

# U4E Model Regulation Guidelines for Energy-Efficient Ceiling Fans

14:15-14:35 UTC

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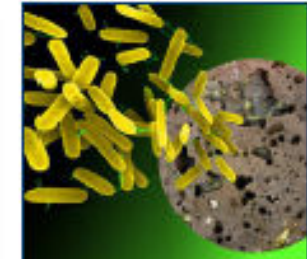
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- Dedicated to solving the most pressing scientific problems facing humanity.
- More than three decades of work internationally on clean energy and climate policy, appliances, buildings, transport, industry, air quality with significant focus on energy efficiency.
- Technical support for Kigali Amendment negotiations.
- Technical support for market transformation programs on efficient air conditioners and refrigerators in various countries including China, India, Brazil, Mexico, Egypt, Indonesia, Rwanda, and United for Efficiency (U4E) "Model Regulation Guidelines".



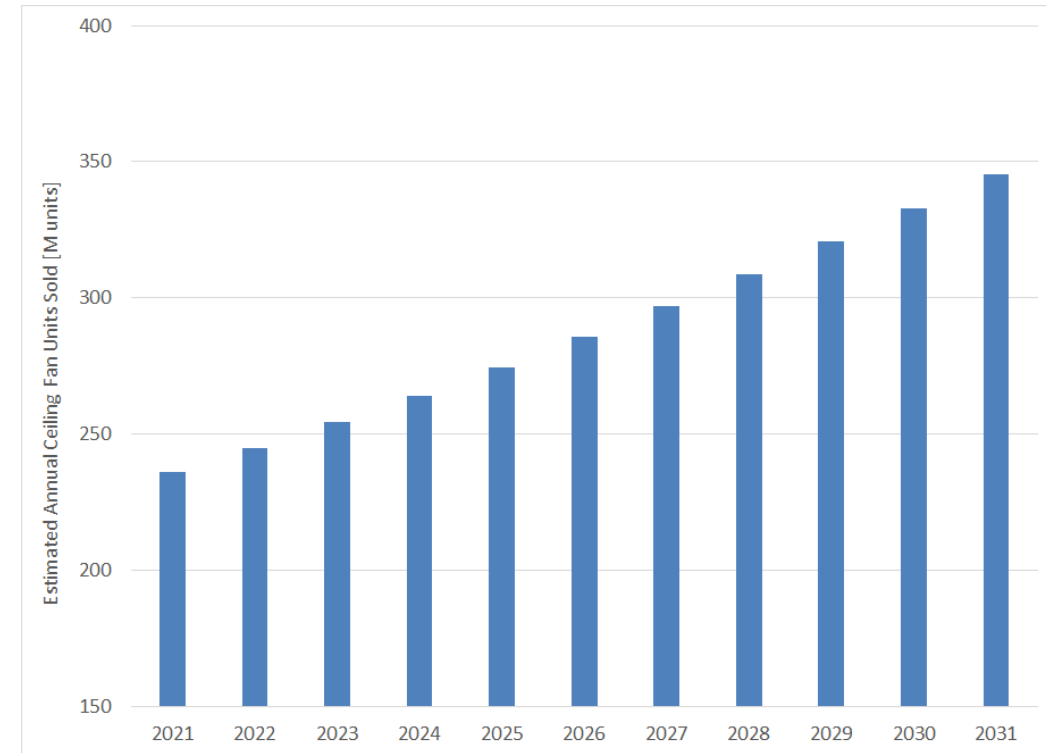
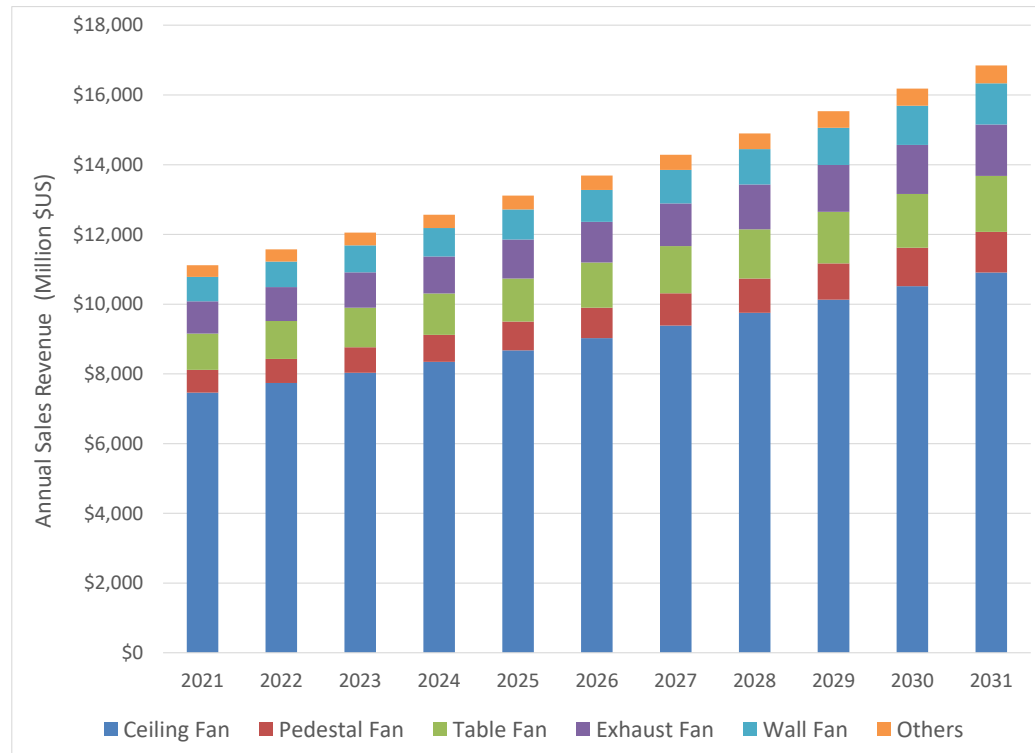
# Topics

- Market Overview and Scope of covered products
- Test methods and standards considerations
- Energy Efficiency analysis, benchmark with existing standards, recommended standard levels
- Safety and functional performance
- Entry into force, Conformity Assessment, Surveillance, and Revision
- Implementation starting points and supporting activities



# Market overview

- Ceiling fan revenues: 45% electric fan market median value
- Current market about \$7.5B and estimated to grow at 3.9% AGR to \$10.9B in 2031
- Approximately 250 million unit sales in 2023 to about 350 million units in 2031



Figures source: Allied Market Research 2023 report

# Market overview

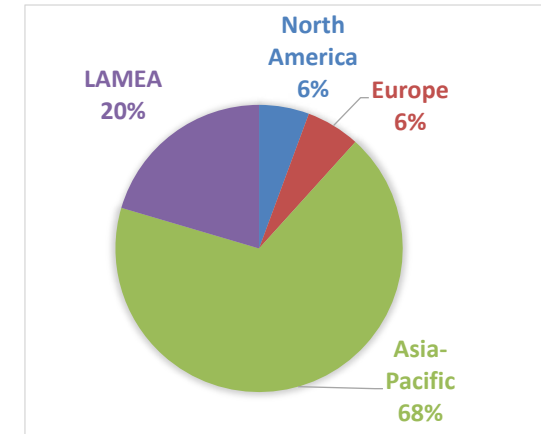
- Asia-Pacific largest regional share in 2023 and 2031

Number of ceiling fans sold annually by region, 2021-2031 (million units)

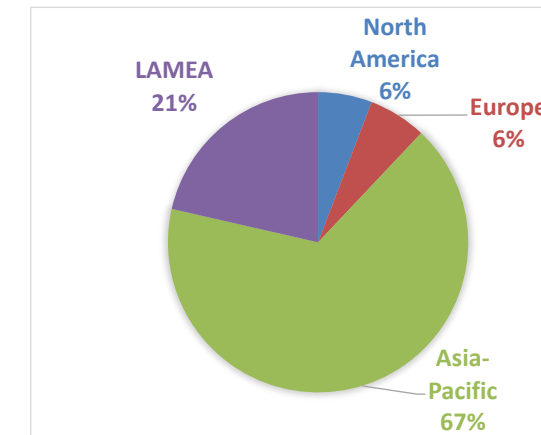
Region	2021	2023	2025	2027	2029	2031	Compound Annual Growth Rate (2022-2031)
Asia-Pacific	161.0	172.0	184.4	197.9	212.0	226.5	3.5%
Europe	14.2	15.4	16.7	18.1	19.6	21.2	4.1%
Latin America, the Middle East and Africa	47.7	51.8	56.4	61.6	67.1	73.0	4.4%
North America	13.2	14.3	15.5	16.8	18.3	19.8	4.1%
Total	236.0	253.4	273.0	294.5	317.0	340.5	3.9%

Source: Allied Market Research (2023).

## 2023 ANNUAL UNIT SALES



## 2031 ANNUAL UNIT SALES (proj.)



# Model guidelines focus on ceiling fans

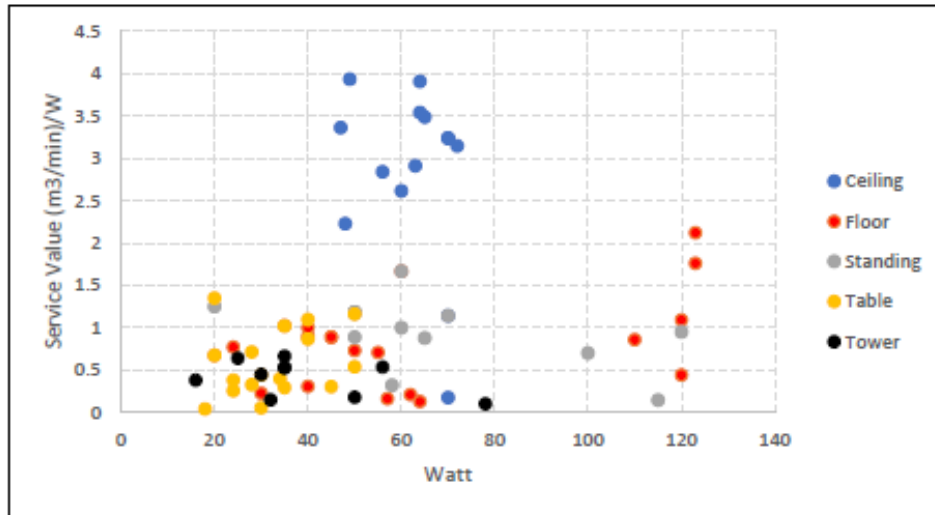


Figure 30: Spread in wattage and service values of comfort fans

- EC 2018 report: CF have 3-6 times higher EE for same power level.
- We recommend separate standards for CF and non-CF since CFs are a large, distinct electric fan market segment

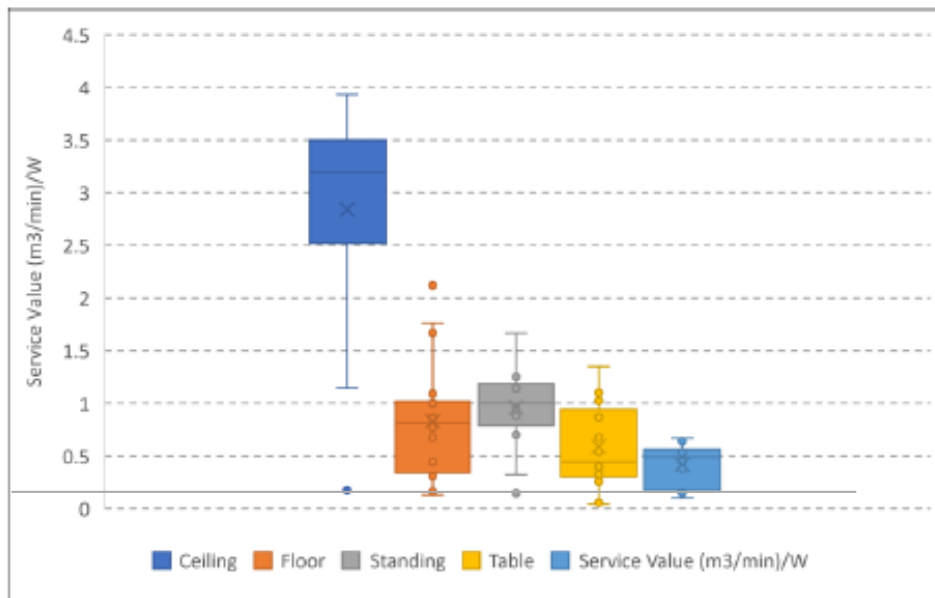
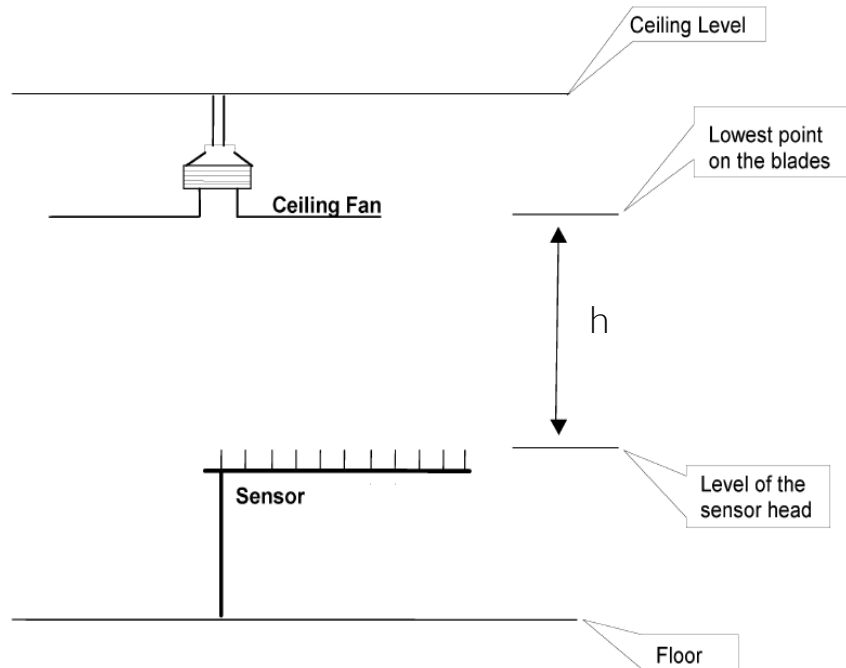


Figure 31: Spread in service values of the different types of comfort fans

# Test method basics

- Test standard: Most countries are based on IEC 60879 test protocol
- Energy efficiency also known as Ceiling Fan Service Value
- Higher air flow, lower power gives greater efficiency
- Larger values of Ceiling Fan Service Value are better



$$\text{Ceiling Fan Service Value} \left( \frac{\text{m}^3}{\text{min} - \text{watt}} \right) = \frac{\text{Air flow}_{\text{Total}}}{P_{\text{full speed}}}$$

where Air flow is measured in a plane at a specified distance from the ceiling fan

Temperature, humidity ranges & other distances are specified by the test protocol

# High potential energy savings from wider MEPs deployment

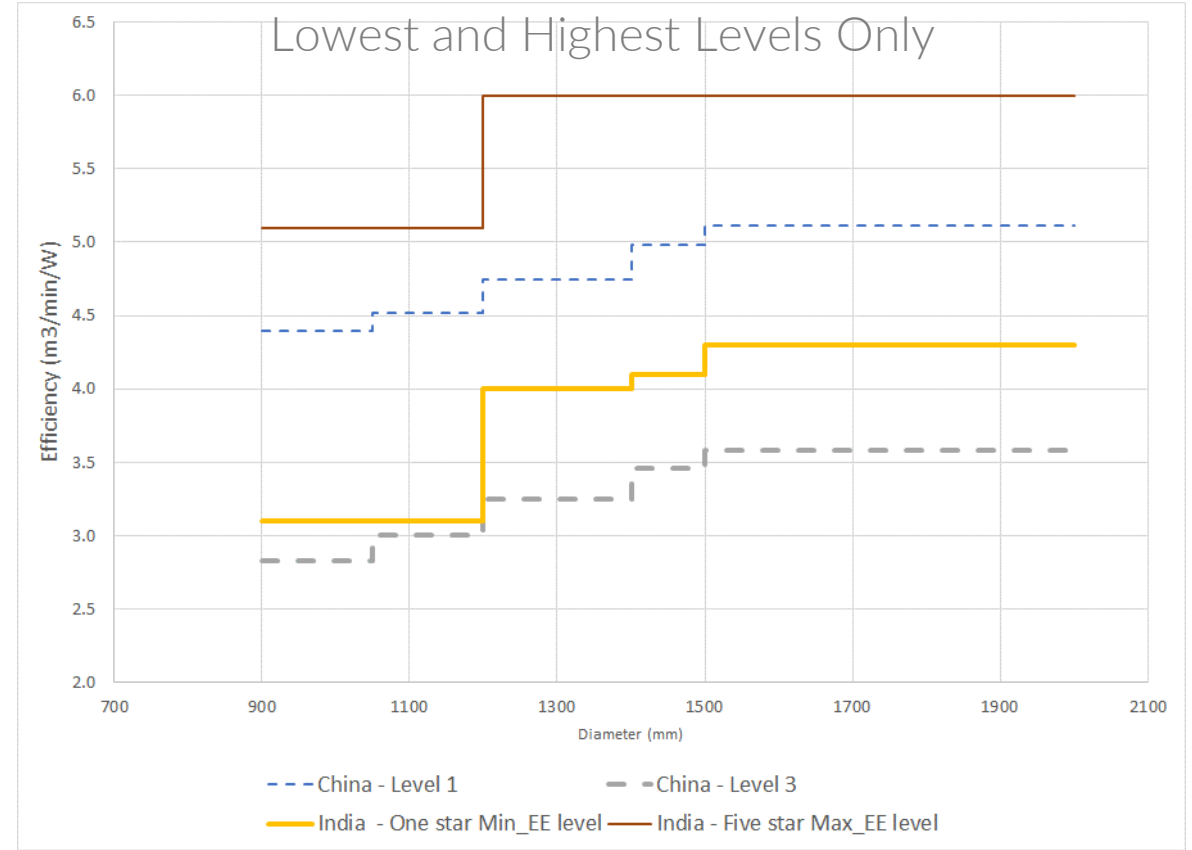
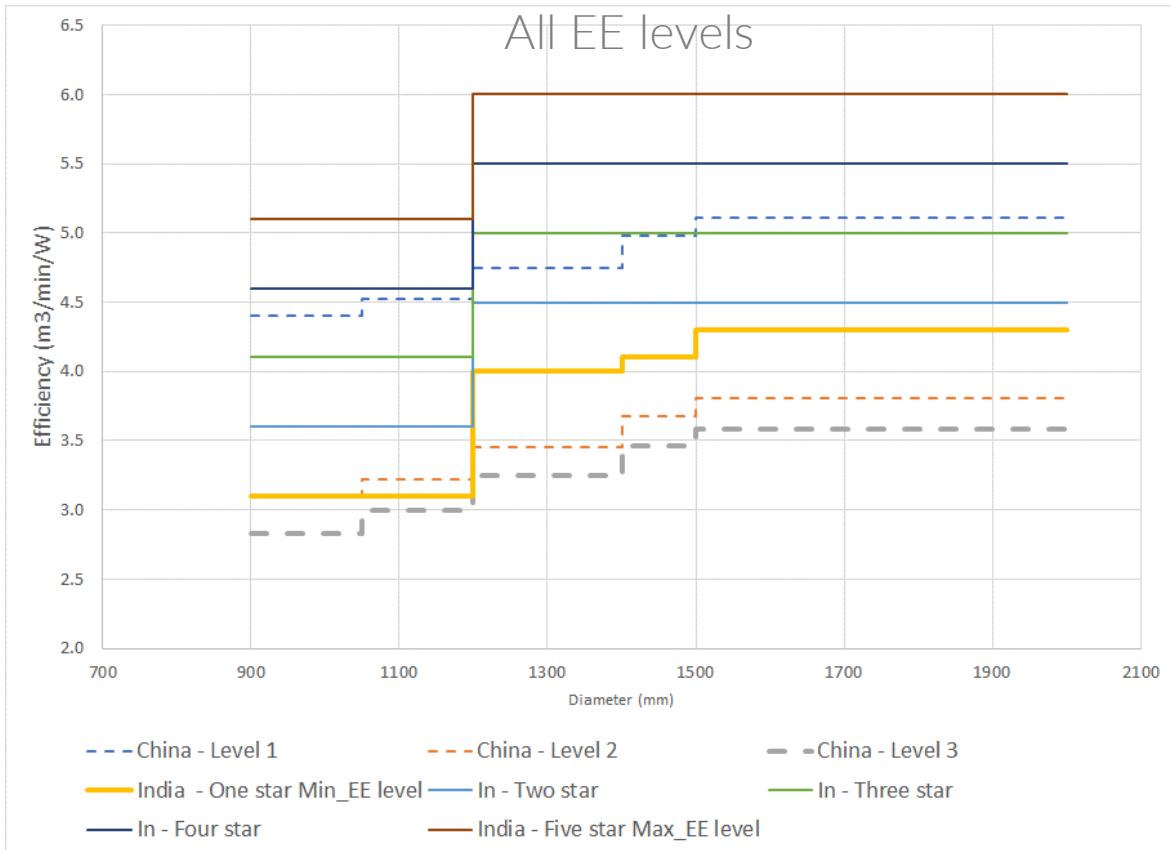
- A limited number of countries have MEPs for Ceiling Fans
- Opportunity for wider MEPS deployment and/or MEPS tightening

Country	Minimum Energy Performance Standards (MEPS)	Test Standards	Reference Test Standards
Bangladesh	BDS 1860:2012	BDS 818:1998 Amend 1: 2006	IEC 60879
Brazil	PI nº 02/2017		
Canada	Energy Efficiency Regulations, 2016 PART 2 DIVISION 1 SUBDIVISION L Ceiling Fans	Same as USA	Same as USA
China	GB 12021.9-2021	GB 13380-2018, QB/T 5262-2018, GB/T 35758-2017	IEC 60879:1986, IEC 62301:2011 (Standby power)
European Union	Commission Regulation (EU) No 206/2012	IEC 60879	
India	IS 374-2019_Notification number S.O. 2210(E) dated May 12, 2022	IS 374:2019	IEC 60879
Malaysia	MS 2574:2014	MS 1220:2010	IEC 60879
Mexico	PROY-NOM-034-ENER / SE-2020	PROY-NOM-034-ENER / SE-2020	IEC 60879
Pakistan	PS:1/2010	PS:1/2010	IEC 60879
Sri Lanka	SLS 1600:2011	SLS 1600:2011, SLS 814:1988	
United States of America	10 CFR 430—Energy Conservation Program: Test Procedure for Ceiling Fans	Appendix U to Subpart B of Part 430 -- Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans	AMCA 208-18, AMCA 230-15, AMCA 230-15 TE, IEC 62301
Viet Nam	TCVN 7826:2015	TCVN 7827:2015	IEC 60879

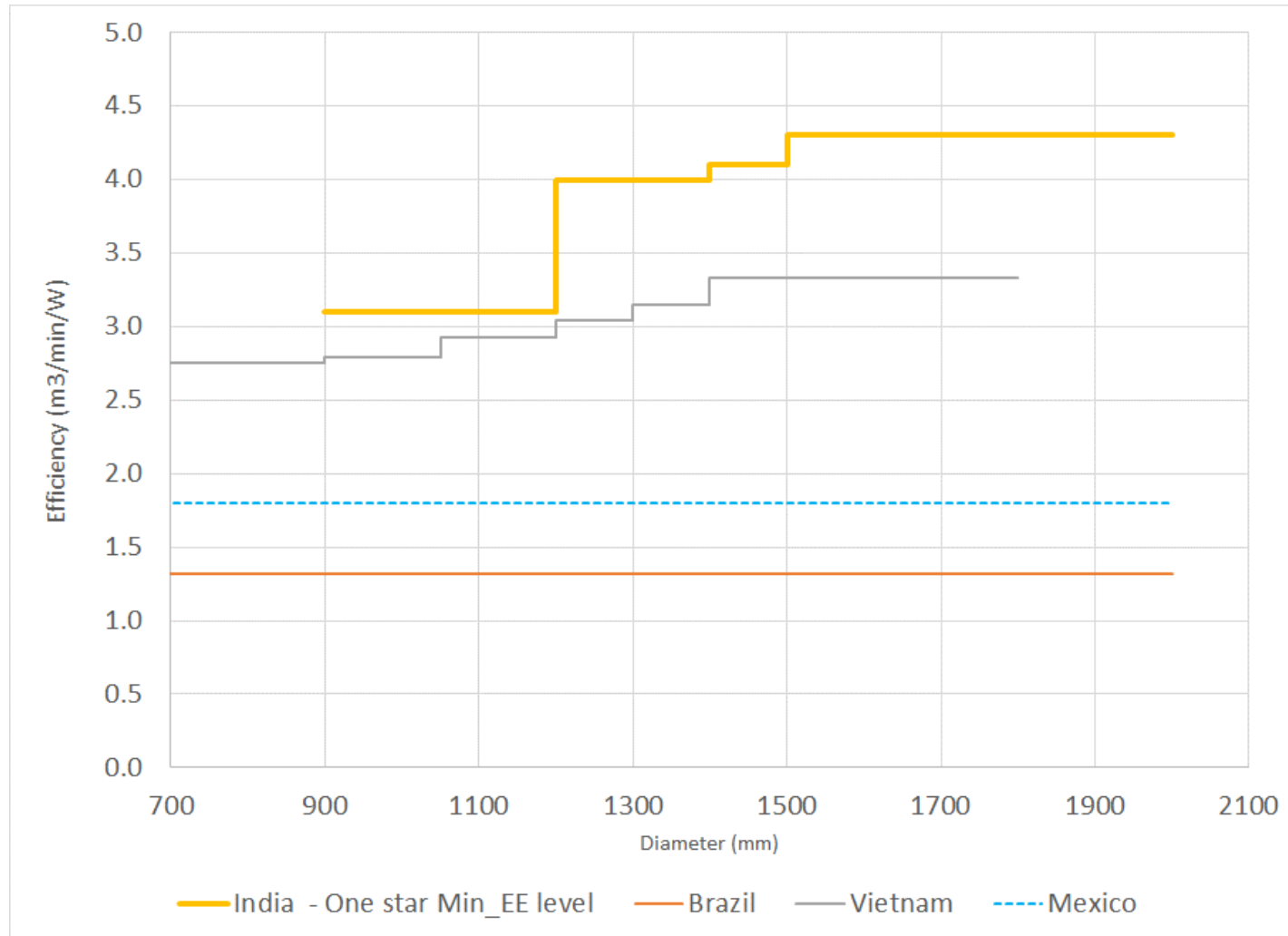


# China and India ceiling fan standards

- EE for CFs defined as Air flow per watt or cubic meters/min per watt or  $m^3/(min-W)$
- China 2021 standards; India 2022 standards
  - Within 9-14% at 900mm diameter to within 15-17% at 2000mm diameter



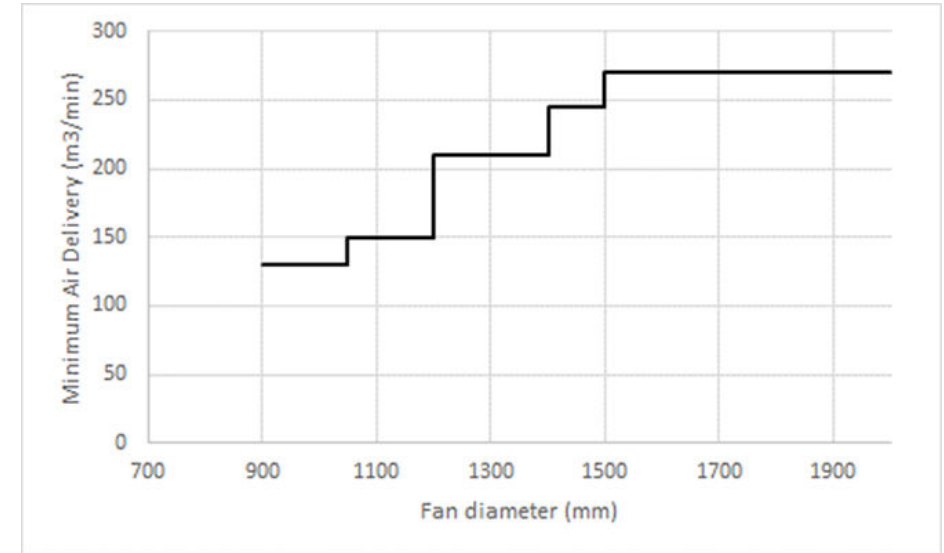
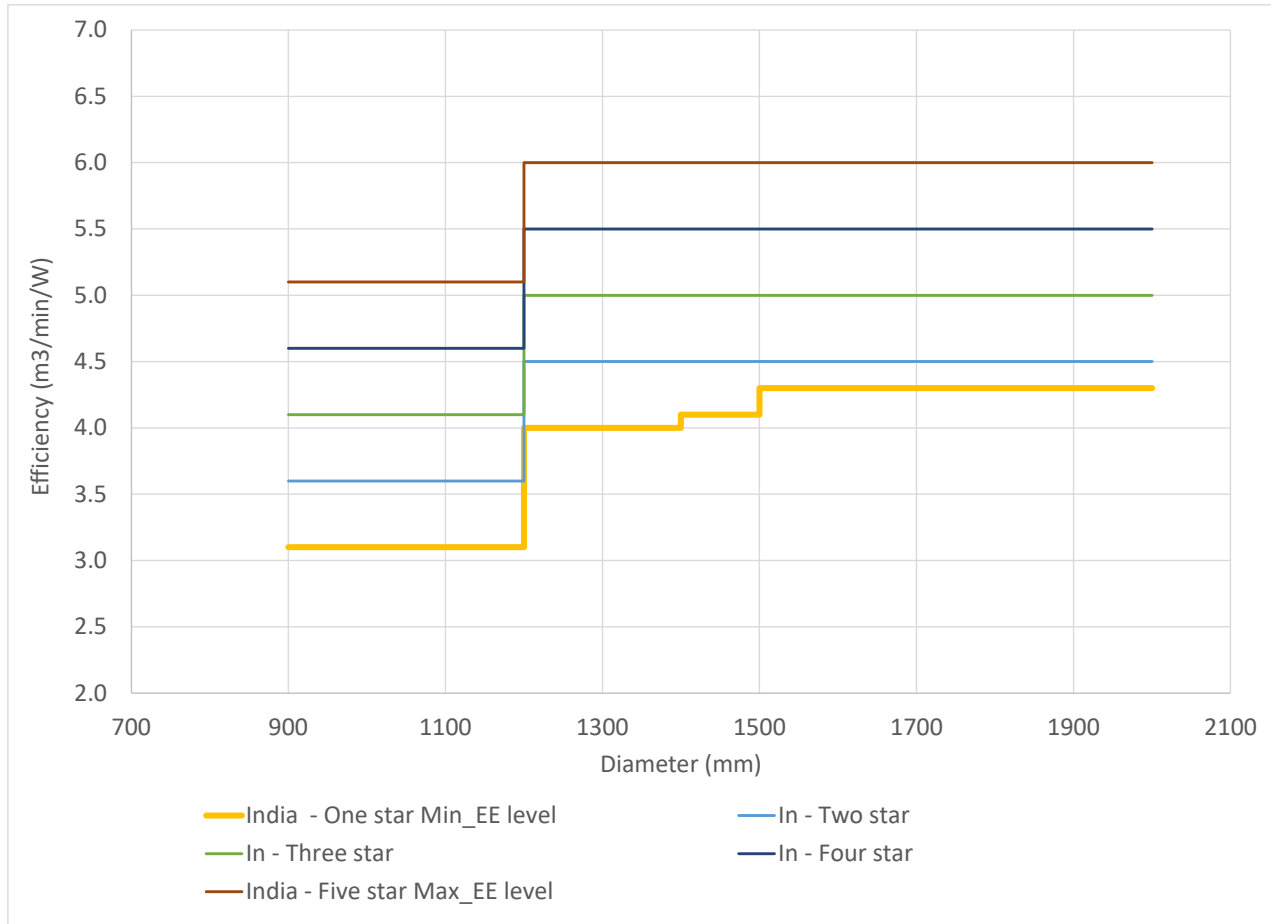
# India, Brazil, Vietnam, Mexico ceiling fan standards



Benchmarking:  
India has the highest EE levels  
(>95% of CF market < 1500mm)

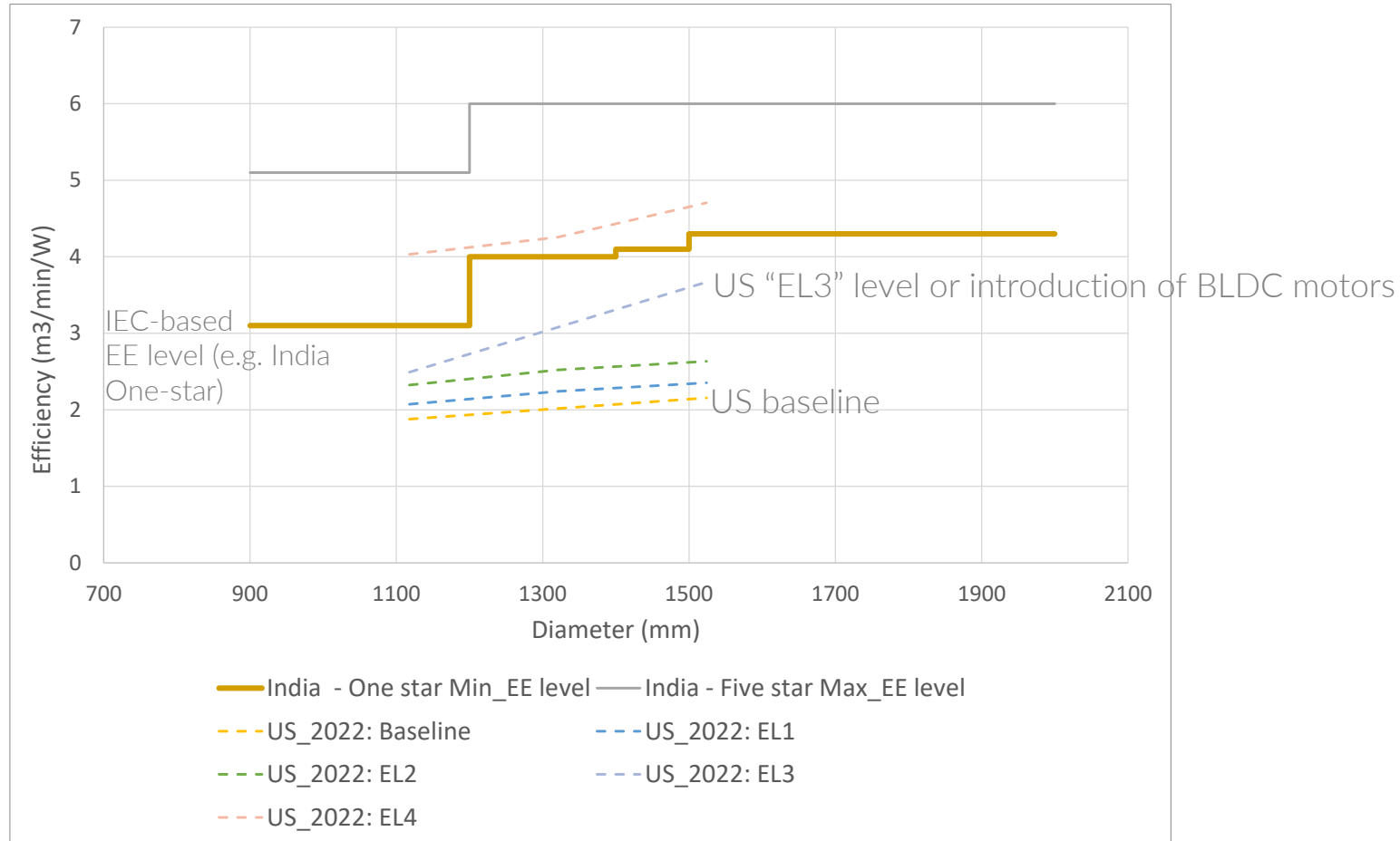
We start with **India\_One Star EE** as  
the proposed U4E min. EE level

# India standards for ceiling fans, 2022



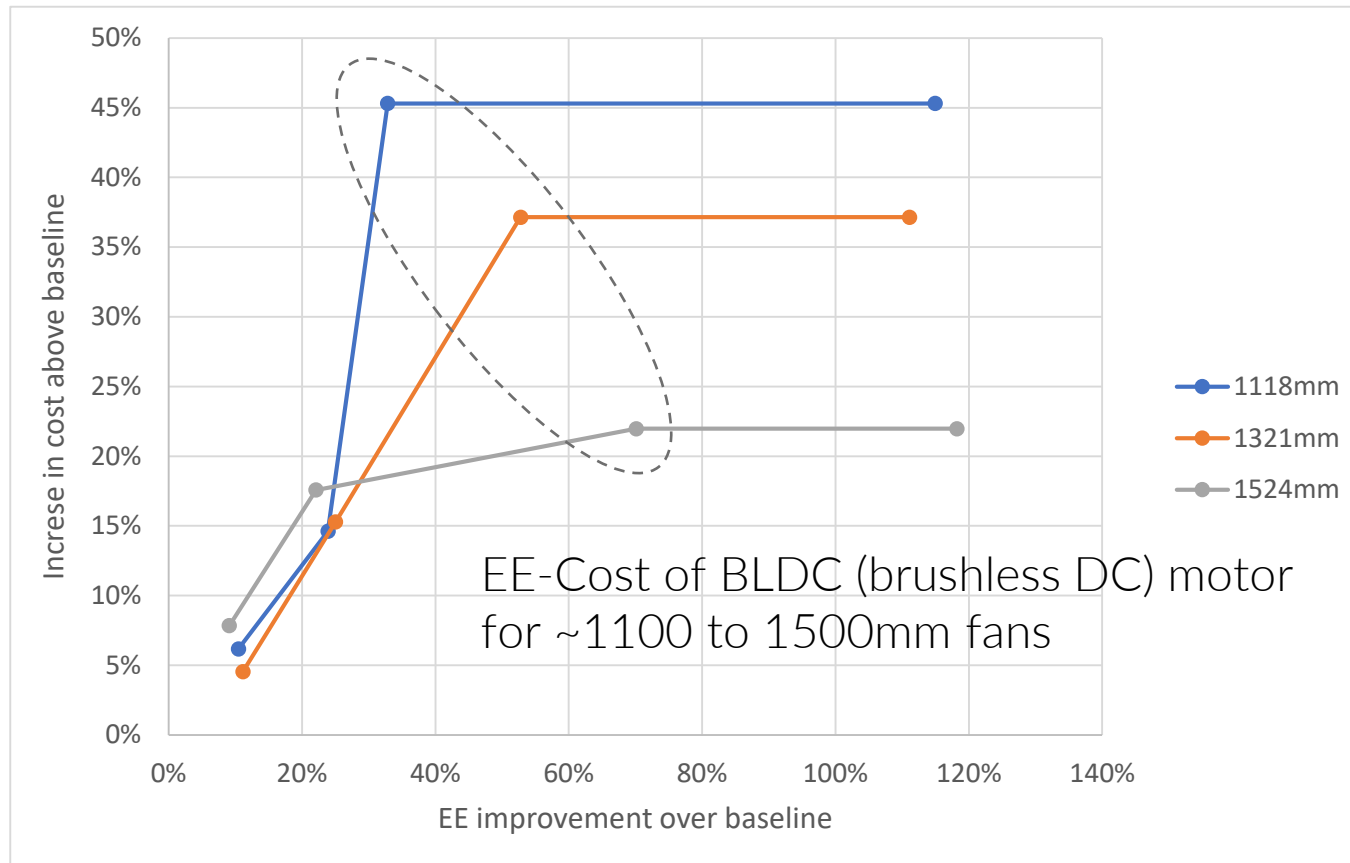
# US and India efficiency standards for ceiling fans

- US 2022 preliminary rulemaking for ceiling fans (standard product class) compared to India 2022 standard below
- US EE standards: lower apparent efficiency values than IEC-based standards due to different test protocols



# Ceiling Fan Efficiency vs Cost (US 2022 preliminary standard)

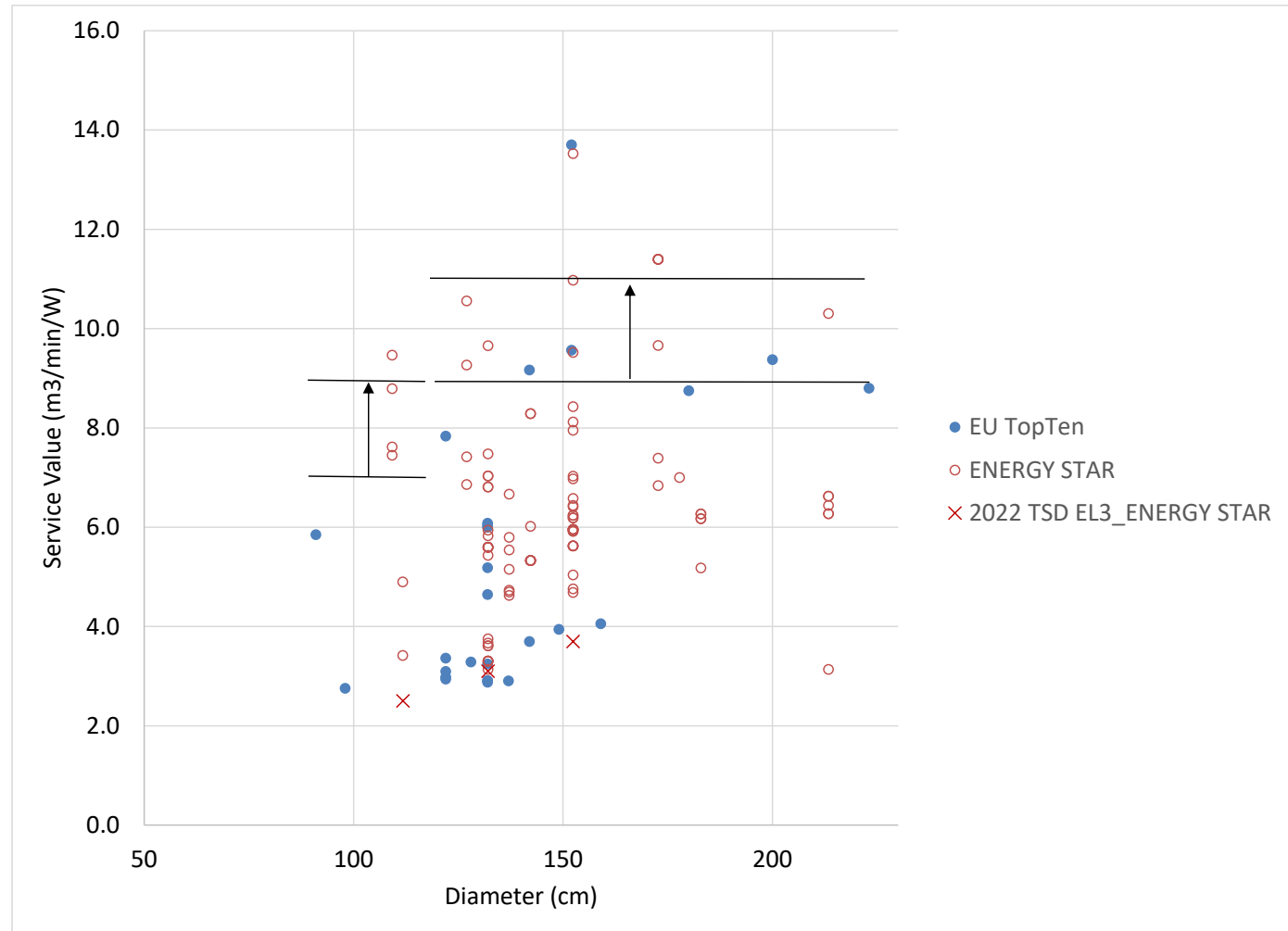
- EE-Cost curve more favorable for larger fans
- 53% EE improvement, 37% increase in cost at most common size 1321mm (52")



Size	EE Level	EE Improvement	Cost increase
1118 mm	<b>EL0 - Baseline</b>		
	<b>EL1</b>	<b>10.4%</b>	<b>6.2%</b>
	<b>EL2</b>	<b>23.9%</b>	<b>14.6%</b>
	<b>EL3 - BLDC</b>	<b>32.8%</b>	<b>45.3%</b>
	<b>EL4</b>	<b>115%</b>	<b>45%</b>
1321 mm	<b>EL0 - Baseline</b>		
	<b>EL1</b>	<b>11.1%</b>	<b>4.5%</b>
	<b>EL2</b>	<b>25.0%</b>	<b>15.3%</b>
	<b>EL3 - BLDC</b>	<b>52.8%</b>	<b>37.1%</b>
	<b>EL4</b>	<b>111.1%</b>	<b>37.1%</b>
1524 mm	<b>EL0 - Baseline</b>		
	<b>EL1</b>	<b>9.1%</b>	<b>7.8%</b>
	<b>EL2</b>	<b>22.1%</b>	<b>17.6%</b>
	<b>EL3 - BLDC</b>	<b>70.1%</b>	<b>22.0%</b>
	<b>EL4</b>	<b>118.2%</b>	<b>22.0%</b>

# Max efficiency levels from US ENERGY STAR with correction for IEC testing

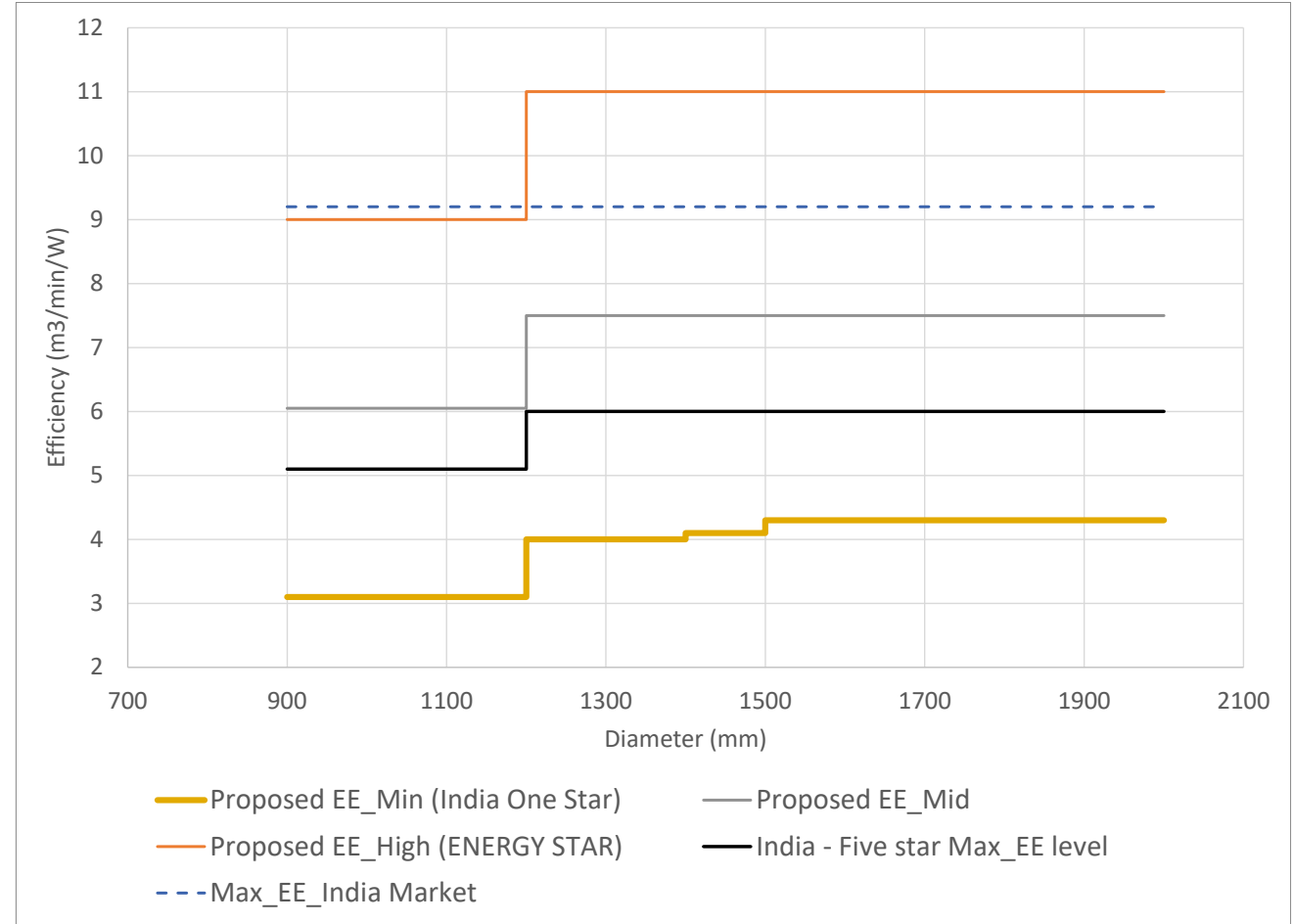
- Need to add nominal EE correction of  $\sim 2$  to proposed EE\_high levels due to testing differences →
  - $D < 120\text{cm}$ : **EE\_high = 9**
  - $D \geq 120\text{cm}$ : **EE\_high = 11**



# U4E recommended minimum, medium, and maximum standards

Blade Dimension <sup>1</sup> (mm)	Min Air Flow Delivery (m <sup>3</sup> /min)	Min Service Value Level (m <sup>3</sup> /(min-W))
750 – 900	130	3.1
900 – 1 050	130	3.1
1 050 – 1 200	150	3.1
1 200 – 1 400	210	4.0
1 400 – 1 500	245	4.1
Greater than 1 500	270	4.3

Blade Dimension <sup>1</sup> (mm)	Medium Service Value Level (m <sup>3</sup> /(min-W))	Maximum Service Value Level (m <sup>3</sup> /(min-W))
750 – 900	6.2	9
900 – 1 050	6.2	9
1 050 – 1 200	6.2	9
1 200 – 1 400	7.5	11
1 400 – 1 500	7.5	11
Greater than 1 500	7.5	11



<sup>1</sup> Blade dimension refers to the diameter of the circular area swept by the outer tips of the fan blades.

# Safety and functional performance

- **Installation:** e.g. structural mounting; CF height and distance from ceiling
- **Operating conditions:** e.g. indoor use only; temperature range guidance
- **Ceiling fan placement considerations:** e.g. distance from fire alarms and water sprinkler systems

*Further information on safety and functional performance can be found in Chapter 10 of the Model Regulation Annex.*



# Entry into force, conformity declaration, market surveillance and revision

- **Entry into force** i.e., start date and minimum duration of regulation
- **Declaration of conformity** e.g., compliance with energy efficiency requirements and conformity assessment report (CAR)
- **Market surveillance** e.g., compliance verification and market monitoring, test lab accreditation
- **Revision** i.e., frequency of strengthening this regulation

*Further information on these items can be found in the Model Regulation*



# Implementation preparation

## Potential starting points

- Any nearby countries with MEPS?
- Any testing facilities nearby?
  
- If fan standard is new, consider starting at min. service level
- If a fan standard already in place, consider mid service level or higher than min. service level

## Supporting activities

- Market study to quantify baseline and potential savings
- Consider program designs to support greater efficiency e.g.
  - MEPS levels
  - Public procurement programs
  - Incentive programs
  - Energy efficiency labels



# Implementation pathways

- **Set objectives:** e.g., establish MEPS, increase awareness
- **Define roles** and regulatory bodies for key tasks & scope
- **Develop a national market assessment** and a study of international or regional best practices
- **Prepare MEPS** considering U4E Model Regulation Guidelines
- **Hold workshops** to present new MEPS, labels, programs proposed for key stakeholders
- **Provide capacity building and training**
- **Build capacity for testing** or establish mutual recognition agreements
- **Build capacity for market surveillance**, addressing Monitoring, Verification and Compliance
- **Develop/ adopt specific programs**
  - E.g., Develop recommendations on Sustainable Public Procurement to drive the purchase of more energy-efficient products.
  - E.g., Develop material to support a communication campaign aimed at consumers about the benefits of more efficient products.



# Standards, labelling, green public procurement and market-based incentives work!

Energy Efficiency of Products in the Market



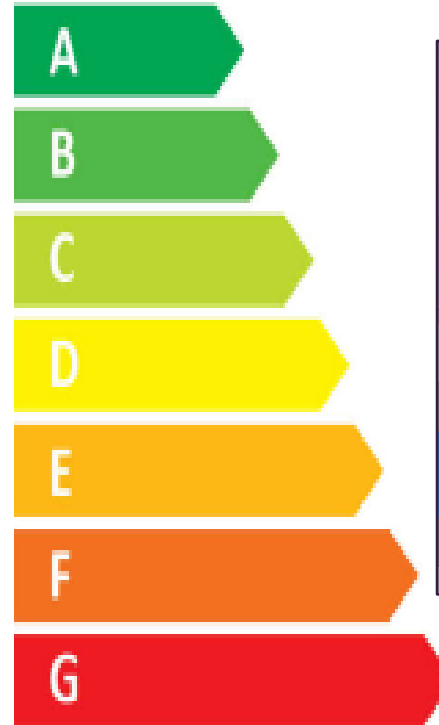
**Financial incentives** support adoption of the best products



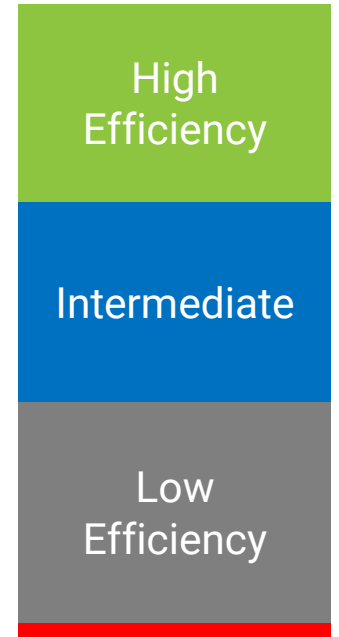
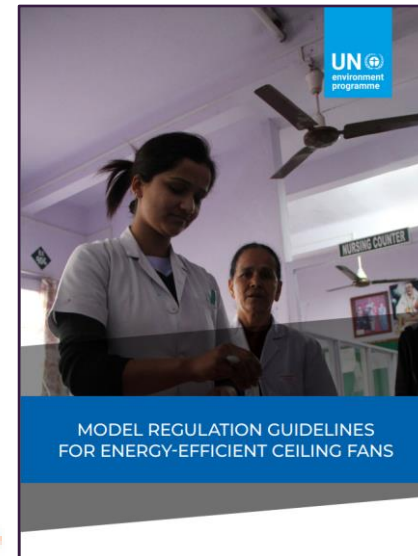
**Labels** help buyers understand energy efficiency benefits



**Minimum Energy Performance Standards (MEPS)** ban the inefficient products



← U4E Model Regulations can guide us in setting up the levels



Minimum Performance Levels



**THANK YOU!**

