

Montenegro



LIGHTING



All
Lighting

COOLING



Residential
Refrigerators



Commercial
Refrigeration



Room Air
Conditioners

EQUIPMENT



Industrial
Electric Motors



Distribution
Transformers

INTRODUCTION

The Country Savings assessments provide a summary of the benefits attained from improved energy efficiency and climate friendly lighting, cooling appliances, and equipment. A market transformation can be obtained through measures such as Minimum Energy Performance Standards (MEPS); product labelling; market monitoring and verification; and financial incentives. For each product, the analysis considers three different scenarios:

- **Business As Usual:** Assumes that no actions are introduced and that the efficiency of products in the market continues to develop in line with historical trends in the absence of regulation.
- **Minimum Ambition:** In which MEPS are introduced in line with the basic requirements of the United Nations Environment Programme (UNEP) United for Efficiency (U4E) Model Regulation Guidelines.
- **High Ambition:** In which more ambitious actions are implemented in line with the highest levels proposed in the Model Regulation Guidelines.

More detailed breakdowns for lighting, cooling appliances and equipment can be found on the [UNEP U4E website](#).

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OVERVIEW OF BENEFITS

ANNUAL SAVINGS IN 2040*



Reduce electricity use by over **150 GWh**

which is over **5.7 %** of the total current national electricity use



Save electricity worth over **22 million US\$**

equivalent to more than

1 power plant [20MW each]



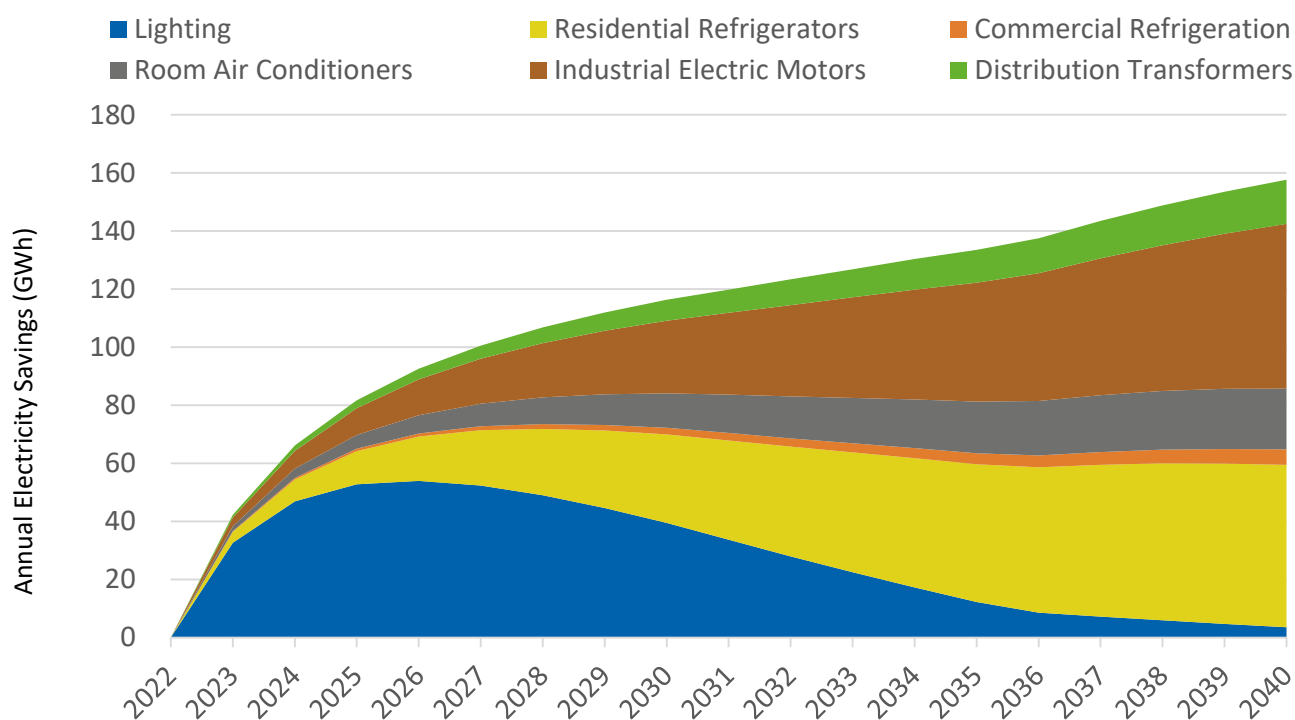
Reduce electricity CO₂ emissions by over **130 thousand tonnes**

equivalent to over

72 thousand passenger cars



ELECTRICITY SAVINGS OVER TIME*



OTHER BENEFITS ACHIEVED IN 2040*



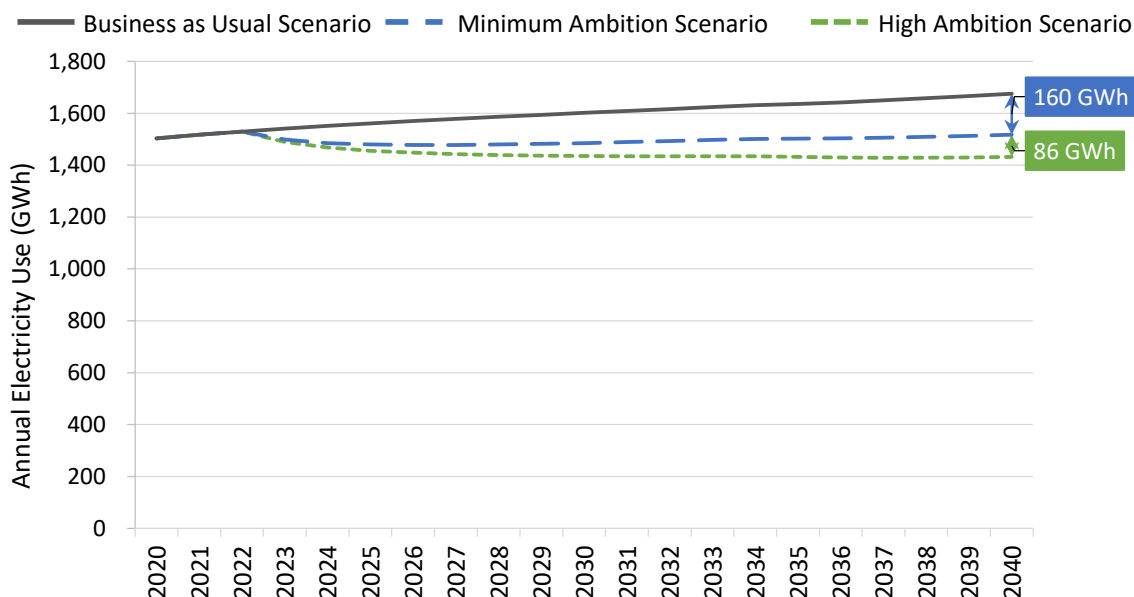
Reduced cumulative direct GHG emissions by **150 thousand tonnes**

* Savings based on Minimum Ambition Scenario



HIGHER AMBITION TO HELP REACH ENERGY AND CLIMATE GOALS

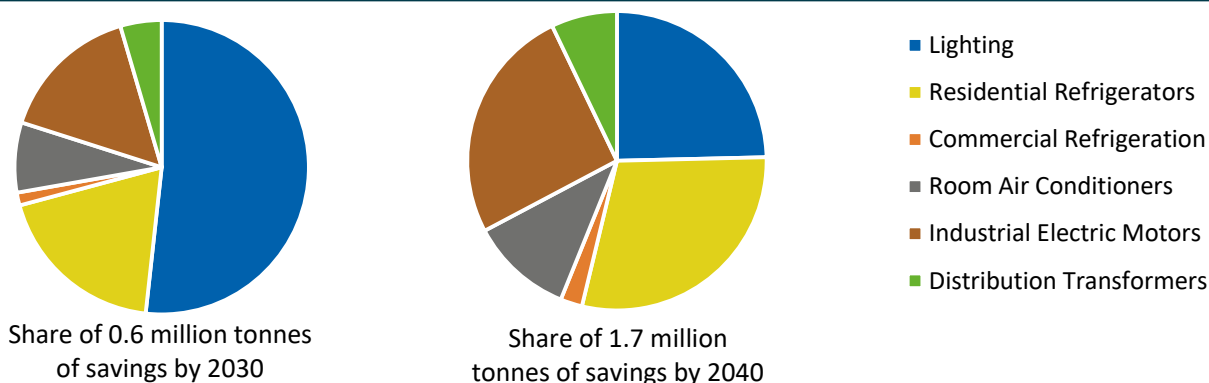
THE MORE AMBITIOUS THE REGULATION, THE MORE SAVINGS ARE POSSIBLE



MEET GLOBAL CLIMATE GOALS BY SIGNIFICANTLY DECREASING EMISSIONS









PRODUCT SHARE OF CO₂ EMISSIONS SAVINGS BY 2030 AND 2040*









* Savings based on Minimum Ambition Scenario

DETAILED BENEFITS AND TYPICAL PRODUCT ASSUMPTIONS

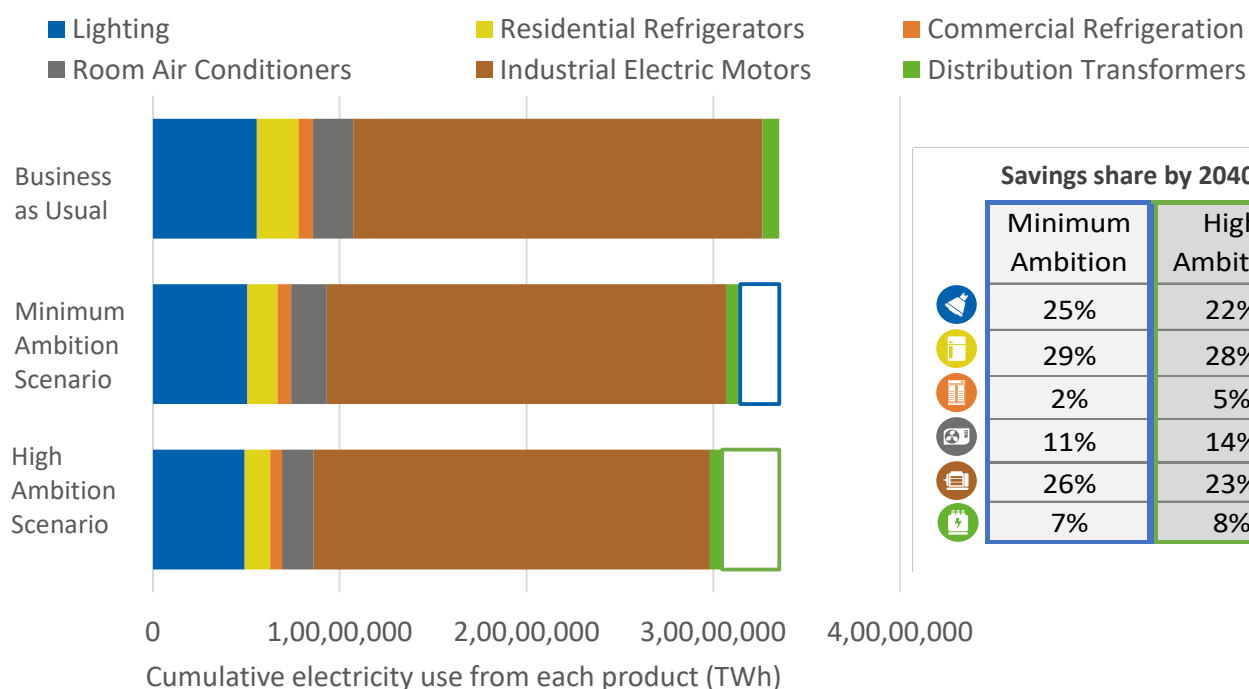
ANNUAL SAVINGS IN 2030 AND 2040*

	2030	2040	2030	2040	2030	2040
Cooling		Residential Refrigerators		Commercial Refrigeration		Room Air Conditioners
Electricity (GWh)	30	56	2.2	5.3	12	21
Electricity Bills (thousand US\$)	4,300	7,900	320	750	1,700	3,000
CO2 Emissions (thousand tonnes)	25	46	1.9	4.4	10	17
Lighting and Equipment		Lighting		Industrial Electric Motors		Distribution Transformers
Electricity (GWh)	39	3.5	25	57	7.2	15
Electricity Bills (thousand US\$)	5,600	490	3,500	8,000	1,000	2,100
CO2 Emissions (thousand tonnes)	33	2.9	21	47	5.9	13

CUMULATIVE SAVINGS BY 2030 AND 2040*

	2030	2040	2030	2040	2030	2040
Cooling		Residential Refrigerators		Commercial Refrigeration		Room Air Conditioners
Electricity (GWh)	140	610	10	49	55	230
Electricity Bills (million US\$)	19	86	1.4	7.0	7.8	33
CO2 Emissions (thousand tonnes)	110	500	8.4	41	46	190
Lighting and Equipment		Lighting		Industrial Electric Motors		Distribution Transformers
Electricity (GWh)	370	520	110	540	33	150
Electricity Bills (million US\$)	52	73	16	76	4.6	21
CO2 Emissions (thousand tonnes)	310	430	92	440	27	120

PRODUCT CONTRIBUTION TO CUMULATIVE ELECTRICITY USE & SAVINGS BY 2040



* Savings based on Minimum Ambition Scenario

SAVINGS POTENTIAL IN CONTEXT


OTHER OPPORTUNITIES COMPARED WITH MEPS BY 2040

Minimum Energy Performance Standards are developed specifically to improve product efficiency in a market, but other important steps can be taken reduce electricity consumption further.

ROOM AIR CONDITIONERS	Savings compared
<ul style="list-style-type: none"> Ensuring products are correctly sized at the time of installation Implementing best practice ongoing maintenance practices Raising the temperature set point for MEPS-compliant units from 22°C can save between 6-10% per degree up to 27°C The use of control systems, sensors and thermal zoning. The savings from AC controls varies greatly depending on the situation but typical savings can be: <ul style="list-style-type: none"> 28-35% for small offices 32-35% for small retail 24% for supermarkets 	<p>U4E MEPS, depending on stringency, will reduce national electricity use by 11%-21%</p> <p>Increasing the temperature set point saves 6%-10%/°C</p> <p>In suitable applications, controls can typically save 24%-35%</p>

LIGHTING	Savings	Compared
<ul style="list-style-type: none"> Occupancy & daylight sensors used in all appropriate settings can typically save up to: <ul style="list-style-type: none"> 40% in commercial settings 30% in industrial settings Dimming controls at off-peak times can typically save as much as: <ul style="list-style-type: none"> 25% for street lighting 	<p>which, by 2040, could save up to:</p> <p>28 GWh/y</p> <p>10.1 GWh/y</p> <p>13.5 GWh/y</p>	<p>U4E MEPS, in the minimum and high ambition scenarios, will reduce national electricity use by 9%-12%</p> <p>In suitable applications, controls can typically save 25%-40%</p>

INDUSTRIAL ELECTRIC MOTORS	Savings	Compared
<ul style="list-style-type: none"> The use of Variable Speed drives in all suitable applications could give an average saving of as much as: <ul style="list-style-type: none"> 20% when used with pumps 20% when used with fans/blowers 10% when used with compressors 5% when used in mechanical applications 	<p>which, by 2040, could save up to:</p> <p>10.6 GWh/y</p> <p>14.1 GWh/y</p> <p>14.4 GWh/y</p> <p>1.1 GWh/y</p>	<p>U4E MEPS, in the minimum and high ambition scenarios, will reduce national electricity use by 2.4%-3.2%</p> <p>In suitable applications, VSDs can typically save 5%-20%</p>

<div data-bbox="130 1619 197 1680"></div> <div data-bbox="225 1646 922 1675">DISTRIBUTION TRANSFORMERS SMART GRIDS</div>	
<p data-bbox="158 1715 627 1814">The main savings opportunities for distribution transformers come from management practices such as:</p> <ul data-bbox="158 1823 654 1995" style="list-style-type: none"><li data-bbox="158 1823 654 1888">▪ Ensuring transformers are correctly sized at the time of installation<li data-bbox="158 1897 654 1995">▪ Implementing best practice ongoing maintenance and rewinding methods	<p data-bbox="721 1715 1339 1736">Using Smart Grids brings other benefits including:</p> <ul data-bbox="721 1749 1431 2031" style="list-style-type: none"><li data-bbox="721 1749 1431 1926">▪ Reducing projected increases in peak demand by as much as 24%, allowing:<ul data-bbox="761 1823 1431 1926" style="list-style-type: none"><li data-bbox="761 1823 1096 1850">▪ reduced capacity overall<li data-bbox="761 1856 1431 1888">▪ delays in maintenance/replacement requirements<li data-bbox="761 1897 1324 1926">▪ reduced CO₂ emissions from peaking plant<li data-bbox="721 1935 1431 2031">▪ Allowing improved integration of distributed and renewable generation, and more electric cars both with associated CO₂ emissions benefits

COUNTRY DATA, TYPICAL PRODUCT ASSUMPTIONS AND METHODOLOGY









GENERAL INFORMATION

Population	628 Thousand
GDP per capita	7,827 US\$
Electrification level	100.0%
CO ₂ emission factor	0.68 kg/kWh

ELECTRICITY MARKET

Residential electricity tariff	0.14 US\$/kWh
Transmission and distribution loss factor	17.6%

TYPICAL PRODUCT ASSUMPTIONS

2022 Unit Energy Consumption (kWh/year) or Efficiency Level									
Product		Business As Usual		Minimum Ambition Scenario		High Ambition Scenario		Type of Product	
Lighting		GSL	15W CFL	15	10W LED	10	7W LED	7	800 lumen bulb: 1,000 hrs/year
		Linear	36W T8	108	20W LED	60	16W LED	48	4 foot tube: 3,000 hrs/year
		HID	70W HPS	307	50W LED	219	40W LED	175	Poletop street light: 4,380hrs/year
Cooling		Residential Refrigerators	589		263		131		2-door refrigerator freezer of average size 270 liters
		Commercial Refrigeration	4,303		3,816		2,826		A market-weighted average of retail display cabinets (both remote and integral), drinks cabinets, storage cabinets, ice-cream freezers, vending machines and scooping cabinets.
		Room Air Conditioners	764		554		404		A mix of 3.5 kW and 7 kW split units with a weighted-average cooling capacity of 5.2 kW
Equipment		Industrial Electric Motors (IEC level)	IE0		IE2		IE3		3-phase induction motors used in the industrial sector
		Distribution Transformers (Model regulation level)	See note		Level 1		Level 2		Three-phase and single-phase liquid-filled and three-phase dry-type power distribution transformers

■ **Distribution transformers Note:** it is assumed that distribution transformers have losses in line with those assumed in the CENELEC harmonization research for the development of the EU standards.

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 each product analysed. The brief methodology is provided below (contact U4E for more information):

- The cooling analyses for refrigerators, commercial refrigeration and air conditioners use a bottom-up stock model approach combined with market data on typical product performance. Future growth is projected based on established relationships between ownership and other known macroeconomic indicators.
- The lighting analysis uses a bottom-up stock model with market data on typical products to estimate current light demand. This is projected forwards in line with IEA estimates of future buildings electricity use. It is then used with an estimate of future average efficacy to calculate electricity consumption. This efficacy is based on assumptions about future trends in lamp switching and product efficacy in different scenarios.
- The equipment models are both top-down estimates. The electricity use of motors is based on its typical relationship to industrial GDP, while distribution transformers are based on the typical capacity required for a total national electricity demand. Electricity use is shared between several typical products and applications based on market data. In both cases, the improvement in average stock efficiency is based on end-of-life stock turnover and new sales.

The savings potential in each scenario assumes Minimum Energy Performance Standards (MEPS) are introduced in 2022 at two different levels of ambition (minimum and high) as shown in the Typical Product Assumptions table above.

Further details of the modelling approach and assumptions are available on the [U4E website](https://www.unep-u4e.org/).

For more information contact: unep-u4e@un.org