



# **CPR Briefing on United for Efficiency**

## **Country Saving Assessments: Energy-Efficient and Climate Friendly Appliances and Equipment**

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# U4E Partner Organizations

## Manufacturers & Industry Associations



## Technical Organizations & Initiatives



## Funders & Financiers



# Country Savings Assessments

## Objective

Analysis on potential impact of adopting Model Regulation guidelines for lighting, room air conditioners, residential refrigerators, commercial refrigeration equipment, industrial electric motors and distribution transformers.

These product categories are responsible for >50% of electricity usage today.

## Overview

- The assessment provides three scenarios: **Business As Usual Scenario (BAU)**– No policy intervention; **Minimum Ambition Scenario** – assumes Minimum Energy Performance Standards (MEPS) implemented; **High Ambition Scenario** – Assumes MEPS are implemented at a higher level of ambition for six products.
- The **energy savings potential** is calculated till 2040 and is computed based on the difference between total energy consumption in the ambition scenarios and that of the BAU scenario and is expressed in terms of **GHG emissions mitigated, Capacity (Power plants) avoidance and financial savings.**

### COUNTRY SAVINGS ASSESSMENT

## Rwanda



**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 certification; 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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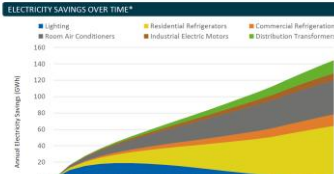
UNEP U4E logo, Clean Cooling Collaborative, Department for Environment, Food & Rural Affairs, UN Environment Programme logos.

### OVERVIEW OF BENEFITS

**ANNUAL SAVINGS IN 2040\***

- Reduce electricity use by over **140 GWh** which is over **20%** of the total current national electricity use
- Save electricity worth over **29 million US\$** equivalent to more than **1 power plant (20MW each)**
- Reduce electricity **100 thousand tonnes** equivalent to over **58 thousand passenger cars**

**ELECTRICITY SAVINGS OVER TIME\***



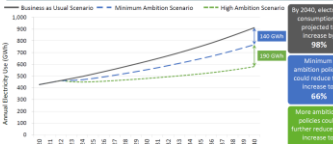
**OTHER BENEFITS ACHIEVED IN 2040\***

- Increased grid connection to **72 thousand households**
- Reduced cumulative direct GHG emissions by **190 thousand tonnes**

UNEP U4E logo, \*Savings based on Minimum Ambition Scenario

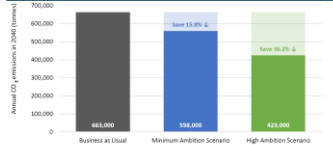
### HIGHER AMBITION TO HELP REACH ENERGY AND CLIMATE GOALS

THE MORE AMBITIOUS THE REGULATION, THE MORE SAVINGS ARE POSSIBLE




By 2040, electricity consumption is projected to reach 965 TWh. Minimum ambition policies could reduce this increase to 66%. Very ambitious policies could further reduce this increase to 20%.

**MEET GLOBAL CLIMATE GOALS BY SIGNIFICANTLY DECREASING EMISSIONS**



Business as Usual: 688,000 million tonnes  
Minimum Ambition Scenario: 598,000 million tonnes (Save 13.2%)\*  
High Ambition Scenario: 428,000 million tonnes (Save 38.2%)\*

**PRODUCT SHARE OF CO2 EMISSIONS SAVINGS BY 2030 AND 2040\***



Share of 8 million tonnes of savings by 2030  
Share of 1.1 million tonnes of savings by 2040

UNEP U4E logo, \*Savings based on Minimum Ambition Scenario

### DETAILED BENEFITS AND TYPICAL PRODUCT ASSUMPTIONS


**ANNUAL SAVINGS IN 2030 AND 2040\***

Product	2030	2040	2030	2040	2030	2040
Cooling						
Electricity (GWh)	23	63	5.4	14	19	42
Electricity bill (thousand US\$)	4,700	13,000	1,020	2,800	3,900	8,400
CO2 Emissions (thousand tonnes)	17	46	3.9	10	14	30
Lighting and Equipment						
Electricity (GWh)	35	1.6	3.5	8.6	4.4	36
Electricity bill (thousand US\$)	3,200	150	700	1,700	800	3,200
CO2 Emissions (thousand tonnes)	31	1.1	2.5	6.3	3.2	12

**CUMULATIVE SAVINGS BY 2030 AND 2040\***

Product	2030	2040	2030	2040	2030	2040
Cooling						
Electricity (GWh)	96	510	23	130	85	430
Electricity bill (thousand US\$)	20	110	4.7	23	17	83
CO2 Emissions (thousand tonnes)	71	400	17	90	62	300
Lighting and Equipment						
Electricity (GWh)	130	10	35	77	17	130
Electricity bill (thousand US\$)	27	18	3.1	36	3.5	24
CO2 Emissions (thousand tonnes)	96	140	11	56	13	86

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



UNEP U4E logo, \*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 to reduce electricity consumption further.

**ROOM AIR CONDITIONERS**

- Ensuring products are correctly used 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 5-15% 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:
  - 28-31% for small offices
  - 32-35% for small retail
  - 24% for supermarkets

**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

**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

**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 power loss due to peak demand by as much as 24%, allowing:
  - reduced capacity overall
  - delays in maintenance/replacement requirements
  - reduced CO2 emissions from peaking plant
  - allowing improved integration of distributed and renewable generation, and more electric cars both with associated CO2 emissions benefits

UNEP U4E logo, \*Savings based on Minimum Ambition Scenario

### COUNTRY DATA, TYPICAL PRODUCT ASSUMPTIONS AND METHODOLOGY

**GENERAL INFORMATION**

Population	13.3 Million	Electricity market	Residential electricity tariff	0.20 US\$/kWh
GDP per capita	526 US\$	Transmission and distribution loss factor		9.2%
Electricity use	40 TWh			
CO2 emission factor	836 kg CO2/kWh			

**TYPICAL PRODUCT ASSUMPTIONS**

Product	2020 Unit Energy Consumption (kWh/unit/yr)	Efficiency level	Type of Product
Lighting	40	High	LED
Room Air Conditioners	1,313	High	Variable Speed Inverter Compressor
Residential Refrigerators	330	High	2-door refrigerator freezer with automatic defrost
Commercial Refrigeration	3,711	High	2-door refrigerator freezer with automatic defrost
Industrial Electric Motors	1,313	High	Variable Speed Drive
Distribution Transformers	See notes	Level 1 / Level 2	Power transformer

**METHODOLOGY**

The analysis uses the UNEP U4E Country Savings Assessment Method to estimate the impact of implementing policies that improve the energy efficiency of each product analyzed. The level of retrofitting is provided below (contact U4E for more information):

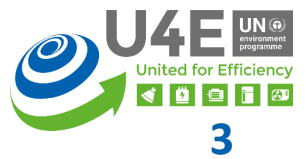
- The savings analysis for refrigeration, commercial refrigeration and air conditioners uses a bottom-up block model approach combined with market data on typical product performance. Future growth is projected based on established relationships between electricity use and other sector measurement indicators.
- The lighting analysis uses a bottom-up block model with market data on typical products to estimate current light demand. This is projected forward in line with ICA estimates of future building 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 electrical GDP, while distribution transformers are based on the typical capacity required for a given national electricity demand. Electricity use is shared between several typical products and applications based on market data. In both cases, the assumptions in the model are often 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 different levels of ambition (business 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](mailto:unep-u4e@un.org)

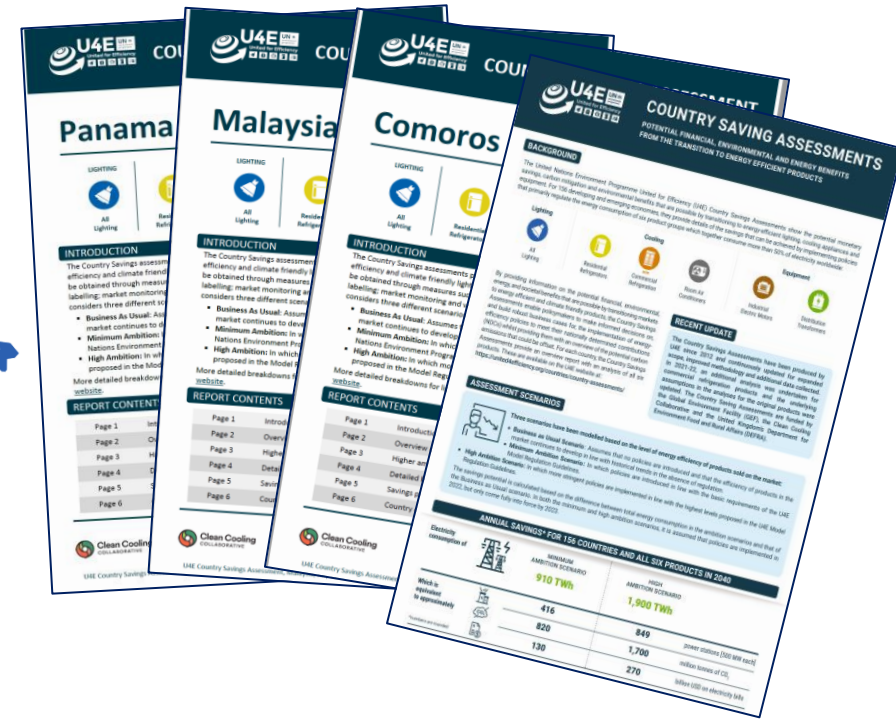
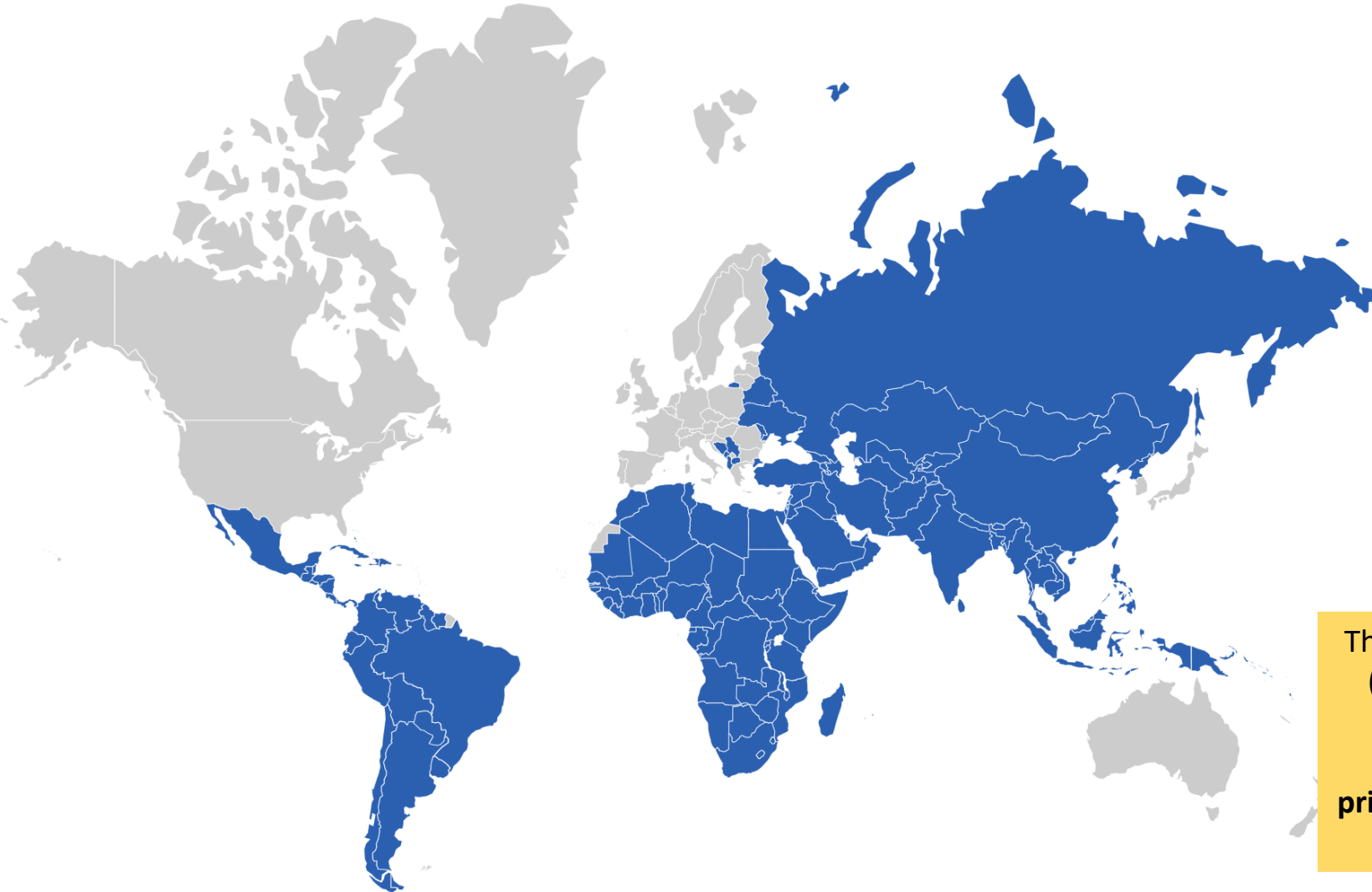
UNEP U4E logo

\* Available in English for all 156 developing and emerging economies. French and Spanish translations are available for select countries





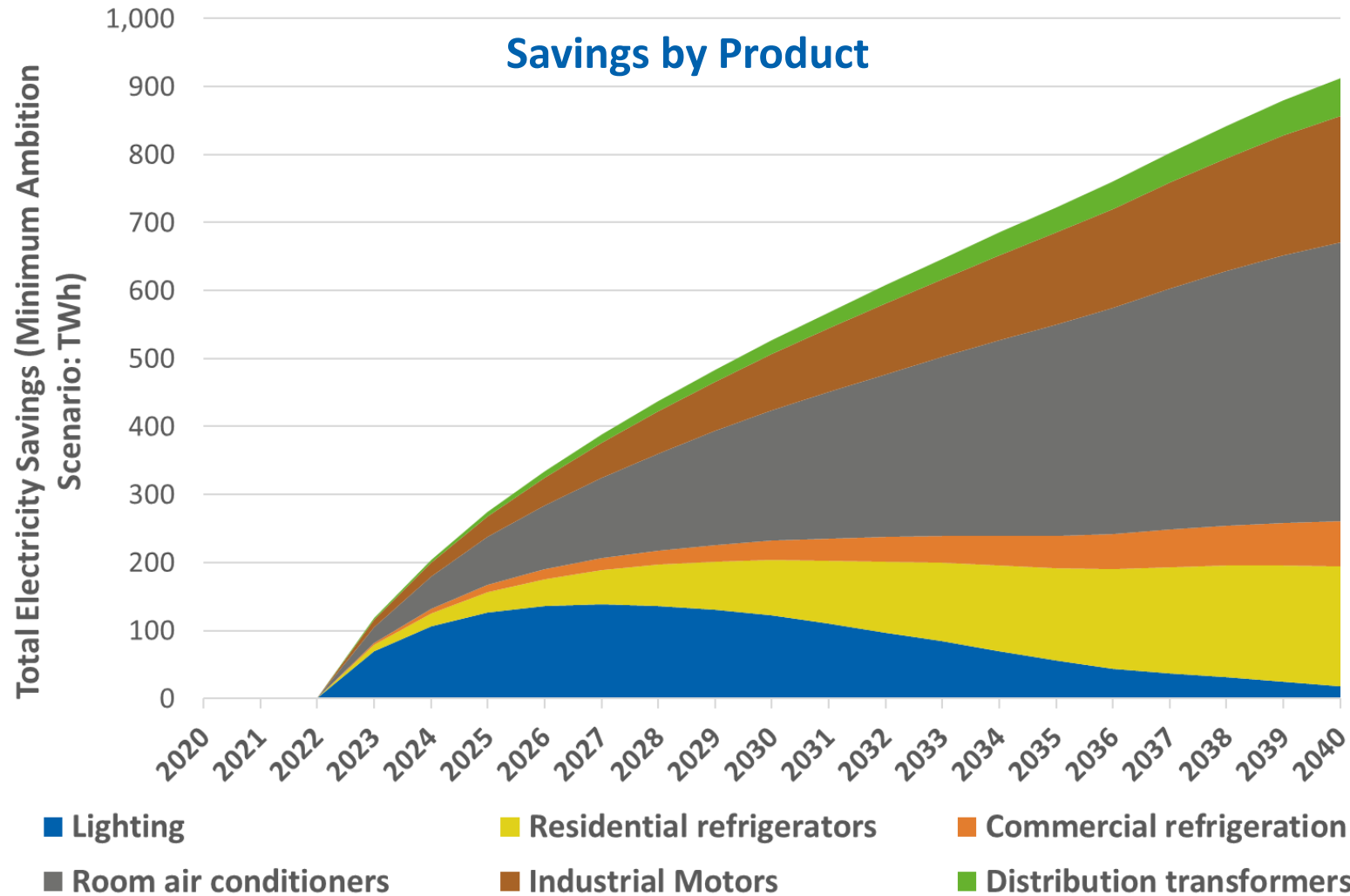
# U4E Country Savings Assessments - Updated 2022



The CSA serves as a powerful tool by providing **tangible (social, economic and environmental) benefits** that enable policymakers to take informed decisions in realizing their climate commitments. It also helps **prioritizing countries for funding/implementing** climate change mitigation projects.

- 156 developing countries and emerging economies have been assessed under the U4E Country Saving Assessments
- Explore for each country on: <https://united4efficiency.org/countries/country-assessments/>
- U4E Country Savings Assessments Factsheet is available [here](#)

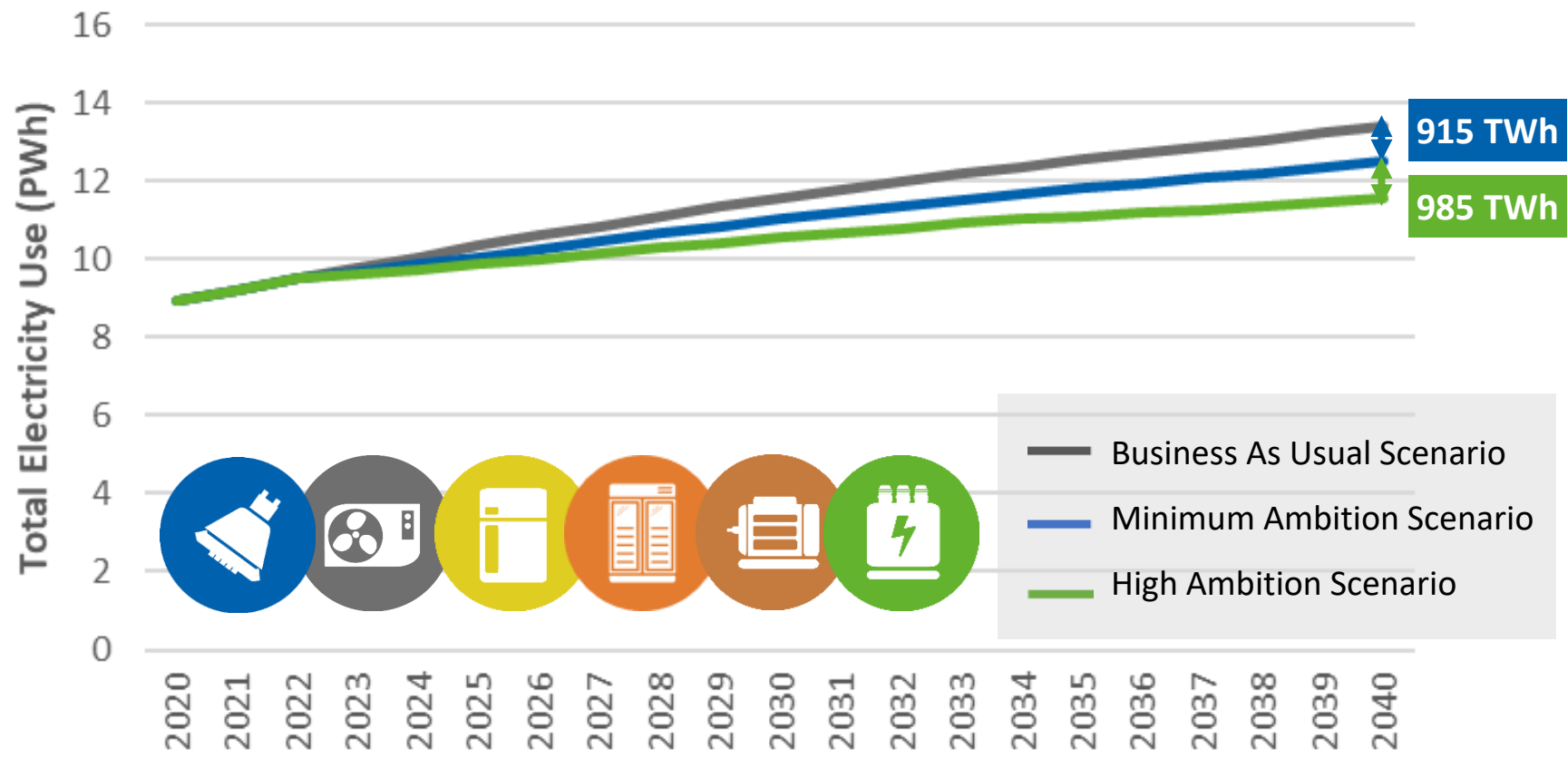
# Global Saving Opportunities Globally from Energy-Efficient Lighting, Appliances and Equipment



\*Savings of all six products with Minimum Ambition Scenario in 2040 for all 156 emerging and developing economies



# Global Saving Opportunities Globally from Energy-Efficient Lighting, Appliances and Equipment

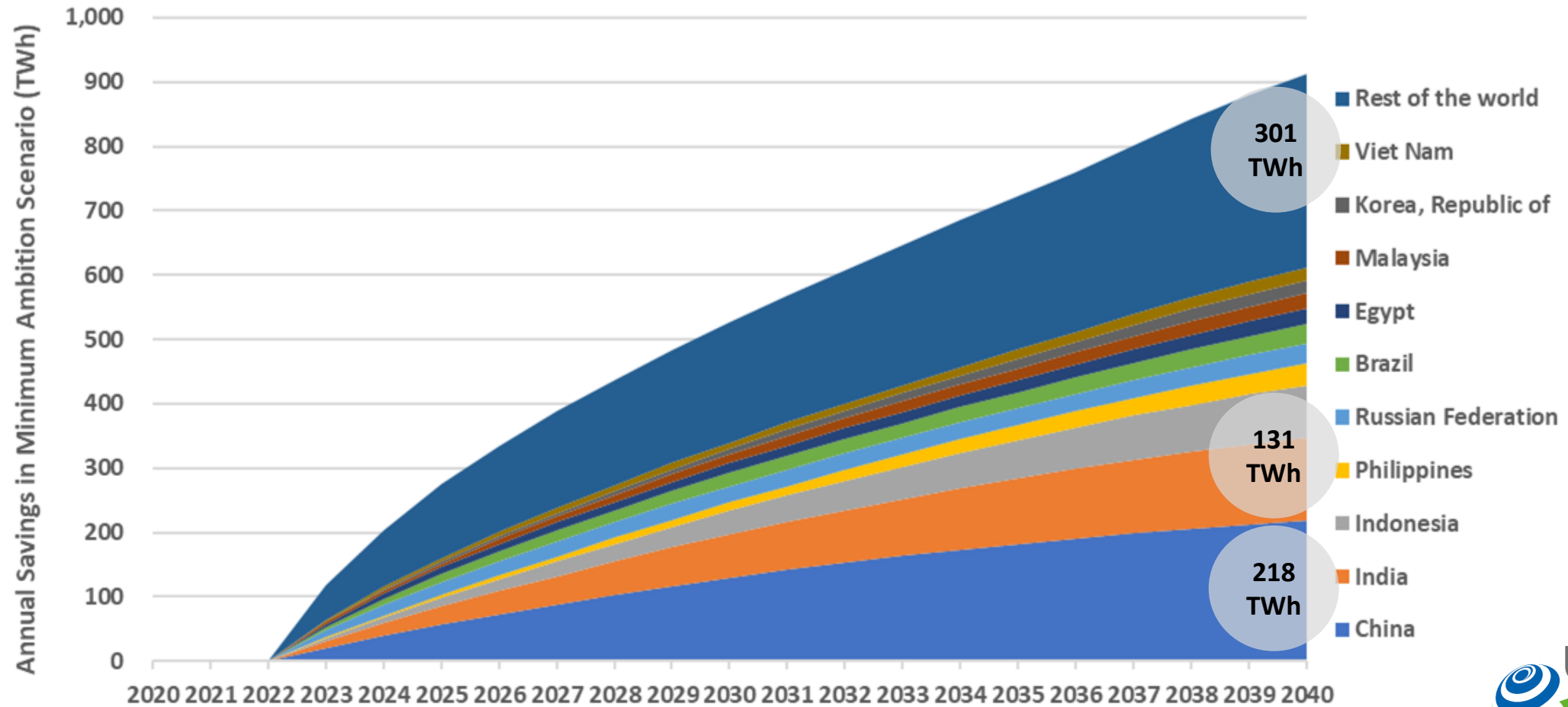


<b>915</b>	<b>820</b>	<b>\$ 130</b>	<b>415+</b>
*TWh	MtCO2e	Billion in electricity bill savings	Power stations [500 MW each]
<b>1900</b>	<b>1700</b>	<b>\$ 270</b>	<b>~850</b>
**TWh	MtCO2e	Billion in electricity bill savings	Power stations [500 MW each]

\*Savings of all six products with Minimum Ambition Scenario in 2040 for all 156 emerging and developing economies  
 \*Annual Savings in 2040 in Minimum Ambition Scenario (rounded)  
 \*\* Annual Savings in 2040 High Ambition Scenario (rounded)

# Global Saving Opportunities from Energy-Efficient Lighting, Appliances and Equipment

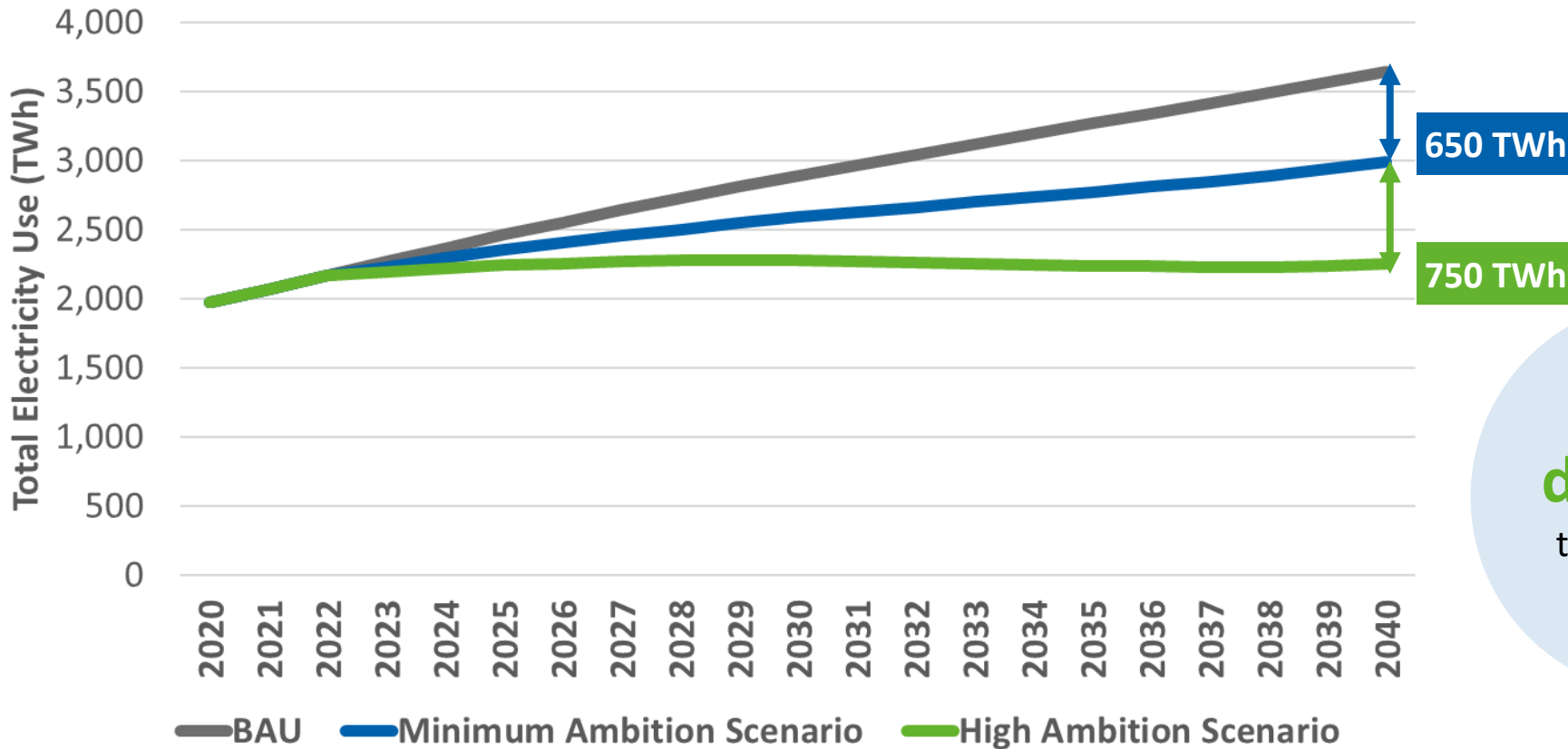
## Savings by Country



Savings refer to the Minimum Ambition Scenario, displayed savings 2040.



# Saving Opportunities Globally for Room Air Conditioners, Residential Refrigerators and Commercial Refrigeration Equipment



By 2040 the **electricity consumption** used for cooling is forecasted to increase by **68%**

\*Policies can **decrease** this growth to **38%** in 2040

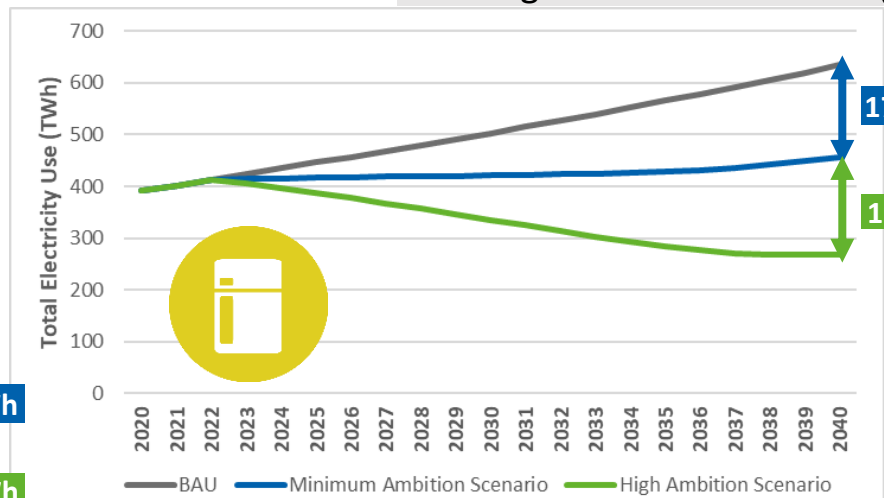
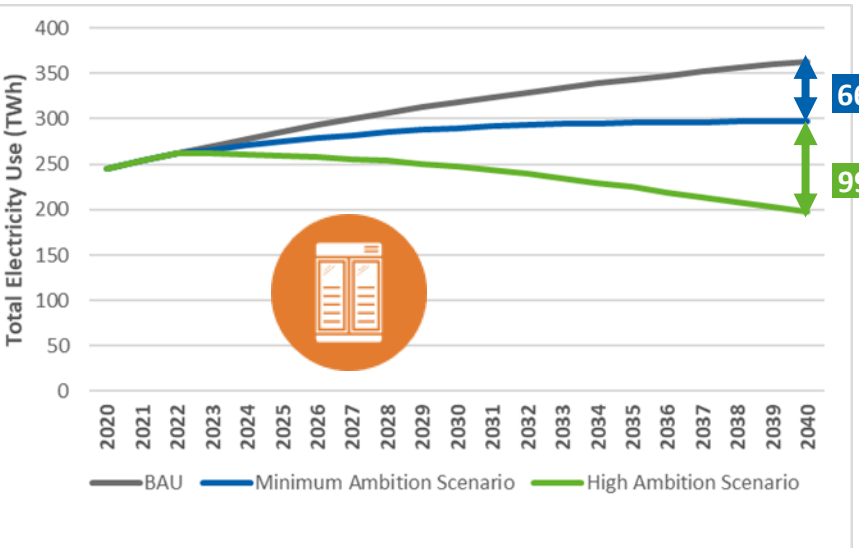
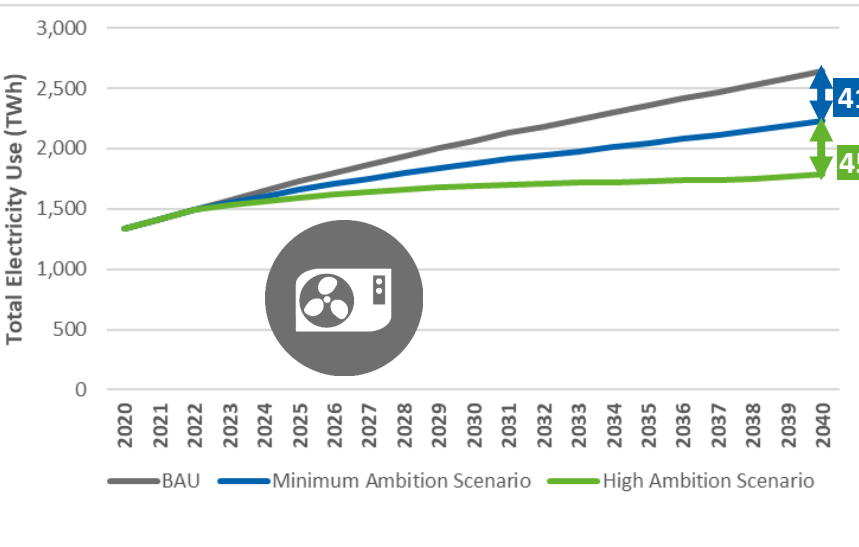
\*\*More stringent policies can even **decrease** this growth to just **4%** in 2040

\*Minimum Ambition Scenario  
\*\*High Ambition Scenario

\*Savings with Minimum Ambition Scenario in 2040 for all 156 emerging and developing economies



# Saving Opportunities Globally for Room Air Conditioners Residential Refrigerators and Commercial Refrigeration



## Electricity consumption growth by 2040

Business As Usual Scenario (BAU)



77%



53%



39%

With Minimum Ambition Scenario (MEPS)

50%

11%

13%

With High Ambition Scenario (HEPS)

20%

(35%)

(24%)

\*( ) indicates 2040 % demand is below the 2022 electricity consumption

## Annual Savings in 2040\*

Electricity Savings (TWh)



410



177



66

equivalent to:

Power Stations [500 MW]

187+

80+

30+

Millions tonnes of CO<sub>2</sub>

355

150

64

billions of USD in electricity bills

61

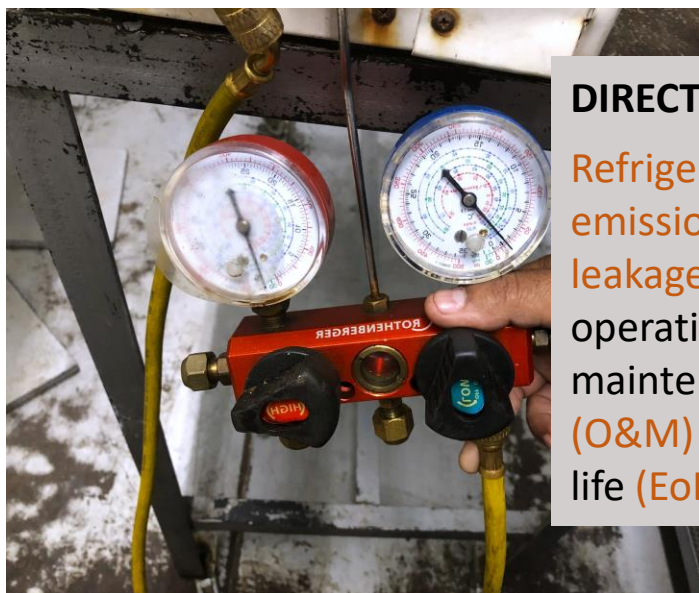
26

10

\*Minimum Ambition Scenario (values are rounded)



# Direct and Indirect Emissions in Cooling sector



## DIRECT EMISSIONS:

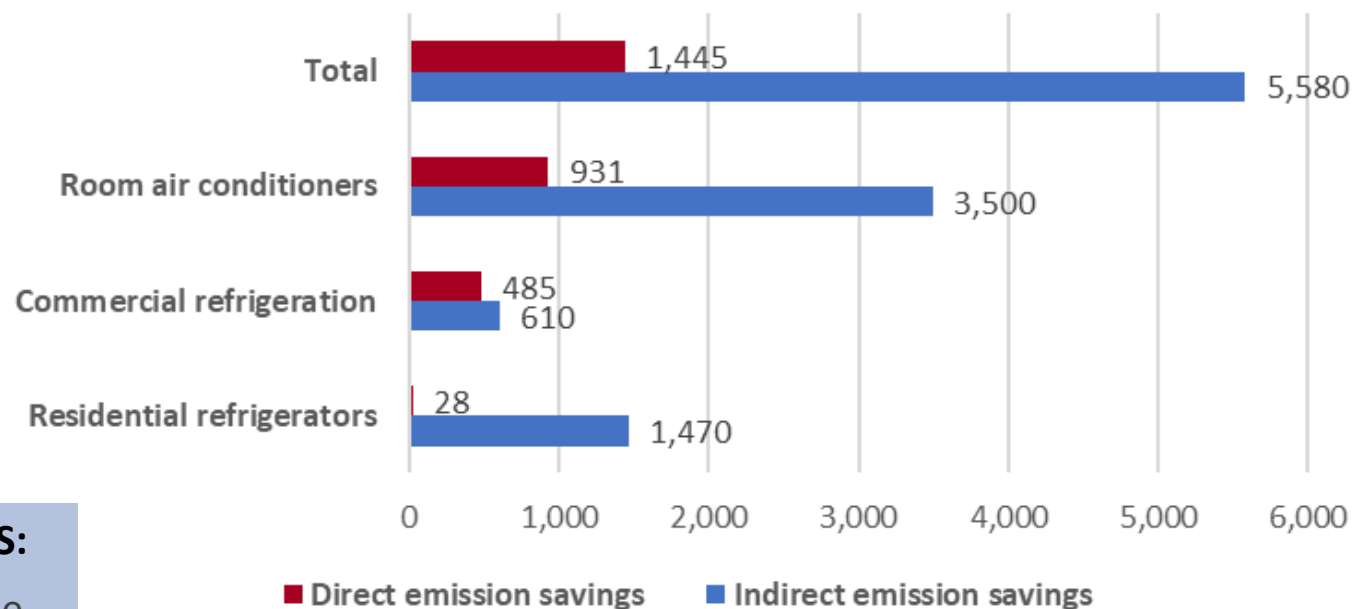
Refrigerant gas emissions due to leakages during the operation and maintenance (O&M) or at end of life (EoL)



## INDIRECT EMISSIONS:

Carbon emissions due to electricity consumption of cooling appliances.

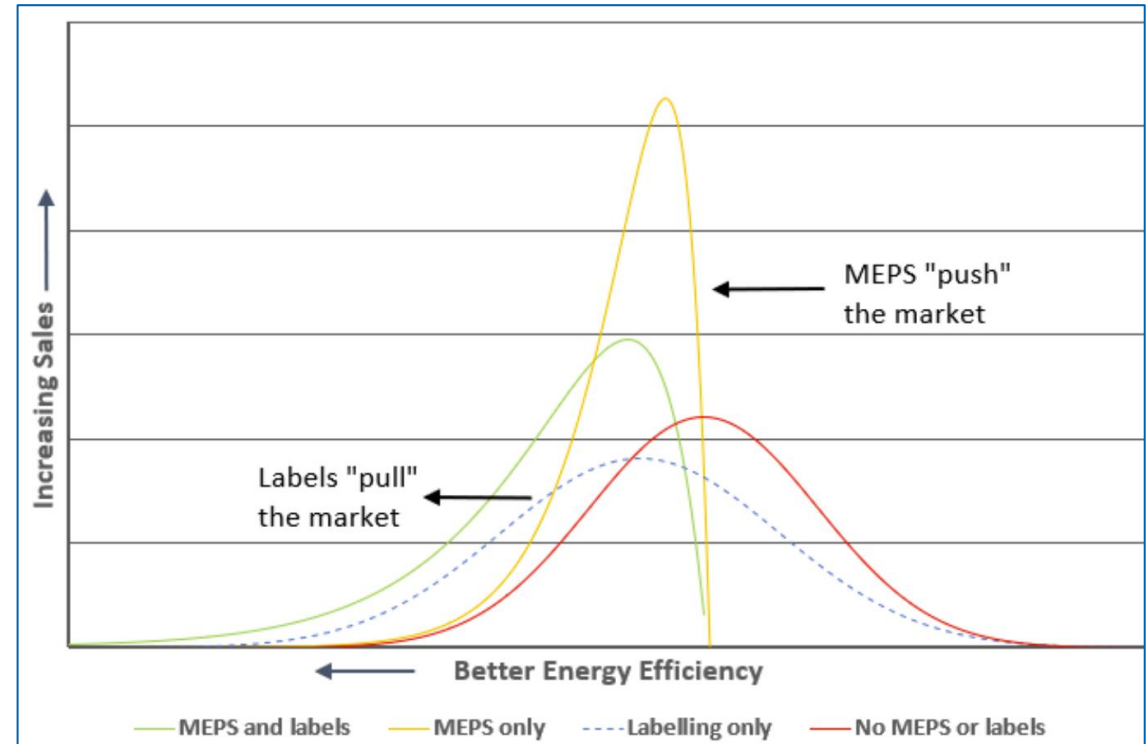
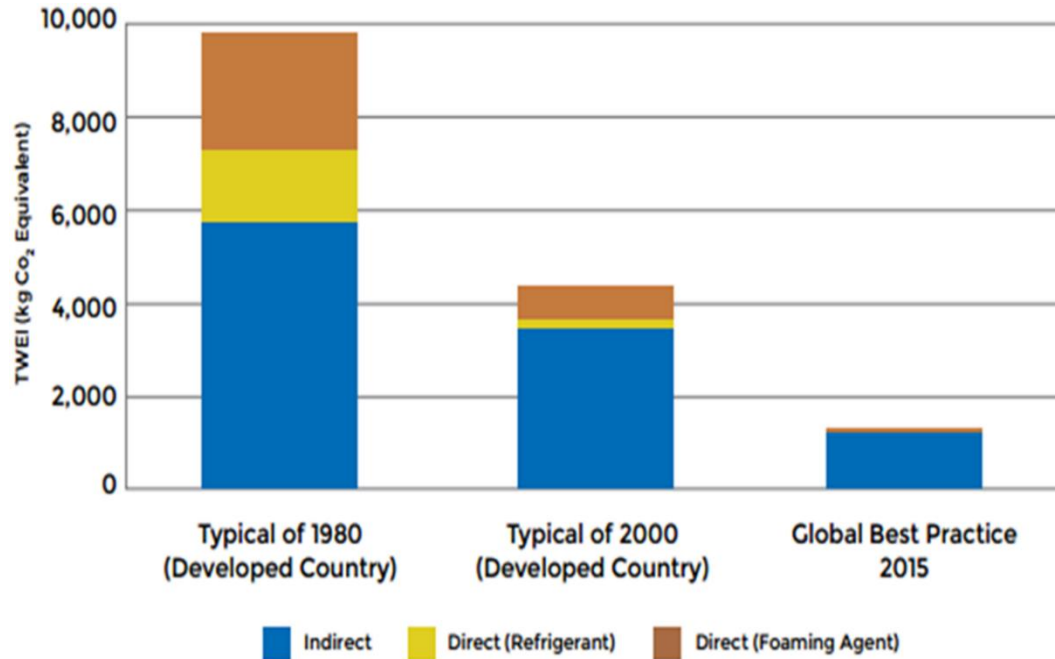
## Cumulative carbon savings (MtCO<sub>2</sub>e) by 2040 through energy-efficient cooling products



Direct emission savings constitute about 21% of the total savings by deploying climate friendly and low GWP refrigerants

# Benefits of Instituting Policy frameworks for MEPS & Labels

MEPS & labelling policies unlock multiple benefits increasing over time



- Reduce stress on electric grid – don't build as much new capacity; reduce outages (particularly during heat waves)
- Extremely cost effective – reduces electric bills
- Help meet CO2 savings targets

# Examples - Internal Linkages & Synergies



- Contributed to the drafting of the COP 28 Cooling Pledge, particularly on requirements for end use cooling products.
- Led and participated in Working Groups on Used Products and National Cooling Action Plans



- Contribute recommendations for requirements for lighting and appliances that are installed within new buildings and sustainable public procurement

**Environmental Sound Management is one of the core vertical of U4E.**

**U4E collaborates closely with multilateral environment agreements and respective initiatives.**



**Substances that Deplete the Ozone Layer (Cooling-refrigerants)**



**Persistent Organic Pollutants, PCBs (polychlorinated biphenyls) in transformers**

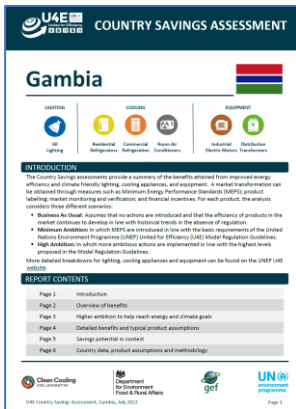


**Mercury in lighting products**

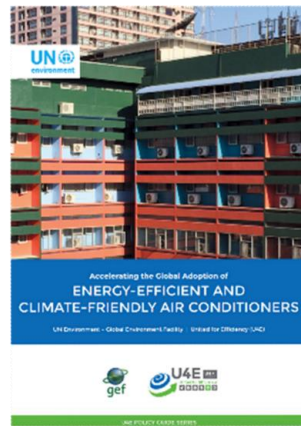


# Conclusion – Next Steps

- ✓ Review the energy, financial and climate benefits potential for their country from implementing energy efficiency regulations and contact U4E to find out how UNEP can help to implement a robust and sustainable market transformation programme.
- ✓ Use the Country Savings Assessment data for their country as an aid in devising/revising their Nationally Determined Contributions (NDCs) and Kigali Implementation Plans (KIPs) of the Montreal Protocol.
- ✓ Investigate the range of U4E's resources and guidance and explore the steps outlined above.



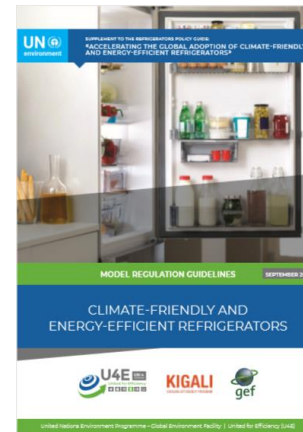
Country Savings Assessments



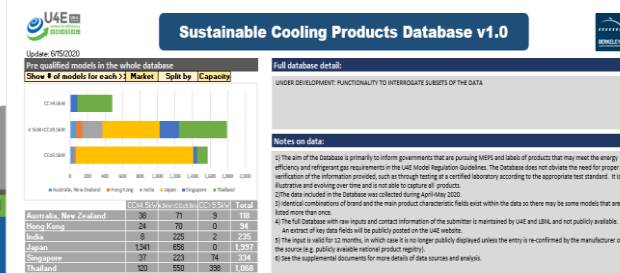
Policy & technical Guides



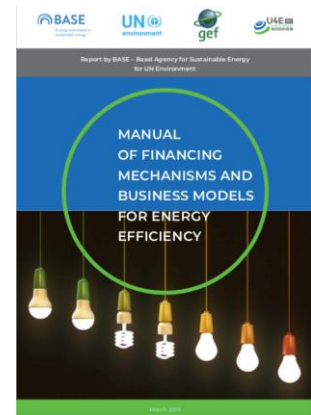
Product Registration System (Guides & prototype)



Model Regulations



Sustainable Cooling Products Database



Financial mechanisms





# Contact

TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS



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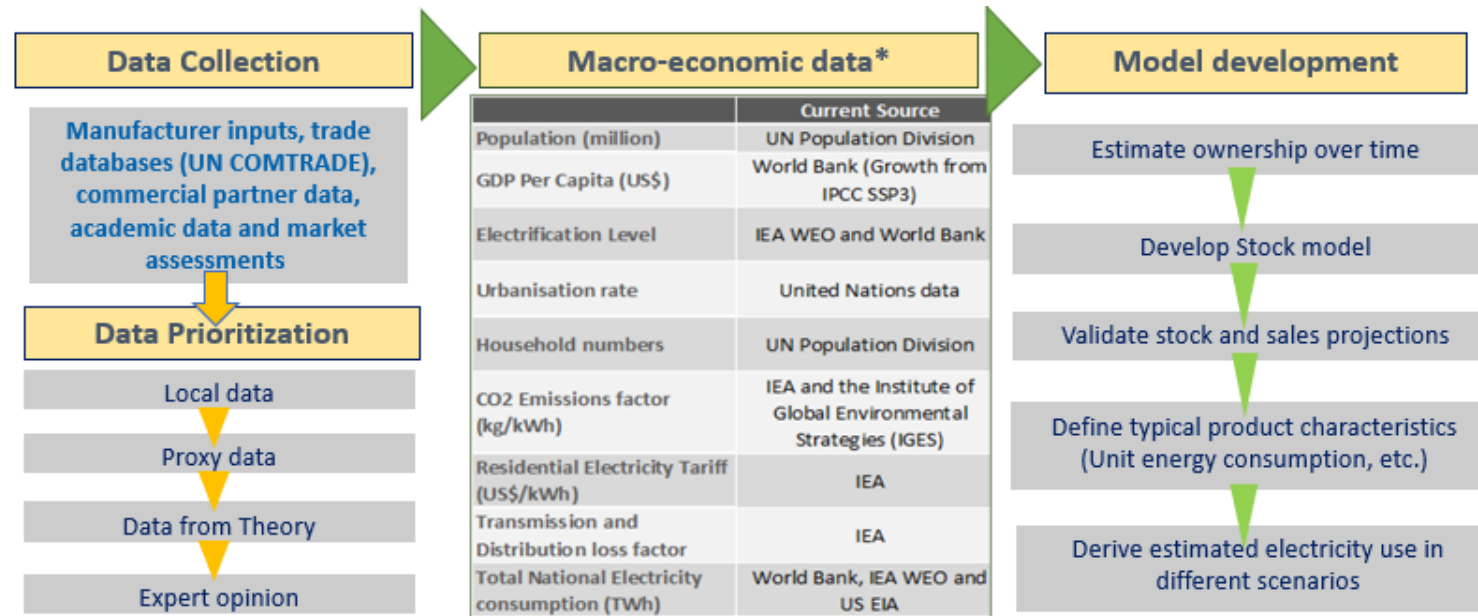
# Country Savings Assessment



## Methodology and Assumptions

The following are the overarching methodologies for stock estimation, which was used along with assumptions for each product\*:

- Bottom-up approach (for **room air conditioners, residential refrigerators and commercial refrigeration equipment**) involved developing ownership levels to 2040 which came from known market data based on relationship to purchasing power for GDP levels, and utilizing the unit energy consumption (UEC), and triangulating with the growth data available across various policy databases
- Top-down approach (for **distribution transformers and industrial motors**) was used based on data on total electricity use in each country and the historical industrial GDP data respectively
- Hybrid approach (for **lighting**) included a bottom-up approach to estimate the stock of each lamp type in 2018 and a top-down analysis to project electricity use into the future.



## Energy Modelling

\* Denotes typical sources. Kindly refer [here](https://united4efficiency.org/resources/u4e-country-savings-assessments-methodology-and-assumptions/) for detailed assumptions and methodology  
[\(https://united4efficiency.org/resources/u4e-country-savings-assessments-methodology-and-assumptions/\)](https://united4efficiency.org/resources/u4e-country-savings-assessments-methodology-and-assumptions/)