



# Botswana



## 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 **320 GWh** which is **8.1%** of current national electricity use

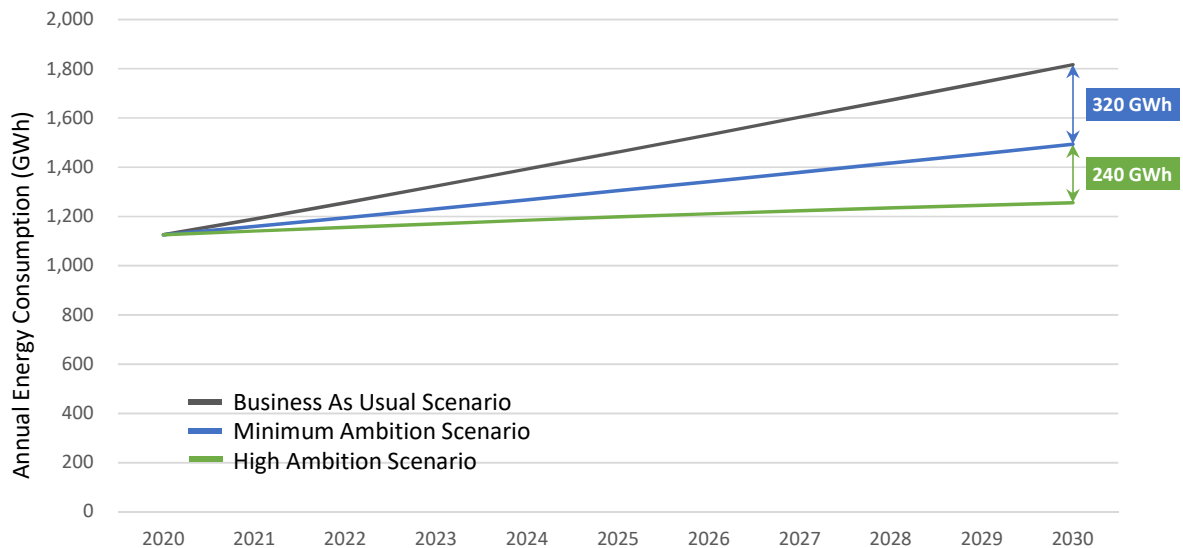


Save electricity worth **27 Million US\$** equivalent to over **3 Power Plants [20MW each]**



Reduce electricity CO<sub>2</sub> emissions by over **640 Thousand tonnes** equivalent to **360 Thousand Passenger Cars**

### EVEN GREATER SAVINGS POSSIBLE WITH MORE STRINGENT REGULATION



### ANNUAL SAVINGS OF LOW GLOBAL WARMING POTENTIAL REFRIGERANTS IN 2030



Direct GHG emissions reduced by over **68 Thousand tonnes**

\* Denotes savings are from the Minimum Ambition Scenario.

# DETAILED BENEFITS

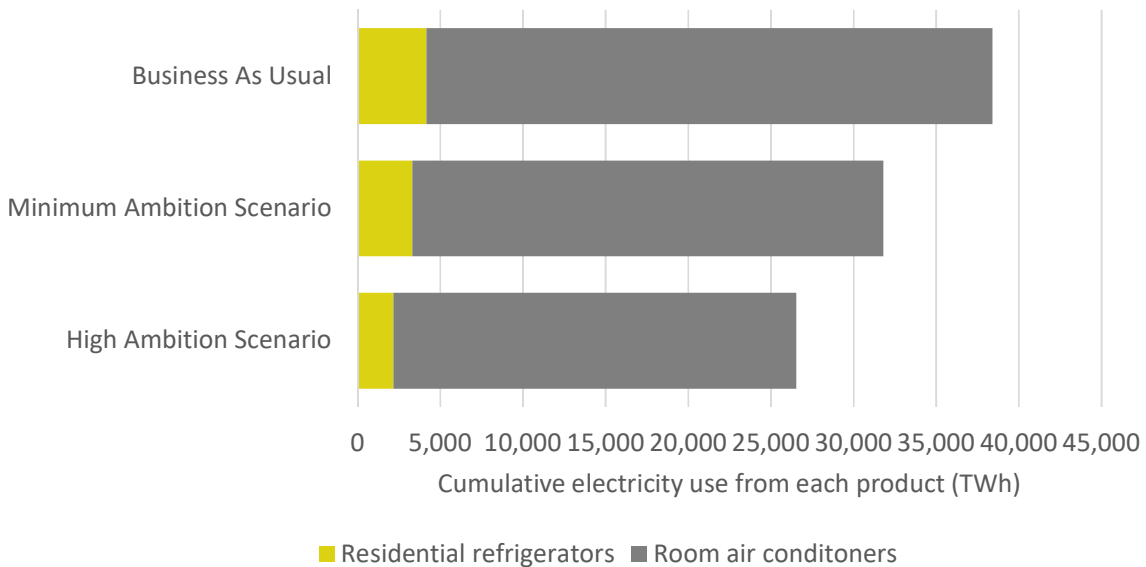
## ANNUAL SAVINGS IN 2025, 2030 AND 2040\*

		Residential Refrigerators			Room Air Conditioners		
		2025	2030	2040	2025	2030	2040
	Electricity (GWh)	17	39	86	140	280	500
	Electricity Bills (Million US\$)	1.4	3.3	7.2	12	24	42
	CO2 Emissions (Thousand tonnes)	34	78	170	280	570	990

## CUMULATIVE SAVINGS BY 2030 AND 2040\*

		Residential Refrigerators		Room Air Conditioners	
		2030	2040	2030	2040
	Electricity (GWh)	200	850	1,600	5,700
	Electricity Bills (Million US\$)	17	72	130	480
	CO2 Emissions (Million tonnes)	0.4	1.7	3.1	11

## CONTRIBUTION TO CUMULATIVE ELECTRICITY USE BY 2040



\* Denotes savings are from the Minimum Ambition Scenario.  
 U4E COUNTRY ASSESSMENT, SEPTEMBER 2019

# Country Data and Input Assumptions



GENERAL INFORMATION		ELECTRICITY MARKET	
Population	2.33 Million	Residential Electricity tariff	0.08 US\$ / kWh
GDP per capita	8,259 US\$	Transmission and distribution loss factor	10.8%
Electrification level	66.0%		
CO2 Emission Factor	1.79 kg / kWh		

## 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	2,673	1,829	1,375	A mix of 3.5 kW and 7 kW Split units with and 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 (2018 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 U.S. 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 World 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

