Electric Fans Energy Efficiency Improvement in APEC Region: Review of Experience and Best Practices

Final Report

APEC Energy Working Group

May 2026

Asia-Pacific Economic Cooperation

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APEC Project: EWG 206 2024A

Produced by
Industrial Technology Research Institute, Chinese Taipei
Rm. 307, 3F, Bldg. 64, 195, Sec. 4, Chung Hsing Rd., Chutung, Hsinchu, 310401
Chinese Taipei
Tel: +886-3-5917794
Email: itriB20826@itri.org.tw
Website: https://www.itri.org.tw/english/index.aspx

Reviewed by
Project Overseers Mr. Yung-Dung CHEN
Energy Administration, Ministry of Economic Affairs, Chinese Taipei
13F., No. 2, Fuxing N. Rd., Zhongshan Dist., Taipei City 104100
Chinese Taipei
Tel: +886-2-27757729
Email: ydchen@moeaea.gov.tw
Website: https://www.moeaea.gov.tw/ECW/english/home/English.aspx

For
Asia-Pacific Economic Cooperation Secretariat
35 Heng Mui Keng Terrace
Singapore 119616
Tel: (65) 68919 600
Fax: (65) 68919 690
Email: info@apec.org
Website: www.apec.org

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APEC#226-RE-04.4

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1. Introduction

Electric fans play a crucial role in the global home appliance market, serving as an essential, accessible, and energy-efficient cooling solution for households across diverse climates and income levels. Unlike more energy-intensive cooling systems such as air conditioners, electric fans provide a cost-effective alternative that is widely adopted in both developed and emerging economies. Available in various types—including ceiling, pedestal, desk, and wall-mounted models—electric fans are indispensable for daily comfort, especially in regions experiencing rapid urbanization, population growth, and rising temperatures. As consumers become increasingly conscious of energy consumption and sustainability, demand continues to rise for innovative, efficient, and environmentally friendly fan technologies. This trend positions electric fans not only as a basic necessity but also as a strategic product category within the broader home appliance sector.

Stricter energy efficiency regulations and global commitments to energy conservation have further strengthened the market's optimistic outlook. Governments and international organizations are actively promoting enhanced energy efficiency standards and labeling schemes to reduce energy consumption and environmental impact. These initiatives motivate manufacturers to innovate and develop advanced electric fan models that use less power while maintaining high performance. The shift toward energy-efficient appliances is driven by both environmental concerns and economic incentives, as consumers increasingly favor products that help lower electricity bills. In emerging markets such as China; Thailand; and Viet Nam, these regulatory measures are paired with industrial policies that promote green technologies, positioning energy-efficient electric fans as a key solution within broader economic sustainability agendas.

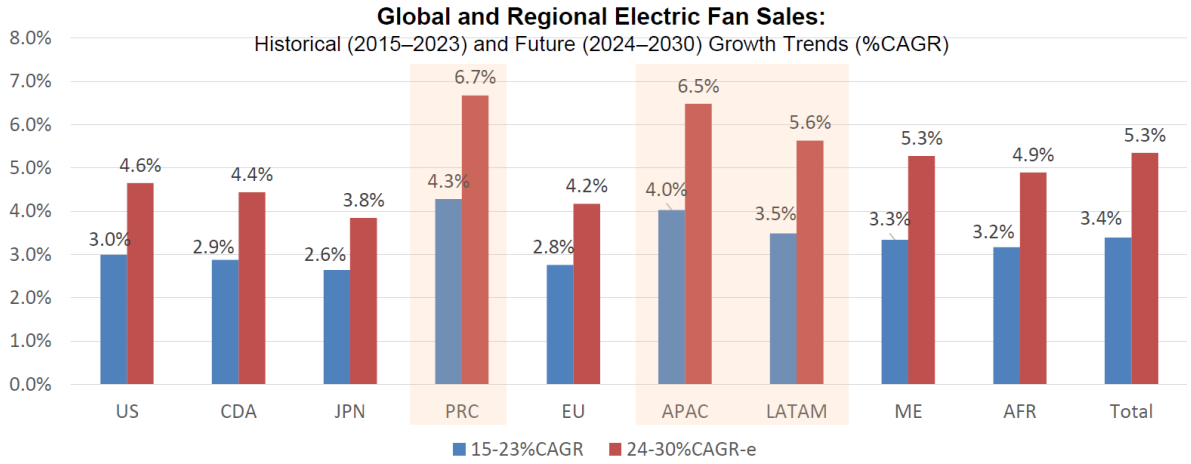
This report aims to provide a detailed summary of the activities and research carried out over the project period, presenting key findings that highlight both challenges and opportunities in the region. It will include data-driven insights gathered from a questionnaire survey conducted among relevant stakeholders, offering a snapshot of current practices, awareness, and adoption levels regarding energy efficiency standards. Additionally, this report will feature a literature review examining existing benchmarks and market share analyses for electric fans, providing a comparative perspective on energy efficiency advancements within the APEC region. To further illustrate practical applications, this report will delve into insights from a workshop that explored case studies of electric fans compliant with energy efficiency regulations. This section will showcase real-world examples, innovative solutions, and lessons learned from successful implementations. By consolidating these elements, this report aims to provide actionable recommendations, foster knowledge sharing, and encourage collaboration among APEC members to drive improvements in energy efficiency for electric fans, contributing to regional sustainability goals.

2. Background and Overview

According to the global survey on electric fan market from GIA (2025), Asia-Pacific (APAC) is the dominant region of electric fans, contributing approximately 43% to the global market growth. Key consumer markets in APAC include China; the Philippines; and Viet Nam, advances in manufacturing technologies and production expansion have enabled companies to offer affordable and premium products at competitive prices. APAC is also the fastest-growing market globally, benefiting from rapid urbanization, infrastructure development, and rising middle-class purchasing power. Government policies supporting affordable housing and expanded access to electricity have further boosted demand for electric fans. In particular, technological innovations in premium and smart electric fans in China and India are driving growth in the high-end segment. The electric fan market in Latin America is experiencing steady growth, supported by rising disposable incomes and the expansion of retail distribution channels. In addition, government programs promoting energy-efficient appliances are encouraging the adoption of low-power-consumption electric fans.

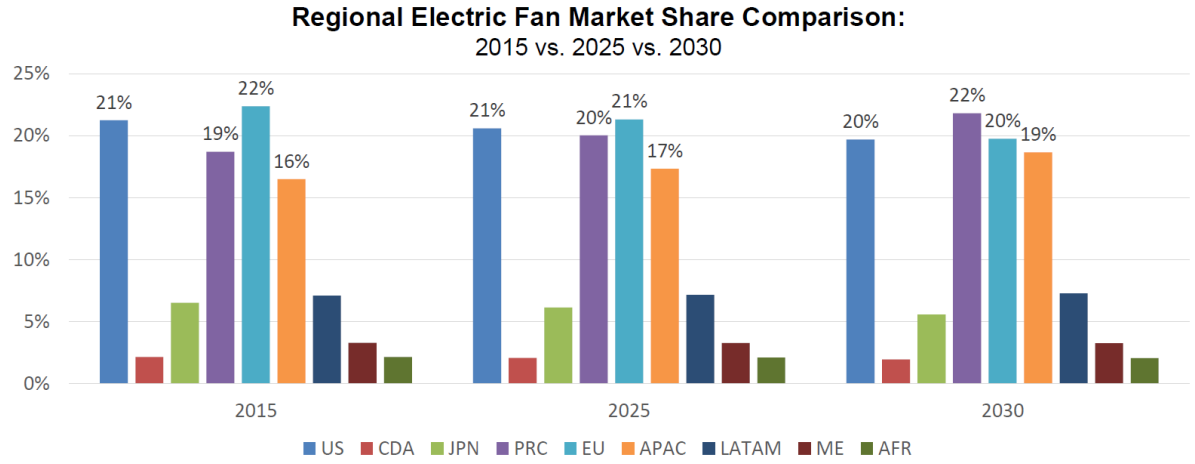
The global electric fan market reached USD 16.3 billion in 2023, reflecting a compound annual growth rate (CAGR) of 3.4% over the review period from 2015 to 2023. Europe represented the largest regional market for electric fans, with sales estimated at USD 2.8 billion in 2015. During the same period, China emerged as the fastest-growing regional market, registering a CAGR of 4.3%. Looking ahead, the global electric fan market is expected to witness steady and sustained growth from 2024 to 2030. Valued at approximately USD 17.1 billion in 2024, the market is projected to expand to USD 23.3 billion by 2030, reflecting a CAGR of 5.4% over the forecast period. China is poised to lead the global growth trajectory, with a projected CAGR of 6.7%, positioning it as the fastest-growing regional market. The Chinese electric fan market, estimated at USD 3.4 billion in 2024, is projected to reach USD 5.1 billion by 2030.

This upward trend is underpinned by a combination of favorable economic conditions, rising consumer demand, and supportive government policies, which together provide a strong foundation for long-term market expansion.



Source: Global Industry Analysts (2025) Electric Fans – A Global Strategic Business Report (MCP24820)[1]

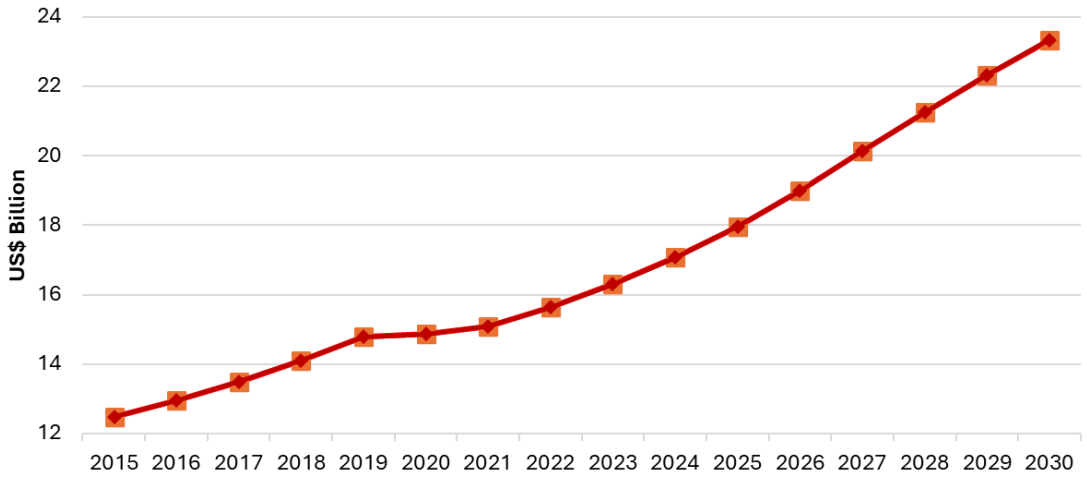
Figure 1 Changes in CAGR and regional market share of the global electric fan market



Source: Global Industry Analysts (2025) Electric Fans – A Global Strategic Business Report (MCP24820)

Figure 2 Regional market share of the global electric fan market

[1] Error tolerance for data in this table is 10% (+/-). Data is reported at Manufacturer's Level. Historic data is reported as is and not standardized to base year (2024) currency values. **CDA:** Canada; **PRC:** People's Republic of China; **JPN:** Japan; **US:** United States; **Europe (EU)** includes Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, The Netherlands, Turkey and The United Kingdom. **Asia-Pacific(APAC)** includes Australia; China; Hong Kong, China; Indonesia; Korea; Malaysia; New Zealand; The Philippines; Singapore; Chinese Taipei; Thailand; India. **Latin America(LATAM)** includes Argentina; Brazil; Chile; Colombia; Ecuador; Mexico; Peru and Venezuela. **Middle East(ME)** includes Iran, Israel, Kuwait, Qatar, Saudi Arabia and The United Arab Emirates. **Africa(AFR)** includes Algeria, Angola, Egypt, Morocco, Nigeria and South Africa.



Source: Global Industry Analysts (2025) Electric Fans – A Global Strategic Business Report (MCP24820)

Figure 3 World electric fans market analysis of annual sales in USD billion for years 2015 through 2030

Over the past decade, electric fan technology has continued to evolve, particularly in terms of energy efficiency. To promote the improvement of energy efficiency in electric fans, governments can adopt various measures. These include providing subsidies for technological research and development to accelerate innovation in energy-saving technologies; offering financial incentives to manufacturers, such as through public procurement programs for high-efficiency products; supporting consumer programs that encourage the replacement of outdated equipment with energy-efficient models; and strengthening the enforcement of mandatory Minimum Energy Performance Standards (MEPS) to ensure compliance across the market. To provide more efficient fans, the market has seen the emergence of electric fans equipped with direct current (DC) motors from a technological perspective. Fans equipped with Direct Current (DC) motors deliver significantly higher energy efficiency than traditional Alternating Current (AC) motor fans. They can use up to 70% less electricity while maintaining comparable airflow performance. In addition to being quieter and smoother in operation, DC fans also allow for variable speed control, offering greater flexibility than the fixed-speed settings of conventional models. The widespread adoption of brushless DC motors (BLDC) stands out as a significant innovation. These motors not only significantly reduce power consumption but also extend product lifespan. When integrated with smart control systems, they enable features such as automatic wind speed adjustment and motion detection. These developments have greatly enhanced fan performance in both energy savings and user convenience.

At the same time, market demand is shifting from basic models to high-end fans with features such as energy efficiency, quiet operation, and smart home integration. Urbanization and the rise of the middle class have driven consumers to favor fans compatible with home automation systems. In response, manufacturers are investing more in R&D to enhance product

performance and energy efficiency. For export-oriented enterprises, meeting energy efficiency standards is no longer just a compliance requirement but also a key to accessing international markets and gaining a competitive edge.

3. Electric Fan Energy Efficiency Workshop

3.1 Summary of the Workshop

In June 2024, the research team submitted a concept note entitled "**Electric Fans Energy Efficiency Improvement in APEC Region: Review of Experience and Best Practices**" to the APEC Energy Working Group (EWG). Following its approval, the workshop was subsequently organized in conjunction with the 65th EGEEC (Expert Group on Energy Efficiency and Conservation) and 63rd EGNRET (Expert Group on New and Renewable Energy Technologies) Joint Meetings at Seoul, Korea. The workshop was held on 17 November 2025, at the **Oakwood Premier Coex Center Seoul** in Korea, under the theme "**Policies, Standards, and Best Practices for Energy-Efficient Electric Fans**". The event featured presentations and discussions led by seven speakers and one moderator, attracting a total of 38 attendees (30 participants) from 12 economies (including 11 APEC economies and 1 Non-APEC economy) and 5 APEC fora, and 3 international organizations. More than 34% attendees are female.

The workshop was structured into morning and afternoon sessions to facilitate focused discussions. The morning session primarily reflected perspectives from international organizations, examining the current status of electric fan policies and technical standards, particularly from the viewpoints of government policy frameworks, technical standard development, and policy advocacy initiatives. The afternoon session focused on practical experiences from individual economies, highlighting policy implementation approaches, best practices, and lessons learned in promoting energy-efficient electric fans. The agenda for the day is provided in Table 1, and the following section summarizes key points from the experts' presentations delivered during the workshop.

Table 1 Workshop agenda

Time	Activities
08:30-09:00 (30 min)	Registration
09:00-09:05 (5 min)	**Welcoming Remarks: Host (Korea)** Mr Youngsun YOU, Director General Korea Energy Agency (KEA)
09:05-09:20 (15 min)	**Opening Remarks & Group Photo** Mr Chia-Ho CHU, Administrative Coordinator Energy Administration, MOEA
09:20-09:30 (10 min)	**Workshop Moderator** Mr. Ting-Jui (Ray) SUN Senior Researcher, Industrial Technology Research Institute (ITRI)
	1.Workshop Overview Dr Chi-Chun HUANG (Rouff), Deputy Division Director Industrial Technology Research Institute (ITRI)
09:30-10:10 (40 min)	**2.Title：IEC 60879:2019 Comfort fans and regulators for household and similar use – Methods for measuring the performance** Ms Wenxiu HUANG, Chief expert on standard & regulation China National Electric Apparatus Research Institute Co., Ltd.
10:10-10:30 (20 min)	Coffee Break
10:30-11:10 (40 min)	**3.Title：Effective policy to improve energy efficiency of electric fans** Dr Kevin LANE, Programme Manager IEA 4E (Energy Efficient End-use Equipment) TCP
11:10-12:10 (60 min)	**4.Title：Electric Fans Energy Efficiency Improvement in China&India** Dr Lei ZENG (Steven), China program LEAD Ms Moumita CHANDRA, Senior Associate, Climate Collaborative Labeling and Appliance Standards Program (CLASP)
12:10-12:30 (20 min)	Q&A
12:30-14:00 (90 min)	Lunch Time
14:00-14:40 (40 min)	**5.Title：Electric Fans Energy Efficiency Improvement in Thailand** Dr Supachai SAMPAO, Engineer, Senior Professional level Department of Alternative Energy Development and Efficiency, Ministry of Energy, Thailand
14:40-15:20 (40 min)	**6.Title：Electric Fans Energy Efficiency Improvement in Indonesia** Mr Totok SULISTIYANTO, Vice Chairman Masyarakat Konservasi dan Efisiensi Energi Indonesia (MASKEEI)
15:20-15:40 (20 min)	**7.Title：Electric Fans Energy Efficiency Improvement in Chinese Taipei** Dr Chi-Chun HUANG, Deputy Division Director Industrial Technology Research Institute (ITRI)
15:40-16:00 (20 min)	Coffee Break
16:00-16:20 (20 min)	Q&A
16:20-16:45 (25 min)	**Knowledge-Sharing by Everyone and Discussion**
16:45-16:55 (10 min)	**Post-Evaluation Survey**
16:55-17:00 (5 min)	**Closing Remarks** Dr Meng LIU, EGEEC Chair
17:00	Adjourn

3.1.1 Preliminary Workshop Survey

According to the 2025 report by Global Industry Analysts (GIA), the global electric fan market continues to grow, with the Asia-Pacific (APAC), China (PRC), and Latin America (LATAM) identified as the fastest-growing regions. Their historical and projected Compound Annual Growth Rates (CAGR) are significantly higher than those of Europe and the United States. It is estimated that by 2030, China will surpass both the U.S. and the EU to become the largest single market in terms of global market share, while the Asia-Pacific region's share will also continue to expand.

Prior to the workshop, a pre-survey was conducted across the 21 APEC economies to better understand the current status of electric fan technologies, market development, and policy promotion within the region. The survey covered policy management frameworks, testing methodologies (including compliance with IEC 60879 and testing approaches for bladeless fans), as well as motor technology developments. Responses were received from nine economies: China; Indonesia; Malaysia; Mexico; New Zealand; the Philippines; Chinese Taipei; Thailand; and Viet Nam. Key findings from the survey include:

- 4 economies have adopted IEC standards (China; Malaysia; the Philippines; Viet Nam).
- 5 economies have implemented mandatory management measures (China; Indonesia; Malaysia; the Philippines; Viet Nam).
- 3 economies have adopted voluntary measures (China; Chinese Taipei; Thailand).

3.1.2 IEC 60879:2019 Comfort fans and regulators for household and similar use – Methods for measuring the performance

3.1.2.1 Evolution of Standards: From Edition 1 to Edition 2

The International Electrotechnical Commission's standard for electric fan performance, IEC 60879, serves as the primary global reference for standards.

- Edition 1 (1986): This legacy version was in use for decades. Its testing methods were relatively simple (single-axis measurement) and did not cover modern fan types.
- Edition 2 (2019): A comprehensive revision featuring several major changes:
    - Renaming: The title was changed to "Methods for measuring performance" to focus specifically on testing methodologies.
    - Inclusion of New Products: Formally introduced definitions and testing methods for tower fans and bladeless fans.

- Improved Precision: For conventional fans, the testing points were upgraded from single-axis to dual-axis (X and Y axes) measurements, significantly enhancing data representativeness and accuracy.

Source: IEC (2025) IEC 60879:2019 ed2.0 (+a1:2025) comfort fans and regulators for household and similar purposes –methods for measuring performance (Ms. Wenxiu HUANG)

Figure 4 Comparison of measurement points between IEC 60879 edition 1 and edition 2

3.1.2.2 Scope and Product Classification

- Specifications: IEC 60879:2019 applies to fans with a rated power input of less than 125 W. Voltage limits are set at no more than 250 V for single-phase fans and 480 V for others (including DC fans), clearly distinguishing household fans from industrial/commercial ones.
- Product Grouping: Based on test room configurations and setups, fans are divided into two categories:
  - Ceiling Fans: Require specific test room dimensions and configurations.
  - Other Fans: Includes pedestal fans, table fans, tower fans, and bladeless fans.

3.1.2.3 Key Energy Efficiency Parameters and Testing Methods

- Service Value: The core indicator for energy efficiency, defined as the ratio of maximum air delivery to power input (m^3/min/W). A higher value indicates better efficiency, meaning the fan provides more airflow for the same amount of power consumed.
- Ceiling Fan Testing:

- Test Room: Must meet specific size requirements to prevent interference from airflow recirculation.
- Measurement Procedure: Uses a matrix measurement system extending from the axis of the blades outward, measuring wind speed in four directions.
- Starting Point: Measurements begin 40 mm from the axis and move horizontally along the room's diagonals at 80 mm intervals until the wind speed drops below 9 m/min.
- Airflow Calculation: The test area is divided into multiple annuli. The air delivery for each annulus is calculated by multiplying its area by its average wind speed. The sum of all annuli represents the total air delivery.

- Non-Ceiling Fan Testing (Pedestal, Table, Tower, and Bladeless):
  - Instrument Requirements:
    - Conventional Fans: Use a vane anemometer with a diameter ≦100 mm.
    - Bladeless and Tower Fans: Use a vane anemometer with a diameter ≦40 mm to accommodate unique outlet structures.
  - Matrix Measurement: Assumes each measurement point represents the wind speed of a square area (40 mm per side). Total air delivery is calculated by integrating the airflow of all grid squares.

3.1.2.4 Amendment in 2025

- Testing Distance for Bladeless Fans: The original standard used "equivalent sweep size diameter" for calculations, but varying interpretations among laboratories led to inconsistent results. The amendment removes the term "equivalent sweep size diameter" and directly defines fixed testing distances (e.g., 1,000 mm for table-top and 2,000 mm for pedestal bladeless fans) to unify testing conditions.
- Accuracy Enhancement: For all fan types, the airflow at the center point is now included in the total air delivery calculation to further improve precision.

3.1.2.5 Frequently Asked Questions and Future Outlook

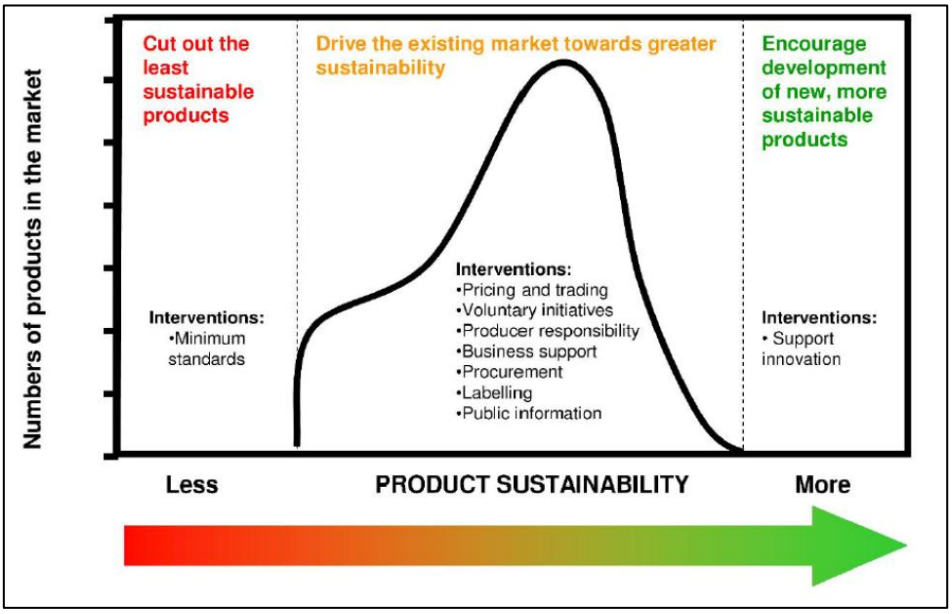
- Instrumentation: The current standard specifies vane anemometers (frequency ≧2 Hz). Regarding industry inquiries about using hot-wire anemometers, the committee noted this may be considered in future revisions.
- Scope Application: While IEC 60879 applies to household fans (≦125 W), industrial or commercial fans (> 125 W) should refer to the ISO 21684:2025 standard.

- Promotion Goals: The IEC SC 59L committee is committed to encouraging more economies to adopt IEC 60879 Edition 2 to achieve global harmonization of testing standards and reduce technical barriers to trade.

3.1.3 Effective policy to improve energy efficiency of electric fans

The International Energy Agency (IEA) **4E TCP (Technology Collaboration Programme on Energy Efficient End-Use Equipment)** is an international government platform aimed at promoting energy efficiency policies for electrical appliances. This presentation highlights the core framework for policy development known as "**Policy Packages**," emphasizing that a single measure is insufficient for market transformation. Instead, a combination of the following three elements is required:

- **Regulation:** Such as Minimum Energy Performance Standards (MEPS), used to phase out the least efficient products from the market.
- **Information:** Such as mandatory labeling, enabling consumers to identify and purchase more efficient products, thereby driving the market average.
- **Incentives:** Such as subsidies or procurement policies to encourage R&D and innovation for "best-in-class" products.



Source: IEA (2025) Effective Policy to improve the energy efficiency of residential fans (Dr. Kevin LANE)

Figure 5 Impact of policies on product sales distribution

3.1.3.1 Policy Benefits and Global Status of Electric Fans

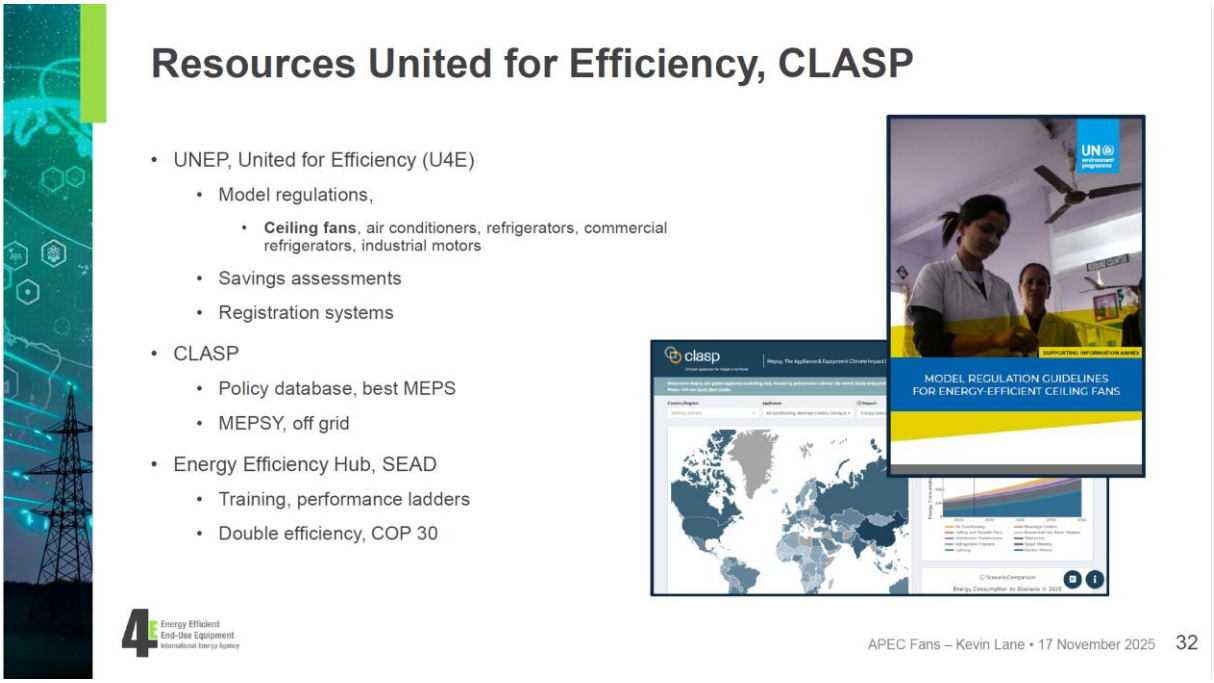
- **Economic Benefits:** According to review studies by IEA 4E, the benefit-cost ratio of energy efficiency standards and labeling programs is as high as 4:1. Long-term implementation can reduce an economy's electricity consumption by 15%.
- **Price Trends:** Empirical data shows that as energy efficiency standards improve, product prices do not rise as expected. Instead, they show a downward trend of 2-3% annually, debunking the myth that higher efficiency leads to higher prices.
- **Cooling Hierarchy:** This presentation emphasizes the positioning of electric fans within cooling strategies: Passive Design (insulation, shading, ventilation) > Fans > Energy-intensive Air Conditioning. Fans should be utilized as a critical tool to reduce reliance on air conditioning.

3.1.3.2 Policy Development Modules and Recommendations

To assist economies in developing effective policies, IEA 4E details a standardized process and its key elements:

- Key Elements:
    - **Testing Standards:** Stable testing procedures must be adopted, typically based on the international standard IEC 60879. This includes strict specifications for voltage, frequency, ambient temperature, wind speed measurement, and test room conditions.
    - **Performance Requirements:** Setting thresholds for MEPS and labels. The efficiency metric for fans is usually m^3/min/W, and standards must be tailored to different fan types.
    - **Compliance Mechanisms (MV&E):** Critical to policy success, these include:
        - **Monitoring:** Market surveillance testing, particularly targeting high-risk products.
        - **Verification:** Testing conducted through accredited laboratories (ISO/IEC 17025).
        - **Enforcement:** Implementing proportionate sanctions for non-compliance and publishing test results to serve as a deterrent.
- **U4E Model Regulations:** IEA strongly recommends referring to the United Nations Environment Programme (UNEP) U4E Model Regulation Guidelines. These provide a ready-made regulatory framework—including scope definitions, testing methods,

performance tiers, safety requirements, and market surveillance mechanisms—which can significantly reduce the administrative costs and time required for policy development.



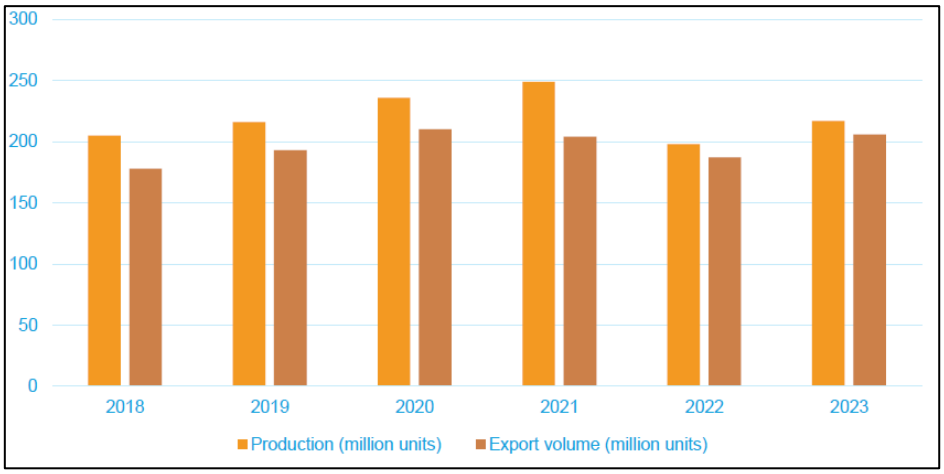
Source: IEA (2025) Effective Policy to improve the energy efficiency of residential fans (Dr. Kevin LANE)

Figure 6 Policy resource for efficient electric fans

3.1.4 Electric Fans Energy Efficiency Improvement in China

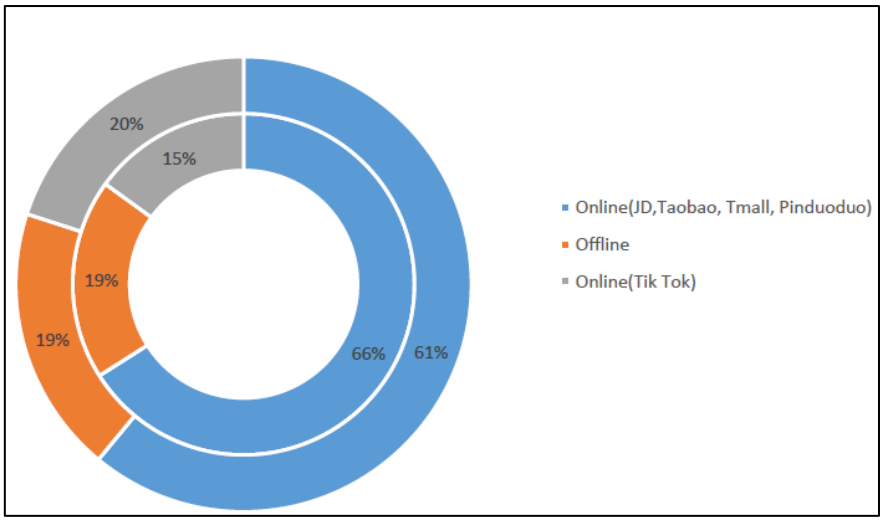
3.1.4.1 Global Manufacturing Hub and Market Scale

- **Production Capacity:** With an annual output exceeding 217 million units and exports reaching 207 million units, China accounts for approximately 30–40% of the global market share, making it the world's largest producer and exporter of electric fans.
- **Export Structure:** Pedestal and table fans are the primary export products, together accounting for 74% of total exports. Major export markets include Japan; Korea; the Philippines; United States; and Viet Nam.
- **Domestic Market:** In 2023, retail sales reached 53 million units. Sales channels are highly digitized, with online sales accounting for 81% (comprising 61% from traditional e-commerce and 20% from livestreaming platforms like Douyin/TikTok), while physical stores account for only 19%.



Source: CLASP (2025) China Energy Efficiency Standards and Energy Labels for Fans (Dr. Lei (Steven) ZENG)

Figure 7 Production and export volumes of electric fans in China (million units)



Source: CLASP (2025) China Energy Efficiency Standards and Energy Labels for Fans (Dr. Lei (Steven) ZENG)
Note: Inner circle: 2023; Outer circle: 2024

Figure 8 Sales channel scale of electric fans in China from March to July

3.1.4.2 Standards and Labeling System

China implements mandatory Energy Conservation Standards (GB) and China Energy Labels (CEL). The evolution is as follows:

- 1989: Released the first AC fan standard (GB 12021.9-1989).
- 2008: Released GB 12021.9-2008.
- 2010: Implemented mandatory energy labeling for AC fans.

- 2021: Released the latest GB 12021.9-2021, which notably integrated AC and DC fans into a single standard. Mandatory labeling for DC fans was fully implemented in 2022.
- **Three-Tier Efficiency System:**
    - Tier 1: Represents the global leading level (top 5% of products).
    - Tier 2: The threshold for energy-saving product certification and government procurement (top 20%).
    - Tier 3: The Minimum Energy Performance Standard (MEPS); products below this level are prohibited from sale.
- **Market Distribution:** Currently, Tier 3 products account for 58% of the market, Tier 2 for 12%, and Tier 1 for 30%.
- **Label Information:** Labels must include the manufacturer, model, efficiency grade (1–3), service value (m^3/min·W), and standby power (W). A QR code is also included to link to the database for verification.

3.1.4.3 Testing Methods and Specific Technical Regulations

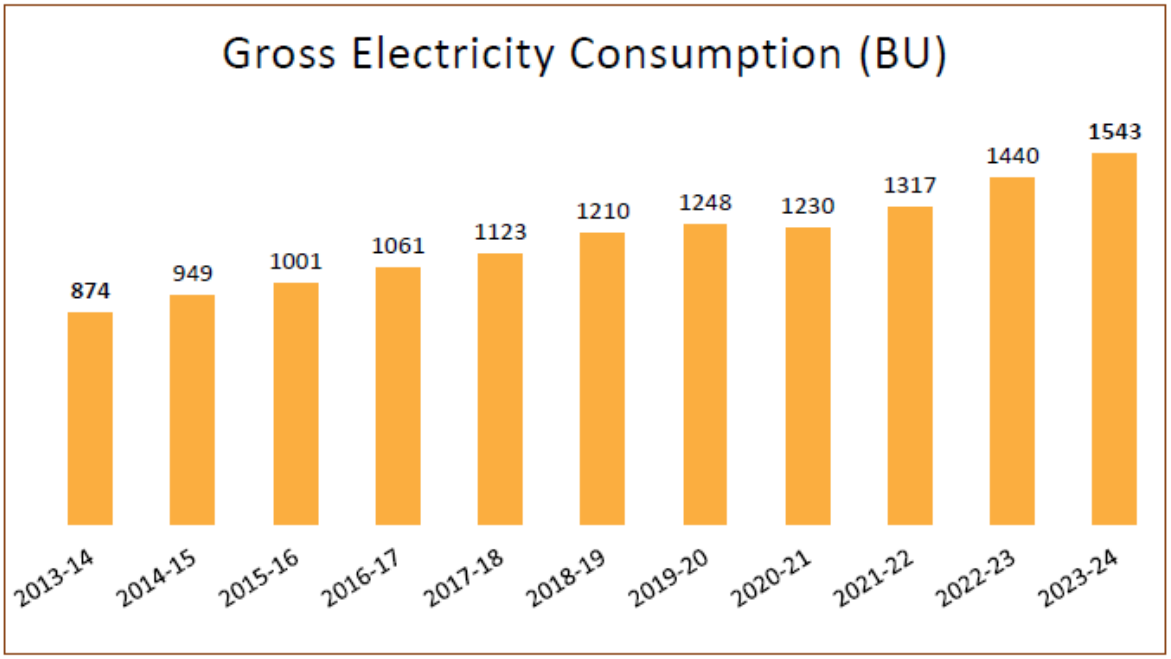
- **Testing Standards:** Based on GB/T 13380-2018, which references IEC 60879.
- **Standby Power Limits:** Given the prevalence of IoT and smart home appliances, the standard strictly regulates standby power:
    - Without Information Display: Standby power ≦0.8W (Tiers 1 & 2) and ≦1.0W (Tier 3).
    - With Information Display: Standby power ≦1.8W (Tiers 1 & 2) and ≦2.0W (Tier 3).
- **Wind Gathering Fans:** For fans where the ratio of inner-ring to outer-ring air delivery exceeds 0.9, a correction coefficient (λ) of 1.15 to 1.25 is applied based on the blade diameter.

3.1.5 Electric Fans Energy Efficiency Improvement in India

3.1.5.1 Market Background and Challenges

India is facing a challenge of surging electricity demand, which has grown 1.8 times over the past decade and is projected to triple to approximately 4 trillion kWh by 2035.

- Core of Household Energy: The residential sector accounts for 24% of total power consumption, with electric fans alone representing 23% of household electricity use.
- Cooling Demand: With 7 to 8 months of hot summer annually, 99% of Indian households own at least one fan. Electric fans are regarded as the most critical product for achieving affordable cooling.



Source: CLASP (2025) Policies, Standards, and Best Practices for Energy-Efficient Electric Fans in India (Ms. Moumita CHANDRA)

Figure 9 India's historical total electricity consumption (billion kWh)

3.1.5.2 Electric Fan Market Overview

- **Market Scale:** In the 2023-2024 financial year, the Indian electric fan industry produced approximately 84 million units.
- **Product Structure:** Ceiling fans dominate the market with a 75% share (approx. 62 million units), while TPW fans (table, pedestal, and wall fans) account for about 15% (approx. 12 million units).

- **Industry Structure:** The sector includes over 500 manufacturers, ranging from large organized enterprises to unorganized small and medium enterprises. The market is expected to grow at a CAGR of 8% until 2030.

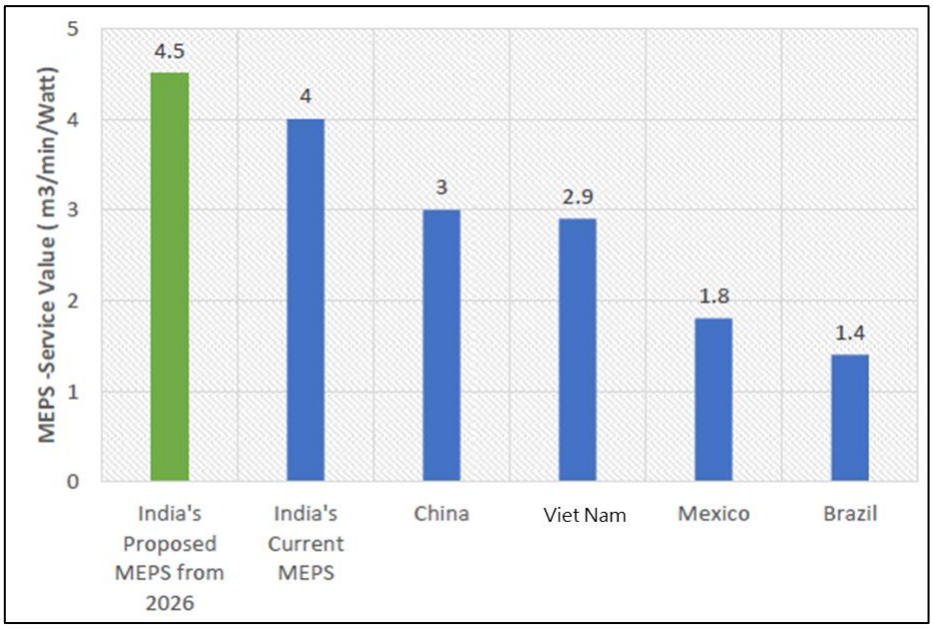
3.1.5.3 Policy Evolution: From Voluntary to Mandatory

The standards and labeling (S&L) program in India is led by the Bureau of Energy Efficiency (BEE) and uses a 5-star rating system, where 5 stars represent the highest efficiency.

- **Ceiling Fan Policy Timeline:**
    - 2008: Launched voluntary labeling (for 1200 mm size).
    - 2019: Expanded scope to include sizes below and above 1200 mm.
    - July 2022: Officially transitioned to a mandatory program.
    - 2024-2026: Released a new star rating table; standard upgrades scheduled for 2026 will phase out current 1-star products.
- **TPW Fan Policy Timeline:**
    - 2023: Included in the voluntary program.
    - October 2026: Scheduled to transition to a mandatory program.

3.1.5.4 Technical Standards and Performance Indicators

- **Reference Standards:**
    - Ceiling fans follow IS 374.
    - TPW fans follow IS 1169 (pedestal) and IS 555 (table/wall).
    - Overall alignment refers to the international standard IEC 60879:1986.
- **Performance Indicator:** Uses service value (m^3/min /W) as the core metric.
- **International Comparison:** India's current MEPS service value for ceiling fans (1200 mm) is approximately 4.0, which is among the highest in the world, surpassing standards in China; Mexico; Viet Nam; and Brazil.

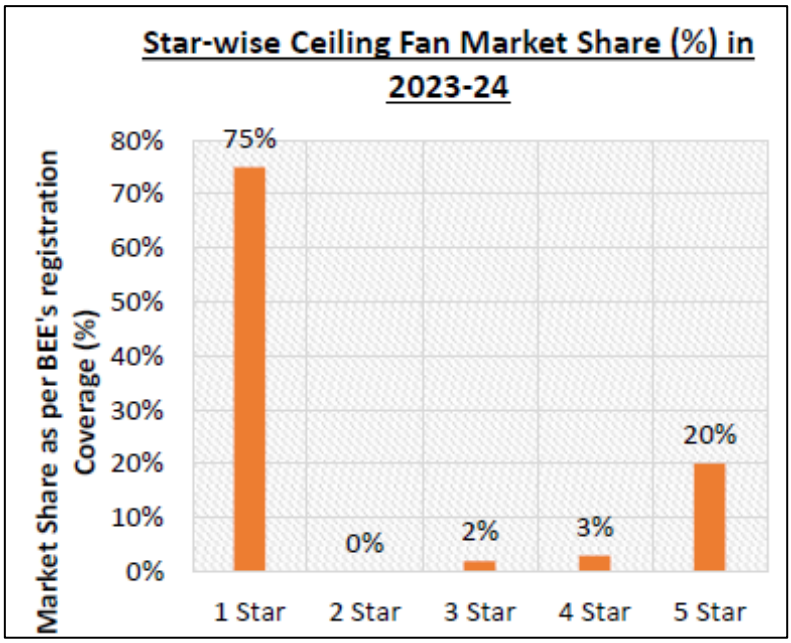


Source: CLASP (2025) Policies, Standards, and Best Practices for Energy-Efficient Electric Fans in India (Ms. Moumita CHANDRA)

Figure 10 International comparison of MEPS benchmarks for ceiling fans

3.1.5.5 Policy Impact and Market Transition Challenges

- **MEPS Improvement Results:** Since 2008, the MEPS for 1200 mm ceiling fans has increased by 41%. For TPW fans, MEPS has improved by 27% (pedestal) and 40% (table/wall) since 2023.
- **Market Transition Pains:** Following the 2022 mandatory regulations, standards were raised significantly (a 4-tier jump), causing many formerly high-star fans to be downgraded to 1-star. Currently, 1-star products hold approx. 75% of the ceiling fan market.
- **Energy Saving Potential:** By 2030, policy drivers are expected to result in 12.6 billion kWh of electricity savings, a 9 million ton reduction in carbon emissions, and savings of approx. INR 34 billion (USD 412 million) for consumers.



Source: CLASP (2025) Policies, Standards, and Best Practices for Energy-Efficient Electric Fans in India (Ms. Moumita CHANDRA)

Figure 11 Market share of ceiling fans in India by star rating

3.1.5.6 Future Strategies and SME Support

To drive the market toward higher efficiency and assist SMEs, India has proposed four strategies:

- **Awareness and capacity building:** Conducting workshops for SMEs to explain standards and efficiency requirements.
- **Technical consultancy:** Providing audits and process diagnostics designed for SMEs to guide manufacturers on material selection and modern manufacturing.
- **Testing infrastructure:** Expanding laboratory capacity, establishing shared testing facilities, and simplifying certification to reduce compliance burdens for SMEs.
- **Financial support:** Collaborating with banks and digital lending institutions to provide low-cost credit and financing for technology upgrades in the SME sector.

3.1.6 Electric Fans Energy Efficiency Improvement in Thailand

3.1.6.1 Policy Management Framework and Responsible Authorities

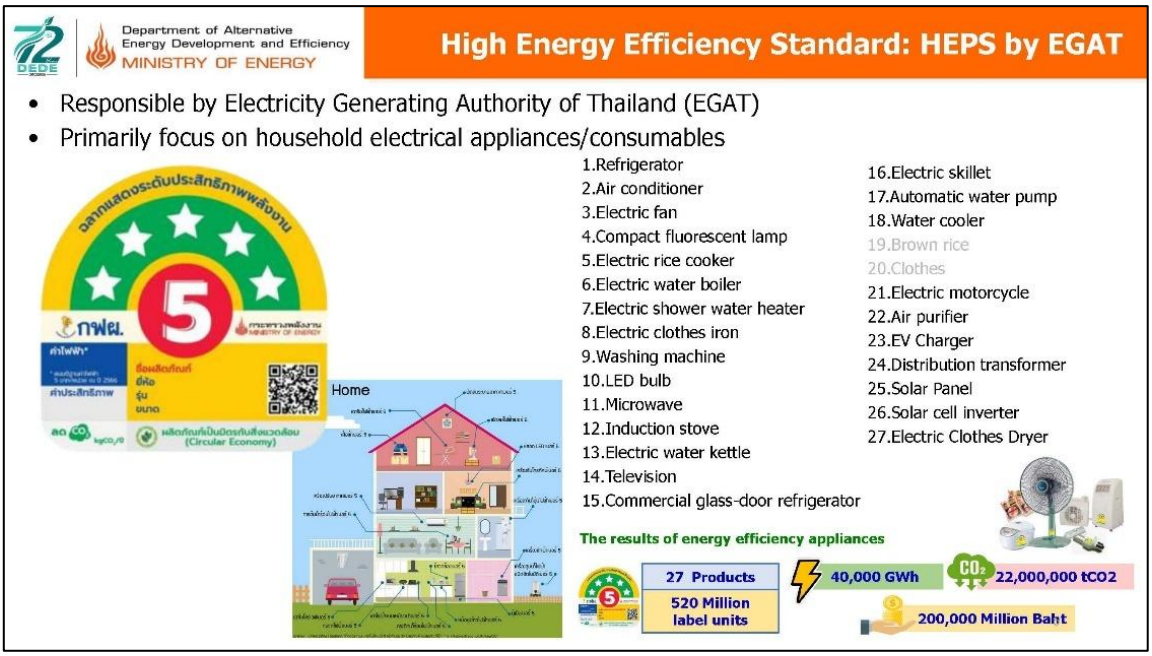
Thailand's energy efficiency management system is operated jointly by the Ministry of Energy and the Ministry of Industry, using a dual-track mechanism that combines mandatory and voluntary programs.

- Department of Alternative Energy Development and Efficiency (DEDE): Under the Ministry of Energy, DEDE is the core policy planning agency. It is responsible for developing energy efficiency plans based on the Energy Conservation Promotion Act (B.E. 2535 and B.E. 2550). Its primary duties include drafting high energy performance standards (HEPS) and minimum energy performance standards (MEPS).
- Electricity Generating Authority of Thailand (EGAT): Collaborates with DEDE to promote the voluntary Label No.5 program, primarily targeting household appliances and office equipment.
- Thai Industrial Standards Institute (TISI): Under the Ministry of Industry, TISI is responsible for supervising mandatory standards based on the Industrial Product Standards Act (B.E. 2511). DEDE and TISI signed a memorandum of understanding in 2007, where DEDE acts as a standards development organization to assist in technical drafting, while final enforcement power resides with TISI.

3.1.6.2 Status of Standards and Labeling Programs

Thailand's standards and labeling programs are categorized into three types:

- Mandatory Standards: Enforced by TISI, currently covering 5 product types, with the primary goal of phasing out the least efficient products from the market.
- Voluntary Standards: Also issued by TISI, currently covering 27 product types.
- High-Efficiency Labels (HEPS labels):
    - EGAT Label No.5: For electrical appliances like fans, refrigerators, and air conditioners. The label displays six levels from 0 to 5 stars, with 5 stars representing the highest efficiency. It currently covers 27 product types.



Source: DEDE (2025) Energy Efficiency Standard and Labeling for Electric Fanin Thailand (Dr. Supachai SAMPAO)

Figure 12 Products of EGAT Label No.5

- DEDE Energy-Saving Label: For non-electrical and industrial equipment, such as gas stoves, motors, building materials, and insulation. It covers 19 product types.

Source: DEDE (2025) Energy Efficiency Standard and Labeling for Electric Fanin Thailand (Dr. Supachai SAMPAO)

Figure 13 EGAT Label No.5

Implementation results for electric fans:

- **Label Issuance:** To date, over 89 million labels have been issued for electric fans.
- **Energy Saving Benefits:** Statistics from 2013 to 2024 show that the fan program has saved a cumulative 1,319 GWh of electricity, reduced CO_2 emissions by 661,548 tons, and saved approximately THB 6.595 billion in energy costs.
- **Market Distribution:** Among models certified with Label No.5, pedestal and table fans account for the vast majority (152 models), followed by ventilating fans (40 models) and ceiling fans (19 models).

3.1.6.3 Technical Standards and Testing Methods

Thailand adopts specific Thai industrial standards (TIS) for testing different types of fans:

- Table and Wall Fans: TIS 92-2536.
- Pedestal Fans: TIS 127-2536.
- Orbit Fans (Two-Way Oscillation): TIS 572-2528.
- Ventilating Fans: TIS 710-2530.
- Safety Standards: All electric fans must comply with the safety specifications of TIS 934-2558.

3.1.6.4 Future Planning and Policy Integration

To eliminate confusion and improve management efficiency, Thailand plans to integrate the label formats of DEDE and EGAT.

- New Label Design: The unified label will display the product name, brand, model, capacity, and a QR code, while clearly indicating estimated annual electricity costs and CO_2 emissions.
- Implementation Timeline: The new label was announced on September 23, 2025, and is expected to be officially launched in January 2026.

3.1.6.5 Tax Incentives

- Objective: To provide tax deductions for enterprises that produce, sell, or use products that have earned the EGAT Label No.5 (limited to 5-star products) or the DEDE high-efficiency label.
- Timeline: This program is expected to be implemented from 2025 to 2029 and is currently in the legal review phase.

3.1.7 Electric Fans Energy Efficiency Improvement in Indonesia

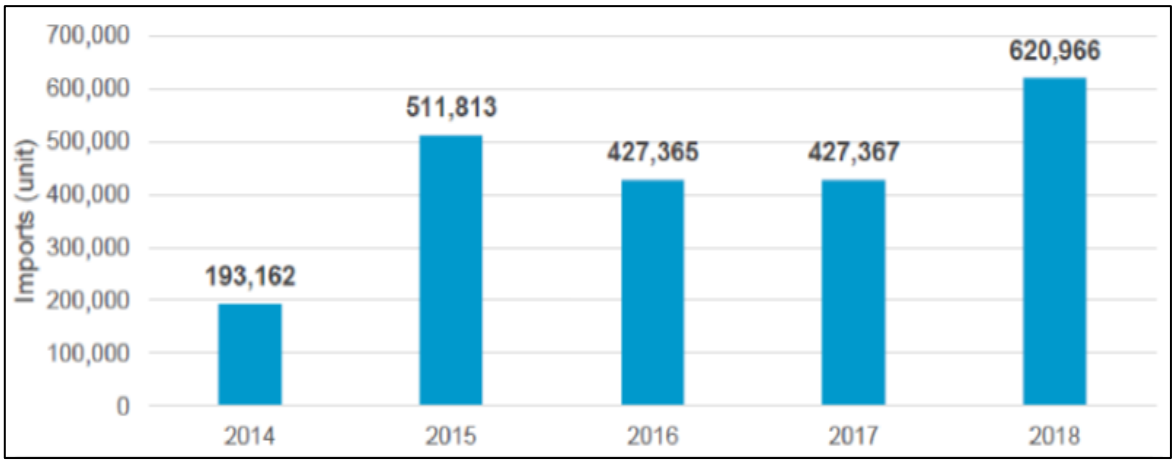
3.1.7.1 Policy and Regulatory Framework

The core of Indonesia's energy efficiency policy is based on Government Regulation No. 33 of 2023 (GR 33/2023).

- **Dual-Track Management:** The regulation distinguishes between upstream measures (energy resource management and preservation) and downstream measures (improvement of energy use efficiency).
- **Mandatory Obligations**: It mandates that energy providers and users (covering industrial, transport, building, and residential sectors) must implement energy conservation measures.
- **Specific Measures:** Manufacturers and importers are required to adopt MEPS and energy-saving labels.
- **Regulatory Body:** Primarily supervised and enforced by the Directorate general of new, renewable energy and energy conservation (EBTKE) under the Ministry of energy and mineral resources (MEMR).

3.1.7.2 Strategic Position of Fans and Market Structure

- **Climatic Demand:** Located in the tropics with a hot and humid climate, electric fans are essential appliances for maintaining comfort and health in Indonesia. Surveys show that Indonesian households use fans for an average of 6.4 hours per day.
- **Market Substitutability:** For low-income families who cannot afford air conditioning, fans are the primary cooling tool; for households with air conditioning, fans assist in ventilation and reduce AC energy consumption.
- **Market Scale:** The market is projected to grow at a CAGR of 4.6% from 2020 to 2026.
- **Dominance of Local Manufacturing:** The Indonesian fan market is highly localized, with 95% of annual sales coming from domestic production (provided by local manufacturers or assembly plants).
- **Import Status:** Imported products account for less than 5% of the market. The primary source of imports is China (77%), followed by Thailand and Singapore (10% each).



Source: MASKEEI(2025) Electric Fans in Indonesia: Market, Policy & Technology Overview (Mr. Totok SULISTIYANTO)

Figure 14 Historical import volume of fans in Indonesia

3.1.7.3 Standards, Testing, and Certification

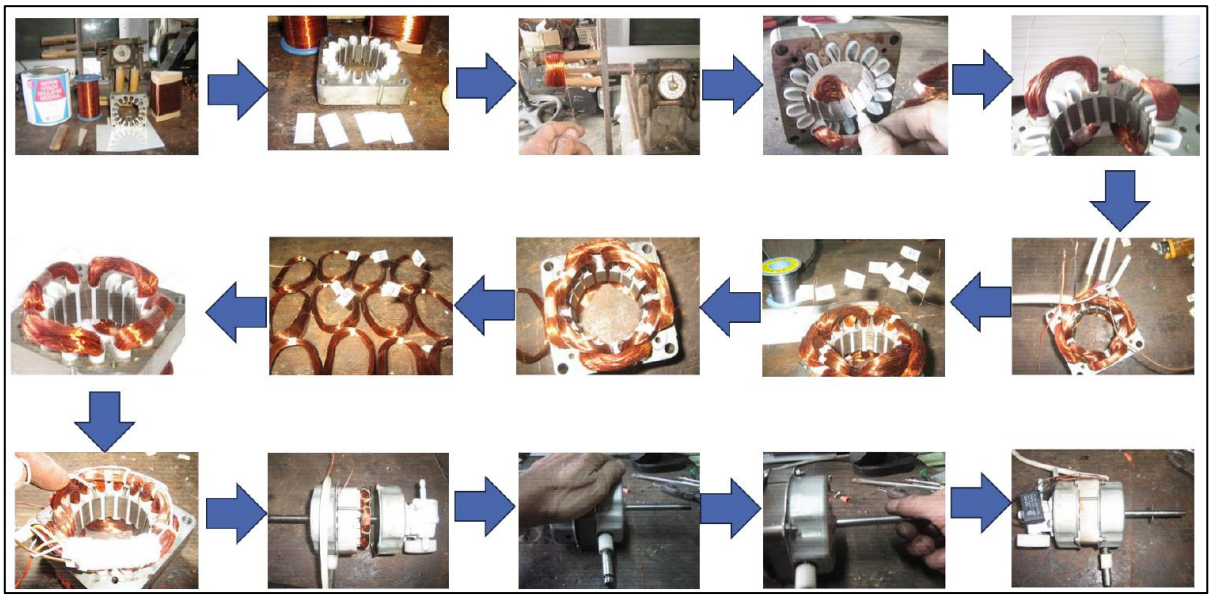
- **SNI Standards:** To ensure safety and quality, all electric fans must comply with Indonesian standards (SNI).
    - SNI 7609:2011: Regulates the safety, performance, and noise of household electric fans.
    - SNI 7859:2013: General safety requirements for household electrical appliances.
- **Testing Items:** Includes electrical safety tests (such as leakage current, temperature rise, and insulation resistance) and electromagnetic compatibility (EMC) tests.

3.1.7.4 Localized Characteristic Strategy: Motor Repair and Rewinding

This presentation proposes an energy efficiency strategy unique to the Indonesian local context: motor repair and rewinding.

- **Rationale:** Since electric fans have a long lifespan and informal repair services (roadside repairs) are very common in Indonesia, many old motors become highly inefficient after repair. Promoting correct repair techniques and material upgrades presents a significant energy-saving opportunity. Recommended measures include:
    - Rewinding using high-efficiency copper wire.
    - Adopting vacuum pressure impregnation (VPI) technology to improve insulation durability.
    - Upgrading old motors to brushless DC (BLDC) motors during the repair process.

- **Impact:** Through proper maintenance and upgrades (such as cleaning, lubrication, and balance calibration), energy consumption is expected to be reduced by 15-30%.



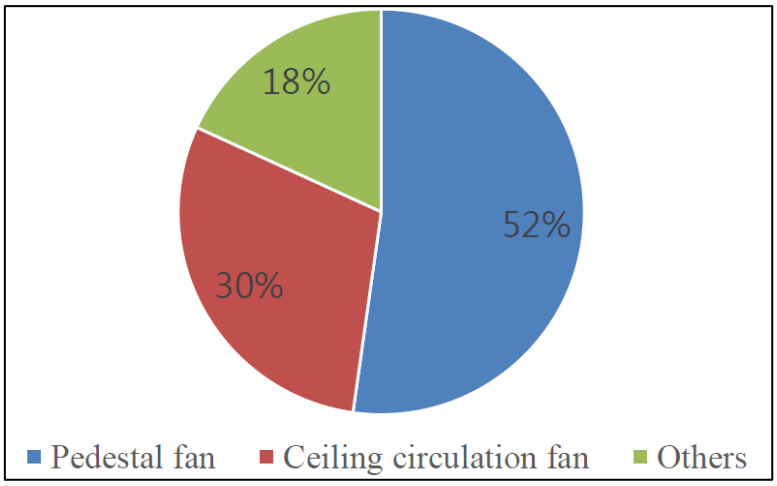
Source: MASKEEI(2025) Electric Fans in Indonesia: Market, Policy & Technology Overview (Mr. Totok SULISTIYANTO)

Figure 15 Motor rewinding technology in Indonesia

3.1.8 Electric Fans Energy Efficiency Improvement in Chinese Taipei

3.1.8.1 Market Characteristics

- High Penetration and Usage Rates: The penetration rate of electric fans in Chinese Taipei's households exceeds 95%, with an average of 3-4 fans per household. During summer, the average daily usage time reaches 7-8 hours.
- Sales Scale: Annual sales volume exceeds 4 million units. Pedestal fans hold the highest share (52%), followed by ceiling circulation fans (30%).



Source: ITRI (2025) Electric Fans Energy Efficiency in Chinese Taipei (Dr Chi-Chun HUANG)

Figure 16 Market share of electric fans in Chinese Taipei

3.1.8.2 Energy Efficiency Labeling System and Standards

Chinese Taipei implements a voluntary Energy Label system for electric fans, which has included fans since 2002. Criteria revisions were conducted in 2011, 2016, and 2022 based on different fan types, as shown in figure 18. Electric fan types are regulated according to the standards (CNS):

- Auto-Rotating Ceiling Fans: CNS 2450.
- Ceiling Fans: CNS 597.
- Ceiling Circulation Fans and Box Fans: CNS 9578.
- Pedestal Fans: CNS 2061.
- Table Fans and Wall Fans: CNS 547.

	2002.10.8	2011.2.8	2016.1.1	2016.2.5	2022.12.1
Product Type	**D (cm)**	**Eff. (CMM/W)**	**Eff. (CMM/W)**	**Eff. (CMM/W)**		**Eff. (CMM/W)**
Auto-rotating Ceiling Fan	15 – 50	1.07 @ 40cm	$0.280 \times D^{0.5}$	$0.336 \times D^{0.5}$	No baseline adjustment; only Article 1, Appendix 3 of the "Energy Conservation Labeling Standards and Methods for Electric Fans" was revised.	$0.336 \times D^{0.5}$
Pedestal Fan	15 – 50	0.87 @ 60cm	$0.224 \times D^{0.5}$	$0.302 \times D^{0.5}$		$0.453 \times D^{0.5}$
Ceiling Fan	30 – 160	1.47 @ 150cm	$0.280 \times D^{0.5}$	$0.434 \times D^{0.5}$		$0.434 \times D^{0.5}$
Table Fan Wall-Mounted Fan	15 – 60	0.91 @ 40cm	$0.224 \times D^{0.5}$	$0.302 \times D^{0.5}$		$0.453 \times D^{0.5}$
Box Fan	15 – 60		$0.224 \times D^{0.5}$	$0.302 \times D^{0.5}$		$0.453 \times D^{0.5}$
Ceiling Circulation Fan				$0.448 \times D^{0.5}$		$0.448 \times D^{0.5}$

Source: ITRI (2025) Electric Fans Energy Efficiency in Chinese Taipei(Dr Chi-Chun HUANG)

Figure 17 Revision history of electric fan standards in Chinese Taipei

3.1.8.3 Certification Status and Technical Transformation

Chinese Taipei's Energy Label fan market exhibits a significant technical transformation. Under the high standards of the Energy Label program, AC motors have been almost entirely phased out, and DC technology has become the absolute mainstream.

- **Certification Data Analysis:** To date, 64 manufacturers have participated in the Energy Label program, with 358 certified product models.
    - Product Category Distribution: Pedestal fans have the highest number of certifications (166 models), followed by ceiling circulation fans (122 models) and ceiling fans (49 models).
    - Motor Technology Distribution: Among all certified products, 351 models utilize DC motors, accounting for approximately 98%. Only 7 models use traditional AC motors, accounting for just 2%. This indicates that under high-efficiency requirements, DC technology has become the dominant standard.
- **Ceiling Fan Market Case Study:** An in-depth analysis was conducted specifically for ceiling fans. Among the 44 ceiling fan models awarded the Energy Label in 2024, 95% featured DC motors, while only 5% featured AC motors.
    - Market Share Reversal: According to actual sales data, the market share of DC ceiling fans has reached 53%, surpassing AC ceiling fans at 47%.
    - Efficiency Comparison: DC ceiling fans are highly efficient, with many models reaching or exceeding 207 CFM/W. In contrast, AC ceiling fans generally have lower efficiency, ranging between 70 and 90 CFM/W.

3.1.8.4 Advanced Technology Opportunities

In addition to standard DC motors, Chinese Taipei identifies the external-rotor brushless DC motor (external-rotor BLDCM) as the next-generation high-efficiency technology opportunity.

- **Technical Advantages:** Compared to traditional internal-rotor motors, the external-rotor design offers the following benefits:
    - High Torque: Provides higher torque at low speeds, which is ideal for electric fan loads.
    - Slim Design: Smaller volume and lighter weight, leading to material savings.
    - Cost-Performance: Efficiency-to-cost ratio can be improved by 63%.
- **Energy Saving Potential Comparison:**

- Standard DC Fans: Can save over 50% energy compared to AC fans.
- External-Rotor BLDC Fans: Data shows that ceiling fans using this technology can achieve efficiencies of 355 to 381 CFM/W, far exceeding the 207 CFM/W of typical DC fans.

- **Carbon Emission Impact:** using the usage-phase carbon emissions of a 52-inch ceiling fan as an example:
  - AC Fans: Approximately 269–286 $kgCO_2e$.
  - General DC Fans: Approximately 147–155 $kgCO_2e$.
  - External-Rotor BLDC Fans: Although similar to general DC fans (approx. 149–159 $kgCO_2e$), they provide significantly higher air delivery while maintaining low carbon emissions, demonstrating an excellent energy-efficiency ratio.

	AC Fan	DC Fan
Weight	Heavy	**Light**
Noise	Loud	**Quiet**
Air Flow	Limited	**Large**
Efficiency	Normal	**High**
Volume	Big	**Small**
Control	3-Speed Switch	**Adjustable**
Heat Generation	High	**Low**
Lifespan	Normal	**High(motor)**
Price	**Low**	High

Source: ITRI (2025) Electric Fans Energy Efficiency in Chinese Taipei(Dr Chi-Chun HUANG)

Figure 18 Comparison of differences between AC and DC electric fans

3.2 Summary of Discussions

During the workshop sessions, we established a dedicated platform to address critical issues surrounding the energy efficiency of electric fans. We invited subject-matter experts to deliver keynote presentations, which were complemented by insightful experience-sharing from representatives of participating economies. These collaborative discussions fostered a robust exchange of perspectives on regulatory frameworks and technical innovations. The following section summarizes the key takeaways from these deliberations.

3.2.1 The Evolution of Technical Standards

During the workshop, experts provided an in-depth analysis of the technical evolution of IEC 60879, spanning from its first edition in 1986 to the second edition in 2019 and its subsequent 2025 amendment. A primary shift occurred in the standard's positioning and scope; the title was revised from "Performance and construction of electric circulating fans" to "Methods for measuring the performance of comfort fans," reflecting a strategic alignment with the IEC TC 59 focus on performance metrics. This update also expanded the scope to include modern technologies such as tower fans and bladeless fans. To enhance measurement precision, the new edition introduced more rigorous testing procedures, such as upgrading airflow velocity measurements for table and pedestal fans from a single-axis approach to a dual-axis (X and Y axes) methodology. It also redefined test room specifications, including chamber dimensions and airflow interference controls, to ensure higher data accuracy across different testing environments. Furthermore, regarding the 2025 amendment (A1), experts highlighted the removal of the "equivalent sweep size diameter" for bladeless fans. This change was implemented to eliminate measurement inconsistencies caused by differing interpretations of outlet structures, replacing it with fixed measuring distances to ensure global reproducibility.

A critical structural change in the new edition is the complete removal of the "Tolerances" clause. This strategic omission is based on the consensus among experts that the primary role of an international standard is to provide scientific, objective, and reproducible measurement methods. Experts emphasized that the determination of specific tolerance limits is the responsibility of governments and regulatory authorities rather than the standard-setting body itself. By removing this section, the standard clarifies that individual economies should define their own compliance thresholds and tolerance levels based on their specific market surveillance requirements and policy objectives.

3.2.2 Policy Framework for Energy Efficiency

During the sessions, representatives and speakers proposed various strategic directions for enhancing electric fan energy efficiency across the product life cycle. Regarding maintenance and circular economy, experts from Indonesia highlighted that the disposal and dismantling of fans generate significant carbon emissions. Furthermore, informal "roadside" repairs often lead to a drastic decline in motor efficiency. Consequently, they recommended that governments subsidize professional repair services to extend product lifespans and establish regulations for the second-hand market to ensure energy performance. Technical solutions discussed included advanced motor rewinding techniques—using high-efficiency copper wires and Vacuum Pressure Impregnation (VPI) for improved insulation and durability—or retrofitting old units with Brushless DC (BLDC) motors during the repair process to achieve both waste reduction and energy savings.

To address the high retail costs associated with universal BLDC adoption, Chinese Taipei suggested that governments use regulatory frameworks to encourage manufacturers to produce

"entry-level" high-efficiency DC fans, ensuring affordable options for the public. China complemented this by proposing price monitoring mechanisms to prevent price gouging during the technological transition. Regarding incentive structures, China implemented a tiered subsidy program for consumers based on efficiency ratings, while India chose to subsidize manufacturers to lower the production costs of high-efficiency models. For market surveillance, the International Energy Agency (IEA) recommended implementing robust post-market sampling systems, emphasizing a risk-based approach that focuses on high-risk and high-viability products rather than exhaustive testing. Lastly, experts from India noted that energy-efficient products must also meet aesthetic and design demands to successfully incentivize consumer adoption.

3.2.3 Harmonization of Regional Standards

In advancing regional standard harmonization, speakers recommend that APEC should actively draw insights from ASEAN's successful implementation of the ASEAN Harmonized Electrical and Electronic Equipment Regulatory Regime (AHEEER). By establishing Mutual Recognition Arrangements (MRAs) that facilitate the "tested once, accepted everywhere" principle, ASEAN has effectively reduced the administrative burden of redundant testing—a model that holds high reference value for unifying electric fan testing protocols under the latest IEC 60879 standards. However, the path to harmonization is fraught with challenges. The primary difficulty lies in the disparate levels of technological development and the inherent variations in electrical grid environments (such as voltage and frequency) across economies. These factors often necessitate lengthy political negotiations and complex industry impact assessments when defining Minimum Energy Performance Standards (MEPS). Furthermore, ensuring consistency in laboratory hardware and metrological precision (especially regarding new requirements like fixed measuring distances for bladeless fans) remains a critical technical hurdle.

Notwithstanding these challenges, the long-term benefits of standard harmonization are substantial. For regulatory authorities, unified testing standards enhance market surveillance effectiveness and allow for risk-based inspection models that prevent the cross-border movement of inefficient products. For manufacturers, harmonization significantly lowers compliance costs for entering multiple markets, mitigating Technical Barriers to Trade (TBT) and enabling economies of scale that drive down the production costs of high-efficiency models. Ultimately, this leads to a market transformation where consumers can access high-quality, energy-efficient products at more competitive prices. By streamlining technical requirements, standard harmonization serves as a pivotal mechanism for achieving the overarching energy-saving and carbon-reduction goals across the Asia-Pacific region.

3.3 Summary of Policy Interventions Developed

International Energy Agency's (IEA) strategic framework for appliance energy efficiency,

emphasizing a holistic "policy package" that integrates regulation, information, and incentives to drive market transformation.

In formulating policy interventions, regulation serves as the foundational push for market progress. By implementing Minimum Energy Performance Standards (MEPS), policymakers can effectively exclude the least efficient products from the market while aligning local requirements with international best practices. Furthermore, regulations should ensure that new appliances are "demand-response ready" to enhance grid flexibility and include strict controls on the import of used, inefficient appliances to prevent them from entering the domestic market.

The information component acts as a vital pull mechanism by addressing information asymmetry and empowering consumers. Policies should mandate clear, comparative energy labels that help buyers identify products based on their total lifetime costs rather than just the initial purchase price. This is complemented by capacity-building initiatives for retailers and manufacturers, alongside public awareness campaigns rooted in behavioral insights, ensuring that high-efficiency options become the preferred choice for informed households.

Finally, incentive programs act as a catalyst to accelerate the adoption of advanced technologies. Governments can lower the financial barriers to high-efficiency appliances through direct rebates, grants, and tax measures on sales or imports. Beyond direct subsidies, the introduction of dynamic electricity pricing and the creation of eligible product lists for financial incentives encourage flexible demand and reward innovation. When these three pillars are synchronized, they create a path toward a 25% reduction in appliance energy use by 2030 and a long-term goal of halving consumption without increasing purchase costs.

4. Policy Recommendations

Regional Policy Roadmap for Energy-Efficient Electric Fans

Drawing on the outcomes of the electric fan energy efficiency workshop, a structured policy roadmap is proposed for APEC economies. The roadmap emphasizes a phased approach that begins with strengthening regulatory foundations, progresses toward market-based incentives, and ultimately supports regional harmonization of standards to facilitate trade, technology diffusion, and energy efficiency improvements.

Near-Term Policy Priority: Strengthening Testing Capacity and MEPS Adoption

In the near term, enhancing measurement and verification capacity is a critical prerequisite for effective policy implementation. Economies with established testing infrastructure are encouraged to prioritize the introduction or strengthening of Minimum Energy Performance Standards (MEPS) to systematically remove inefficient electric fan products from the market. For economies where testing capacity remains limited, two practical pathways are

recommended: direct adoption of relevant IEC standards or the establishment of mutual recognition arrangements to leverage certification systems from economies with mature testing capabilities. These approaches can accelerate policy implementation while reducing institutional burden.

Medium-Term Policy Direction: Market Incentives and Product Lifecycle Optimization

Over the medium term, policy attention may shift toward stimulating market transformation through targeted incentives and lifecycle management strategies. Recommended measures include tiered subsidy schemes linked to efficiency performance, support for professional maintenance and repair services to extend product lifespans, and incentive programs promoting high-efficiency motor technologies such as Brushless DC (BLDC) motors. These policy instruments not only improve energy performance but also support circular economy objectives by reducing electronic waste and resource consumption.

Long-Term Regional Goal: Standards Harmonization and Market Integration

From a longer-term regional perspective, greater alignment with international standards such as IEC 60879 is encouraged to promote regulatory convergence across APEC economies. Harmonization can reduce technical barriers to trade, lower compliance costs for manufacturers, and facilitate broader dissemination of high-efficiency technologies. At the same time, consistent standards contribute to consumer confidence by ensuring product safety, performance reliability, and sustainability across diverse markets within the APEC region.

5. Conclusion

Electric fans were once commonly regarded as low-tech traditional appliances. However, through the electric fan workshop, their critical strategic position in climate change and energy transition has been firmly established.

Experts from the International Energy Agency (IEA) explicitly stated that in the journey toward net-zero emissions, priority should be given to passive design (insulation, shading, and ventilation), followed by electric fans, and lastly by high-energy-consuming air conditioning. For tropical developing economies such as India and Indonesia, electric fans are the cornerstone of achieving energy equity and meeting basic cooling needs.

The case of India shows that fans account for 23% of household electricity consumption, the highest share of any single appliance. In Indonesia, households use fans for an average of 6.4 hours per day. For developing economies, improving fan energy efficiency is an effective means of reducing grid burdens and household expenses.

When formulating energy efficiency standards or regulatory policies for fans, international experts generally recommend the following steps:

- **Market Research:** Conduct a comprehensive and in-depth market survey to understand the types, performance, and market distribution of domestic fan products.
- **Standards:** Establish corresponding standards. If the technical capacity and resources are available, domestic testing laboratories should be built; if technical expertise or manpower is temporarily lacking, adopting international standards or recognizing existing labels from other economies can serve as an alternative.
- **Institutional Implementation:** Implementation can begin with voluntary measures. Through continuous promotion and public awareness campaigns, market acceptance can be gradually increased before moving into the mandatory regulation stage.

Drawing from the shared experiences of the expert speakers at the electric fan workshop, the following four dimensions are recommended for the future policy-making regarding electric fans:

1. **Establish Mandatory MEPS to Phase Out Low-Quality Products:** The IEA's policy mix recommendations point out that the function of Minimum Energy Performance Standards (MEPS) is to "eliminate the least sustainable products." According to their findings, 17 out of the 21 APEC economies have already implemented mandatory MEPS for electric fans. For example, China enforces a mandatory 3-tier energy efficiency standard, barring products below Tier 3 from the market; India also brought ceiling fans under mandatory regulation in 2022. While Chinese Taipei possesses high-efficiency DC products, the market may still be flooded with low-efficiency AC products that have not applied for labels. In the future, introducing a baseline MEPS could be considered. We may refer to India's strategy: starting with large-surface-area fans where standards are relatively easier to meet, then gradually expanding to smaller products to ensure a market floor and prevent low-efficiency products from circulating in non-labeled markets.
2. **Strengthen Financial Incentives and Replacement Policies:** To accelerate the adoption of top-tier high-efficiency technologies (such as our domestic outer-rotor BLDC motors) and raise overall fan efficiency, labeling systems alone may not be sufficient. China has implemented a "Trade-in" policy for household appliances, providing direct subsidies of 20% for Tier 1 efficiency products and 15% for Tier 2. This differentiated subsidy approach effectively stimulates consumption. Thailand is currently developing tax incentives for high-efficiency equipment, lowering purchase barriers through installment plans, and integrating payments with telecommunications bills. If economies aim to further promote ultra-high-efficiency fans and increase their market share, these types of fiscal tools could be used to reduce initial acquisition costs.
3. **Make Label Information More Impactful and Digitalized:** Thailand's upcoming new version of its energy label will integrate electricity cost and carbon emission information,

allowing consumers to see exactly how much money they can save and how much carbon they can reduce annually. China's labels mandate the display of standby power and include a QR code, making it easy for the public to link directly to the database for verification. Given that electric fans are used for long periods in some economies, adding readable and verifiable information to the labels would more effectively resonate with consumers.

4. **Harmonize Standards and Enhance Efficiency:** IEC 60879:2019 (Ed 2.0) has already incorporated testing methods for bladeless and tower fans, and the air volume measurement has shifted to a dual-axis testing point system. As these new types of fans become increasingly popular in our domestic market, it is recommended that we accelerate the harmonization of CNS standards with the new IEC versions. Furthermore, participants generally agreed on the need to strengthen consumer awareness of Life Cycle Costs. Specifically, the "motor maintenance and rewinding" efficiency upgrade concept proposed by Indonesia effectively prevents the decline in energy efficiency caused by improper repairs. This represents a non-traditional energy-saving pathway worth considering for promoting the circular economy and extending product lifespans.

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