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Cooling

Residential Refrigerators | Room Air Conditioners

Energy efficiency benefits from residential refrigerators and room air conditioners with the implementation of Minimum Energy Performance Standards at two levels of ambition (minimum and high) as detailed in the United Nations Environment Programme (UNEP) United For Efficiency (U4E) Model Regulation Guidelines.

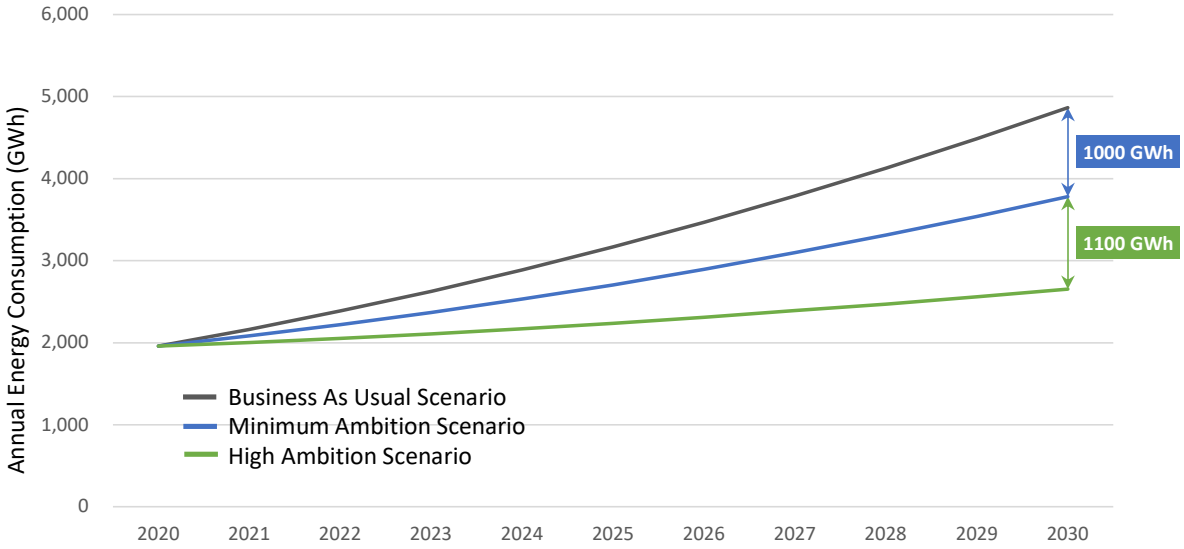
ANNUAL SAVINGS IN 2030*

Reduce electricity use by over **1 TWh** which is **10.4%** of current national electricity use

Save electricity worth **68 Million US$** equivalent to over **2 Power Plants [100MW each]**

Reduce electricity CO_2 emissions by over **3.8 Thousand tonnes** equivalent to **2.1 Thousand Passenger Cars**

EVEN GREATER SAVINGS POSSIBLE WITH MORE STRINGENT REGULATION



TOTAL SAVINGS OF LOW GLOBAL WARMING POTENTIAL REFRIGERANTS BY 2030

Direct GHG emissions reduced by **48 Thousand tonnes**

* Denotes savings are from the Minimum Ambition Scenario.

DETAILED BENEFITS

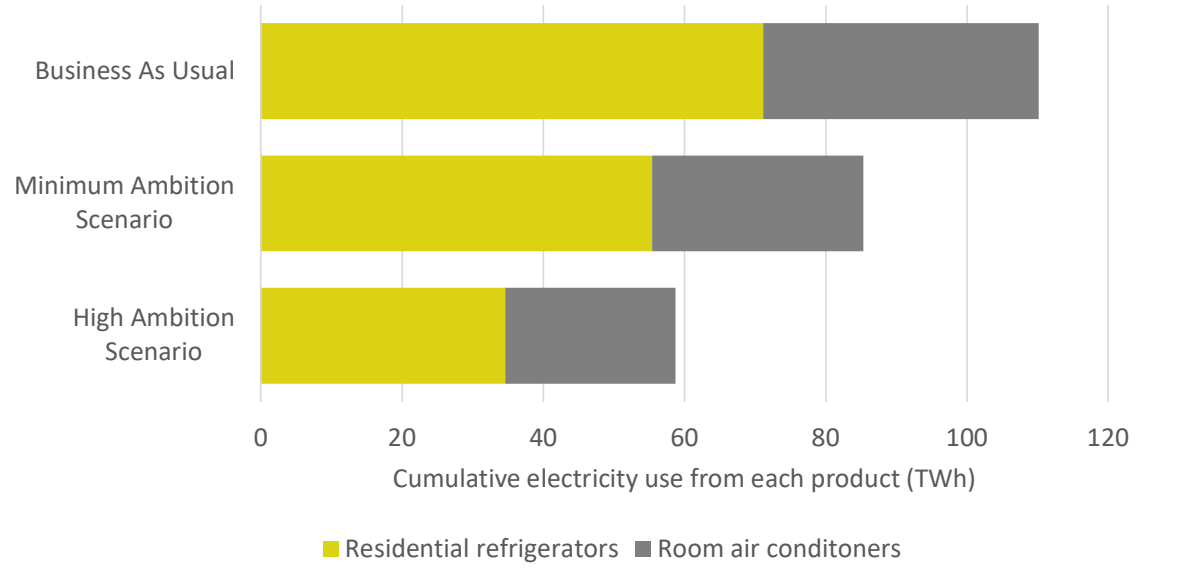
ANNUAL SAVINGS IN 2025, 2030 AND 2040*

		Residential Refrigerators			Room Air Conditioners		
		2025	2030	2040	2025	2030	2040
	Electricity (GWh)	290	680	1,700	180	400	950
	Electricity Bills (Million US$)	18	43	110	11	25	60
	CO2 Emissions (Thousand tonnes)	1.0	2.4	6.0	0.6	1.4	3.4

CUMULATIVE SAVINGS BY 2030 AND 2040*

		Residential Refrigerators		Room Air Conditioners	
		2030	2040	2030	2040
	Electricity (TWh)	3.4	16	2.0	9.1
	Electricity Bills (Million US$)	210	990	130	570
	CO2 Emissions (Thousand tonnes)	12	56	7.2	32

CONTRIBUTION TO CUMULATIVE ELECTRICITY USE BY 2040



* Denotes savings are from the Minimum Ambition Scenario.

Country Data and Input Assumptions

GENERAL INFORMATION

Population	84 Million
GDP per capita	562 US$
Electrification level	28.4%
CO2 Emission Factor	0.00 kg / kWh

ELECTRICITY MARKET

Residential Electricity tariff	0.06 US$ / kWh
Transmission and distribution loss factor	15.1%

ASSUMPTIONS

Product	Unit Energy Consumption (kWh/year) or Efficiency Level			Type of Product
	Business As Usual	Minimum Ambition Scenario	High Ambition Scenario	
Residential Refrigerators	340	247	123	2-door refrigerator-freezer of average size 210 liters
Room Air Conditioners	3,198	2,049	1,503	A mix of 3.5 kW and 7 kW split units with a weighted-average cooling capacity of 5 kW

METHODOLOGY

The analysis uses the UNEP-U4E's Country Savings Assessment Models to estimate the impacts of implementing policies that improve the energy efficiency of new household air conditioners and refrigerators. The savings potential in each scenario assumes Minimum Energy Performance Standards (MEPS) are introduced in 2020 at two different levels of ambition (minimum and high) as shown above.

ASSUMPTIONS AND DATA SOURCES

- Market size was estimated by household ownership forecasts derived from population, climate, and macroeconomic indicators as described below. This data was validated by comparison with data from industry partners; the UN COMTRADE database and other market research.
- Population (2019 and future forecasts) comes from the UN Population Division.
- GDP per capita data (2018) comes from the World Bank with future growth forecasts derived from the IPCC's SSP3 scenario.
- Cooling Degree Days are based on average monthly temperatures from weatherbase.com, degreedays.net or given by wunderground.com.
- Current total electricity consumption comes from the World Bank and the US Energy Information Administration (EIA) with future forecasts derived from the International Energy Agency's (IEA) World Energy Outlook 2018.
- Residential electricity tariffs are based on IEA data.
- Transmission and distribution loss factor is a regional average calculated from electricity production and consumption data published by the IEA.
- Electrification levels come from the IEA's Word Energy Outlook 2018 and the World Bank.
- CO2 emission factors come from the IEA and the Institute of Global Environmental Strategies (IGES) and are assumed constant in future years.
- Product typical characteristics are based on analysis from the UNEP-U4E Model Regulation Guidelines and other data from UNEP-U4E industry partners and technical experts including the US Lawrence Berkeley National Laboratory (LBNL) and GIZ.
- The approach of calculating the potential direct emissions saving of refrigerators and air conditioners is based on expert input from GIZ and LBNL.
- Additional to the above sources, a questionnaire was used to gather data from country officials.
- In a small number of instances, additional data was obtained from internet research or by using proxy data from similar markets.

Further details of the modelling approach and assumptions are available on the U4E website. For more information contact: U4E@un.org

* Denotes savings are from the Minimum Ambition Scenario.