



Cooling sector

Prospects

Lebanon

How fast is the demand for cooling growing and what can be done?

What is the energy and emissions saving potential for Lebanon by 2050 if it were to implement a comprehensive sustainable cooling strategy for air conditioning and commercial refrigeration?

Can Lebanon meet the sustainable cooling challenge?

Underlying trends are driving an increased demand for cooling.



Population growth



Increasing urbanization



Economic growth



Warmer climate

The amount of buildings in Lebanon and total floor area is projected to increase 1.35-fold by 2050. Combined with the above factors, this is resulting in projections that the amount of **AC systems will roughly double** from 1.9 million units in 2020 to approx. 3.8 million units by 2050. Less rapid growth is expected in commercial refrigeration where the number of systems is expected to go from 1.4 million to 1.9 million. Combined, this would result in a **1.4-fold increase in electricity demand** for the sector, requiring significant investment in additional electricity generation capacity.

The use of air conditioners is set to rise rapidly, driving up energy use, emissions and costs. Action can be taken to control runaway growth.

Electricity consumption
TWh

1.4X
increase

with no
policy action

4.7 TWh

3.5

2020

6.6 TWh

5.1

2050

41%
reduction

with strong
policy action

3.9 TWh

2.6

2050

Air
conditioning



Commercial
refrigeration



Egypt's success will be determined by use of effective policy.



Reducing
cooling
demand



Boosting
energy
efficiency



Utilising
natural
refrigerants



Reducing
refrigerant
leakage

Early action and swift implementation of highly efficient technologies with natural refrigerants is key to achieve reductions and avoid the lock-in effects. Indirect emissions can be tackled by installing more efficient AC and refrigeration equipment, as well as employing passive cooling and building envelope technologies. Direct emissions from refrigerant leakage can be countered with use of natural refrigerants, periodic checks and end of life procedures. Capacity building of certified technicians is key to unlocking these reductions.

Prospects for mitigation actions

Introducing the four prospects for the transition of the cooling sector to 2050

Prospect 0
Current trend

Prospect 1
Moderate impact

Prospect 2
High impact

Prospect 3
High impact +

Modelling results for each prospect is given for:



Electricity demand

Provides results on the development of energy demand up to 2050 resulting from the AC and commercial refrigeration sectors.



GHG emissions

Provides results of the corresponding direct GHG emissions from refrigerant leakage and indirect GHG emissions from energy consumption of AC and commercial refrigeration units.



Economic costs

Provides results on the overall expected investment costs and corresponding annuities discounted over the lifetime of the project up to 2050. Comparison of these costs also provides the expected costs savings of the different prospects compared to the P0 trend.

Energy efficiency of systems



Use of natural refrigerants



Reduction in refrigerant leakage

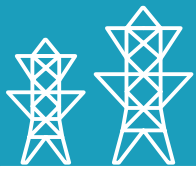


Reduced cooling demand



Leapfrog HFC





How much can electricity demand be reduced?

Electricity demand growth comes almost exclusively from growth in the residential AC market



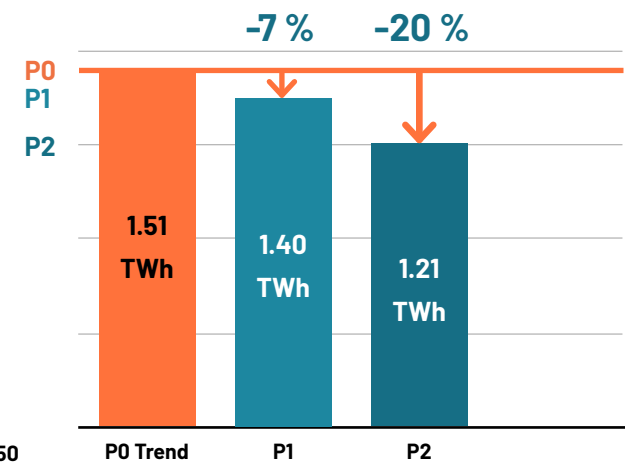
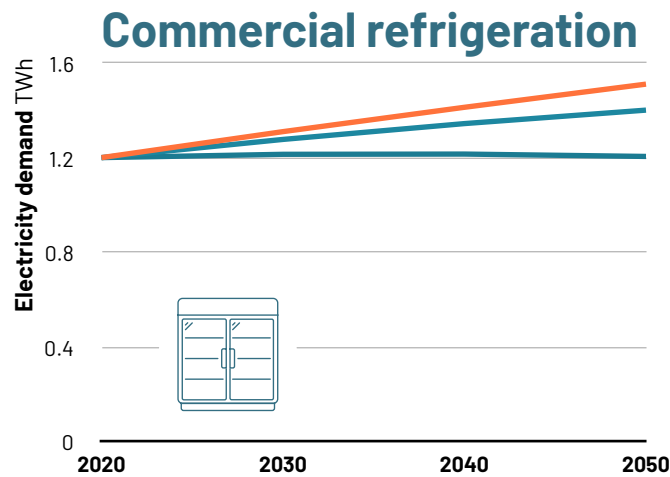
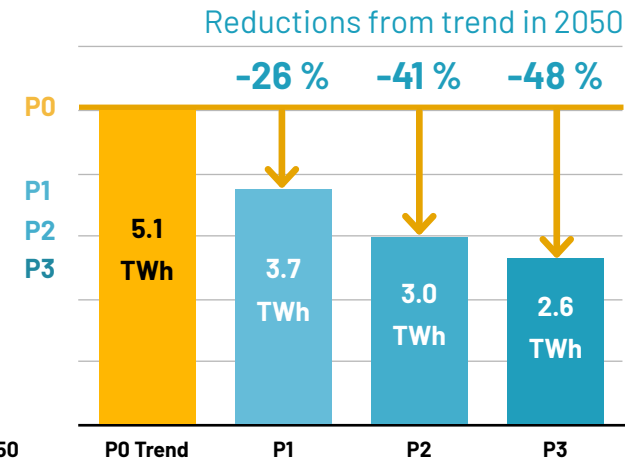
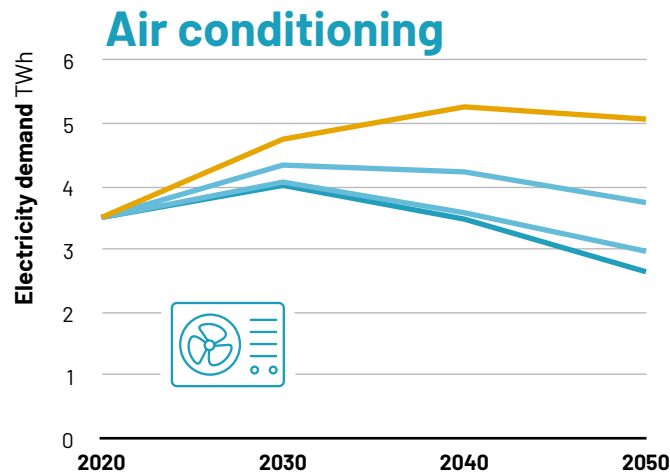
High growth of the RAC market represents both challenges and opportunities

The RAC market in Lebanon is growing fast with a **2-fold increase** in number of air conditioning systems expected by 2050, primarily from growth in the residential AC market. This growth leads to a strong increase electricity demand under current conditions and would require significant investment in additional electricity generation capacity and possibly power grid infrastructure upgrades as well.

Significant electricity savings are possible by ambitious measures

The potential success of policy measures and regulatory controls can not only stop growth in electricity demand but also help reduce it. Electricity demand is projected to **grow by 40%** from 2020 under current trends but **savings of 22-41%** could be achieved from this increase depending on the prospect.

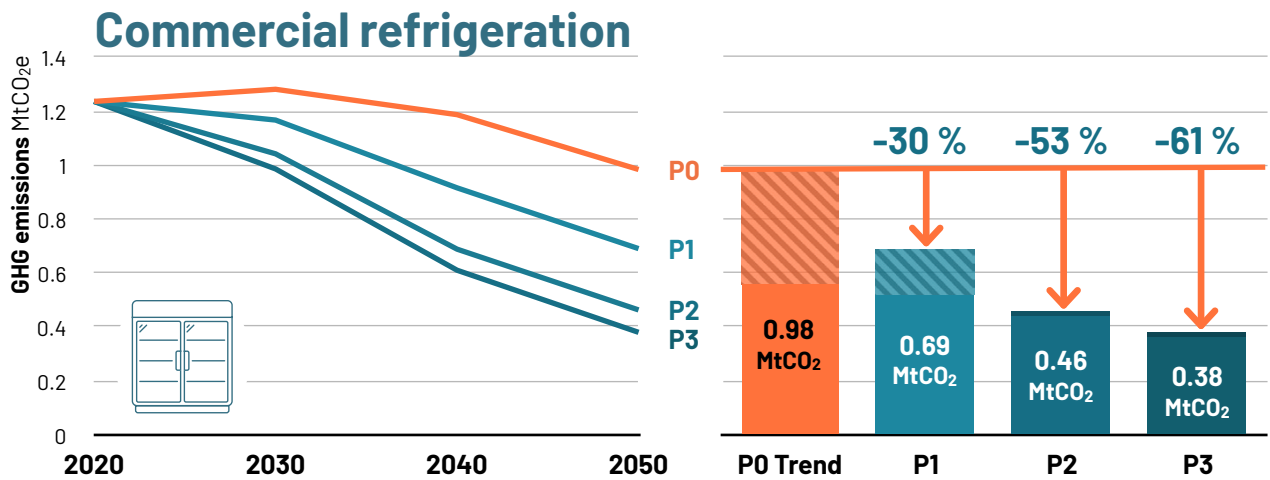
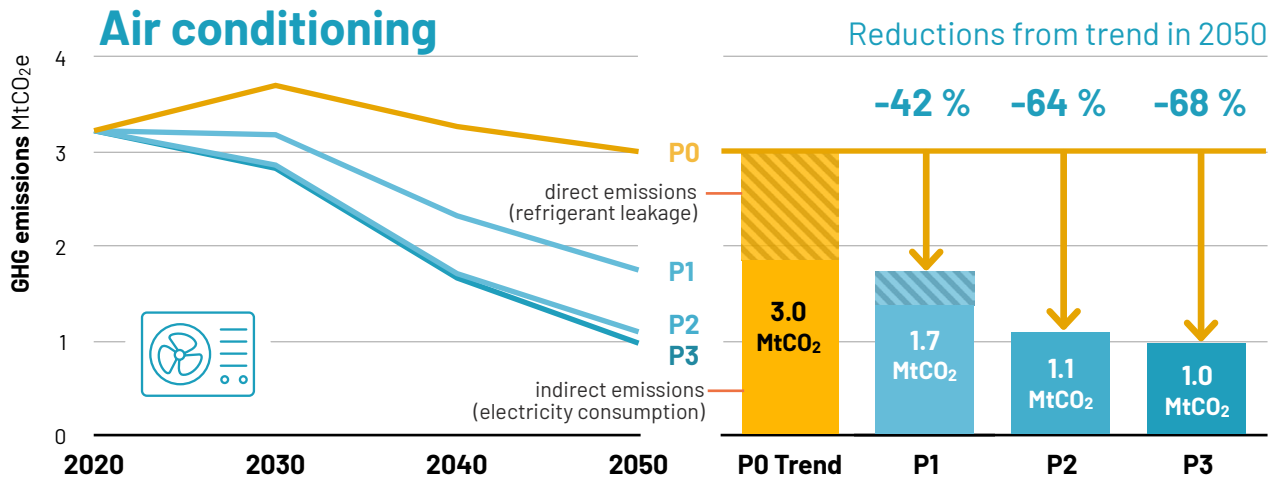
Rapid growth in electricity demand can be limited by policy measures that help install more efficient cooling equipment and build more thermally efficient buildings





Emissions reductions potential

Early adoption of highly efficient technologies with natural refrigerants is key to avoiding the lock-in effect and stopping growth in direct and indirect GHG emissions



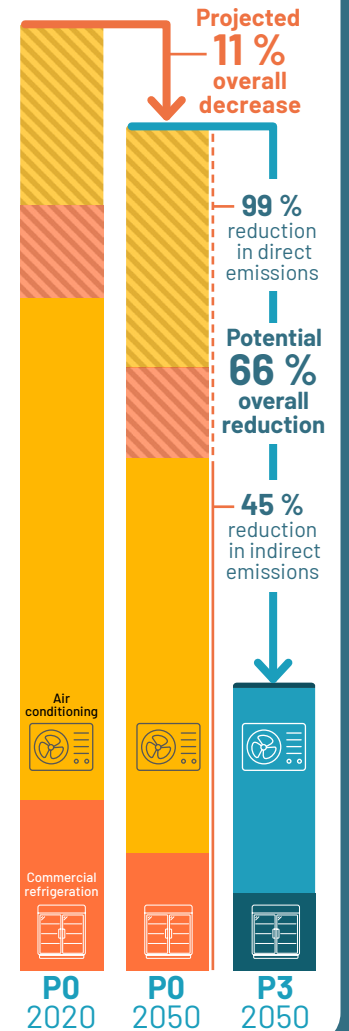
Direct emissions from refrigerant leakage can be virtually eliminated through use of natural refrigerants

Significant emissions reductions are possible

Under current conditions, overall market growth is set to dramatically increase emissions from the cooling sector. This is despite the electricity grid having a declining emissions intensity from adoption of renewables that will lower indirect emissions over time. Direct emissions account for almost 30% of total emissions and there is potential to all but eliminate them.

Early action and swift reductions are key

A fast transformation of the RAC sector towards more efficient technologies and natural refrigerants is key to avoiding the lock-in effects from outdated equipment using standard refrigerants (such as R410A, R134a). This transition will counteract emissions from overall market growth, help achieve the Kigali targets and deliver a range of additional benefits.





Investment and electricity costs

Prospect

Investment costs

Equipment costs rise rapidly but higher and faster for sustainable cooling

The annuities or discounted CAPEX costs required to increase the number of AC systems from 1.9 M to 3.8 M and refrigeration from 1.4 M to 1.9 M by 2050 will reach approx. 3.6B € in 2050 under current trends. Under P1 and P2 these costs will be 15% higher at 4.1B € and 30% higher at 4.7B € respectively due to the higher costs of installing higher efficiency, natural refrigerant technologies.



Electricity costs

Significant electricity costs savings are possible with ambitious measures

More cooling results in higher annual electricity costs. These costs are expected to rise to 9.1B € by 2050 under current trends, 15 times higher than 2020 levels. This level of increase can be limited to 8 to 12 times 2020 levels depending on the P1 to P3 prospect, a 22-45% saving that more than offsets increased costs for efficient, sustainable cooling technologies.

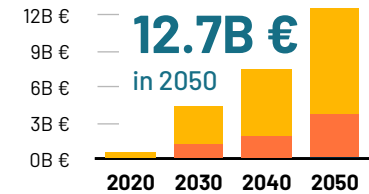
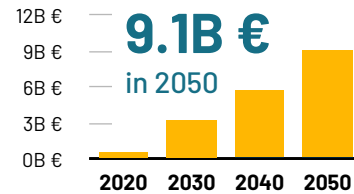
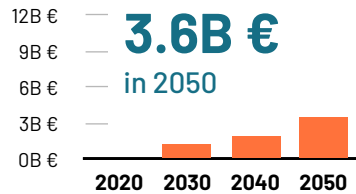


Total costs

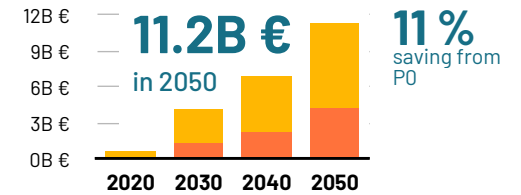
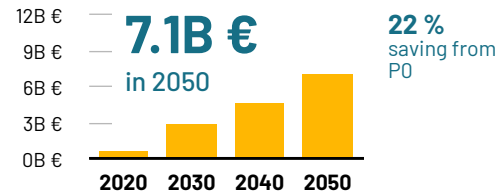
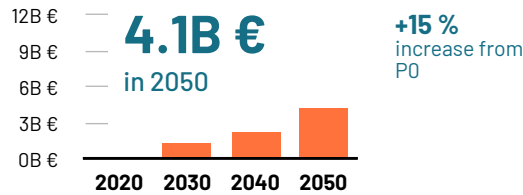
Savings outweigh costs, investing in sustainable cooling is financially smart

The overall situation shows that the higher costs of investing in sustainable cooling technologies are more than offset by the lower electricity costs, resulting in substantially lower emissions for a net financial saving. The savings could be even higher depending on electricity costs, which have risen in recent years. The electricity grid also benefits, particularly with avoided costs for peaking plants.

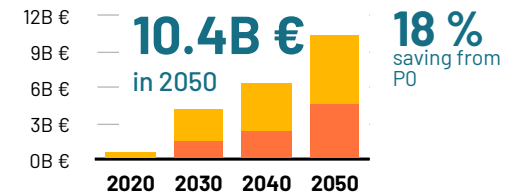
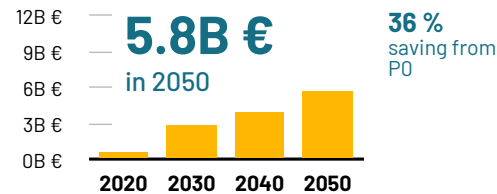
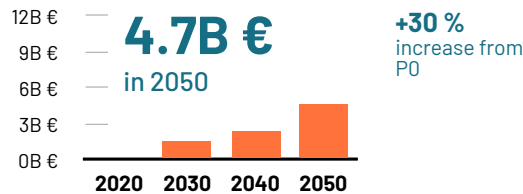
P0
Current trend



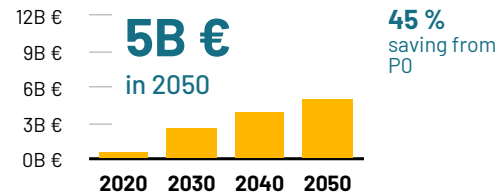
P1
Moderate impact



P2
High impact



P3
High impact +





More information

Full reports

This snapshot is based on the 2023 report entitled:

Cooling sector prospects study Lebanon:

Energy and emission saving potential up to 2050 in the refrigeration and air conditioning sector

There are reports in the same series for Egypt and Jordan

