# COUNTRY SAVINGS ASSESSMENT

# Mali

**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

# OVERVIEW OF BENEFITS

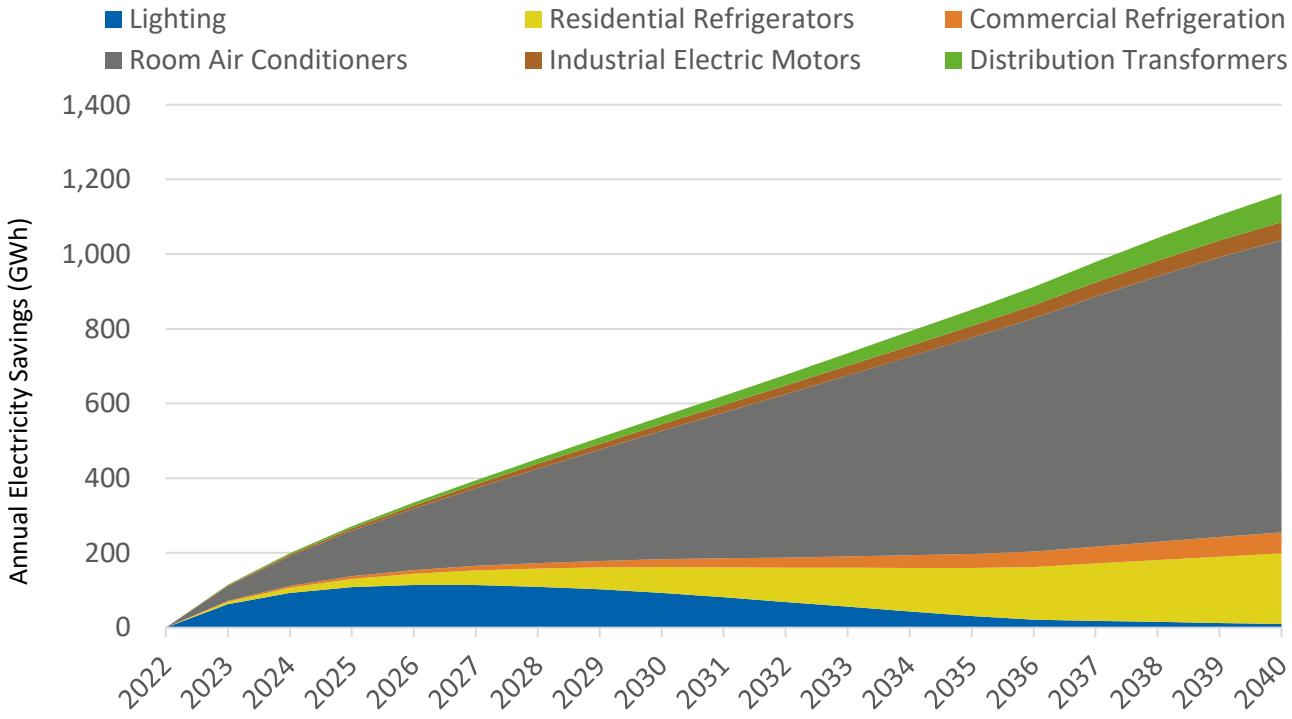
## ANNUAL SAVINGS IN 2040*

Reduce electricity use by over **1.1 TWh** | which is over **31 %** of the total current national electricity use

Save electricity worth over **160 million US$** | equivalent to more than **2 power plants [100MW each]**

Reduce electricity $CO_2$ emissions by over **820 thousand tonnes** | equivalent to over **460 thousand passenger cars**

## ELECTRICITY SAVINGS OVER TIME*




## OTHER BENEFITS ACHIEVED IN 2040*

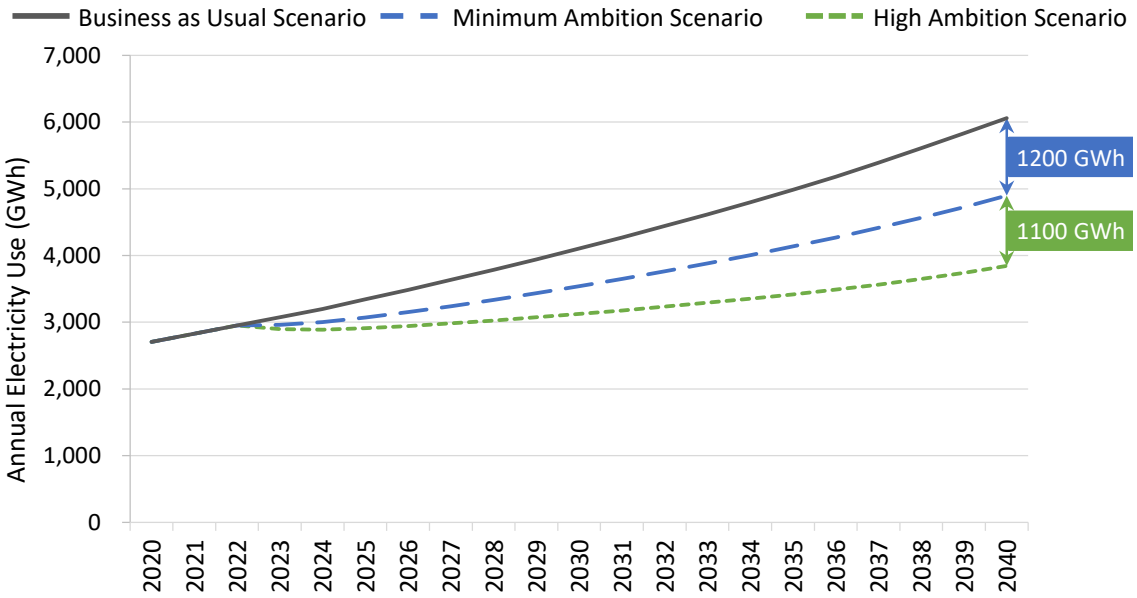
Increased grid connection to **580 thousand households**

Reduced cumulative direct GHG emissions by **760 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

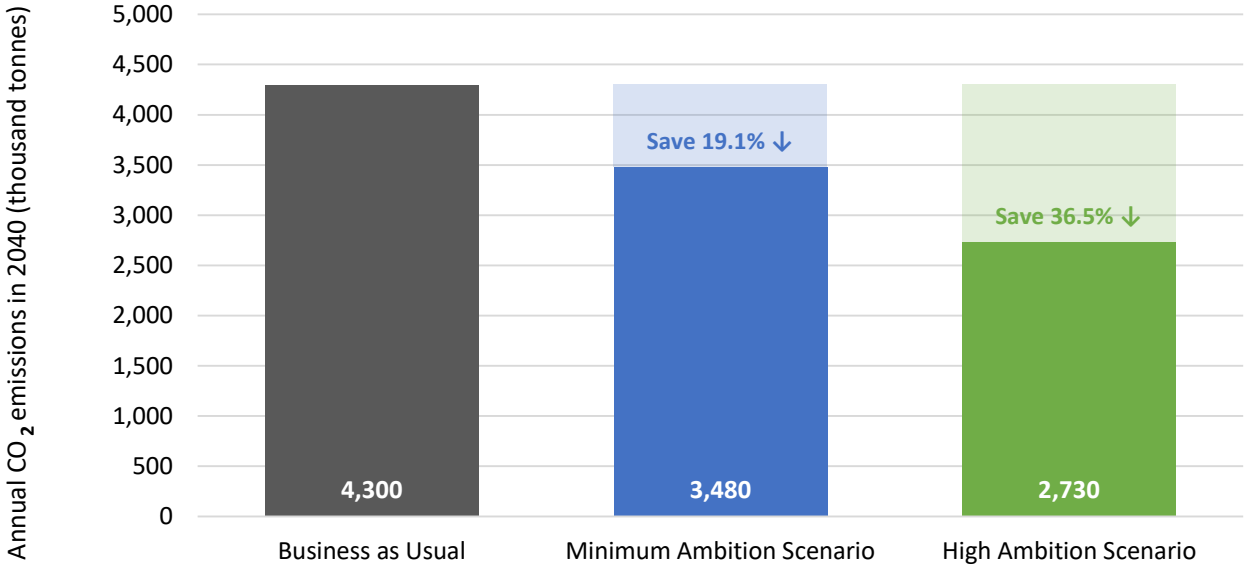



By 2040, electricity consumption is projected to increase by **105%**

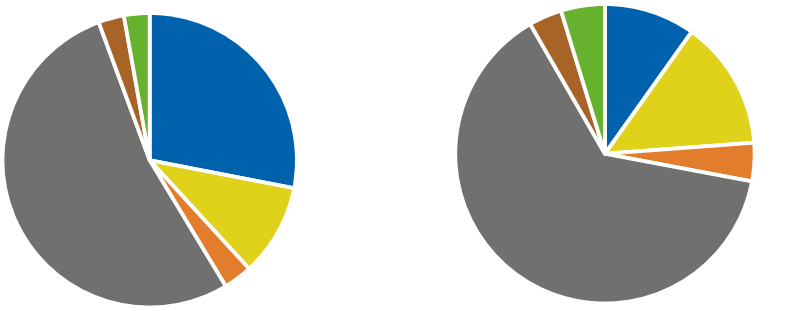
Minimum ambition policies could reduce this increase to **66%**

More ambitious policies could further reduce this increase to **30%**

## MEET GLOBAL CLIMATE GOALS BY SIGNIFICANTLY DECREASING EMISSIONS




## PRODUCT SHARE OF $CO_2$ EMISSIONS SAVINGS BY 2030 AND 2040*




Share of 2 million tonnes of savings by 2030

Share of 8.3 million tonnes of savings by 2040

* Savings based on Minimum Ambition Scenario

# DETAILED BENEFITS AND TYPICAL PRODUCT ASSUMPTIONS

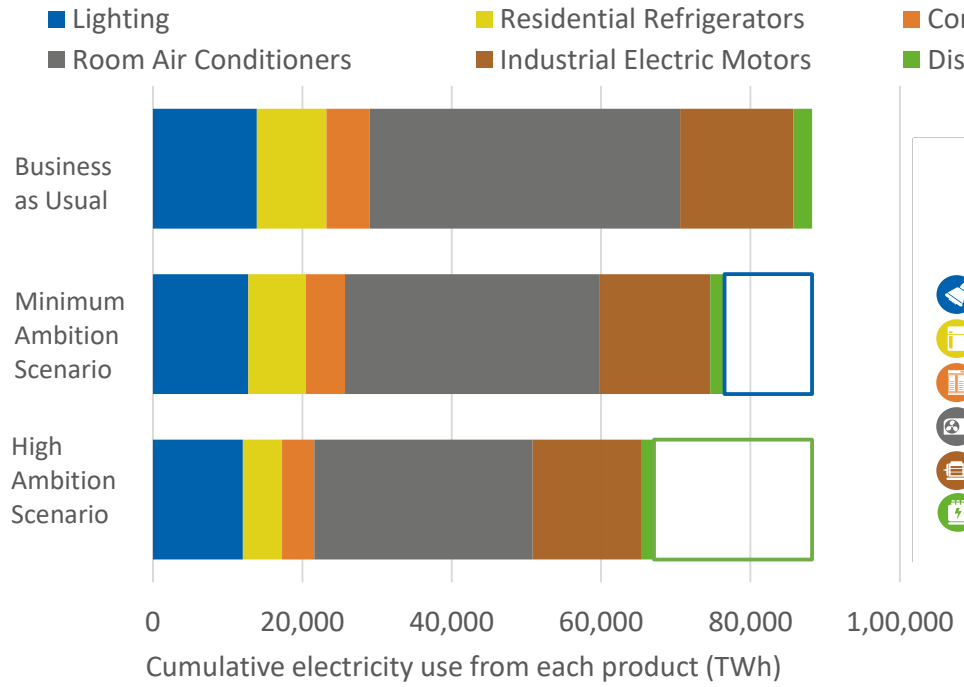
## ANNUAL SAVINGS IN 2030 AND 2040*

| | 2030 | 2040 | 2030 | 2040 | 2030 | 2040 |
|---|---|---|---|---|---|---|
| **Cooling** | | Residential Refrigerators | | Commercial Refrigeration | | Room Air Conditioners |
| Electricity (GWh) | 69 | 190 | 21 | 56 | 340 | 780 |
| Electricity Bills (million US$) | 10 | 27 | 3.0 | 8.0 | 49 | 110 |
| CO2 Emissions (thousand tonnes) | 49 | 130 | 15 | 40 | 240 | 560 |
| **Lighting and Equipment** | | Lighting | | Industrial Electric Motors | | Distribution Transformers |
| Electricity (GWh) | 93 | 9.5 | 18 | 48 | 20 | 76 |
| Electricity Bills (million US$) | 13 | 1.3 | 2.6 | 6.9 | 2.9 | 11 |
| CO2 Emissions (thousand tonnes) | 66 | 6.7 | 13 | 34 | 14 | 54 |

## CUMULATIVE SAVINGS BY 2030 AND 2040*

| | 2030 | 2040 | 2030 | 2040 | 2030 | 2040 |
|---|---|---|---|---|---|---|
| **Cooling** | | Residential Refrigerators | | Commercial Refrigeration | | Room Air Conditioners |
| Electricity (GWh) | 290 | 1,600 | 90 | 480 | 1,500 | 7,500 |
| Electricity Bills (million US$) | 41 | 230 | 13 | 69 | 210 | 1,100 |
| CO2 Emissions (thousand tonnes) | 200 | 1,200 | 64 | 340 | 1,100 | 5,300 |
| **Lighting and Equipment** | | Lighting | | Industrial Electric Motors | | Distribution Transformers |
| Electricity (GWh) | 800 | 1,200 | 80 | 420 | 80 | 560 |
| Electricity Bills (million US$) | 110 | 160 | 11 | 60 | 11 | 79 |
| CO2 Emissions (thousand tonnes) | 570 | 820 | 57 | 300 | 57 | 390 |

## PRODUCT CONTRIBUTION TO CUMULATIVE ELECTRICITY USE & SAVINGS BY 2040




**Savings share by 2040:**

| | Minimum Ambition | High Ambition |
|---|---|---|
| Lighting | 10% | 9% |
| Residential Refrigerators | 14% | 19% |
| Commercial Refrigeration | 4% | 7% |
| Room Air Conditioners | 64% | 58% |
| Industrial Electric Motors | 4% | 3% |
| Distribution Transformers | 5% | 4% |

* 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 | 18%-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% |
| **127.2 GWh/y** | | |
| **33.4 GWh/y** | | |
| | In suitable applications, controls can typically save | 25%-40% |
| **44.7 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 | 2.8%-3.7% |
| **8.3 GWh/y** | | |
| **11.1 GWh/y** | | |
| **11.3 GWh/y** | In suitable applications, VSDs can typically save | 5%-20% |
| **0.8 GWh/y** | | |

### DISTRIBUTION TRANSFORMERS

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

### SMART GRIDS

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 | 20.9 Million |
| GDP per capita | 888 US$ |
| Electrification level | 50.4% |
| $CO_2$ emission factor | 0.65 kg/kWh |

## ELECTRICITY MARKET

| | |
|---|---|
| Residential electricity tariff | 0.14 US$/kWh |
| Transmission and distribution loss factor | 9.2% |

## TYPICAL PRODUCT ASSUMPTIONS

| | Product | 2022 Unit Energy Consumption (kWh/year) or Efficiency Level: Business As Usual | Minimum Ambition Scenario | High Ambition Scenario | Type of Product |
|---|---|---|---|---|---|
| Lighting | *GSL*<br>*Linear*<br>*HID* | *15W CFL* 15<br>*36W T8* 108<br>*70W HPS* 307 | *10W LED* 10<br>*20W LED* 60<br>*50W LED* 219 | *7W LED* 7<br>*16W LED* 48<br>*40W LED* 175 | 800 lumen bulb: 1,000 hrs/year<br>4 foot tube: 3,000 hrs/year<br>Poletop street light: 4,380hrs/year |
| Cooling | Residential Refrigerators | 330 | 247 | 123 | 2-door refrigerator freezer of average size 210 liters |
| Cooling | Commercial Refrigeration | 3,706 | 3,326 | 2,518 | A market-weighted average of retail display cabinets (both remote and integral), drinks cabinets, storage cabinets, ice-cream freezers, vending machines and scooping cabinets. |
| Cooling | Room Air Conditioners | 4,219 | 2,786 | 2,022 | 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 |
| Equipment | 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