



# Presentation and discussion on proposed MEPS for Air Conditioners

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# Summary of U4E Model Regulation Guidelines for Air Conditioners



Scope and product categories



MEPS & performance labelling requirements



Test methods and efficiency metrics



Refrigerant requirements

## Adopted from the U4E Model Regulation Guidelines

- Air conditioners, Ductless single-split, Self-contained, Portable types
- Largely aligned with international best practices (split & self-contained)

### *Ductless Split & Self-contained*

- ISO 5151 & 16358
- CSPF (cooling-only ACs)

### *Portable*

- ISO 18326
- EER (cooling-only ACs)

### *Ductless Split*

- GWP 750 or less
- ODP 0

### *Self-contained & Portable*

- GWP 150 or less
- ODP 0

# Existing Room Air conditioner MEPS in the region (1)

## Regional SADC MEPS

Minimum CSPF Requirements for Air Conditioners

Category	CSPF (CONSIDERATION 2024)	CSPF (CONSIDERATION 2027 and beyond)
CC ≤ 4.5 kW	4.50	6.10
4.5 kW < CC ≤ 9.5 kW	4.20	5.10
9.5 kW < CC ≤ 16.0 kW	3.80	4.50
Outdoor Temperature Bin Hours	Table 7 (Table 3 in ISO 16358-1:2013)	

Minimum Requirements for EER of Portable Air Conditioners

Type	EER
All	3.10

# Existing Room Air conditioner MEPS in the region (2)

## Regional ECOWAS MEPS

Type of air conditioners	EER
All AC with capacity up to 20 kW	EER $\geq$ 2.8

The fixed speed units approximately translate to 3 CSPF

## MEPS in Ghana

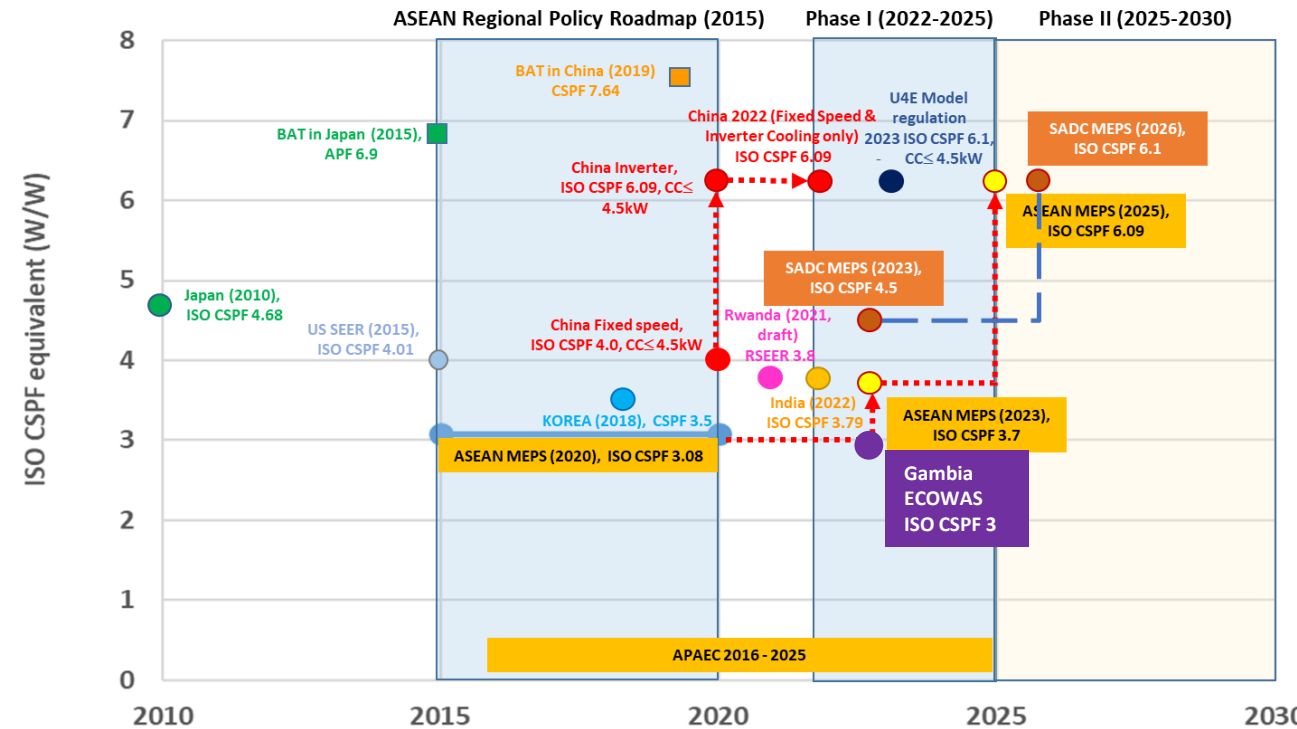
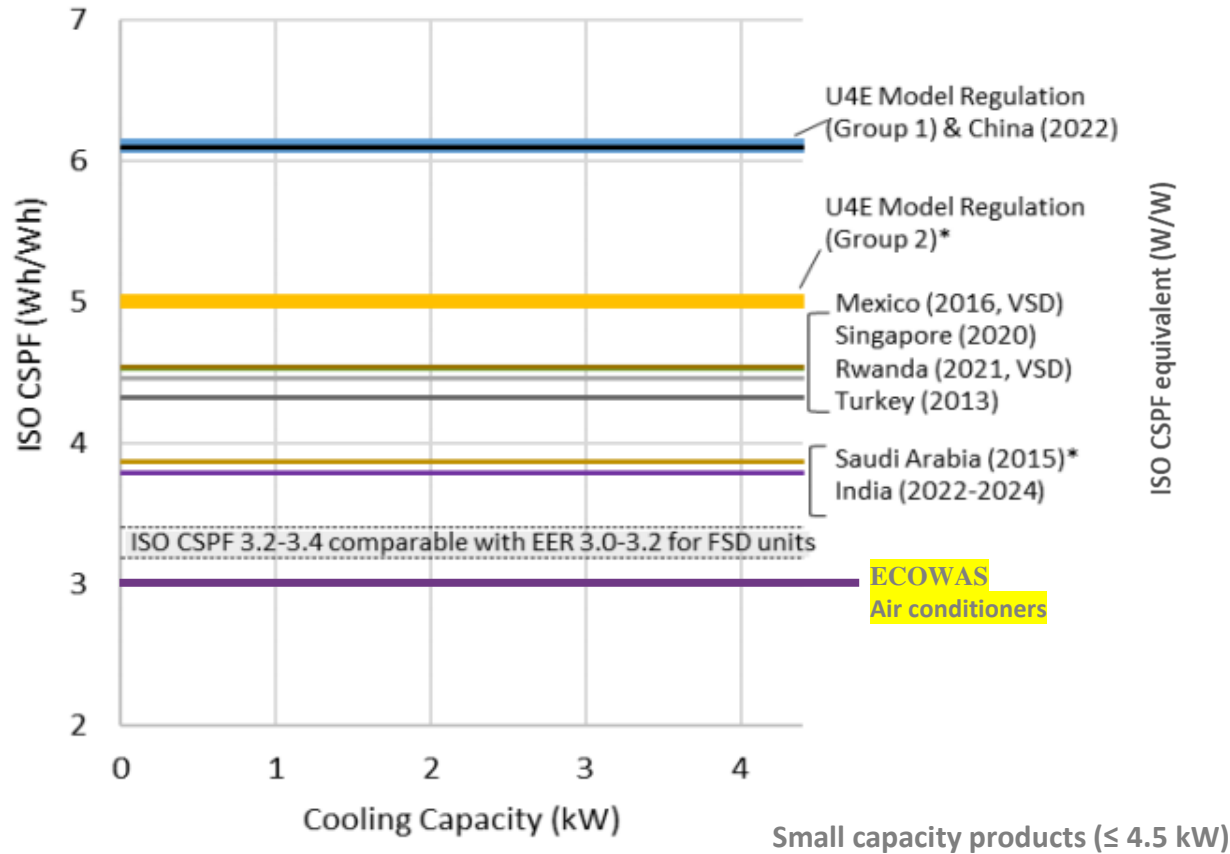
Category	MEPS (AEER)
CC $\leq$ 4 kW	3.66
4 kW < CC $\leq$ 10 kW	3.2 (3.4 CSPF)
10 kW < CC $\leq$ 39.0 kW	3.1
39 kW < CC $\leq$ 65.0 kW	3

## MEPS in Nigeria (Proposed)

Energy class	All sizes and types except portable air conditioners	Portable Air Conditioners
5-Star (Most efficient)	SEER $\geq$ 7.40	EER $\geq$ 4.20
4-Star	6.60 $\leq$ SEER < 7.40	3.80 $\leq$ EER < 4.20
3-Star	5.80 $\leq$ SEER < 6.60	3.40 $\leq$ EER < 3.80
2-Star	5.10 $\leq$ SEER < 5.80	3.10 $\leq$ EER < 3.40
1-Star	4.40 $\leq$ SEER < 5.10	2.90 $\leq$ EER < 3.10

# RAC– Minimum Energy Performance Requirements Global Trends

The Model Regulation Guidelines suggest requirements to be consistent with the market transition expected from technology and policy improvements in major and emerging economies.



*Inefficient products can't meet these levels, and there are stretch tiers for labels.*

See the Model Regulation Guidelines Supporting Information for more details.

# Scope of Products – Room Air conditioning appliances



**Single Split**



**Window/ self-contained**



**Portable**



# Scope of Products – Room Air conditioning appliances

Covered	Not covered
<ul style="list-style-type: none"><li>• Electrical single-phase</li><li>• Non-ducted single-split</li><li>• Self-contained</li><li>• Portable</li><li>• Rated cooling output <math>\leq 16</math> kW</li></ul>	<ul style="list-style-type: none"><li>• Rated cooling output <math>&gt; 16</math> kW</li><li>• Water-cooled ACs, water-source HPs</li><li>• Multi-split ACs and HPs</li><li>• Ducted equipment</li><li>• Non-Vapor compression technologies</li></ul>

ACs: air conditioners; HPs: heat pumps



# Terms, Test Standards and Metrics

- Terms and definitions are harmonized with those in the reference standards.

	Testing/Rating Standards	Metric
Ductless split & Self-contained	<ul style="list-style-type: none"><li>• ISO 16358: 2013</li><li>• ISO 5151: 2017</li></ul>	<ul style="list-style-type: none"><li>• CSPF (AC)</li></ul>
Portable	<ul style="list-style-type: none"><li>• ISO 18326: 2018 + Amd 1: 2021</li></ul>	<ul style="list-style-type: none"><li>• EER (AC)</li></ul>

CSPF: cooling seasonal performance factor; HSPF: heating seasonal performance factor; APF: annual performance factor  
EER: energy efficiency ratio; COP: coefficient of performance

# RAC– Energy Performance Grade Requirements

The high-efficiency levels represent approximately 30-60 percent of the efficiency improvement that is possible in energy-efficient technologies globally, but similar to or less than the efficiency levels of best available technologies.

**Table 13: Labeling Requirements for Air Conditioners in Group 1 Countries**

Climate Group (Temperature Bin Hours)	Grade	Rated Cooling Capacity ≤ 4.5 kW	4.5 kW < Rated Cooling Capacity ≤ 9.5 kW	9.5 kW < Rated Cooling Capacity ≤ 16.0 kW
Group 1 (ISO 16358-1: 2013)	High Efficiency	8.00 ≤ CSPF	7.60 ≤ CSPF	7.10 ≤ CSPF
	Intermediate	7.10 ≤ CSPF < 8.00	6.40 ≤ CSPF < 7.60	5.80 ≤ CSPF < 7.10
	Low Efficiency	6.10 ≤ CSPF < 7.10	5.10 ≤ CSPF < 6.40	4.50 ≤ CSPF < 5.80
0A (Model Regulation)	High Efficiency	7.40 ≤ CSPF	7.00 ≤ CSPF	6.60 ≤ CSPF
	Intermediate	6.60 ≤ CSPF < 7.40	6.00 ≤ CSPF < 7.00	5.50 ≤ CSPF < 6.60
	Low Efficiency	5.70 ≤ CSPF < 6.60	4.90 ≤ CSPF < 6.00	4.30 ≤ CSPF < 5.50
1A (Model Regulation)	High Efficiency	7.00 ≤ CSPF	6.60 ≤ CSPF	6.20 ≤ CSPF
	Intermediate	6.20 ≤ CSPF < 7.00	5.70 ≤ CSPF < 6.60	5.20 ≤ CSPF < 6.20
	Low Efficiency	5.40 ≤ CSPF < 6.20	4.70 ≤ CSPF < 5.70	4.20 ≤ CSPF < 5.20
2A (Model Regulation)	High Efficiency	7.30 ≤ CSPF	6.90 ≤ CSPF	6.50 ≤ CSPF
	Intermediate	6.50 ≤ CSPF < 7.30	5.90 ≤ CSPF < 6.90	5.40 ≤ CSPF < 6.50
	Low Efficiency	5.60 ≤ CSPF < 6.50	4.80 ≤ CSPF < 5.90	4.30 ≤ CSPF < 5.40
3A (Model Regulation)	High Efficiency	7.00 ≤ CSPF	6.60 ≤ CSPF	6.20 ≤ CSPF
	Intermediate	6.20 ≤ CSPF < 7.00	5.70 ≤ CSPF < 6.60	5.20 ≤ CSPF < 6.20
	Low Efficiency	5.40 ≤ CSPF < 6.20	4.70 ≤ CSPF < 4.70	4.20 ≤ CSPF < 5.20

Primary Climate Group <sup>a</sup>	Secondary Climate Group <sup>b</sup>			
	Thermal	Humid	Dry	Marine
Group 1	Extremely Hot	0A (Extremely Hot-Humid)		
	Very Hot	1A (Very Hot-Humid)		
	Hot	2A (Hot-Humid)	2B (Hot-Dry)	
	Warm	3A (Warm-Humid)	3B (Warm-Dry)	3C (Warm-Marine)
Group 2	Extremely Hot		0B (Extremely Hot-Dry)	
	Very Hot		1B (Very Hot-Dry)	
Group 3	Mixed	4A (Mixed-Humid)	4B (Mixed-Dry)	
	Cool	5A (Cool-Humid)	5B (Cool-Dry)	
	Cold	6A (Cold-Humid)	6B (Cold-Dry)	
	Very Cold		7	
	Subarctic/Arctic		8	

<sup>a</sup> For cooling energy efficiency calculation, primary climate group 1 and 3 refer to ISO 16358-1: 2013, and primary climate group 2 refers to ISO 16358-1: 2013/Amd 1:2019.

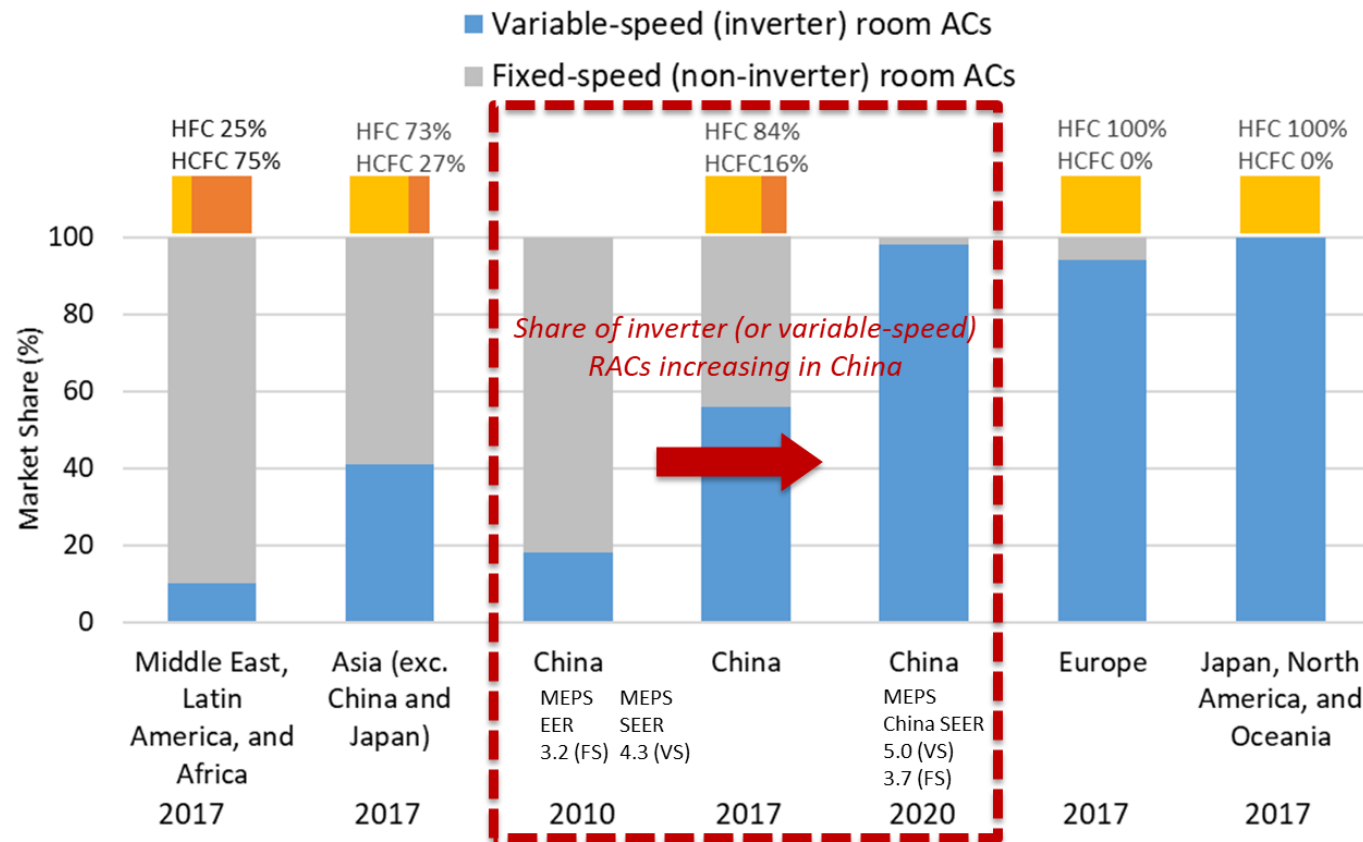
<sup>b</sup> According to ASHRAE climate zone definitions available at ANSI/ASHRAE Standard 169-2013.

# Global Air conditioner Trends: Overview



## Global AC Market

The global RAC market and policies are amid transition toward energy-efficient and sustainable solutions.



•Source: Updated from Park et al. (2021) Harmonizing Energy-Efficiency Standards for Room Air Conditioners in Southeast Asia, and JRAIA (2018) World AC Demand



# Test Requirements for Cooling (ISO 16358)

Operating condition		Fixed	Two-stage	Multi-stage	Variable
Full capacity and power input	Standard Temperature Outdoor DB 35°C / WB 24°C Indoor DB 27°C / WB 19°C	Required	Required	Required	Required
Half capacity and power input		- <sup>a</sup>	-	Default <sup>c</sup>	Required
Minimum capacity and power input		-	Default <sup>c</sup>	-	-
Full capacity and power input	Low Temperature Outdoor DB 29°C / WB 19°C Indoor DB 27°C / WB 19°C	Default <sup>b</sup>	Default <sup>b</sup>	Default <sup>b</sup>	Default <sup>b</sup>
Half capacity and power input		-	-	Required	Default <sup>b</sup>
Minimum capacity and power input		-	Required	-	-

- For **fixed-speed units**, determine CSPF by **using only one set of test data** at full-capacity operation at 35°C and use another set of data points at 29°C calculated by predetermined equations
- This results in a linear relationship with EER, i.e.,  $CSPF = 1.062 \times EER$  with the ISO reference temperature bin hours.
- For **variable-speed units**, determine CSPF while reducing compliance costs **by using two sets of test data** at full- and half-capacity operation at 35°C and another set of data points at 29°C calculated by predetermined equations, without considering a minimum-capacity operation.

<sup>a</sup> '-' represents Not applicable or Not considered.

<sup>b</sup> Performance at the lower temperature shall be calculated by using predetermined equations as below:

$Full\ Capacity(29^\circ C) = Full\ Capacity(35^\circ C) \times 1.077$ ;  $Full\ Power\ input(29^\circ C) = Full\ Power\ input(35^\circ C) \times 0.914$

$Half\ Capacity(29^\circ C) = Half\ Capacity(35^\circ C) \times 1.077$ ;  $Half\ Power\ input(29^\circ C) = Half\ Power\ input(35^\circ C) \times 0.914$

<sup>c</sup> Performance at the standard temperature shall be calculated by using predetermined equations as below:

$Half\ Capacity(35^\circ C) = Half\ Capacity(29^\circ C) \div 1.077$ ;  $Half\ Power\ input(35^\circ C) = Half\ Power\ input(29^\circ C) \div 0.914$

$Min\ Capacity(35^\circ C) = Min\ Capacity(29^\circ C) \div 1.077$ ;  $Min\ Power\ input(35^\circ C) = Min\ Power\ input(29^\circ C) \div 0.914$

# Cooling Seasonal Performance Factor (CSPF)

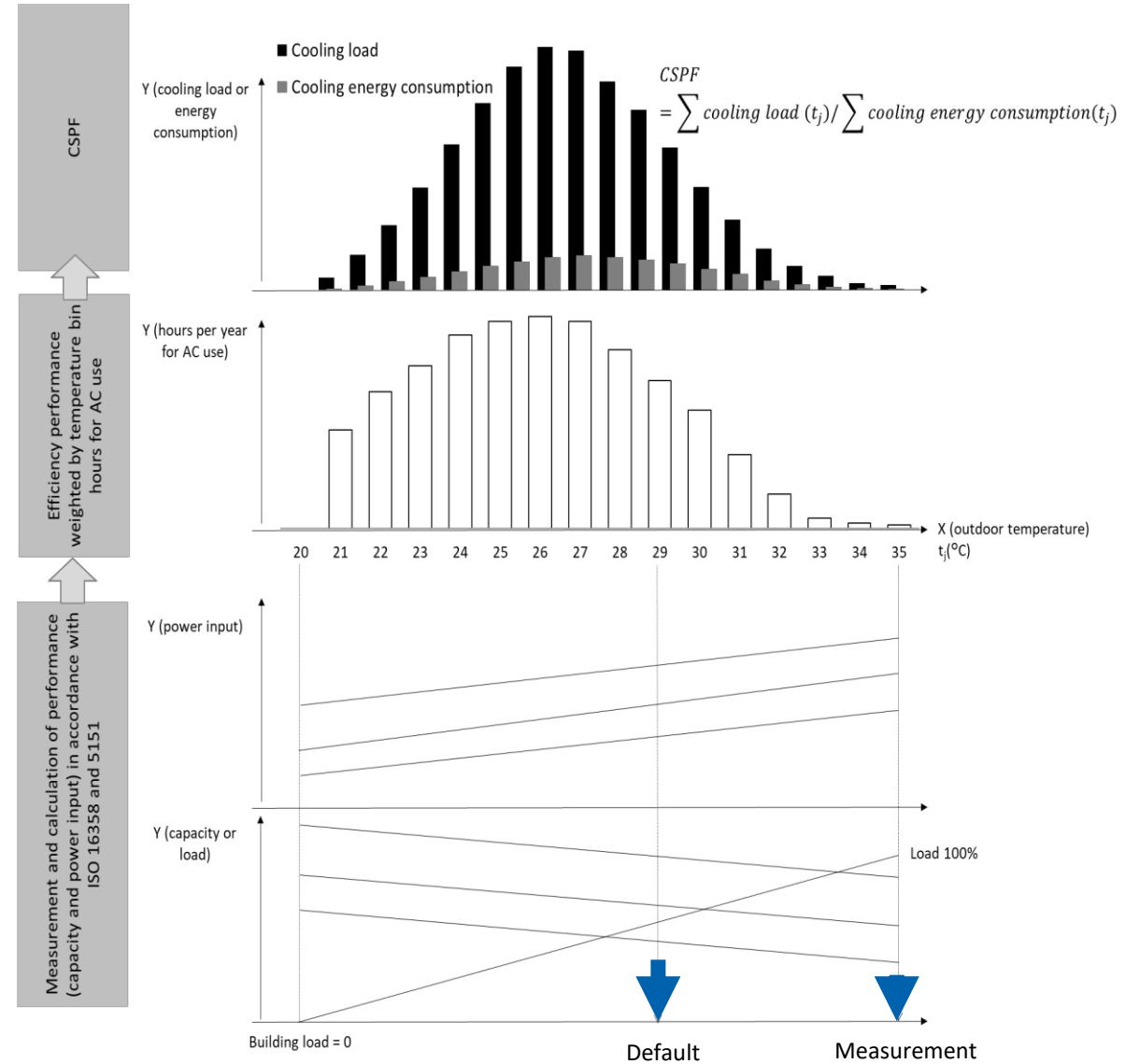
$$F_{CSP} \text{ (CSPF)} = \frac{L_{CST} \text{ (CSTL)}}{C_{CSE} \text{ (CSEC)}}$$

CSTL: cooling seasonal total load  
CSEC: cooling seasonal energy consumption

Parameter	Load 0%	Load 100%
Cooling Load (W)	0	$\phi_{ful}(t_{100})$
Outdoor Temperature (°C)	$t_0 = 20$	$t_{100} = 35$

Bin number j	1	2	3	4	5	6	7	8	9	10
Outdoor temperature $t_j$ (°C)	21	22	23	24	25	26	27	28	29	30
Bin hours	100	139	165	196	210	215	210	181	150	120

	11	12	13	14	15	Total
	31	32	33	34	35	-
	75	35	11	6	4	1817



# RAC– Refrigerant Requirements

Refrigerant GWP values refer to those specified in the IPCC’s Fourth Assessment Report on which the GWPs of HCFCs and HFCs listed in Annex C and Annex F of the Montreal Protocol are based. The GWP values of refrigerants not included in the IPCC fourth assessment can be based on the latest IPCC assessment report.

Category	GWP	ODP
Self-Contained & Portable	150	0
Ductless Split	750	0

**All units shall comply with standard ISO 5149 or IEC 60335-2-40:2018, a subsequent revision, or a nationally-modified edition of ISO 5149 or IEC 60335-2-40.**

ISO 5149: Refrigerating Systems And Heat Pumps - Safety And Environmental Requirements

IEC 60335-2-40: Household and similar electrical appliances - Safety - Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers





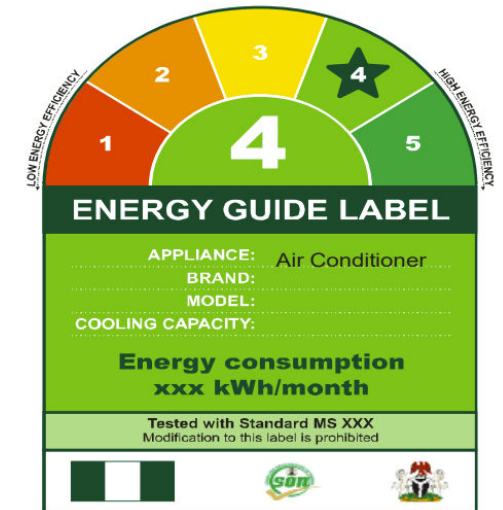
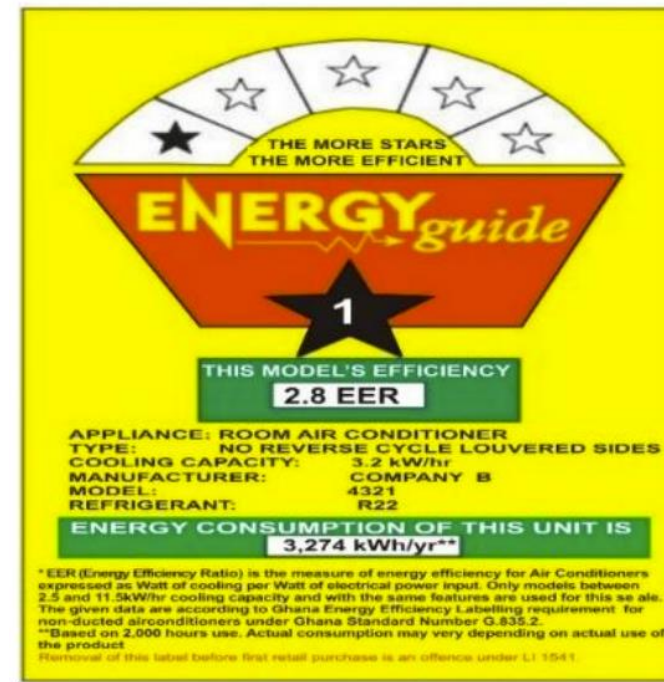
# RAC– Label Information of the Product

All representations of energy performance shall indicate that the performance rating is based on the measurement according to [test standard name], an indicative value, and not representative of actual annual energy consumption in all situations.

## Air Conditioners

- 1) Model name / serial number
- 2) Type of unit [ductless split, self-contained, or portable]
- 3) Country where the product was manufactured
- 4) Rated cooling (and heating, if applicable) capacity in kW
- 5) Rated maximum power consumption in kW
- 6) Rated performance grade
- 7) Rated energy efficiency in [CSPF, APF, EER, or COP], and yearly electricity consumption in kWh
- 8) Refrigerant designation in accordance with [ISO 817 or ASHRAE 34], including ODP and GWP.

Sample for regional (ECOWAS) EE label



# Summary of MEPS in the region

	Region/Country				
MEPS level (CSPF)	SADC	ECOWAS	Ghana	Nigeria	The Gambia
Current/Planned	4.5	3	3.4	4.3	3
Future	6.1		4		

**The findings from Market Assessment report shall reinforce the MEPS and the respective tiers**



# Open discussion



# Contact

TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS



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