Panama

LIGHTING	COOLING			EQUIPMENT	
All Lighting	Residential Refrigerators	Commercial Refrigeration	Room Air Conditioners	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.

REPORT CONTENTS

Clean Cooling COLLABORATIVE

Department for Environment Food & Rural Affairs

gef

UN environment programme

OVERVIEW OF BENEFITS

U4E United for Efficiency
UN environment programme

ANNUAL SAVINGS IN 2040*

Reduce electricity use by over **2.8 TWh** | which is over **23 %** of the total current national electricity use

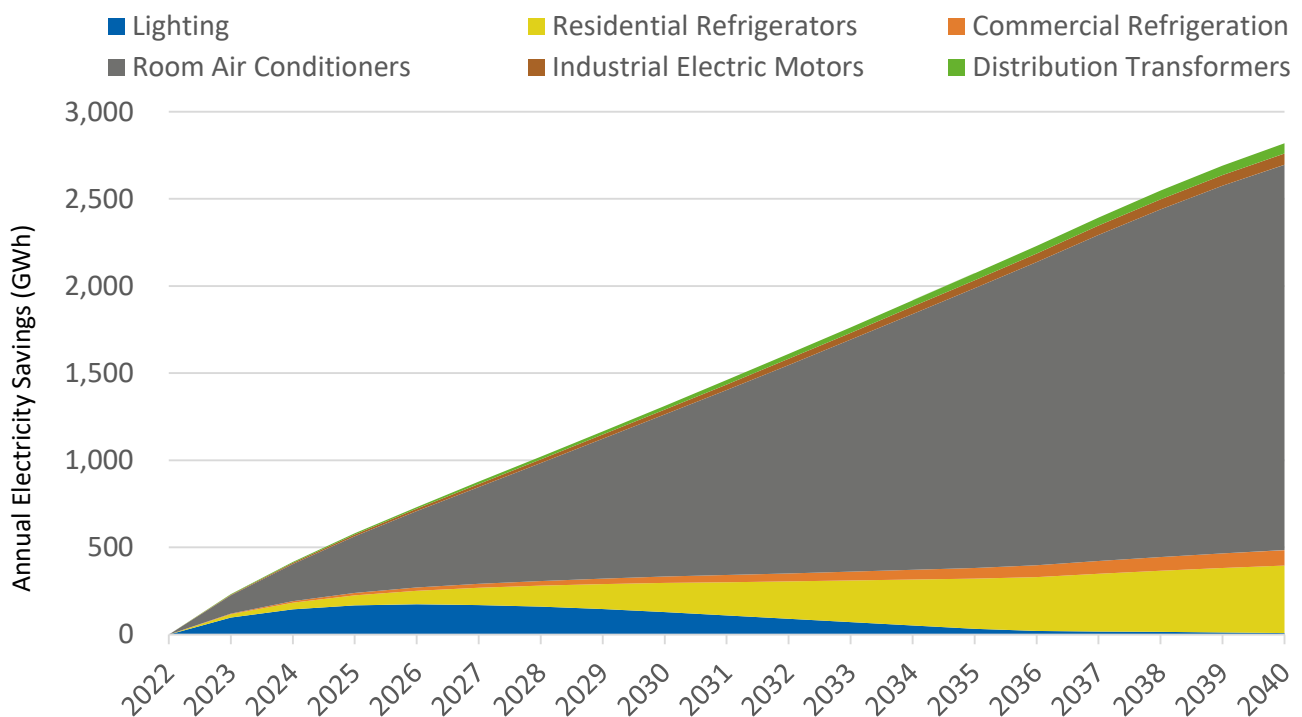Save electricity worth over **720 million US$** | equivalent to more than **1 power plant [500MW each]**

Reduce electricity CO_2 emissions by over **2.2 million tonnes** | equivalent to over **1.2 million passenger cars**

ELECTRICITY SAVINGS OVER TIME*

Legend:
- Lighting
- Residential Refrigerators
- Commercial Refrigeration
- Room Air Conditioners
- Industrial Electric Motors
- Distribution Transformers

Annual Electricity Savings (GWh)

Y-axis: 0, 500, 1,000, 1,500, 2,000, 2,500, 3,000

X-axis: 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040
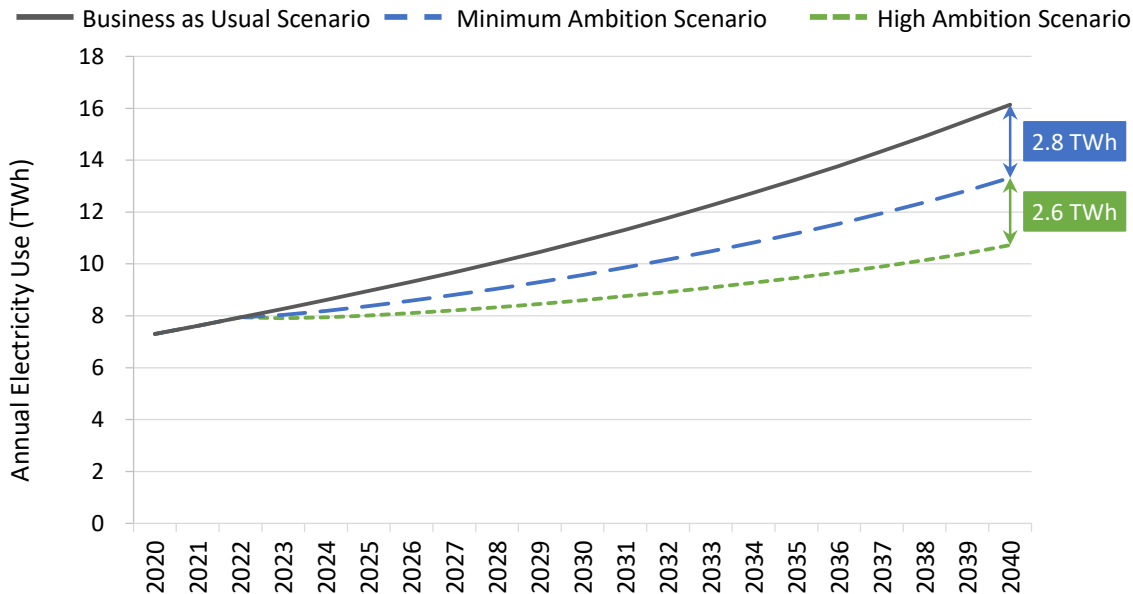
OTHER BENEFITS ACHIEVED IN 2040*

Reduced cumulative direct GHG emissions by **2.4 million tonnes**
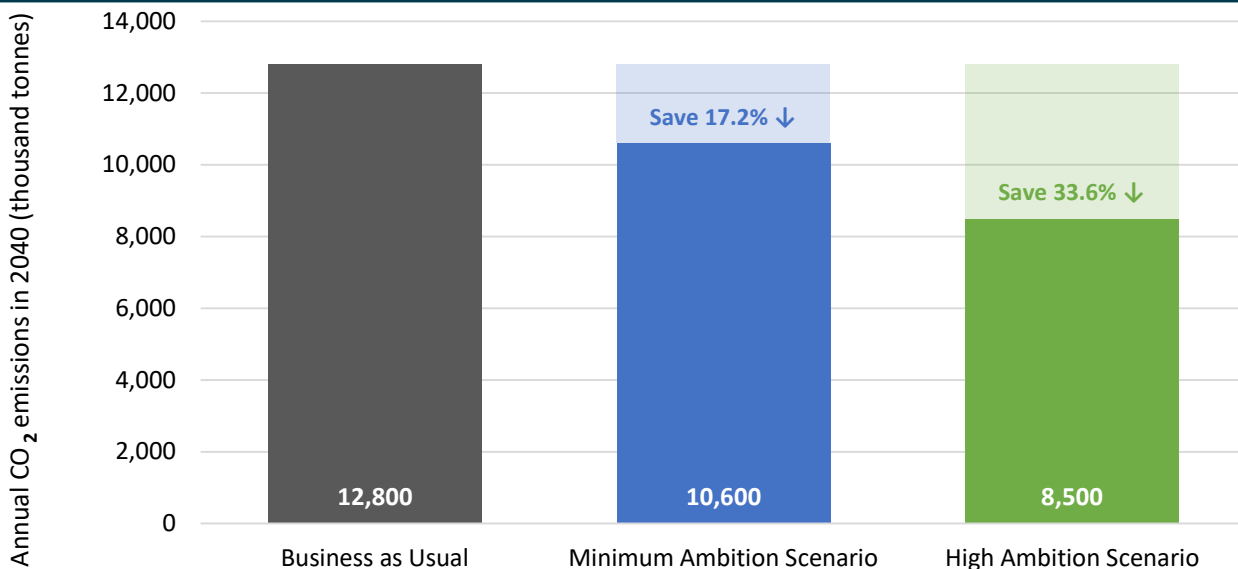
* Savings based on Minimum Ambition Scenario

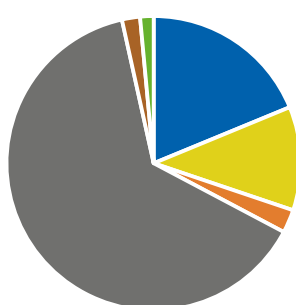# HIGHER AMBITION TO HELP REACH ENERGY AND CLIMATE GOALS

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United for Efficiency

THE MORE AMBITIOUS THE REGULATION, THE MORE SAVINGS ARE POSSIBLE

— Business as Usual Scenario   – – Minimum Ambition Scenario   – – High Ambition Scenario

Annual Electricity Use (TWh)

(Line chart, x-axis years 2020–2040, y-axis 0–18 TWh)

2.8 TWh

2.6 TWh

By 2040, electricity consumption is projected to increase by **103%**

Minimum ambition policies could reduce this increase to **68%**

More ambitious policies could further reduce this increase to **35%**

MEET GLOBAL CLIMATE GOALS BY SIGNIFICANTLY DECREASING EMISSIONS

Annual CO_2 emissions in 2040 (thousand tonnes)

(Bar chart)

Save 17.2% ↓

Save 33.6% ↓

12,800 Business as Usual

10,600 Minimum Ambition Scenario

8,500 High Ambition Scenario

PRODUCT SHARE OF CO_2 EMISSIONS SAVINGS BY 2030 AND 2040*

(Two pie charts)

Share of 5 million tonnes of savings by 2030
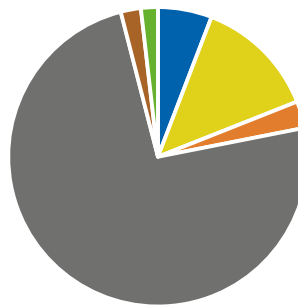
Share of 22.1 million tonnes of savings by 2040

- ■ Lighting
- ■ Residential Refrigerators
- ■ Commercial Refrigeration
- ■ Room Air Conditioners
- ■ Industrial Electric Motors
- ■ Distribution Transformers

* Savings based on Minimum Ambition Scenario

DETAILED BENEFITS AND TYPICAL PRODUCT ASSUMPTIONS

ANNUAL SAVINGS IN 2030 AND 2040*

Cooling	2030	2040		2030	2040		2030	2040
		Residential Refrigerators			Commercial Refrigeration			Room Air Conditioners
Electricity (GWh)	170	390		37	88		930	2,200
Electricity Bills (million US$)	42	98		9.3	22		240	560
CO2 Emissions (thousand tonnes)	130	310		29	70		740	1,800
Lighting and Equipment		Lighting			Industrial Electric Motors			Distribution Transformers
Electricity (GWh)	130	10		28	65		22	59
Electricity Bills (million US$)	33	2.4		7.1	16		5.6	15
CO2 Emissions (thousand tonnes)	100	7.6		22	51		17	47

CUMULATIVE SAVINGS BY 2030 AND 2040*

Cooling	2030	2040		2030	2040		2030	2040
		Residential Refrigerators			Commercial Refrigeration			Room Air Conditioners
Electricity (GWh)	720	3,700		160	810		4,000	21,000
Electricity Bills (million US$)	180	930		41	210		1,000	5,200
CO2 Emissions (thousand tonnes)	570	2,900		130	640		3,200	16,000
Lighting and Equipment		Lighting			Industrial Electric Motors			Distribution Transformers
Electricity (GWh)	1,200	1,600		130	610		94	510
Electricity Bills (million US$)	300	410		32	150		24	130
CO2 Emissions (thousand tonnes)	940	1,300		100	480		74	400

PRODUCT CONTRIBUTION TO CUMULATIVE ELECTRICITY USE & SAVINGS BY 2040

- Lighting
- Residential Refrigerators
- Commercial Refrigeration
- Room Air Conditioners
- Industrial Electric Motors
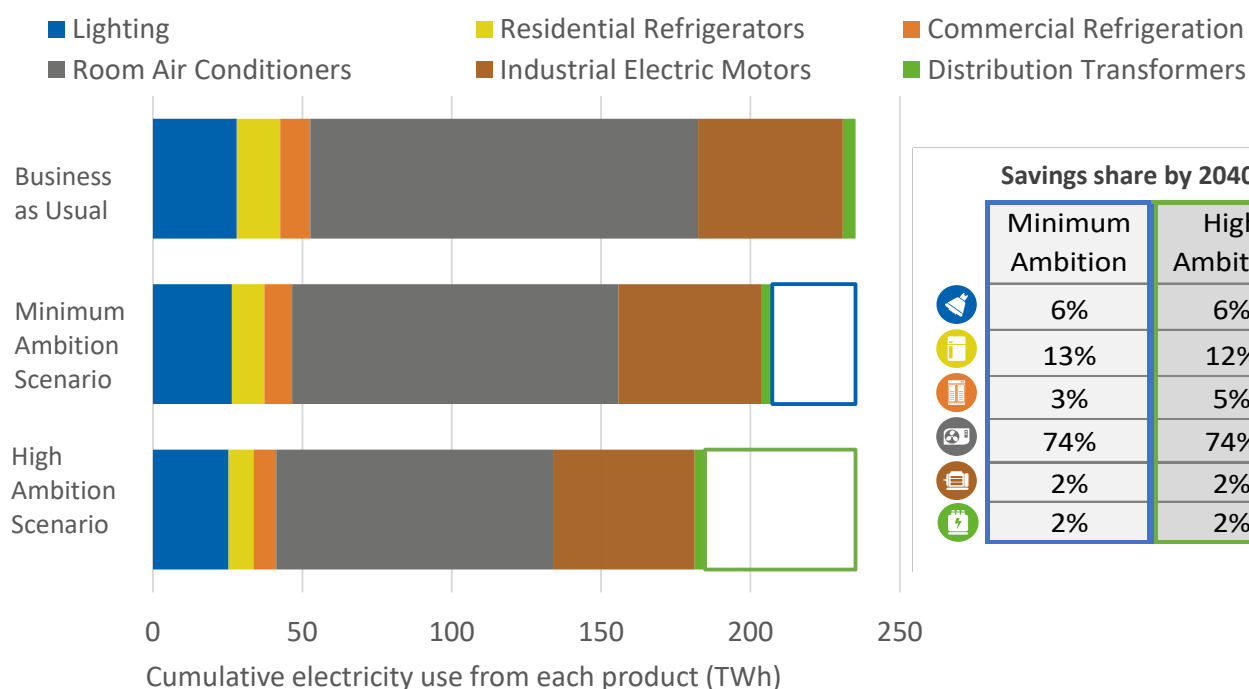- Distribution Transformers

Cumulative electricity use from each product (TWh)

Savings share by 2040:

	Minimum Ambition	High Ambition
(Lighting)	6%	6%
(Residential Refrigerators)	13%	12%
(Commercial Refrigeration)	3%	5%
(Room Air Conditioners)	74%	74%
(Industrial Electric Motors)	2%	2%
(Distribution Transformers)	2%	2%

* Savings based on Minimum Ambition Scenario

SAVINGS POTENTIAL IN CONTEXT

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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

- 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:
  - 28-35% for small offices
  - 32-35% for small retail
  - 24% for supermarkets

Savings compared	
U4E MEPS, depending on stringency, will reduce national electricity use by	16%-29%
Increasing the temperature set point saves	6%-10%/°C
In suitable applications, controls can typically save	24%-35%

LIGHTING

	Savings	Compared	
	which, by 2040, could save up to:	U4E MEPS, in the minimum and high ambition scenarios, will reduce national electricity use by	6%-10%

- Occupancy & daylight sensors used in all appropriate settings can typically save up to:
  - 40% in commercial settings — 175.3 GWh/y
  - 30% in industrial settings — 64.6 GWh/y
- Dimming controls at off-peak times can typically save as much as:
  - 25% for street lighting — 100.4 GWh/y

In suitable applications, controls can typically save	25%-40%

INDUSTRIAL ELECTRIC MOTORS

	Savings	Compared	
	which, by 2040, could save up to:	U4E MEPS, in the minimum and high ambition scenarios, will reduce national electricity use by	1.3%-2.1%

- The use of Variable Speed drives in all suitable applications could give an average saving of as much as:
  - 20% when used with pumps — 24.6 GWh/y
  - 20% when used with fans/blowers — 33 GWh/y
  - 10% when used with compressors — 33.5 GWh/y
  - 5% when used in mechanical applications — 2.5 GWh/y

In suitable applications, VSDs can typically save	5%-20%

DISTRIBUTION TRANSFORMERS   SMART GRIDS

The main savings opportunities for distribution transformers come from management practices such as:
- Ensuring transformers are correctly sized at the time of installation
- Implementing best practice ongoing maintenance and rewinding methods

Using Smart Grids brings other benefits including:
- Reducing projected increases in peak demand by as much as 24%, allowing:
  - reduced capacity overall
  - delays in maintenance/replacement requirements
  - reduced CO_2 emissions from peaking plant
- Allowing improved integration of distributed and renewable generation, and more electric cars both with associated CO_2 emissions benefits

COUNTRY DATA, TYPICAL PRODUCT ASSUMPTIONS AND METHODOLOGY

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GENERAL INFORMATION

Population	4.38 Million
GDP per capita	12,903 US$
Electrification level	96.6%
CO_2 emission factor	0.68 kg/kWh

ELECTRICITY MARKET

Residential electricity tariff	0.25 US$/kWh
Transmission and distribution loss factor	14.3%

TYPICAL PRODUCT ASSUMPTIONS

	Product	2022 Unit Energy Consumption (kWh/year) or Efficiency Level			Type of Product
		Business As Usual	Minimum Ambition Scenario	High Ambition Scenario	
Lighting	*GSL* *Linear* *HID*	*15W CFL* 15 *36W T8* 108 *70W HPS* 307	*10W LED* 10 *20W LED* 60 *50W LED* 219	*7W LED* 7 *16W LED* 48 *40W LED* 175	800 lumen bulb: 1,000 hrs/year 4 foot tube: 3,000 hrs/year Poletop street light: 4,380hrs/year
Cooling	Residential Refrigerators	457	263	131	2-door refrigerator freezer of average size 270 liters
	Commercial Refrigeration	5,399	4,792	3,579	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	3,573	2,504	1,839	A mix of 3.5 kW and 7 kW split units with a weighted-average cooling capacity of 4.6 kW
Equipment	Industrial Electric Motors (IEC level)	*IE1*	*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.
For more information contact: unep-u4e@un.org