedures. ▪ The monitoring/reporting/verification mechanism is not completely implemented. ▪ The implementation partially meets the planned targets.
Low level of compliance/ implementation	<p>One of the following conditions applies:</p> <ul style="list-style-type: none"> ▪ Low level of compliance (e.g., most of the buildings do not comply with the code) ▪ There is no clear monitoring/reporting/verification mechanism in place. ▪ The implementation has not started and/or far from meeting the planned targets.
C. Technical aspects	
Specified	<p>One of the following conditions applies:</p> <ul style="list-style-type: none"> ▪ The criterion/topic has been explicitly specified in the policy instrument ▪ Clear targets and/or plans have been identified.
Not specifically mentioned	<p>One of the following conditions applies:</p> <ul style="list-style-type: none"> ▪ The criterion/topic has not been mentioned but other provisions indirectly lead to and/or promote this criterion/topic. ▪ The aspect will be considered in the update of the policy instruments or is planned to be included.
Not provided	The aspect is not covered and/or not considered

The third group of aspects covers the relevant technical criteria including EE of RACHP equipment, reducing cooling demand, phase out of ODS, phase down of HFCs and promoting natural refrigerants. Table 4 explains the meaning of each (for example, technical aspects such as reducing the cooling demand are an integral part of any plan or policy instrument to phaseout ODS consumption).

Table 4 Explanation of the technical aspects considered in the regulatory analysis in Lebanon

C. Technical aspects	Description and example
EE of RACHP equipment and systems	Addressing energy efficient operation of RACHP equipment and systems, e.g., by establishing energy monitoring, setting targets for Seasonal Energy Efficiency Ratio (SEER) or other parameters, enhancing maintenance etc.
Reducing cooling demand	In buildings: Addressing energy consumption of buildings through measures assessing and reducing the cooling demand such as e.g., energy monitoring, insulation, shading, and utilizing renewable energy to meet the cooling demand etc.
Phase out of ODS	Addressing import, manufacture, export, and destruction of bulk ODS as well as import, manufacture, export, installation, servicing, maintenance, end-of life management of equipment and systems containing or relying on ODS.
Phase down of HFCs	Addressing import, manufacture, export, reclamation and destruction of bulk HFCs as well as import, manufacture, export, installation, servicing, maintenance, end-of life management of equipment and systems containing or relying on HFCs.
Promoting natural refrigerants	Addressing production and use of natural refrigerants in refrigeration and air conditioning.

Awareness raising, capacity building, training, and certification will be considered when it is related to sustainable cooling (e.g. by promoting consumer information, enhancing labelling, providing information for different target groups, setting requirements for technician training and certification, and capacity building of planners, relevant authorities, etc.).

4. Summary of key findings and recommendations

The Government of Lebanon ratified the Kigali Amendment on February 5th, 2020 and has progressed in meeting its commitments relevant to the Montreal Protocol, implementing several relevant programs, laws, and other policy instruments such as codes and standards. For the regulatory analysis, the policy instruments governing the RAC sector in Lebanon were analysed to identify the key strengths and shortcomings towards phasing down HFCs, using natural refrigerants and reducing cooling demand.

Lebanon has been working to meet its international commitments, implementing a staged approach to comply with the adjusted control schedule for Annex-C Group-I substances (HCFCs), and completing HPMP Stage-I (2011 to 2015) activities relating to industry phase-out prior to 2015. These efforts have contributed to a decrease in HCFC consumption in the country. The Stage II (2016 to 2025) of the HPMP was approved in 2016 and focuses on RAC industries and the RAC servicing sector. Furthermore, several other national policies such as the 2nd NEEAP (2016-2020) and a NCP (2021) were developed. Lebanon also published an updated NDC in 2021 with new commitments to reduce emissions. Most of those national plans have been either successfully implemented or under implementation. However, lack of funding appears as a major barrier to implementation.

Lebanon has developed several laws that govern ODS phase out, enhance energy efficiency and environmental protection. This includes -for example- the Environment protection law, Waste Management Framework Law, and the Decree No. 3277/2016 which regulates the imports of materials and the licensing system of importers included in the MP and its amendments. Lack of enforcement is the main challenge facing these laws and regulations and is mostly due to a lack of awareness amongst end-users as well as a scarcity of resources at enforcing authorities. For example, some entities, such as the IRI, have the competences to test the safety of equipment and other types of tests ratified by laws while others, such as the customs offices, lack the needed system/software.

Lebanon is at a different stage of development and implementation with regards to MEPS and energy labels. Mandatory standards are limited to compact fluorescent lamps and solar water heaters. MEPS for refrigerators, AC split units and heat pumps are under development and mostly focus on systems performance, instead of focusing on specific uses of natural refrigerants and sustainable cooling. Standards are developed by LIBNOR and mainly issued as voluntary standards. A standard must be translated into a Governmental Decree to be applied as a mandatory. Such a Decree should also define the enforcing entities (monitoring, inspection, and judicial police). This process mandates skill development and capacity building across all involved entities. Awareness raising among end-users is also needed to increase their understanding of using natural refrigerants, specifically to calm their safety concerns.

In general, Lebanon has been successful in implementing several national plans to comply with the MP and its commitments, however, the country has room to improve achieved success and faces challenges around lack of enforcement, availability of funding and capacity buildings programs for various stakeholder groups.

Based on this analysis, some key policy recommendations have been derived to support the preparation of policy frameworks that guide the transition towards sustainable cooling and natural refrigerants use.

1. Amend, update and enforce National Cooling Plan

The National Cooling Plan for Lebanon is an integrated document linked to climate, energy and economic development strategies. The NCP consists of a market study to understand the stock of appliances and their technical and performance characteristics. It also proposed MEPS and Labels regulation, a financing approach to support the introduction of energy-efficient appliances through the enforcement of a MEPS and Labels system, and a roadmap for the transition to carbon neutrality in the cooling sector by 2050. However, the cooling plan does not include steps to enforce and implement the use of natural refrigerants in efficient RAC systems.

2. Energy conservation law and its decrees

The energy conservation law aims to establish the concepts of rationalization of energy consumption and energy efficiency in all sectors (buildings, electrical equipment, transportation, ...). This Project of law stresses the necessity of adopting energy auditing in the building sector, as well as the adoption of labels and minimum standards for energy consumption (MEPS) for all energy-consuming equipment and machines.

The energy conservation law is the umbrella of all energy efficiency sectors in the country including MEPS for cooling systems. Development for decrees to enforce this law once adopted by the Lebanese parliament is a must.

3. National F-gas regulation

National legislation on F-gases will be drafted by MoE and other relevant ministries and based on experience from the EU and other countries. F-gas legislation could either expand existing legislation on ozone-depleting substances or represent a self-standing legal act (possibly plus side legislation). Consultations with stakeholders concerned, including other ministries and government agencies, industry (all sectors concerned), associations and other experts, to discuss targets and potential measures are to be foreseen. The national rules would implement the commitments of the Kigali Amendment but could also go beyond in view of national strategies, e.g., climate targets. Measures to be covered include the following three categories:

Measures addressing HFC consumption for servicing needs:

- Containment: Leakage control through leak checks, record-keeping, rules on maintenance and repair
- Recovery during maintenance and at end-of life; end-of life treatment of appliances and refrigerants
- Possibly servicing ban related to certain high-GWP refrigerants, if retrofit of existing equipment is possible.

Measures addressing HFC consumption in new products and equipment:

- Licensing/quota allocation for HFC phase down and related rules for quota distribution, trading etc.
- Possibly bans on the use of HFCs in certain products and equipment, if low-GWP alternatives are available: e.g., domestic refrigeration, small commercial refrigeration units, mobile air conditioning in cars, insulation foams, aerosol sprays etc.

Overarching measures:

- Possibly obligation for equipment operators to submit equipment records to authorities (through an electronic reporting tool; not for residential and small commercial appliances but larger RAC equipment)
- Possibly training and certification of technicians: Obligation to meet minimum requirements, should relate to F-gases but could also include F-gas alternatives. Mainly relevant for refrigeration and air conditioning (stationary and mobile) but also for fire protection sector.

4. National certification scheme for RAC technicians

Qualification and certification of RAC technicians is of key importance for the transition to low GWP alternatives as required under the Kigali Amendment, especially regarding the safe use of flammable, toxic and high-pressure (natural) refrigerants. Training programmes should meet minimum requirements to address F-gas emission reductions, leakage control, documentation, safe handling of alternative refrigerants (including flammable refrigerants). To get certified, technicians should pass an exam proofing the minimum qualification. The requirement for certification could be set out through a national F-gas regulation and/or the national ODS regulation and should also relate to alternatives to both ODS and F-gases (e.g., natural refrigerants).

5. Support Decrees development including MEPS and building codes

As part of the enforcement of the energy conservation project of law, MEPS for equipment and updates on the Lebanese building code shall be developed. MEPS for RAC systems in the NCPL shall be reviewed and updated if needed. Based on the recommended MEPS in the NCP, it has been concluded that the MEPS do not particularly tackle the labelling and MEPS for commercial refrigeration. Therefore, it is of great importance to elaborate or adopt new standards (MEPS) for different RAC applications in commercial and household sectors to promote the transition to the low-GWP alternatives and the use of energy-efficient RAC appliances.

Attention should also be paid to the energy efficiency of buildings since the reduction of cooling demand could be explored further, especially for the building stock. The Lebanese building code does not include an energy efficiency code for heating and cooling equipment.

6. End-of-life management of RAC equipment

For recovery and waste management of appliances and refrigerants, no fully operational procedures appear to be in place in Lebanon. However, the IRI stated to operate some detection systems for e.g., the identification of the purity of HCFCs, supposedly from mobile AC systems. However, an operational strategy for waste management could include setting the legal requirement that recovery and subsequent handling of refrigerants may only be performed by certified personnel, i.e., certified RAC technicians.

7. NDC support (if requested)

Lebanon's NDC published in April 2021 includes conditional target of GHG emissions. While the cooling and dehumidification are the highest-consuming usages in the building sector, the targets do not include objectives directly related to the cooling sector. As for the GHG, the NDCs tackled only CO₂, CH₄, and N₂O.

Lebanon commits to unconditionally generate 18% of its power demand (i.e., electricity demand) and 11% of its heat demand (in the building sector) from renewable energy sources in 2030. Moreover, Lebanon conditionally commits to generate 30% of its power demand (i.e., electricity demand) and 16.5% of its heat demand (in the building sector) from renewable energy sources in 2030. On the other hand, Lebanon has committed to unconditionally reduce the power demand of 3% through energy efficiency measures in 2030 compared to the demand under the BAU scenario. This number would reach 10% under certain conditions.

8. Accompanying measure: Awareness activities

Mainly, awareness activities about natural refrigerants and outreach to the relevant private and public stakeholders. Awareness activities should include crucial topics such as sustainable cooling technologies and disposal of conventional refrigerants. Consumer awareness activities are needed as well to increase demand for higher energy efficient cooling appliances and for improved energy performance of buildings.

5. Regulatory analysis

5.1. International protocols and commitments

Lebanon is party to the Montreal Protocol (MP). In line with the Protocol obligations, Lebanon implements a staged approach for complying with the adjusted control schedule for Annex-C Group-I substances (HCFCs). HCFC Phaseout Management Plan (HPMP) Stage-I (2011 to 2015) activities relating to industry phase-out have been completed before 1 January 2015. This has contributed to a decrease in HCFC consumption in the country. Stage-II (2016 to 2025): The Stage II of the HPMP was approved in 2016 and focuses on RAC industries and RAC servicing sector. Figure 3 shows the amount of HCFC consumed in ODP tonnes between 2015 and 2020.

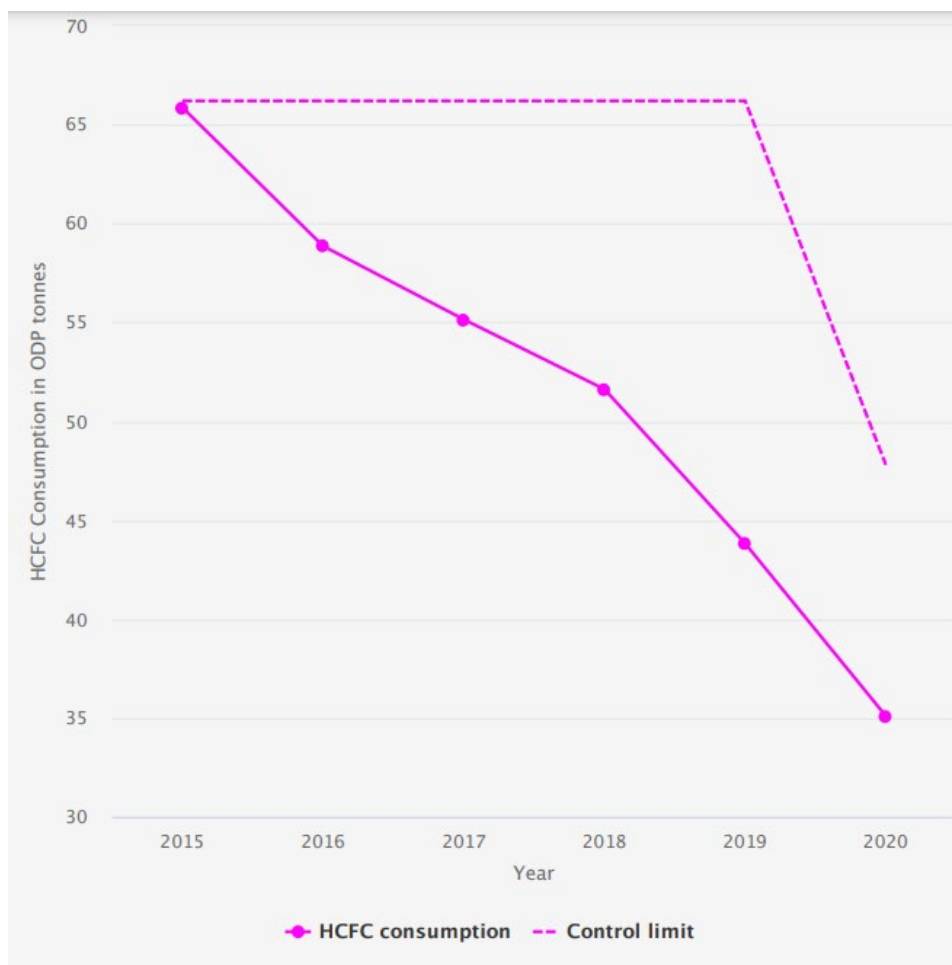


Figure 3 Lebanon's HCFCs consumption⁴, Source: (UNEP 2021)

The Government of Lebanon has approved joining the Kigali Amendment on 29 March 2019 under law 119/2019 and ratified the Kigali Amendment on February 5th, 2020. According to the Kigali Amendment, Lebanon has committed to phasing down HFCs according to the following schedule:

- ▶ 2024-2028: Freeze
- ▶ 2029-2034: 10% reduction
- ▶ 2035-2039: 30% reduction
- ▶ 2040-2044: 50% reduction
- ▶ 2045: 80% reduction

⁴ Source: <https://ozone.unep.org/countries/profile/lbn>

Lebanon signed the Paris Agreement on 22 April 2016. The Lebanese parliament ratified the Paris Agreement on March 6th, 2019. The instrument of ratification was deposited with the UN on February 5th, 2020. The Lebanese Republic also updated its Nationally Determined Contributions in 2020 where Lebanon committed to unconditionally increase its greenhouse gas emission reduction target relative to the Business-as-Usual (BAU) scenario from 15% to 20%, and conditionally increasing its GHG emission reduction target relative to the BAU scenario from 30% to 31%. Also Lebanon commits to unconditionally generate 18% of its electricity demand and 11% of its heat demand in the building sector from renewable sources by 2030⁵. (Ministry of Environment 2020)

For the international protocols and commitments, the analysis will consider the first two group of aspects, the status and the implementation aspects.

Table 5 International Protocols

Policy instrument/ commitment/ protocol	Aspects of analysis	
	Status	Compliance and Implementation
Montreal Protocol	In place	As a member of the Montreal Protocol Lebanon is implementing the HPMP and the HFC phase down projects.
Kigali Amendment and Kigali Ratification	Ratified	Law 119-2019 Kigali: Agreeing to the government to accede to the Kigali Amendment related to the Montreal Protocol

Lebanon has received financial assistance from different entities for implementing environmental and energy efficiency measures as well as from Multilateral Fund (MLF) in order to meet its obligations under the Montreal Protocol and its amendments. The NOU is responsible for monitoring and implementing all Montreal Protocol activities in Lebanon. Other types of funds are available such as the GCF readiness programme. It enhances the country ownership and climate finance access to the Green Climate Fund.

The Lebanon Pollution Abatement Project (LEPAP), providing a 15 Million USD loan at subsidized rates to industrial enterprises was also available until recently. This loan was funded by the World Bank through the IBRD and it ends in December 2022. Other international funds were integrated under national financing mechanism for EE and RE measures from different entities, namely the EIB and AFD. (UNDP n.d.)

Table 6 International project and/or programs

International project and/or programs	Aspects of analysis	
	Status	Compliance and Implementation
Phase-out of CFCs, Halons and Methyl Bromide	Completed	In 2010
HCFC phase-out management plan Stage I (2011-2015)	Completed	Meet 10% reduction from the baseline (73.5 ODP Tonnes)
HCFC phase-out management plan Stage II (2016-2025)	Ongoing	Meet 50% reduction from the baseline (73.5 ODP Tonnes)
Phase-down of HFCs	Under Construction	By 2040
Kigali enabling activities	Completed	Review the licensing and data reporting systems on HFCs
Kigali Cooling Efficiency Programme (KCEP)	Completed	Development of the National Cooling Plan

The phase-out of CFCs, Halons and Methyl Bromide was completed in 2010, while the first stage of the HCFC phase-out management plan was completed in 2015. The objective of Stage I was to meet 10%

⁵ Lebanon's Nationally Determined Contribution Updated 2020 Version

reduction from the baseline where the baseline consumption was 73.5 ODP Tonnes, while the second stage of the HCFC phase-out management plan (Stage II) objective was to meet 50% reduction from the baseline by 2020. In fact, the consumption in 2017 reached 55 ODP Tonnes, which is equivalent to 74.8% of the baseline consumption. (Haidar 2019)

As for the Kigali enabling activities, the Ministry of Environment and the NOU have defined and published the next steps including by the National Cooling Plan for Lebanon. As per the National Cooling Plan (NCP), the Government of Lebanon has already issued HCFC import quotas for 2018 at 52.58 ODP tons, which is lower than the MP control targets and the maximum allowable consumption set in its Agreement with the Executive Committee (ExCom).

5.2. National plans and strategies

Lebanon has issued several national action plans and strategies to phase down HFC and improve the energy efficiency of energy use sectors, including the RAC sector. In April 2021 Lebanon published an updated NDC with more ambitious greenhouse gas targets. Under the Kigali Cooling Efficiency Program (K-CEP) financed programme, the NOU and UNDP Lebanon developed a NCP that was published in May 2021 under the title of "Guidance for integrating efficient cooling in national policies in Lebanon"⁶. Other policies include the second National Energy Efficiency Action Plan (NEEAP) 2016-2020. The NEEAP addresses both primary and end-user-oriented energy savings. It specified in its horizontal measures chapter, MEPS as the first initiative to be implemented in Lebanon. MEPS implementation is cited as a major measure to be achieved during the period 2016-2020. The decarbonization of the energy supply has been addressed through the National Renewable Energy Action Plan 2016-2020.

Updated NDC (2021)

Lebanon's NDC published in April 2021 includes conditional target for GHG emissions. While the cooling and dehumidification are the highest-consuming usages in the building sector, the targets do not include objectives directly related to the cooling sector. As for the GHG, the NDCs tackled only CO₂, CH₄, and N₂O.

Lebanon has committed to unconditionally generate 18% of its power demand (i.e. electricity demand) and 11% of its heat demand (in the building sector) from renewable energy sources in 2030. Moreover, Lebanon conditionally committed to generate 30% of its power demand (i.e. electricity demand) and 16.5% of its heat demand (in the building sector) from renewable energy sources in 2030. On the other hand, Lebanon has committed to unconditionally reduce the power demand of 3% through energy efficiency measures in 2030 compared to the demand under the BAU scenario. This number would reach 10% under certain conditions. (Ministry of Environment 2020)

National Cooling Plan (NCP)

The NCP tackles the greenhouse gases (GHG) and ozone-depleting substances (ODS) emissions from cooling demand in all its forms with coherent policies. In addition to an overview of the current market status and available regulations, the NCP suggests several recommendations to reduce emissions and increase systems energy efficiency, especially a MEPS and labelling scheme for the domestic refrigerators and unitary air conditioners. It also provides recommendations to support the preparation for the implementation of the MP, especially the Kigali Amendment. (NOU 2021)

The NCP includes five main parts as follows:

- ▶ The market study, to better understand the stock of appliances and technical characteristics.
- ▶ A proposal for a MEPS and Labels regulation.
- ▶ The financing approach to support the introduction of energy-efficient appliances

⁶ National Ozone Unit Lebanon, "Guidance for Integrating Efficient Cooling in National Policies in Lebanon"

- ▶ The NCP includes recommendation to integrate the NCP into Lebanon's NDC, in which climate friendly and energy efficiency cooling can contribute with a mitigation effort by up to 4 MT CO₂-eq or about up to 20% of Lebanon's current GHG emissions.
- ▶ A roadmap for the transition to carbon neutrality in the cooling sector by 2050.

In addition to the development of the NDC, there are K-CEP funded project activities within HPMP stage II in Lebanon each with their own objectives:

- a) Improving energy efficiency and avoiding HFCs: Development of an incremental training module on energy efficiency linked to, and supporting, Lebanon's on-going and future HPMP activities.
- b) Developing cooling standards to enable retirement of inefficient equipment: Assist the development of policies, standards and the appropriate regulatory framework to implement minimum energy performance standards and develop a roadmap for accelerating market transformation in the domestic refrigerator and air conditioning (RAC) sectors.
- c) National efficiency cooling plan: Fill the gap in energy efficiency expertise needed to assist Lebanon to implement MP projects and management plans taking into consideration energy efficiency aspects and opportunities relating to refrigeration and air conditioning.
- d) Incremental costs for energy efficiency in refrigeration: The objective of this project is to assess the potential incremental capital and operating costs for improved energy efficiency in domestic and commercial refrigeration.

Moreover, the national cooling plan for Lebanon focuses on energy efficiency aspects for the RAC systems and do not include any methodology to enforce the integration of natural refrigerants into the Lebanese RAC market.

National Energy Efficiency Action Plan (NEEAP)

Lebanon has issued a NEEAP. MEPS were tackled in the first NEEAP (2011-2015). It was also picked up in the second NEEAP (2016-2020) and highlighted in its 'Horizontal measures' chapter as the first initiative that should be implemented in Lebanon. MEPS were not implemented due to several challenges, however, initiatives were taken as part of the needed roadmap. (Lebanese Center for Energy Conservation 2016) A specific workshop with all national stakeholders was held in March 2017 to identify the needs and the gaps to set the ground for proposing MEPS and labels for equipment in Lebanon. Equipment discussed included cooling and heating systems, lighting equipment, TVs and washing machines.

Two projects funded by the Italian Ministry for the Environment Land and Sea are currently being executed in Lebanon. The first project is the "National Heat Pumps Project of Lebanon," which aims at introducing heat pump technology at large scale in Lebanon, specifically for space heating and hot water production. The project includes the construction of a testing laboratory in Lebanon and the legislation of a decree that mandates the installation of solar water heaters for domestic hot water generation and, if not feasible, the obligation of installing heat pump technologies. The testing facility would be accredited and in-line with international standards to test air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.

The second project is the Program "Italian Energy Efficient Home Appliances" (IEEHA), which promotes Italian home appliances that have the best-available energy rating according to the European labelling scheme. The consumers that buy Italian high energy efficient appliances with an EU energy label, can potentially benefit from a rebate on their purchase. This initiative had allowed used survey input to determine the types of appliances used in the Lebanese households including split AC units and others. It also disseminates awareness regarding the energy efficient equipment and includes a programme to finance part of the purchased efficient equipment if it is of Italian origin.

The first NEEAP (2011-2015) and the second NEEAP (2016-2020) also tackle the development of Energy Efficiency Building Codes (EEBC) and double wall installation (in the NEEAP 2016-2020). However, none of the measures related to the building code were finalized. The 3rd NEEAP is currently being drafted.

Key Conclusions of analysis of the national plans and strategies

Overall, the Lebanese national plans and strategies have been pushing the cooling and refrigeration sector to meet the commitments Lebanon has endorsed. Several national policies such as the NEEAP, National Cooling Plan were proposed and adopted throughout the years. Most of them were implemented. However, lack of funding is identified as a major barrier in the implementation.

Table 7 Status of key national strategies relevant to ODS phaseout and cooling demand reduction in Lebanon. Source: author based on various sources as mentioned in the report. For colour codes, refer to Table 3

National Plans/ strategies	Status	Compliance and implementation	Technical aspects				
			EE of RACHP equipment and systems	Reducing cooling demand	Phase out of ODS	Phase down of HFCs	Promoting Natural Refrigerants
NDC	In place, updated (2021)	Being Implemented	Part of the EE targets	Part of the EE targets	Not Available	Will be added once included in Lebanon's GHG inventory.	Not included
NCP, 2021	In place	In process to be endorsed by the Government	EE is mentioned	Specified	Mentioned	Support the preparation for the implementation of the MP	By 2030 most of the transition towards natural refrigerants (low GWP) for the AC subsector has been completed.
NEEAP 2016-2020	In place	Being Implemented	EE is mentioned (Use of efficient equipment and development of EEBC)	Savings vary per type of equipment and performance	Not provided	Not provided	Not provided
HPMP, 2016-2025	In place	Being implemented	Not mentioned	Not mentioned	Mentioned	Not mentioned	Not mentioned
HFC phase-down plan	Planned	Phase down of HFCs by 2040 (under construction)					

5.3. Laws and bylaws and other national legislation

Lebanon has developed several laws and regulations that govern the ODS phase out and energy efficiency and environmental protection.

National Commitments

The Lebanese government, under law 359/1994, has joined the United Nations Framework Convention on Climate Change, signed in Rio De Janeiro on the 6th of June 1992. While on the 29th of March 2019, the Government of Lebanon has approved joining the Kigali Amendment under law 119/2019 as well as Paris agreement under law 115/2019. The Kigali Amendment was also ratified on the 5th of February 2020.

ODS Regulation

As per decree No. 3277/2016, it is prohibited for any natural or legal person to import or export the prohibited materials included in the Montreal Protocol and its amendments. Moreover, the Ministry of Environment annually publishes an official register of the names of the registered importers and the quantities licensed to be imported annually according to the ODS Management Program. Every natural or legal person registered as an importer must submit a report to the Ministry every three months from the

date of implementation of the provisions of this decree. (Council of Ministers, Amending Decree No. 2604/2009 of 9/17/2009 relating to the control of substances that deplete the ozone layer 2016)

Energy Conservation Project of law

On the 5th of May, 2022, the council of ministers approved the energy conservation law and transferred it to the parliament for discussion and adoption. This law was developed by the Ministry of Energy and Water and LCEC to execute the second NEEAP and additional policy efforts expanding on it. It includes three articles related to the development of MEPS and labelling for all types of electric equipment. However, this law shall be followed by executive decrees to organize the application of each of its articles. The contents of key articles include the following:

- ▶ Article 18: Every distributor or manufacturer of equipment, tools and vehicles that consume energy shall ensure that the energy efficiency labels issued by the LCEC are used and that they indicate the level of energy consumption.
- ▶ Article 19: The Minister shall, upon the proposal of the LCEC, issue a regulation specifying equipment, tools and vehicles to be labelled.
- ▶ Article 20: The Minister proposes to the Ministry of Finance and the Supreme Council of Customs to ban the introduction of equipment, tools, and vehicles that are not energy efficient, "based on a list prepared by the LCEC according to the standards and specifications issued according to the Lebanese rules.

In addition to MEPS, this proposed law tackles energy efficiency in the buildings sector, the industrial sector and the public sector.

Decree 167-2017 on tax exemptions for environmentally-friendly equipment imported in Lebanon is published. However, it does not define the "equipment", thus executive decrees are still needed to implement it correctly.

Renewable Energy project of law

A Decentralized Renewable Energy Project of law has been approved by the council of ministers on the 23rd of March, 2022 and it was transferred to the parliament for discussion and adoption. This law was prepared by the ministry of energy, and EBRD to incentivize the installation of small-scale renewables energies systems, specifically net metering and peer to peer applications among others.

Environment protection law against pollution from harmful waste and hazardous materials (64)

Law 64/1988 emphasizes the importance of preserving the environment against pollution from harmful waste and hazardous materials. On the other hand, Decree No. 3277/2009 states that the Ministry of Environment makes decisions, measures or amendments to include any prohibited or restricted materials from importing, using or exporting in a manner that suits the public interest and protects the environment. (Council of Ministers, Preserving the environment against pollution from harmful waste and hazardous materials 1988)

Waste Management Framework Law

As per article 7 of law 64: Preserving the environment against pollution from harmful waste and hazardous materials, waste is discharged either by the person responsible for it, or by public or private institutions specialized in disposal. The types of waste that are discharged by each category are determined by a decree issued by the Council of Ministers based on the proposal of the Ministers of Health, Agriculture and Industry. This decree specifies the manner of disposing of this waste and its technical conditions.

Law 80/2018 on integrated Solid Waste Management defines the institutional framework for integrated solid waste management (hazardous and non-hazardous).

Building law (646/2004)

The Lebanese Building law (646/2004) and its enforcement decrees tackle the construction. However, they include one clause related to the installation of a double wall in case the developer/end-user decided to install one. A double wall in this law and its enforcement decrees is not mandatory.

The General Budget Law 2019 in article 66 makes references to sustainable buildings, pushing towards sustainable construction. As per this law, sustainable buildings (green buildings) are the ones that fit into specific environmental, social, organizational, and energy requirements. The law does not tackle technical specifications, however it only specified the benefits/incentives for the developer/end-user.

Key conclusions of analysis of the national legislation

Laws and legislative development in Lebanon are subject to political circumstances. Despite this fact, several laws and bylaws were passed. The lack of enforcement is mostly due to the lack of awareness among the end-users and the lack of competences at the level of enforcing authority most of the time. Some entities such as the IRI have all types of competences needed to test the safety of equipment and other types of tests ratified by laws. However, specific entities, such as the directorate of customs, lack the needed system/software for customs to enforce these laws on the relevant equipment.

Table 8 Initial assessment of laws relevant to the RAC sector. Colour coding as described in Table 3⁷

Laws and bylaws	Status	Compliance and implementation	Technical aspects				
			EE of RACHP equipment and systems	Reducing cooling demand	Phase out of ODS	Phase down of HFC	Promoting Natural Refrigerants
National Commitments	In place	Enforced					
ODS regulation	In place	Enforced			Specifically addressed		
F-gas regulation	Not available						
Energy Conservation law and Decentralized Renewable Energy law	Approved by CoM and sent to Lebanese Parliament	No Enforcement			Not provided	Not provided	Not provided
Environment Protection Law	In place	Enforced					
Waste Management Framework Law	Law 80/2018 Integrated Solid Waste Management	Enforced					
Building Law	In place	Enforced			Not provided	Not provided	Not provided

⁷ Source: <http://www.legallaw.ul.edu.lb/>

5.4. Standards and codes

MEPS and energy labels have been introduced in Lebanon and are at different stages of development and process of implementation. The standards listed below in Table 9 are standards for testing the performance in Lebanon. Currently, there is no threshold applied for acceptable minimum energy performance.

Standards developed by LIBNOR must be translated into governmental decrees to be applied as mandatory standards for testing cooling systems. The standards focus on the performance of the system only and are not specific to the use of natural refrigerants.

Table 9 MEPS in Lebanon: Current Status

Type of equipment	Current status	Stakeholders involved
Solar water heaters + Compact fluorescent lamps	Mandatory standards for testing performance are in place No threshold is applied for minimum acceptable performance	Council of ministers Ministry of Energy and Water LCEC IRI
Residential appliances, e.g., Refrigerators, Television, Washing Machine, Electric/Gas Water Heaters, AC split units and Heat Pumps + Electric Motors + Electric Transformers	MEPS in development voluntary standards for testing the performance of electric ACs, heat pumps and chillers are in place. Voluntary programs promote the use of efficient appliances	Ministry of Energy and Water LCEC LIBNOR Italian Ministry of Environment IRI Directorate General of Urban Planning Ministry of Environment CTCN
Focus on Refrigerants and ACs (all types)	MEPS in development No Voluntary programs promote the use of efficient RAC	Ministry of Energy and Water Ministry of Environment LCEC IRI NOU Lebanese Customs Authority Car Registration Authority International and local consortium funded by K-CEP LIBNOR Manufacturers and assemblers RAC sellers Order of Engineers and Architects Servicing Companies

Several standards related to RAC systems performance testing were adopted by LIBNOR. However, these standards are mainly voluntary till now. Testing facilities are currently being designed by the LCEC under the project entitled "The National Heat Pump project" funded by the Italian Ministry of Environment Land and Sea. Regarding mandatory standards, they are limited to compact fluorescent lamps and solar water heaters.

In addition, the Energy Conservation project of law includes articles related to Labelling and MEPS for all types of electric consuming equipment. This project of law also mentions the need to develop a labelling system for buildings that considers their annual performance.

The Lebanese RAC market already includes labelled equipment that are mainly imported. However, MEPS are not developed although several relevant actions have been put forth recently in the National Cooling Plan.

Regarding building standards, the Thermal Standard for Buildings in Lebanon (TSBL 2005) has been developed in the context of Project "Capacity Building for the adoption and application of Thermal Standards for Buildings". The project was funded by the Global Environment Facility, managed by the United Nations Development Programme, and executed under the Lebanese General Directorate of Urban Planning, Ministry of Public Works and Transport. The project falls under the Climate Change focal area and aims at establishing a Thermal Standards for Buildings, and at enabling their adoption and application

through the provision of capacity building and information dissemination. It should be noted that the word Standard in the TSBL 2005 does not reflect the conventional definition of a standard and is not linked to Standards developed by LIBNOR. TSBL 2005 is a report including a set of recommendations for those willing to develop energy efficient buildings.

Following the NEEAP 2016-2020, a technical committee was created at LIBNOR to develop a standard that tackles sustainable buildings. The standard is under preparation, and it will be entitled: A Building Environmental Performance - Principles, Requirements and Guidelines. This standard will be published as a voluntary standard, then can be transformed to a mandatory one if any of the Lebanese stakeholders request this.

Key Conclusions of analysis of the standards and codes

MEPS development would require the definition of the legal framework which is not in place currently. It requires also the definition of the enforcing entities (monitoring, inspection and judicial police) as well as skills development and capacity building of all involved entities. Regarding codes and standards, LIBNOR has all the needed competencies for adopting and proposing new standards. For better enforcement, standards shall first be proposed as voluntary to test the market and then become mandatory. As per experience, as long as the end-user, importer or retailer has the option of voluntary standard, low end products are always present in the market.

Table 10 Summary of the assessment of standards and codes relevant to the RAC and building sectors

Standards and codes	Status	Compliance and Implementation	Technical aspects				
			EE of RACHP equipment and systems	Reducing cooling demand	Phase out of ODS	Phase down of HFC	Promoting Natural Refrigerants
RAC MEPS	planned	NEEAP (2016-2020) and NCPL 2021	mentioned				
RAC Labels	planned	NEEAP (2016-2020) and NCPL 2021	mentioned				
MEPS and Labels for Buildings	planned	NEEAP (2016-2020)			Not provided	Not provided	Not provided

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