Ethiopia

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.

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 **2.4 TWh** which is over **14 %** of the total current national electricity use

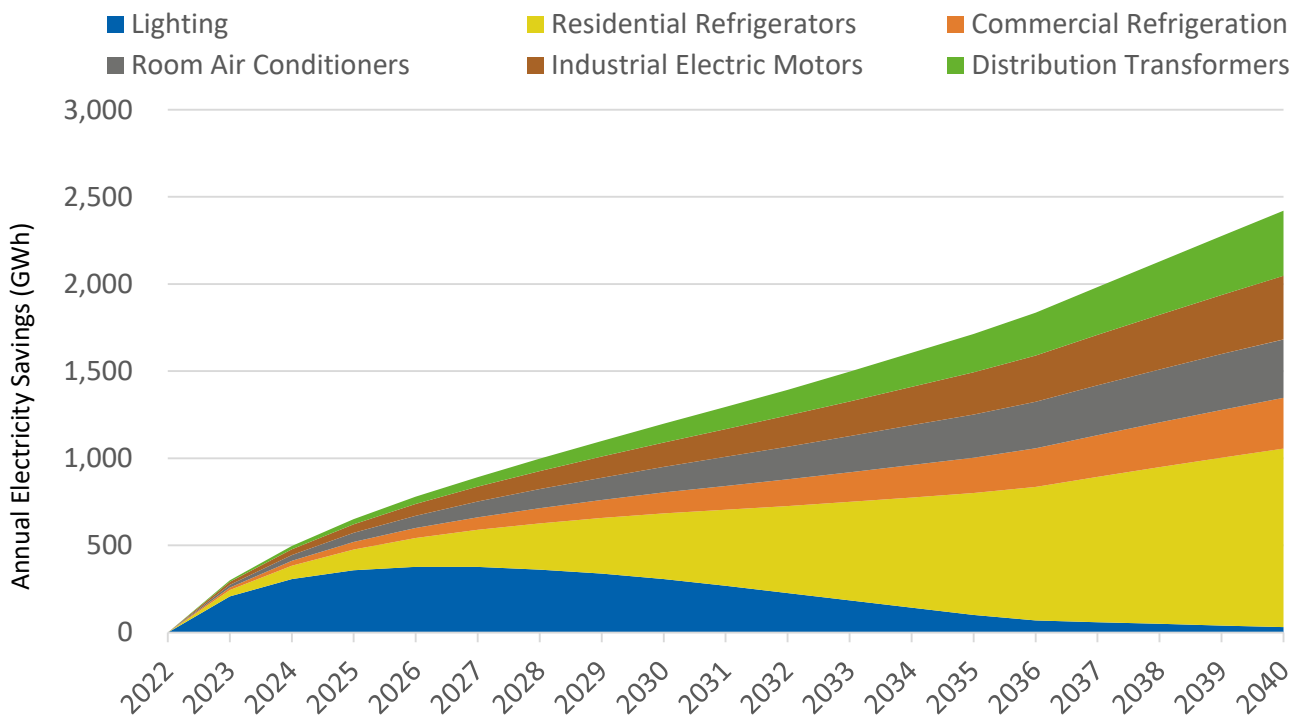Save electricity worth over **87 million US$** equivalent to more than **1 power plant [500MW each]**

Reduce electricity CO_2 emissions by over **130 thousand tonnes** equivalent to over **74 thousand passenger cars**

ELECTRICITY SAVINGS OVER TIME*

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

Annual Electricity Savings (GWh) — years 2022 to 2040

OTHER BENEFITS ACHIEVED IN 2040*

Increased grid connection to **1.2 million households**

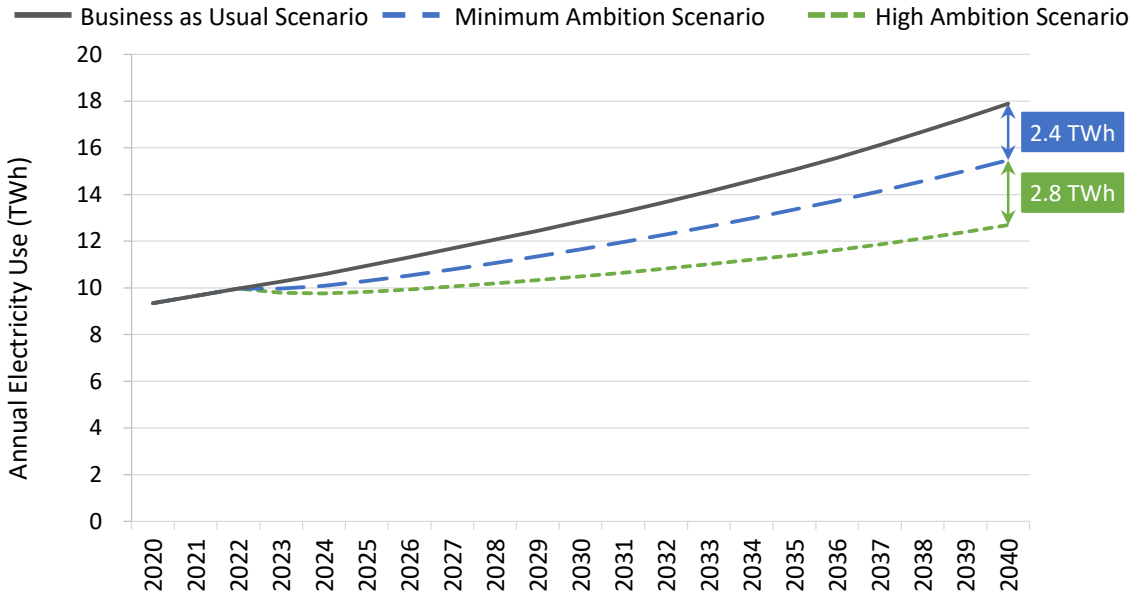Reduced cumulative direct GHG emissions by **2.4 million tonnes**

* Savings based on Minimum Ambition Scenario

HIGHER AMBITION TO HELP REACH ENERGY AND CLIMATE GOALS

U4E United for Efficiency
UN environment programme

THE MORE AMBITIOUS THE REGULATION, THE MORE SAVINGS ARE POSSIBLE

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

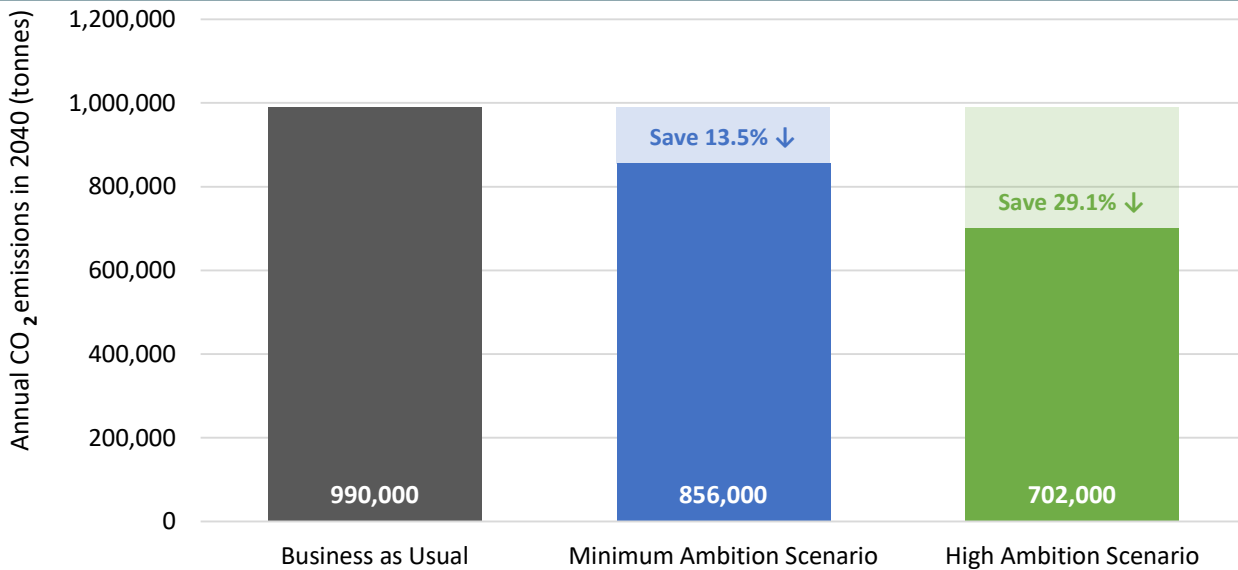Annual Electricity Use (TWh) — years 2020 to 2040

2.4 TWh
2.8 TWh

By 2040, electricity consumption is projected to increase by **80%**

Minimum ambition policies could reduce this increase to **55%**

More ambitious policies could further reduce this increase to **27%**

MEET GLOBAL CLIMATE GOALS BY SIGNIFICANTLY DECREASING EMISSIONS

Annual CO_2 emissions in 2040 (tonnes)

- Business as Usual: **990,000**
- Minimum Ambition Scenario: **856,000** — Save 13.5% ↓
- High Ambition Scenario: **702,000** — Save 29.1% ↓

PRODUCT SHARE OF CO_2 EMISSIONS SAVINGS BY 2030 AND 2040*
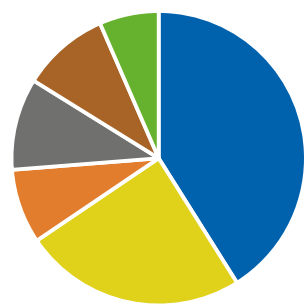
Share of 0.4 million tonnes of savings by 2030
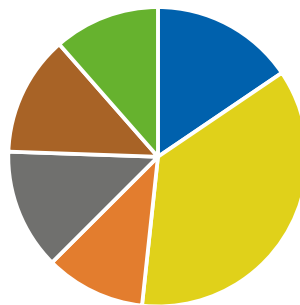
Share of 1.4 million tonnes of savings by 2040

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

* Savings based on Minimum Ambition Scenario
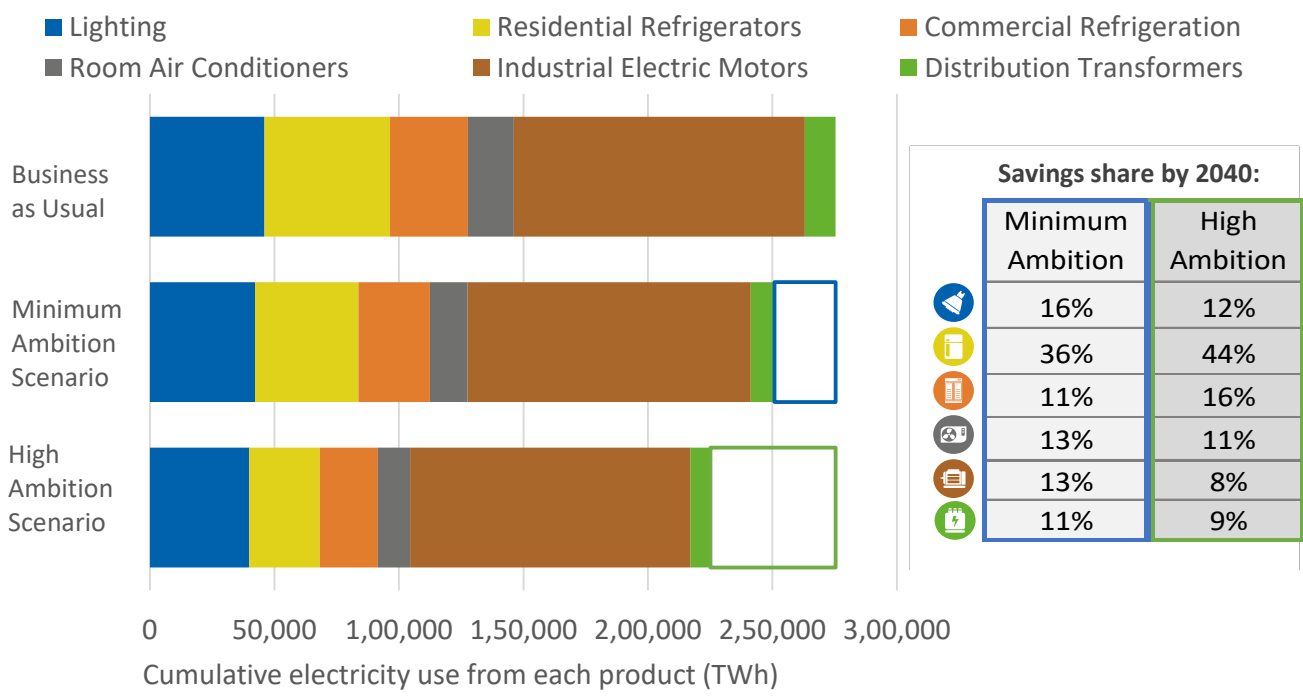
DETAILED BENEFITS AND TYPICAL PRODUCT ASSUMPTIONS

ANNUAL SAVINGS IN 2030 AND 2040*

	2030	2040		2030	2040		2030	2040
Cooling		Residential Refrigerators		Commercial Refrigeration		Room Air Conditioners		
Electricity (GWh)	380	1,000	120	290	150	330		
Electricity Bills (million US$)	14	37	4.3	10	5.3	12		
CO2 Emissions (thousand tonnes)	21	57	6.6	16	8.2	18		
Lighting and Equipment		Lighting		Industrial Electric Motors		Distribution Transformers		
Electricity (GWh)	310	31	140	370	110	370		
Electricity Bills (million US$)	11	1.1	5.0	13	3.9	13		
CO2 Emissions (thousand tonnes)	17	1.7	7.7	20	6.0	21		

CUMULATIVE SAVINGS BY 2030 AND 2040*

	2030	2040		2030	2040		2030	2040
Cooling		Residential Refrigerators		Commercial Refrigeration		Room Air Conditioners		
Electricity (TWh)	1.6	8.9	0.5	2.7	0.6	3.2		
Electricity Bills (million US$)	57	320	19	96	23	120		
CO2 Emissions (thousand tonnes)	87	490	29	150	36	180		
Lighting and Equipment		Lighting		Industrial Electric Motors		Distribution Transformers		
Electricity (TWh)	2.6	3.8	0.6	3.2	0.4	2.8		
Electricity Bills (million US$)	95	140	22	110	15	100		
CO2 Emissions (thousand tonnes)	150	210	34	180	23	160		

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	16%	12%
Residential Refrigerators	36%	44%
Commercial Refrigeration	11%	16%
Room Air Conditioners	13%	11%
Industrial Electric Motors	13%	8%
Distribution Transformers	11%	9%

* 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

- 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	17%-30%
Increasing the temperature set point saves	6%-10%/°C
In suitable applications, controls can typically save	24%-35%

LIGHTING

- Occupancy & daylight sensors used in all appropriate settings can typically save up to:
  - 40% in commercial settings
  - 30% in industrial settings
- Dimming controls at off-peak times can typically save as much as:
  - 25% for street 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	8%-13%
421.1 GWh/y		
110.7 GWh/y		
	In suitable applications, controls can typically save	25%-40%
148.1 GWh/y		

INDUSTRIAL ELECTRIC MOTORS

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

Savings	Compared	
which, by 2040, could save up to:	U4E MEPS, in the minimum and high ambition scenarios, will reduce national electricity use by	2.7%-3.6%
63.4 GWh/y		
84.8 GWh/y		
86.2 GWh/y	In suitable applications, VSDs can typically save	5%-20%
6.4 GWh/y		

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

GENERAL INFORMATION

Population	118 Million
GDP per capita	966 US$
Electrification level	57.9%
CO₂ emission factor	0.05 kg/kWh

ELECTRICITY MARKET

Residential electricity tariff	0.04 US$/kWh
Transmission and distribution loss factor	18.7%

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	330	247	123	2-door refrigerator freezer of average size 210 liters
	Commercial Refrigeration	3,714	3,333	2,522	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	1,431	964	695	A mix of 3.5 kW and 7 kW split units with a weighted-average cooling capacity of 5 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: BAU assumes that 10% of the market is influenced by the most recent technical specifications for all liquid-filled types in Mozambique and Rwanda and dry-types in Mozambique.*

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