Overview of western Africa Energy Efficiency Saving Assessment for Lighting, Appliances & Equipment

Saikiran Kasamsetty
Soledad Garcia

April 2024

Introduction to United for Efficiency Initiative

Supporting Countries to Save 20% of their Electricity

By accelerating the Global Transition to **much more energy efficient lighting and appliance technologies** by strengthening country capacities around the world, as well as ensuring environmentally sound management practices. Building synergies among stakeholders, sharing knowledge and information, helping create strategic policy and regulatory frameworks, and addressing technical and quality issues.

United for Efficiency (united4efficiency.org)

Electric Motors Systems

Outdoor and Indoor Lighting and controls

Domestic and Commercial Refrigerators

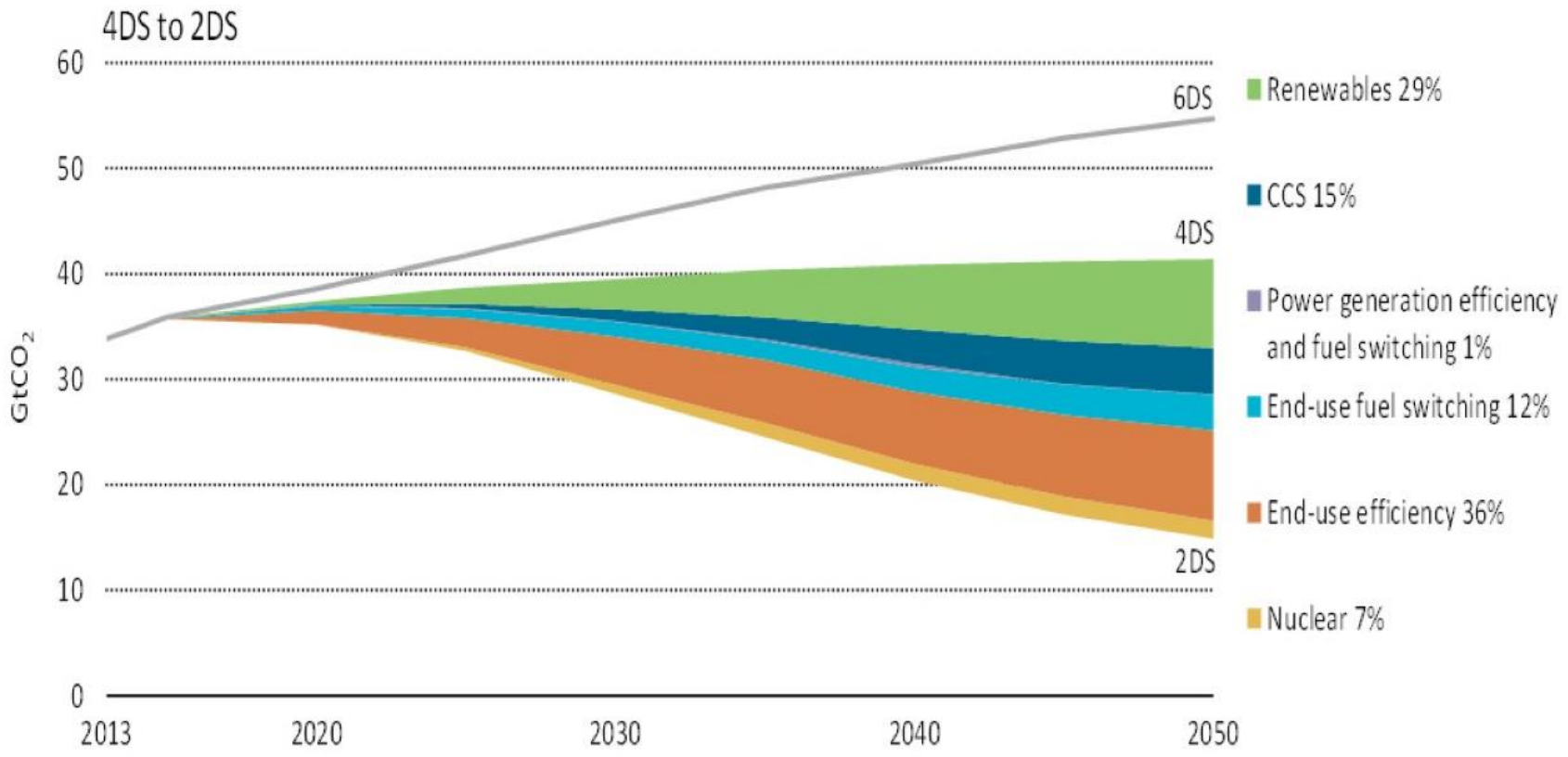
Room Air Conditioners

Power Distribution Transformers

Heat Pumps

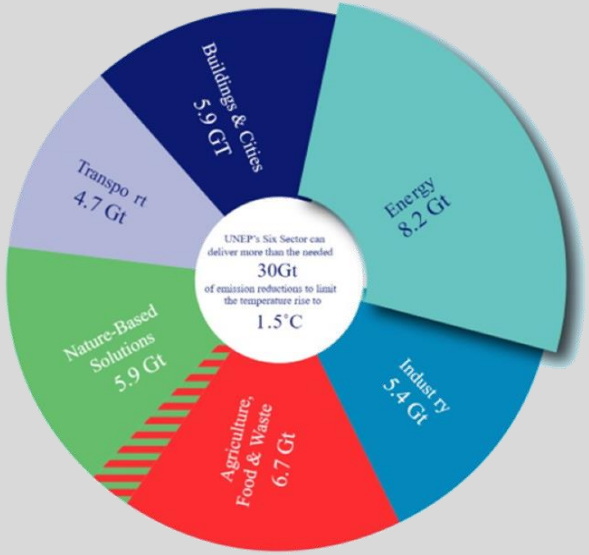
Data Centers & Computer Servers

The Largest GHG Reductions to get to 2 Degrees need to come from End Use Energy Efficiency and Renewables

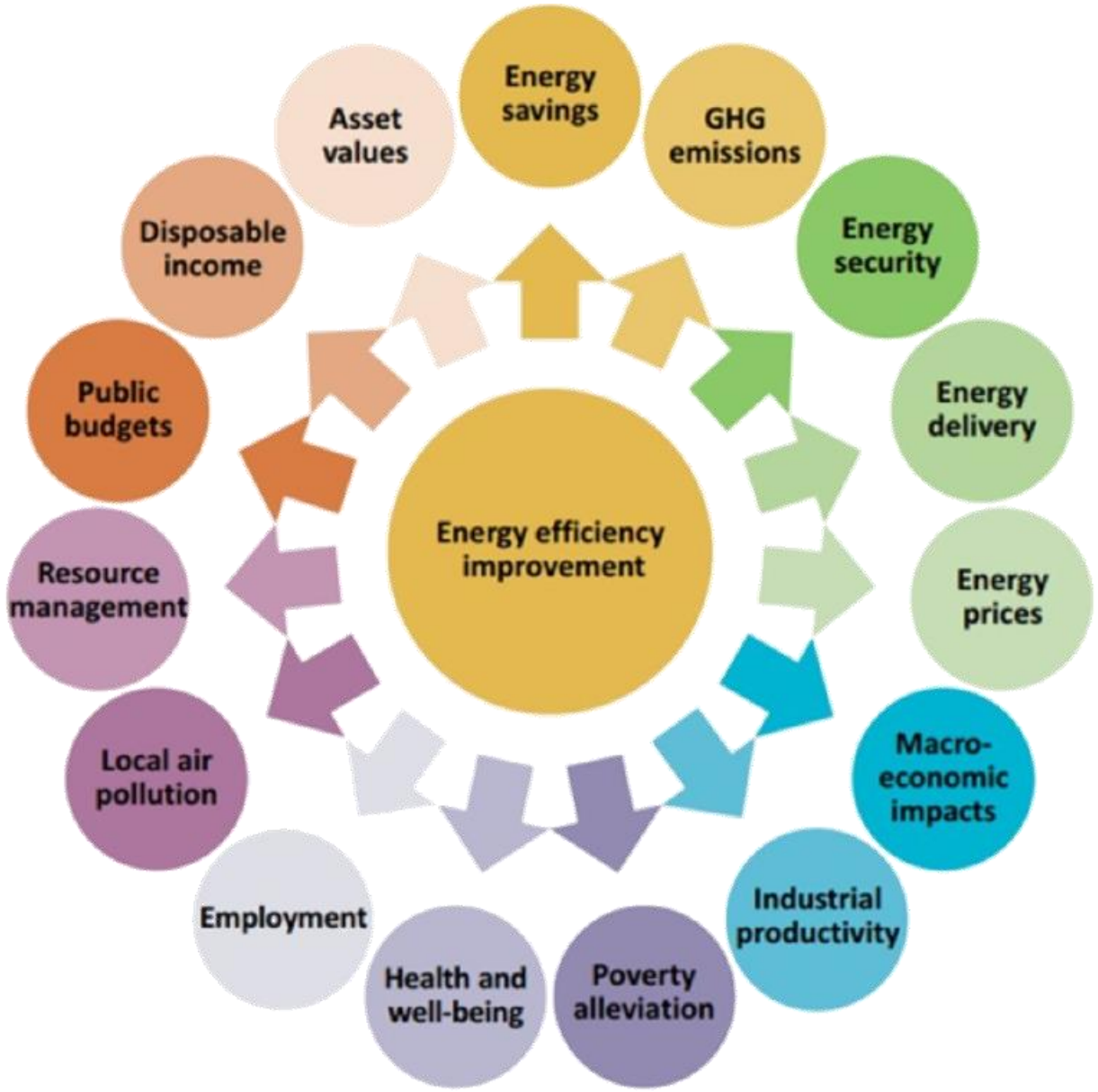


Source: IEA *Energy Technology Perspectives*

In the energy sector, we can cut **12.5 gigatonnes** (Gt) greenhouse gas emissions annually. No need to wait for new inventions

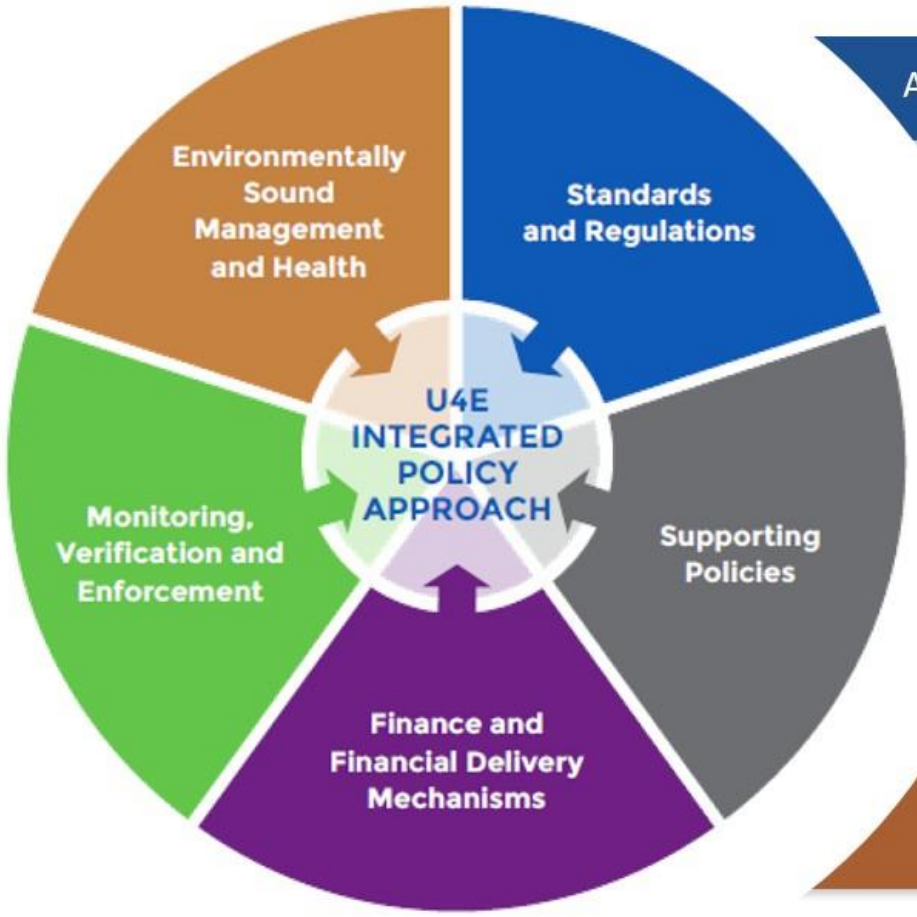


Multiple Benefits of Energy Efficiency



How do we fulfill our Mission?
Strategic 5-year Integrated Policy Approach Programmes do work

U4E implements a proven, effective approach to an accelerated, sustainable transformation.



Adopt minimum energy performance and internationally-recognized test standards

Ensure effective labels are in place and that appropriate consumer information and advice is available

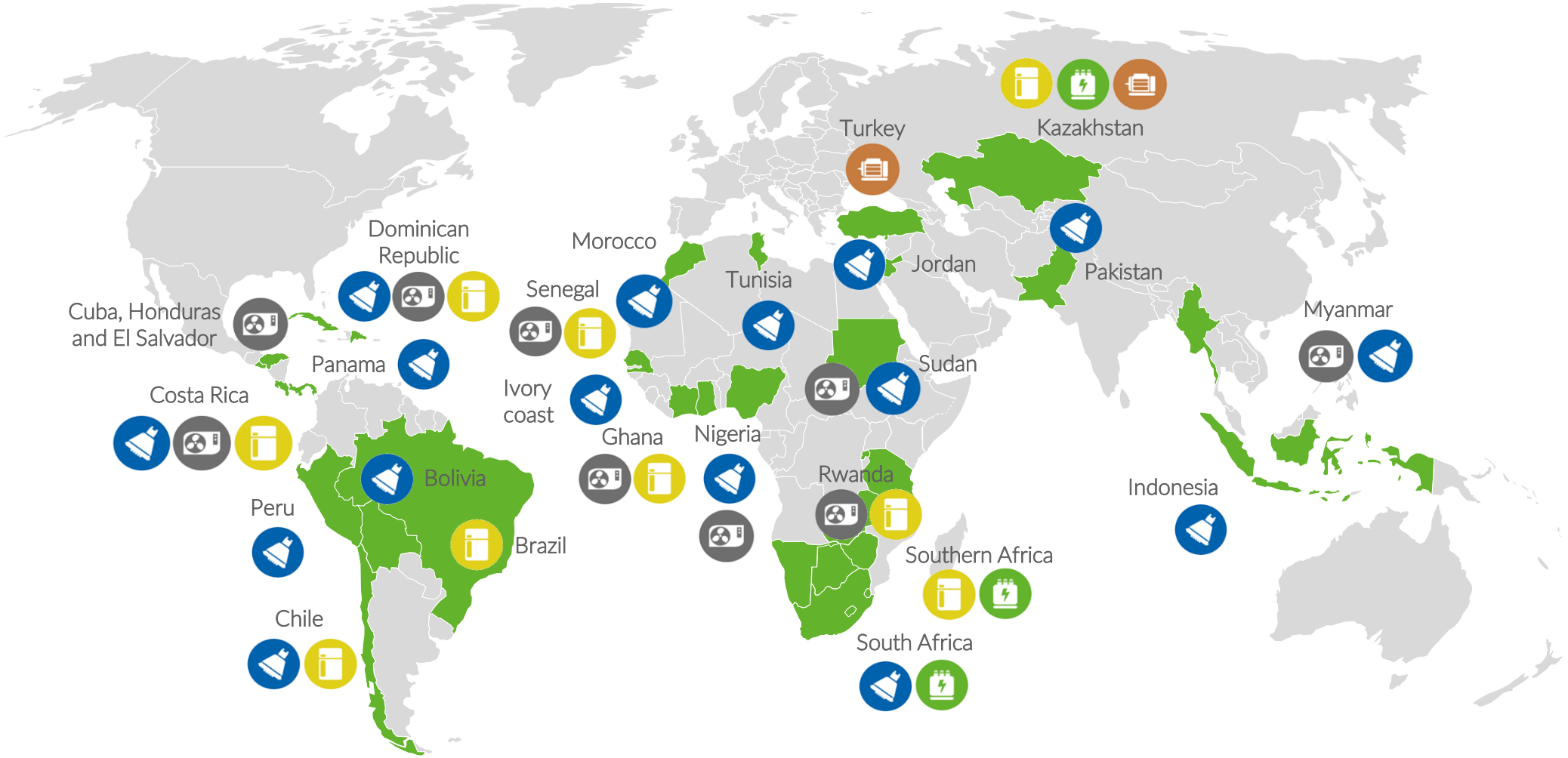
Consider a blend of financing mechanisms and incentives to help offset the incremental costs of energy-efficient products

Include legal authority, enforcement powers, capacities and penalties in the national legal and enforcement frameworks;
Use a product registration system as an initial compliance gateway

Provide for Materials Recovery (e.g. glass, ferrous and nonferrous metals and phosphors including any mercury in lamps and refrigerant gases).

Market Transformation on the ground

U4E National Projects



U4E Partner Organizations

MANUFACTURERS & INDUSTRY ASSOCIATIONS

OSRAM
SANHUA
International Copper Association Copper Alliance
GREE
Electrolux
mabe
B/S/H/
arçelik
Whirlpool Corporation
signify
ABB

TECHNICAL ORGANISATIONS & INITIATIVES

BERKELEY LAB
olade
COPENHAGEN CENTRE ON ENERGY EFFICIENCY SE4ALL EE HUB
SACREEE SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY
RCREEE Regional Center for Renewable Energy and Energy Efficiency
EACREEE Building a Sustainable Energy Future
giz
clasp
African Energy Commission
NRDC
GELC
CARBON TRUST
IIEC International Institute for Energy Conservation
BASE
AMBILAMP
ASEAN CENTRE FOR ENERGY ACE
topten
EESL
4E
NIS

FUNDERS, FINANCIERS & IMPLEMENTING AGENCIES

UN environment United Nations Environment Programme
UNDP
gef
KIGALI COOLING EFFICIENCY PROGRAM
GREEN CLIMATE FUND
Department for Environment Food & Rural Affairs
GLOBAL CLIMATE PARTNERSHIP FUND managed by responsAbility
BANQUE AFRICAINE DE DEVELOPPEMENT AFRICAN DEVELOPMENT BANK
Sida SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
DEVELOPMENT BANK OF RWANDA www.brd.rw
BRD We empower you

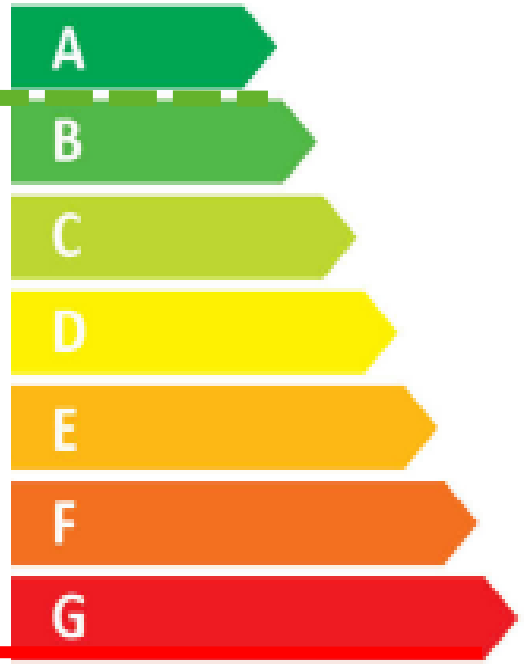
STANDARDS, LABELLING, GREEN PUBLIC PROCUREMENT AND MARKET BASED INCENTIVES WORK

Energy Efficiency of Products in the Market

Offer incentives support the adoption of the best products (e.g. rebates, financing, bulk procurement)

Promote efficient products (e.g. labels and awareness campaigns to help buyers understand EE benefits)

Minimum Energy Performance Standards (MEPS) ban the worst products



Monitor the market for MEPS compliance, test the products and enforce the rules

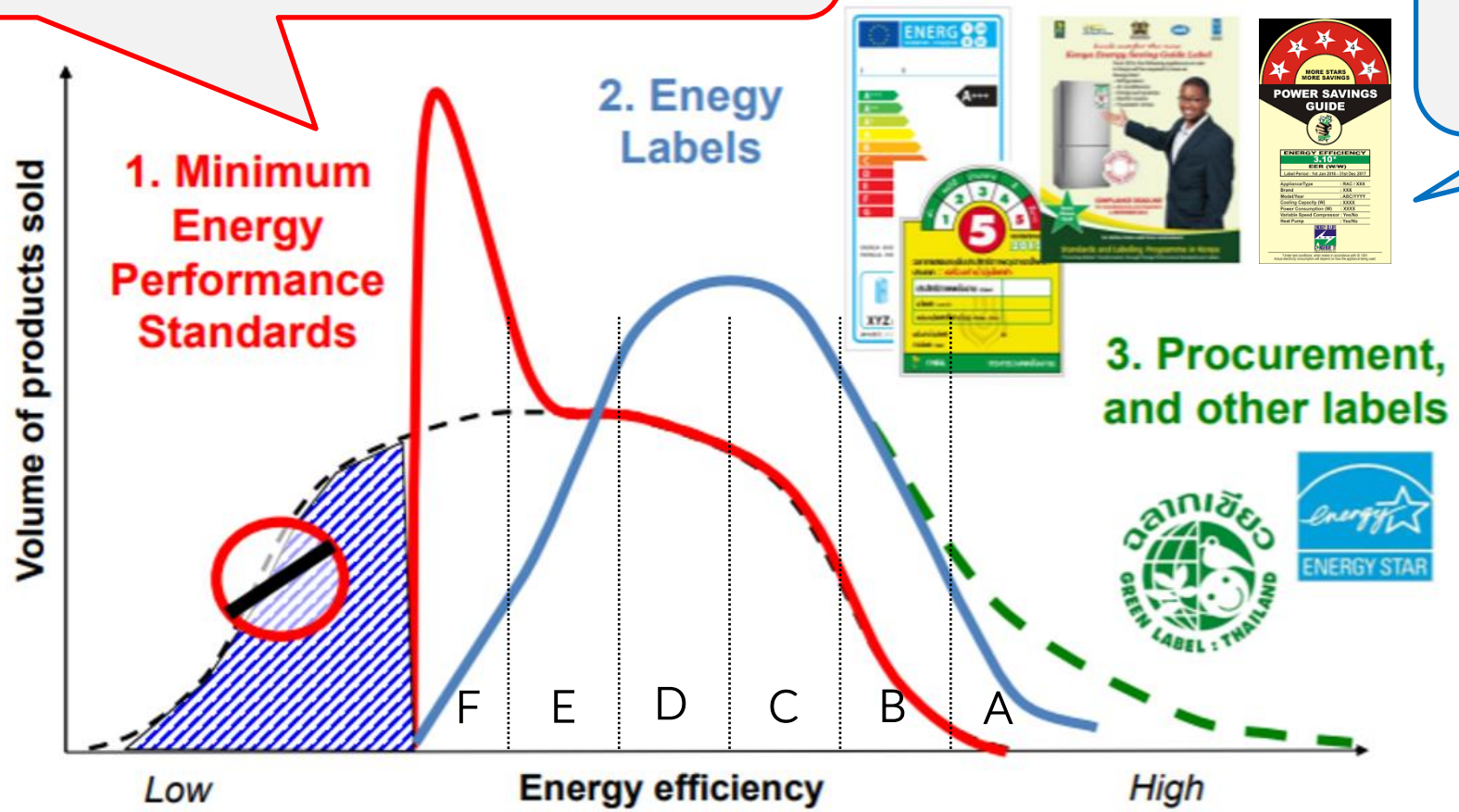
+

ESM for Recycle & dispose old products in a sustainable way

Policy Matters: MEPS, HEPS and Labels, the framework

RAISE THE FLOOR!
MEPS eliminate products that are obsolete or inefficient from the market and "PUSHES" manufactures to produce more efficient lighting, appliances and equipment.

RAISE THE CEILING!
Stimualte consumer demand for energy efficiency products by provideing information to the end user to make informed purchasing decisions.



RAISE THE CEILING FURTHER!
Ambitious performance and eco-design to leverage public purchasing power to drive the national market.

Policy Matters: MEPS, HEPS and Labels, the framework

Challenges

- ✓ **Lack of knowledge of own local and regional market.**
- ✓ **Unawareness of the products/technologies yet globally available** in the market.
- ✓ Wrongly **considering that the market will regulate itself** without the need to introduce performance standards or policies.
- ✓ Lack of **information at the continental and regional levels** that compares the different normative status, level of regulations, level of MEPS and efficiency classes among countries.
- ✓ **Absence of harmonized regulations** among countries and lack of framework that foster it.
- ✓ **No reference** to update policies regularly.
- ✓ **Technical limitations** to respond to common questions, such as:
  - What is the scope of products that have to be included in the norm/regulation?
  - What are the parameters and metrics that I should use to assess the energy efficiency of products?
  - What are the test methods that I should use/reference to measure energy consumption?
  - What is a good level of efficiency to be used as MEPS and HEPS for Public Procurement?
  - What should be the efficiency levels that define the efficiency classes on the label?

The U4E Model Regulation Guidelines and SPP Technical Specifications can help regulatory authorities and policy makers with some of these questions and concerns

U4E Tools and Resources for moving markets to energy efficient products

Country Savings Assessment

- Showing the potential financial, environmental, energy, and societal benefits that are possible with a transition to energy-efficient products.
- 156 developing countries and emerging economies have been assessed.
- Regional Assessments for ASEAN and African regions.
- Explore for each country on: https://united4efficiency.org/countries/country-assessments/

MR Guideline on the following products: General Service Lamps and Linear Lighting, Commercial and Domestic Regrigerators, Room Air conditioners and Fans, Electric Motors and Transformers.

Model Regulation Guidelines

- Minimum Energy Performance Standards and Labels Template for countries considering a voluntary, regulatory or legislative framework for market transformation interventions.

Sustainable Public Procurement Technical Guidelines

- Higher ambition technical specifications and guidance on leveraging public purchasing power to drive the national market.
- Tools for environmental/economic impact bids comparison
- More information at: united4efficiency.org/sustainable-public-procurement/

U4E Tools and Resources for moving markets to energy efficient products

Product Registration System

- Prototype product regulation system which is an off-the-shelf tool that can be tailored to a countries individual needs and the complementary regional product database that can facilitate regional sharing of market and compliance information.
- Guidance and notes about PRS to provide guidelines to countries in building their own system.
- More information at: https://united4efficiency.org/product-registration-systems/

Policy and Supporting Guidelines

- Complementary guides on fundamental elements for a successful market transformation, such:
  - ✓ Guidelines on Harmonized System Customs Codes and National Statistical Codes for Energy-Efficient Lighting
  - ✓ Finance to Accelerate Adoption of More Energy-Efficient and Climate-Friendly Appliances
  - ✓ Model Quality and Performance Guidelines for Off Grid Refrigerators
  - ✓ Energy Labelling Guidance, among others.

Case Studies and Factsheets

Reports with detailed insights from project outcomes, activities implementation and leasons learn worth expreding to replicate similar successful pathways in other countries.

U4E Project examples:

Ivory Coast EE Lighting Project – " Promotion of Energy Efficiency Lighting in Public, Commercial and Residential Buildings ".

Q4 2017 – Q2 2019

Main components

- Development of a **Market Assessment** on the current national lighting situation.
- Consensus among National Stakeholders for a **National Lighting Strategy**.
- Development of a regulatory framework for **Minimum Energy Performance Standards (MEPS), including LED lighting products** and the adoption of UEMOA labelling.
- Propose a **regulatory framework for lighting product waste management** to be incorporated in the National Strategy, recycling service organization (CRSO) and training on international regulations, extended producer responsibility and CRSOs creation and operation.
- Enhancement of **National Testing capacities** through tailored trainings sessions and implementation of a Market Surveillance System through the proposal of a National Product Registry System for lighting products.

Donor: gef

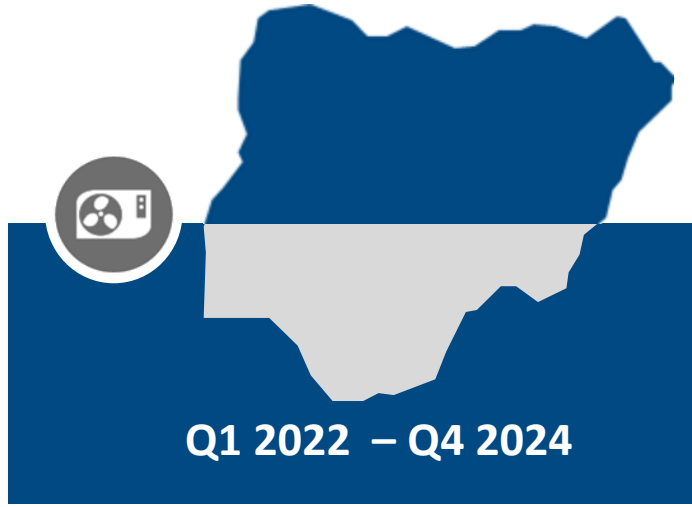
Partner:

U4E Project examples:

Nigeria EE ACs Project – “Scaling-Up Energy-Efficient and Climate-Friendly Cooling in Nigeria’s NDC Revision”.

Main components

- Conduct a **Market Assessment on Air Conditioners** (AC) and leverage existing data
- **Update AC MEPS and Energy Labels** to enhance energy efficiency and address refrigerant global warming potential (GWP)
- Recommend **monitoring, verification and enforcement protocols** and provide capacity building to strengthen compliance.
- Conduct an **Awareness Campaign** for vendors and consumers
- Train technicians on energy-efficient & climate-friendly room ACs
- Recommend **cooling targets in the Nationally Determined Contribution** (NDC) to the Paris Climate Agreement



Donor: Clean Cooling COLLABORATIVE

Partner: Energy Commission of Nigeria

U4E United for Efficiency

U4E Project examples:

SADC and EAC Regional Harmonization projects.

Main components

- Development of **regionally harmonized Minimum Energy Performance Standards and Labelling** for the East African Community (EAC) and Southern African Development Community (SADC) → Total of 21 countries (16 SADC & 6 EAC).

- Facilitate **stakeholder engagements** including technical committee meetings and public enquiry.

- **National adoption** of the MEPS by the country members.
- **Public awareness** including preparation of public sensitisation materials.
- **Capacity building** for customs agencies, standards organizations, and other important stakeholders

Donor: gef | Clean Cooling COLLABORATIVE | Department for Environment Food & Rural Affairs

Partner: EACREEE Building a Sustainable Energy Future | SACREEE SADC CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY | U4E United for Efficiency

Regional Savings Assessment Approach, Methodology and Assumptions

Country Savings Assessments

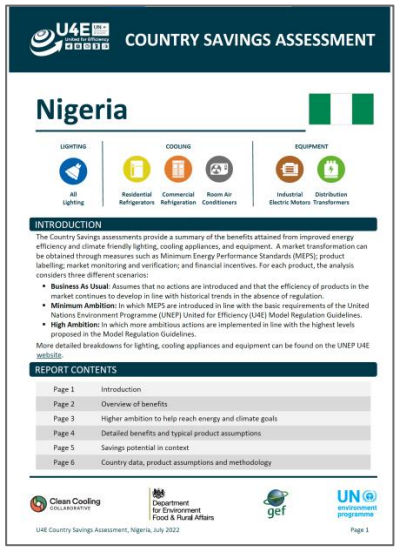
Objective

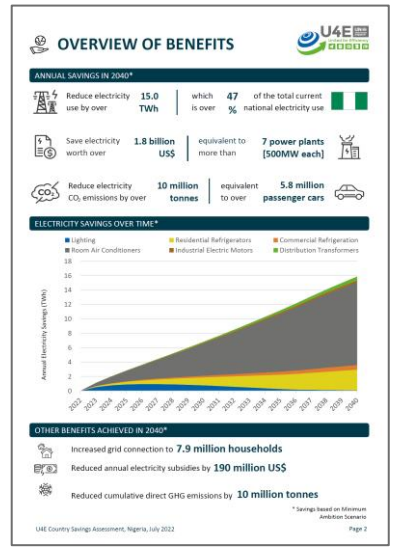
Analysis on **potential impact** of adopting Model Regulation guidelines for **lighting, room air conditioners, residential refrigerators, commercial refrigeration equipment, industrial electric motors and distribution transformers.**

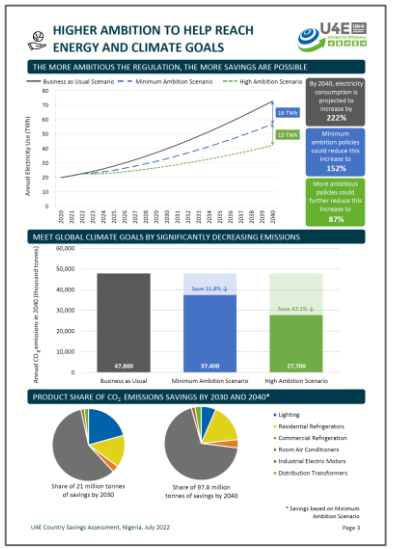
These product categories are responsible for **>50% of electricity usage** today.

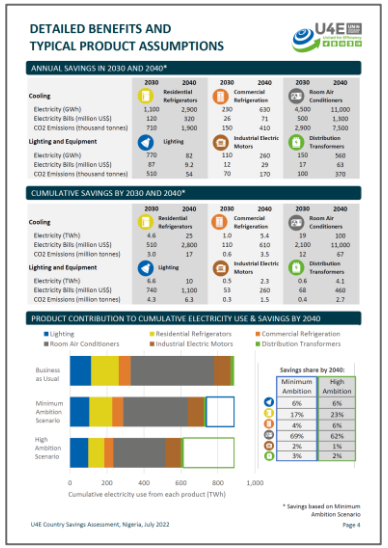
Overview

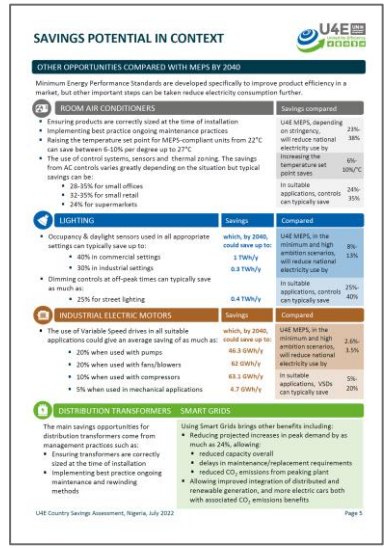
- The assessment provides three scenarios: **Business As Usual Scenario (BAU)**– No policy intervention; **Minimum Ambition Scenario** – assumes Minimum Energy Performance Standards (MEPS) implemented; **High Ambition Scenario** – Assumes MEPS are implemented at a higher level of ambition for six products.
- 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.**

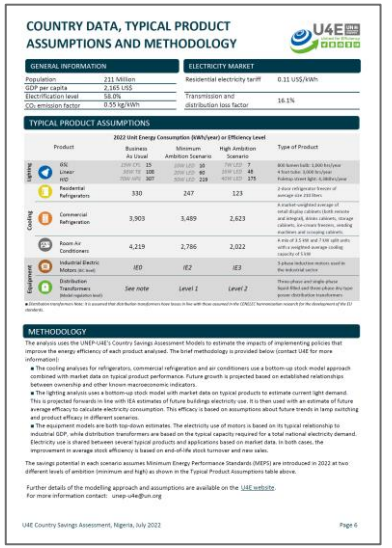








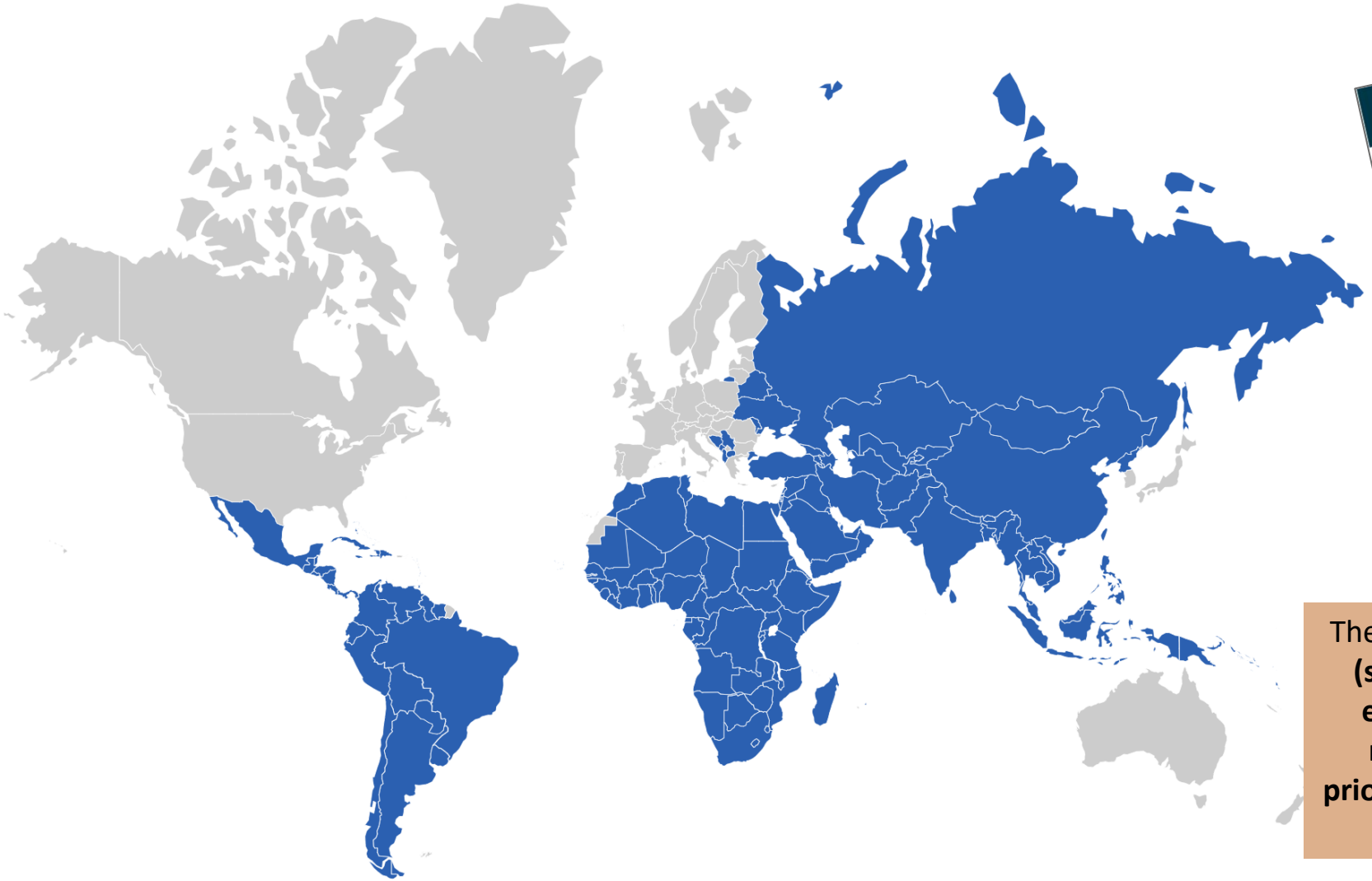




*Available in English for all 156 developing and emerging economies. French and Spanish translations are available for select countries

Individual country CSA reports can be downloaded from https://united4efficiency.org/countries/country-assessments/

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.

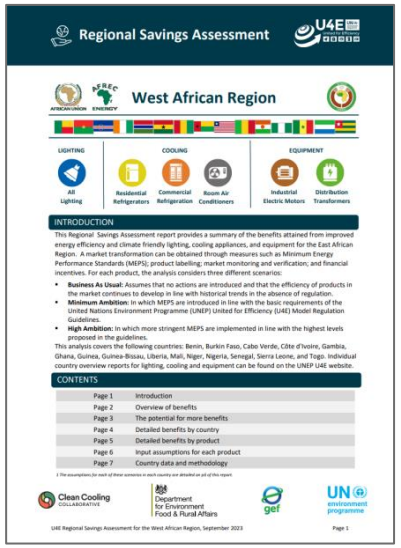
- 156 developing countries and emerging economies have been assessed under the U4E Country Saving Assessments
- Explore for each country on: https://united4efficiency.org/countries/country-assessments/
- U4E Country Savings Assessments Factsheet is available here

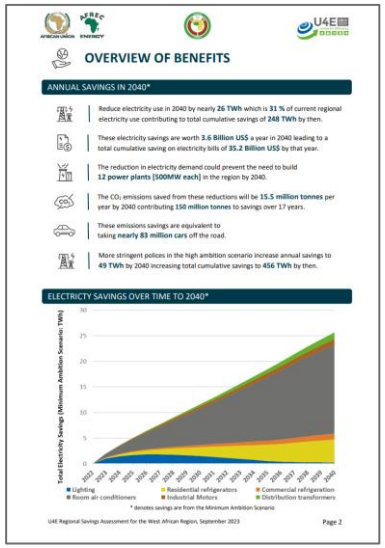
Regional Savings Assessments

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 **for a region.**

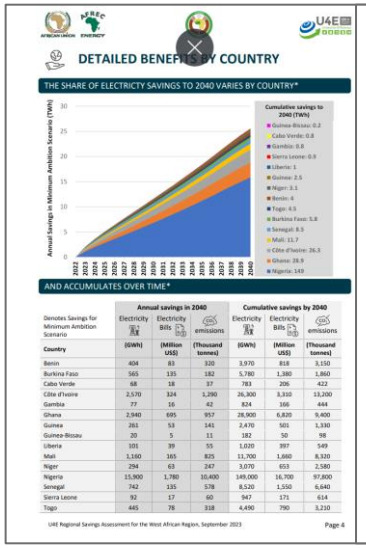
The savings scenarios are similar to the country savings assessment

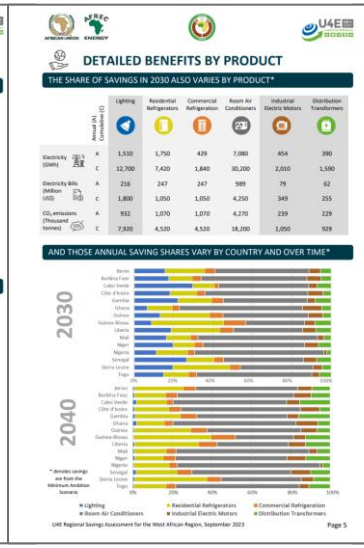


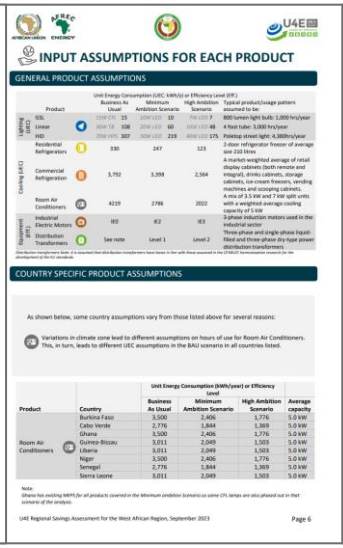


Overview of the Report

- Introduction
- Overview of Benefits
- The Potential or more benefits
- Detailed annual and cumulative benefits in 2040 by country
- Detailed benefits in 2030/40 by product
- Assumptions by products
- Country data and methodology







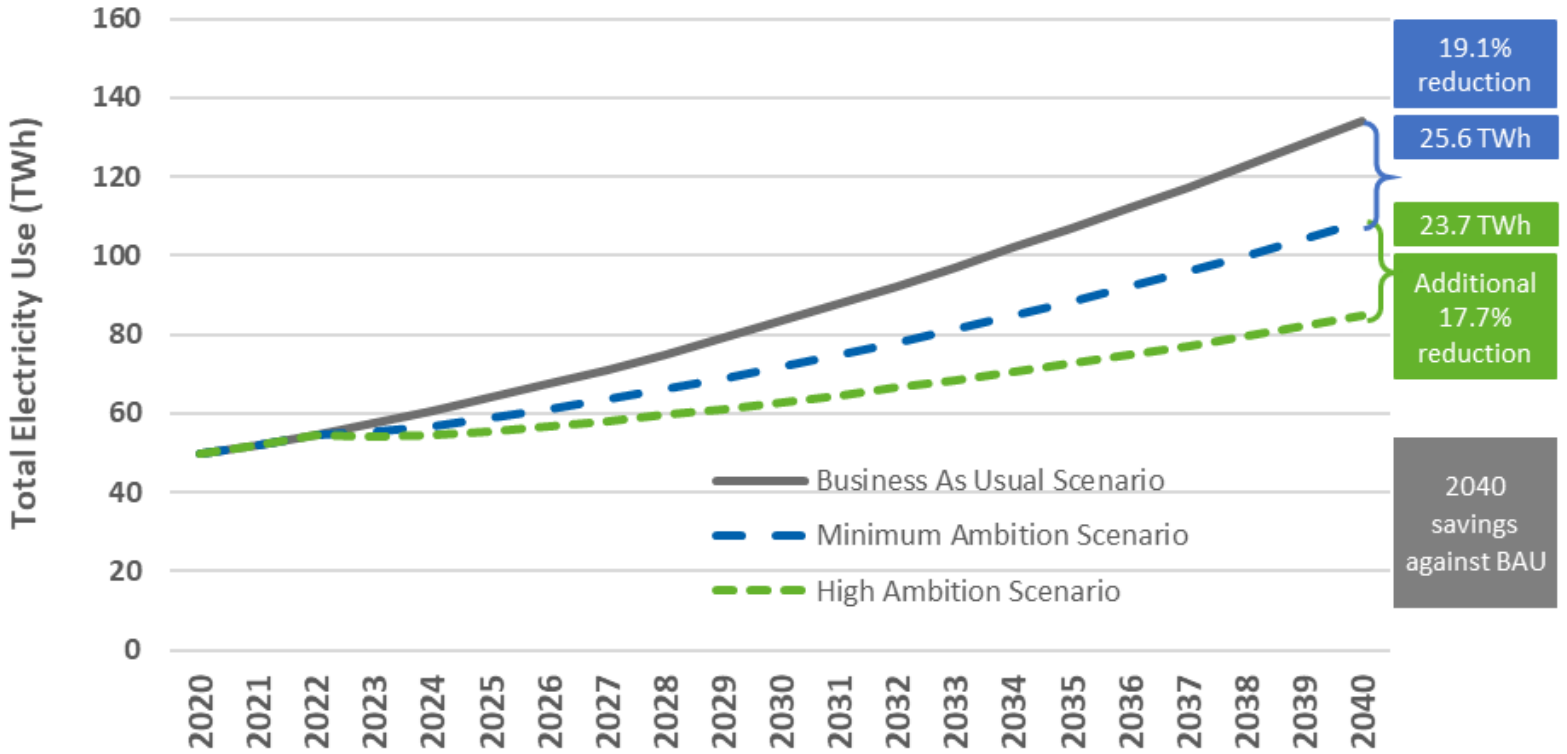
*Regional savings assessments are available for East Africa, North Africa, Southern Africa , Western Africa and South-east Asia.

Individual country/regional savings reports can be downloaded from https://united4efficiency.org/countries/country-assessments/

Overview of U4E modelling approach

Estimate energy use of each product between 2020-2040 in three scenarios

- *Business As Usual (BAU):* assumes no policy interventions
- *Minimum Ambition:* assumes Minimum Energy Performance Standards (MEPS) are introduced in line with the U4E model regulations
- *High Ambition:* Assumes MEPS introduced at a more stringent level



Overview of U4E modelling approach

Estimating BAU total national electricity use of a product is done in one of two ways:

1. Bottom up (cooling and lighting):
   - A stock model is used to estimate the total installed stock and sales of the product over time
   - Typical product energy use then allows an estimate of total annual electricity consumption
2. Top down (equipment):
   - Total product electricity use is estimated based on macroeconomic data

Policy scenarios then assume that new product energy consumption falls allowing savings to be estimated

- Bottom up: All new and replacement product sales from the stock model meet the new MEPS level introduced
- Top down: product lifetime defines a % of electricity use replaced by MEPS compliant products along with any growth in electricity demand

Overview of U4E modelling approach

Methodology

Data Collection

Manufacturer inputs, trade databases (UN COMTRADE), commercial partner data, academic data and market assessments

Data Prioritization

- Local data
- Proxy data
- Data from Theory
- Expert opinion

Macro-economic data*

	Current Source
Population (million)	UN Population Division
GDP Per Capita (US$)	World Bank (Growth from IPCC SSP3)
Electrification Level	IEA WEO and World Bank
Urbanisation rate	United Nations data
Household numbers	UN Population Division
CO2 Emissions factor (kg/kWh)	IEA and the Institute of Global Environmental Strategies (IGES)
Residential Electricity Tariff (US$/kWh)	IEA
Transmission and Distribution loss factor	IEA
Total National Electricity consumption (TWh)	World Bank, IEA WEO and US EIA

Model development

- Estimate ownership over time
- Develop Stock model
- Validate stock and sales projections
- Define typical product characteristics (Unit energy consumption, etc.)
- Derive estimated electricity use in different scenarios

ECOWAS Region Product Assumptions

GENERAL PRODUCT ASSUMPTIONS

	Product	Unit Energy Consumption (UEC: kWh/y) or Efficiency Level (Eff.) Business As Usual	Minimum Ambition Scenario	High Ambition Scenario	Typical product/usage pattern assumed to be:
Lighting (UEC)	GSL	*15W CFL* 15	*10W LED* 10	*7W LED* 7	800 lumen light 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 (UEC)	Residential Refrigerators	330	247	123	2-door refrigerator freezer of average size 210 litres
	Commercial Refrigeration	3,792	3,398	2,564	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	4219	2786	2022	A mix of 3.5 kW and 7 kW split units with a weighted-average cooling capacity of 5 kW
Equipment (Eff.)	Industrial Electric Motors	IE0	IE2	IE3	3-phase induction motors used in the industrial sector
	Distribution Transformers	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.

ECOWAS Region Product Assumptions (Country updates)

Variations in climate zone lead to different assumptions on hours of use for Room Air Conditioners. This, in turn, leads to different UEC assumptions in the BAU scenario in all countries listed.

Product	Country	Unit Energy Consumption (kWh/year) or Efficiency Level			
		Business As Usual	Minimum Ambition Scenario	High Ambition Scenario	Average capacity
Room Air Conditioners	Burkina Faso	3,500	2,406	1,776	5.0 kW
	Cabo Verde	2,776	1,844	1,369	5.0 kW
	Ghana	3,500	2,406	1,776	5.0 kW
	Guinea-Bissau	3,011	2,049	1,503	5.0 kW
	Liberia	3,011	2,049	1,503	5.0 kW
	Niger	3,500	2,406	1,776	5.0 kW
	Senegal	2,776	1,844	1,369	5.0 kW
	Sierra Leone	3,011	2,049	1,503	5.0 kW

Note:
Ghana has existing MEPS for all products covered in the Minimum ambition Scenario so some CFL lamps are also phased out in that scenario of the analysis.

Improving future analyses

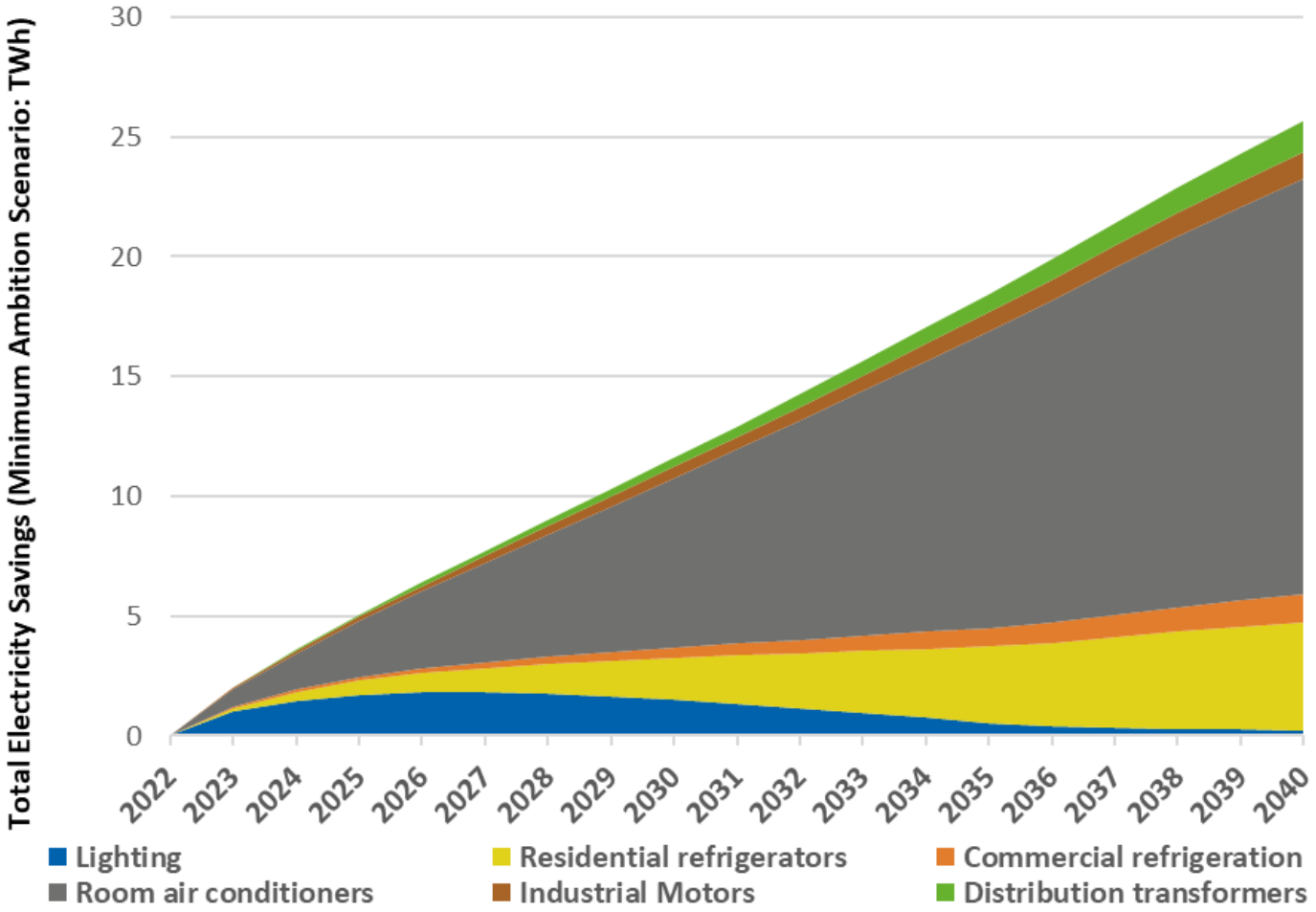
- Good quality data is key to more robust analyses and savings projections
- The hierarchy of data collections methods

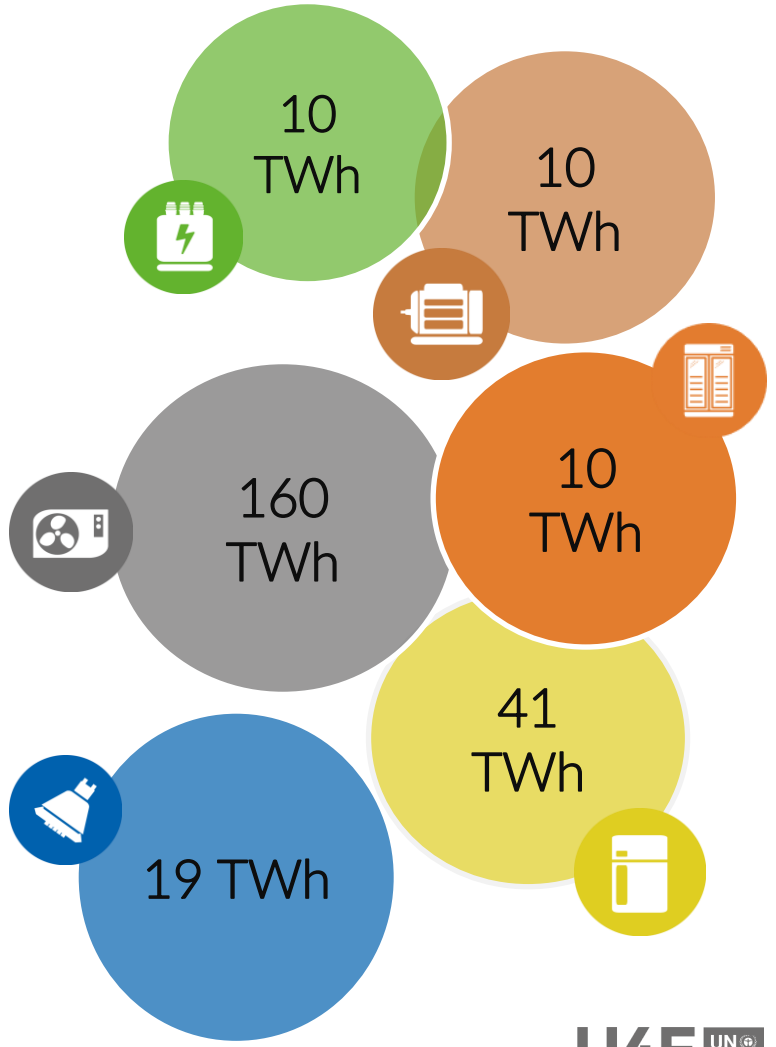
	Product technical data e.g. efficiency	Product price data	Market share/unit sales by product	Product usage data	Energy cost data	Macro socio-economic data	Environmental data - emissions factors and refrigerants	Other analysis specific data
Product Registration System	✓		✓				✓	
Surveys, questionnaires (retail, manufacturer, domestic)	✓	✓	✓	✓	✓			
Customs		✓	✓					
Internet sales	✓	✓	✓				✓	
Market research	✓	✓	✓				✓	✓
Utilities				✓	✓			
International data/Census data						✓		✓

Regional Savings Assessment Results

Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

Total Cumulative Electricity savings to 2040, detailed per product*





*Savings with Minimum Ambition Scenario, displayed savings in 2040

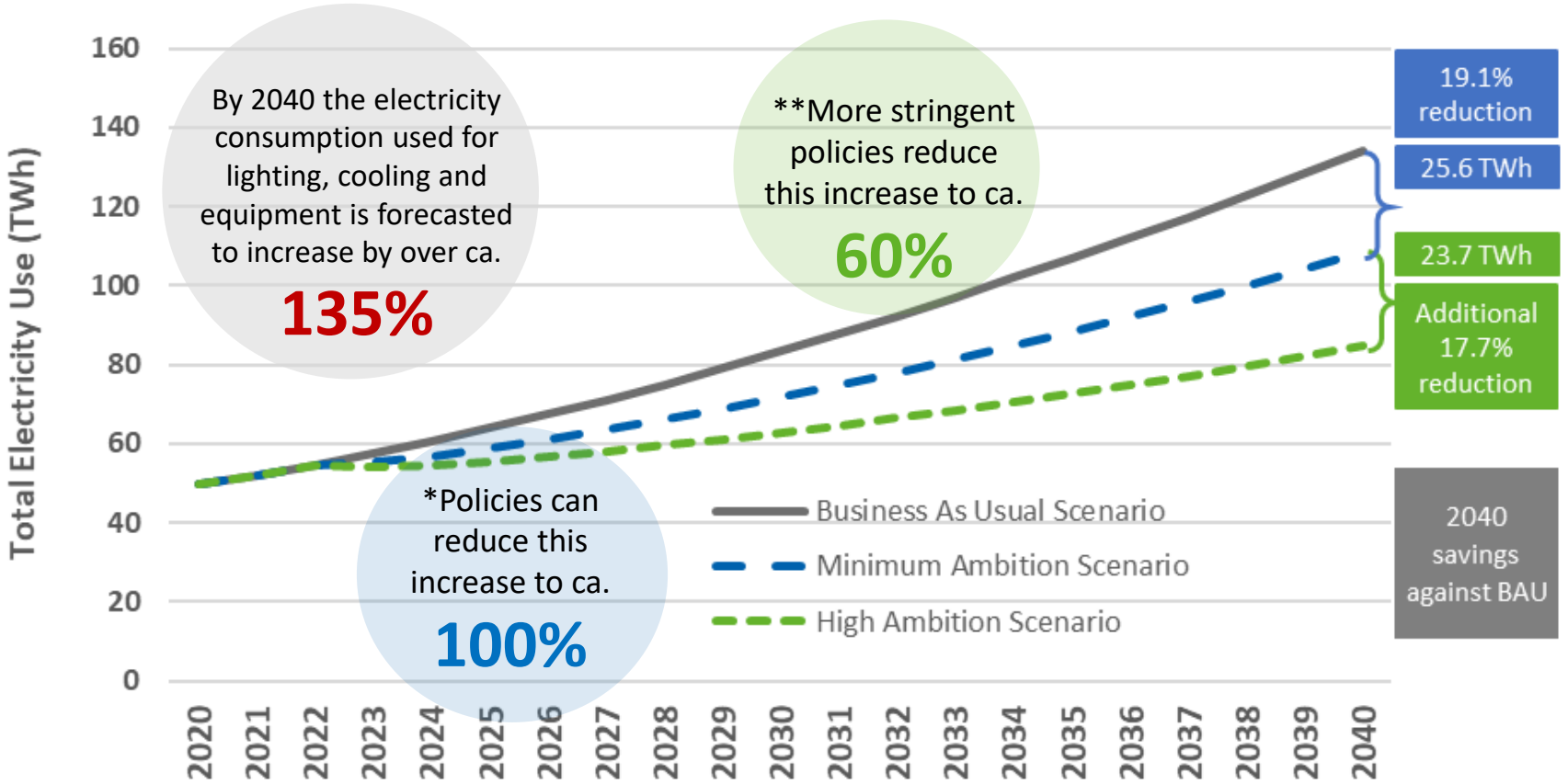
Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

Total Electricity savings to 2040, detailed per product

	Annual (A) Cumulative (C)	Lighting	Residential Refrigerators	Commercial Refrigeration	Room Air Conditioners	Industrial Electric Motors	Distribution Transformers
Electricity (GWh)	A	1,510	1,750	429	7,080	454	390
	C	12,700	7,420	1,840	30,200	2,010	1,590
Electricity Bills (Million US$)	A	216	247	247	989	79	62
	C	1,800	1,050	1,050	4,250	349	255
CO_2 emissions (Thousand tonnes)	A	932	1,070	1,070	4,270	239	229
	C	7,920	4,520	4,520	18,200	1,050	929

Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

Total Electricity consumption forecast to 2040



Annual Savings by 2040*

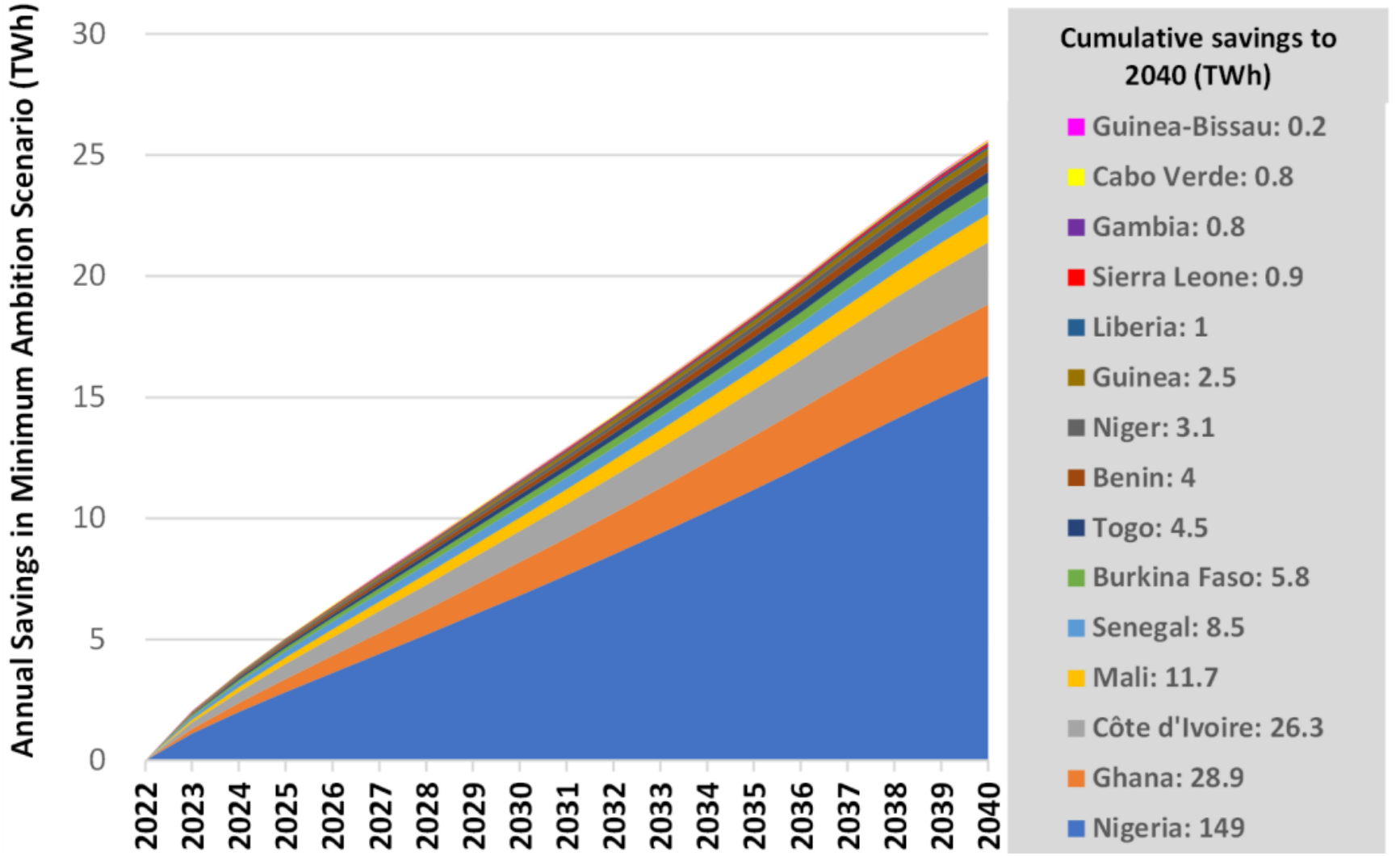
Between **26 to 50 TWh** of electricity consumption, which is equivalent to:

- **30 to 60%** of current regional electricity
- **12 to 22** Power Plants [500MW each]
- **16 to 30 million tonnes** per year of **CO_2**
- **US$ 3.6 to 7 billion per year** in electricity bill savings

* Range Savings of all five products from a Minimum Ambition Scenario and a Higher Ambition Scenario to current international standards/norms

Savings Potential in Southern Africa from Energy-Efficient Lighting, Appliances and Equipment

Total Electricity Savings to 2040, detail per Country



Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

Total Annual and Cumulative Electricity Savings to 2040, Detail per Country

Denotes Savings for Minimum Ambition Scenario	Annual savings in 2040			Cumulative savings by 2040		
	Electricity	Electricity Bills	CO_2 emissions	Electricity	Electricity Bills	CO_2 emissions
Country	**(GWh)**	**(Million US$)**	**(Thousand tonnes)**	**(GWh)**	**(Million US$)**	**(Thousand tonnes)**
Benin	404	83	320	3,970	818	3,150
Burkina Faso	565	135	182	5,780	1,380	1,860
Cabo Verde	68	18	37	783	206	422
Côte d'Ivoire	2,570	324	1,290	26,300	3,310	13,200
Gambia	77	16	42	824	166	444
Ghana	2,940	695	957	28,900	6,820	9,400
Guinea	261	53	141	2,470	501	1,330
Guinea-Bissau	20	5	11	182	50	98
Liberia	101	39	55	1,020	397	549
Mali	1,160	165	825	11,700	1,660	8,320
Niger	294	63	247	3,070	653	2,580
Nigeria	15,900	1,780	10,400	149,000	16,700	97,800
Senegal	742	135	578	8,520	1,550	6,640
Sierra Leone	92	17	60	947	171	614
Togo	445	78	318	4,490	790	3,210

Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

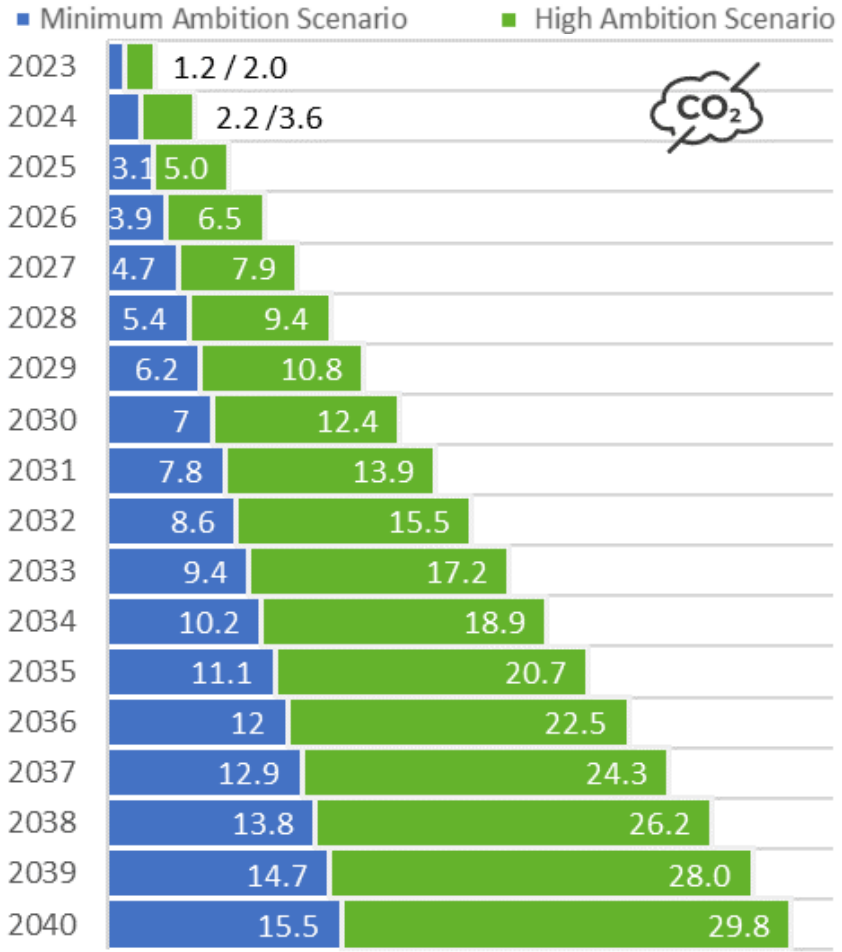
CO_2 Emissions Savings (Million Tonnes)

Cumulative Savings to 2040:

- 150 million tonnes
- 275 million tonnes

Cumulative Savings to 2030:

- 34 million tonnes
- 58 million tonnes



These emissions savings by 2040 are equivalent to taking between 19 to 32 million* fossil fuelled cars off the road.

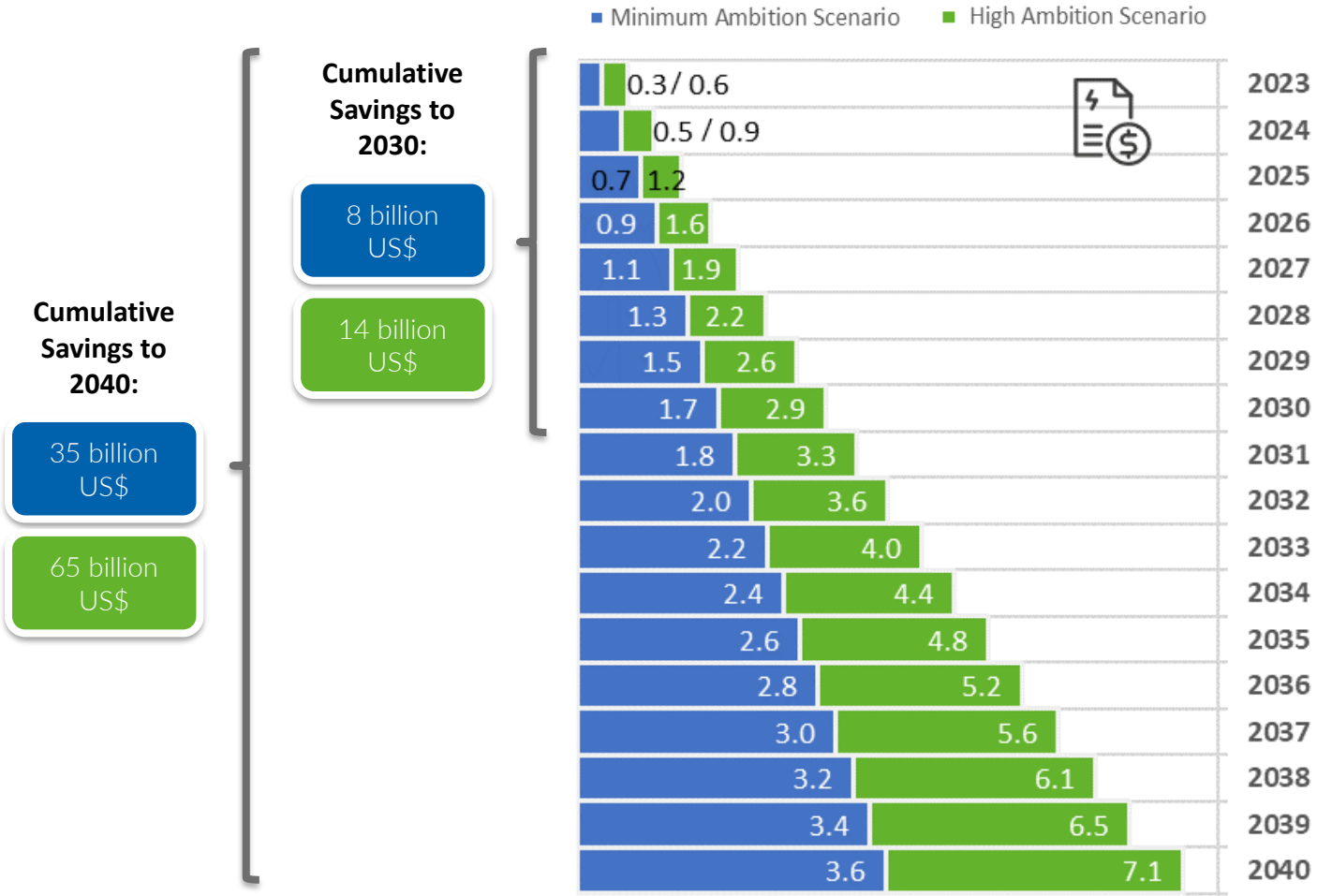
Reduced cumulative direct GHG emissions from refrigerants by

17 million tonnes*

* Range Savings of all six products from Minimum Ambition Scenario and High Ambition Scenario

Savings Potential in Western Africa from Energy-Efficient Lighting, Appliances and Equipment

Economical Savings (Billion $ USD)



Reduced annual electricity bills between 3.6 – 7 billion US$*

Increased grid connection to between 12 - 23 million households*

* Range Savings of all six products from Minimum Ambition Scenario and High Ambition Scenario

Western Africa Regional Savings Assessment

Available in multiple languages:

English French Portuguese

Regional Savings Assessment and Assumptions:

https://united4efficiency.org/countries/country-assessments/

KNOW MORE ABOUT U4E and AFREC AND JOIN US:

Check our websites

Find out tools, policy guides and policy briefs, webinars, model regulations, country assessments and news releases on our official website.

http://united4efficiency.org/

https://au-afrec.org/

U4E introduction video

Need a quick introduction to our project? Our three-minute general video is at:
EN http://united4efficiency.org/accelerating-the-transition-to-high-efficiency-products/

Want to know more about AFREC-U4E African Energy Efficiency Programme? See our factsheet at:
https://united4efficiency.org/resources/african-energy-efficiency-program/


WE NEED MORE
ENERGY EFFICIENCY
TO COOL THE WORLD
U4E
United for Efficiency
UN environment

Contact

TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS

Thank you

EMAIL

Soledad Garcia – soledad.garcia@un.org
Saikiran Kasamsetty – saikiran.kasamsetty@un.org

WEBSITE

united4efficiency.org