Regional Savings Assessment

West African Region

LIGHTING

All Lighting

COOLING

Residential Refrigerators

Commercial Refrigeration

Room Air Conditioners

EQUIPMENT

Industrial Electric Motors

Distribution Transformers

INTRODUCTION

This Regional Savings Assessment report provides a summary of the benefits attained from improved energy efficiency and climate friendly lighting, cooling appliances, and equipment for the West African Region. 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 stringent MEPS are implemented in line with the highest levels proposed in the guidelines.

This analysis covers the following countries: Benin, Burkin Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Individual country overview reports for lighting, cooling and equipment can be found on the UNEP U4E website.

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1 The assumptions for each of these scenarios in each country are detailed on p6 of this report.

OVERVIEW OF BENEFITS

ANNUAL SAVINGS IN 2040*

Reduce electricity use in 2040 by nearly **26 TWh** which is **31 %** of current regional electricity use contributing to total cumulative savings of **248 TWh** by then.

These electricity savings are worth **3.6 Billion US$** a year in 2040 leading to a total cumulative saving on electricity bills of **35.2 Billion US$** by that year.

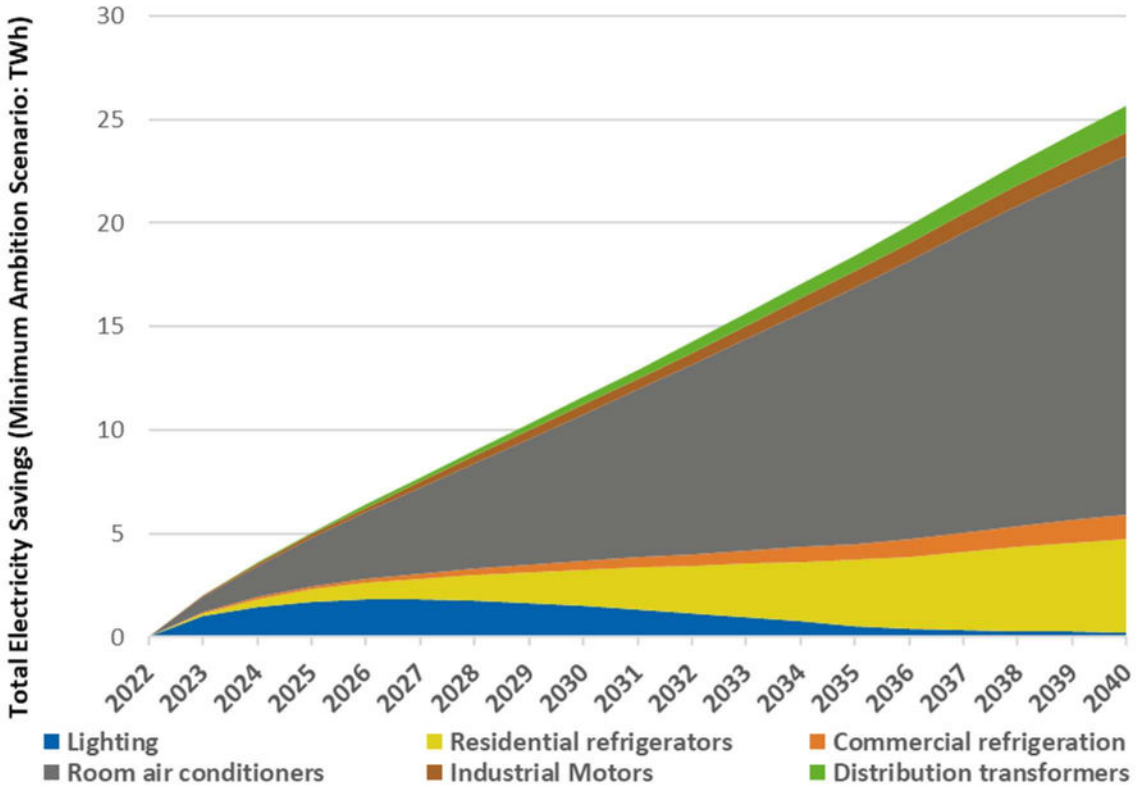
The reduction in electricity demand could prevent the need to build **12 power plants [500MW each]** in the region by 2040.

The CO_2 emissions saved from these reductions will be **15.5 million tonnes** per year by 2040 contributing to **150 million tonnes** of savings over 17 years.

These emissions savings are equivalent to taking **nearly 83 million cars** off the road.

More stringent polices in the high ambition scenario increase annual savings to **49 TWh** by 2040 increasing total cumulative savings to **456 TWh** by then.

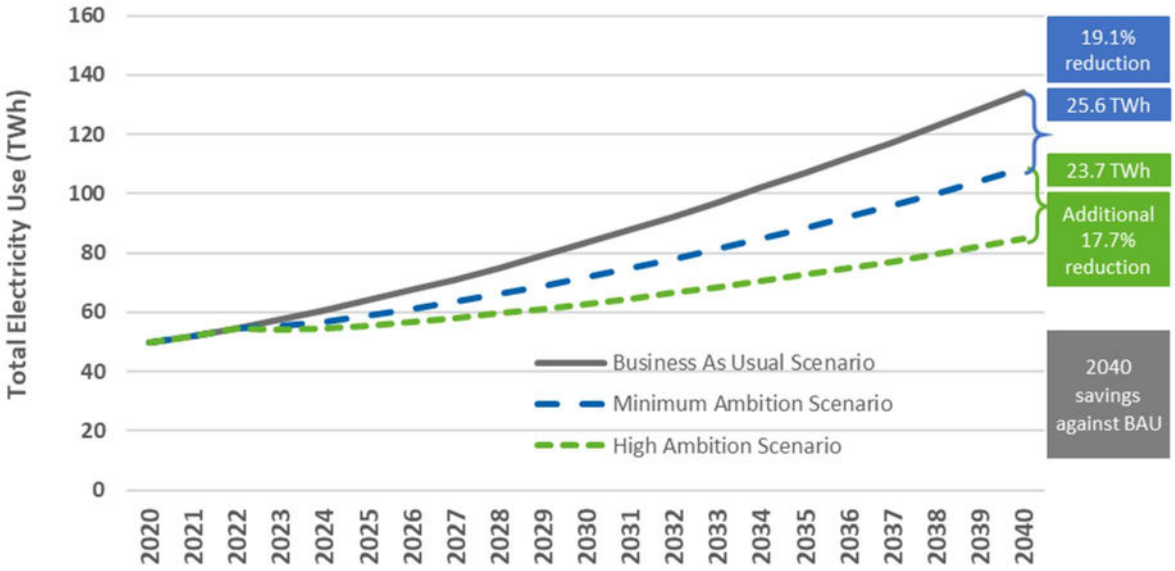
ELECTRICTY SAVINGS OVER TIME TO 2040*



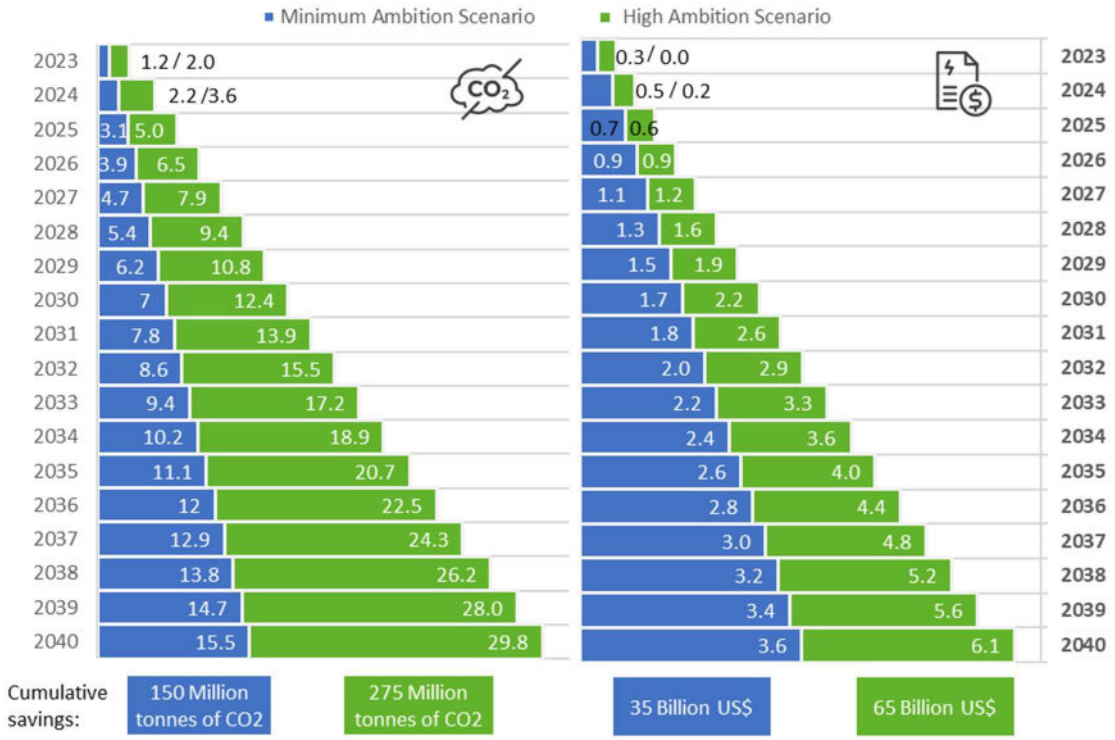
* denotes savings are from the Minimum Ambition Scenario

THE POTENTIAL FOR MORE BENEFITS

THE MORE AMBITIOUS THE POLICY, THE MORE ELECTRICITY SAVINGS ARE



BRINGING EXTRA SAVINGS OVER TIME IN BOTH CO_2 AND ELECTRICITY BILLS



AND OTHER SOCIETAL BENEFITS IN 2040 BY SCENARIO**

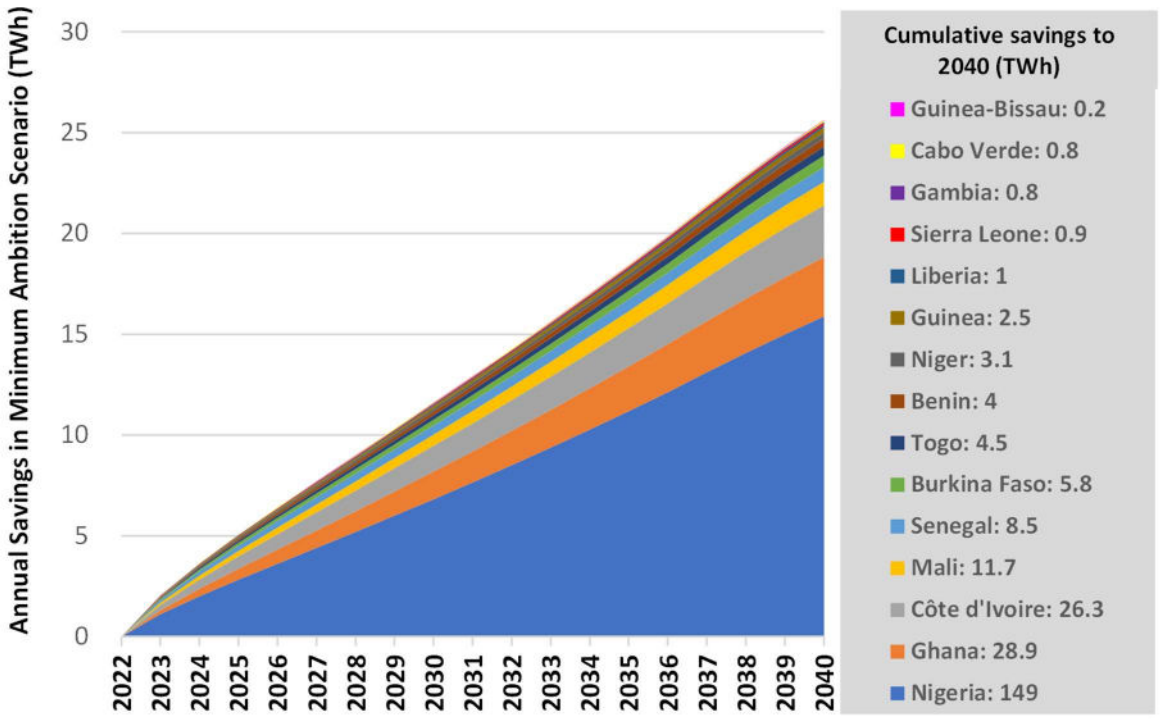
Increased grid connection to between **12 – 23 Million households**

Reduced cumulative direct GHG emissions by nearly **17 Million tonnes**

** denotes a range of savings are shown from the Minimum Ambition to the High Ambition Scenario

DETAILED BENEFITS BY COUNTRY

THE SHARE OF ELECTRICTY SAVINGS TO 2040 VARIES BY COUNTRY*



AND ACCUMULATES OVER TIME*

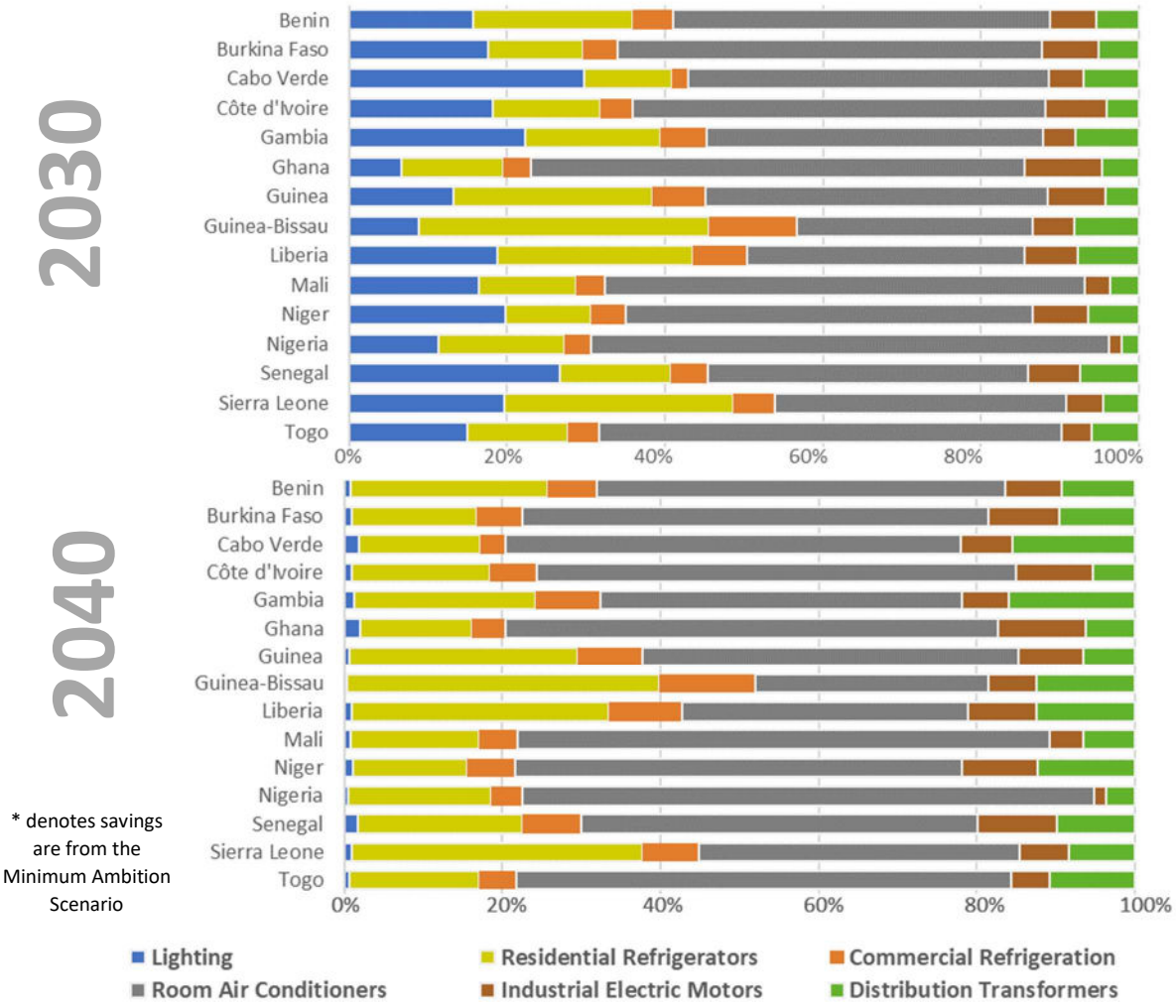
Denotes Savings for Minimum Ambition Scenario	Annual savings in 2040			Cumulative savings by 2040		
	Electricity	Electricity Bills	CO_2 emissions	Electricity	Electricity Bills	CO_2 emissions
Country	**(GWh)**	**(Million US$)**	**(Thousand tonnes)**	**(GWh)**	**(Million US$)**	**(Thousand tonnes)**
Benin	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

DETAILED BENEFITS BY PRODUCT

THE SHARE OF SAVINGS IN 2030 ALSO VARIES BY 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

AND THOSE ANNUAL SAVING SHARES VARY BY COUNTRY AND OVER TIME*



* denotes savings are from the Minimum Ambition Scenario

INPUT ASSUMPTIONS FOR EACH PRODUCT

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.

COUNTRY SPECIFIC PRODUCT ASSUMPTIONS

As shown below, some country assumptions vary from those listed above for several reasons:

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.

COUNTRY DATA AND METHODOLOGY

COUNTRY DATA

ELECTRICITY MARKET

	Population (million)	GDP Per Capita (US$)	Electrification Level	CO_2 Emissions factor (kg/kWh)	Residential Electricity Tariff (US$/kWh)	Transmission and Distribution loss factor
Benin	12.5	1,321	46.5%	0.72	0.21	9.2%
Burkina Faso	21.5	884	23.4%	0.28	0.24	13.4%
Cabo Verde	0.6	3,159	96.3%	0.49	0.26	9.2%
Côte d'Ivoire	27.1	2,465	74.2%	0.43	0.13	14.3%
Gambia	2.5	797	62.4%	0.49	0.20	9.2%
Ghana	31.7	2,287	85.4%	0.25	0.24	22.6%
Guinea	13.5	1,271	56.6%	0.49	0.20	9.2%
Guinea-Bissau	2.0	750	33.1%	0.49	0.27	9.2%
Liberia	5.2	665	30.8%	0.49	0.39	9.2%
Mali	20.9	888	50.4%	0.65	0.14	9.2%
Niger	25.1	579	21.0%	0.49	0.21	41.8%
Nigeria	211.4	2,165	58.0%	0.55	0.11	16.1%
Senegal	17.2	1,510	74.1%	0.68	0.18	12.9%
Sierra Leone	8.1	525	24.4%	0.40	0.18	38.0%
Togo	8.5	944	56.9%	0.21	0.18	71.0%

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. Details are available on request but, in summary:

- 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 forwards 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. Motors electricity use 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.
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