

Market Assessment Study and Technical Analysis Support of India's Efficiency Policy Development for Table- & Wall Mounted Fans

Comprehensive Market Assessment

December 2022

Partners



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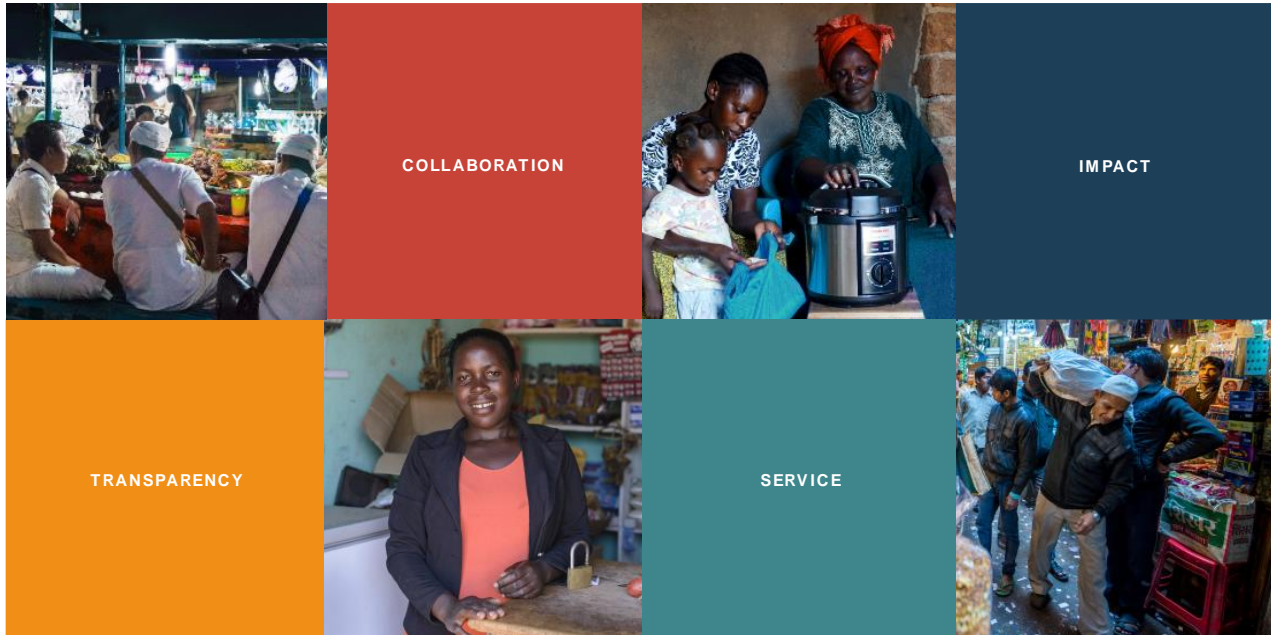
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List of abbreviation

AC	Air Conditioning
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
CAGR	Compound Annual Growth Rate
CGF	Competitive Grants Facility
DCs	Designated Consumer
EWS	Economically Weaker Section
GHG	Green House Gases
ICAP	India Cooling Action Plan
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IFMA	Indian Fan Manufacturers Association
INR	Indian Rupee
LIG	Low Income Group
MEPS	Minimum Energy Performance Standard
MOIT	Ministry of Industry and Trade
NABL	National Accreditation Board for Testing and Calibration Laboratories
SEC	Specific Energy Consumption
S&L	Standards & Labelling
US	United States

Acknowledgment

We express our sincere gratitude to CLASP for entrusting ICF with the project titled 'Market Assessment Study and Technical Analysis Support of India's Efficiency Policy Development for Table- & Wall Mounted Fans'.

We express our sincere thanks CLASP for their support and guidance in the preparation of the Comprehensive Market Assessment Report.

Executive Summary

The fan industry in India is well-established and has shown significant growth over the years. The Indian fan industry presently generates over 60 million units annually and is valued at around Rs. 8,000 crores (\$1.07 billion; 2018–19). The industry grew at a 9% CAGR from FY12-FY17. In India, the electric fan market is expected to exceed \$ 2 billion¹ by 2023. The growing presence of organized retail outlets, increasing spending power, and rising preference for online sales platforms and modular homes are expected to boost demand for electric fans in India over the coming years.

Furthermore, government initiatives such as the Integrated Power Development Scheme ("IPDS") and the Deendayal Upadhyaya Gram Jyoti Yojna ("DDUGJY") are expected to have a positive impact on the country's electric fan market.

The fan industry will be boosted further by the India Cooling Action Plan (ICAP), which was launched in 2019 and has a long-term vision to address cooling demand across sectors. It lists actions that can help reduce cooling demand. It aims to reduce cooling demand across sectors by 20% to 25% by 2037-38, refrigerant demand by 25% to 30% by 2037-38, and cooling energy requirements by 25% to 40% by 2037-38. These actions will have a significant impact on the environment.

ICAP would provide the following societal benefits in addition to environmental benefits: (i) thermal comfort for all - provision for cooling in EWS and LIG housing; (ii) sustainable cooling - low GHG emissions associated with cooling; (iii) Make in India - domestic manufacturing of electric fans and other cooling equipment; and (iv) robust R&D on alternative cooling technologies - to spur innovation in the cooling sector.

CLASP collaborated with ICF Consulting India Pvt. Limited to conduct a thorough market assessment and technical analysis of table- and wall-mounted fans. The goal of this study is to support in assessing the market to understand product sales, import and export trends, available Indian test standards and test facilities, international labeling program comparisons, and recommendations for developing energy efficiency metrics for table- & wall-mounted fans.

Table- & wall-mounted fans are some of the most common electrical appliances to circulate cool breeze around a larger space and regulate temperature. Because of their portability and affordability, these fans are in high demand in India. These types of fans are manufactured by both organized and unorganized domestic manufacturers, and imported numbers are also significant for these types of fans.

¹ India Electric Fans Market by Type, By Distribution Channel, By End User, Competition Forecast & Opportunities, 2013-2023

The report proposes service value as the energy performance metric based on minimum service values specified in Indian Standard (IS) IS 555:1979. Based on an assessment of service values through market research for around 1000 models, an energy efficiency metric is proposed, that can be considered to develop energy efficiency policy by Bureau of Energy Efficiency (BEE). The associated energy savings and GHG savings are also projected. The proposed labeling program focuses on table- & wall- mounted fans of sweep sizes as per IS 555, i.e., 200 mm, 250 mm, 300 mm, & 400 mm.

According to the technical analysis, it is estimated that the Indian market for table- and wall-mounted fans would grow to around 11.1 million by 2030, leading to savings of 1.8 TWh of electricity and 1.5 MtCO₂ emissions by 2030.

About Table- & Wall-Mounted Fans

1.About Table- and Wall-Mounted Fans

1.1 About the technology

India is a tropical country, and it is impossible to picture a home without a fan. Fans, unlike air conditioning technology, do not lower the temperature or relative humidity of the air; rather, they improve convection and help sweat evaporate to produce a cooling effect on the body. Fans are more common in areas where the weather is hot and humid.

There are three broad categories of fan technology (Figure 1).

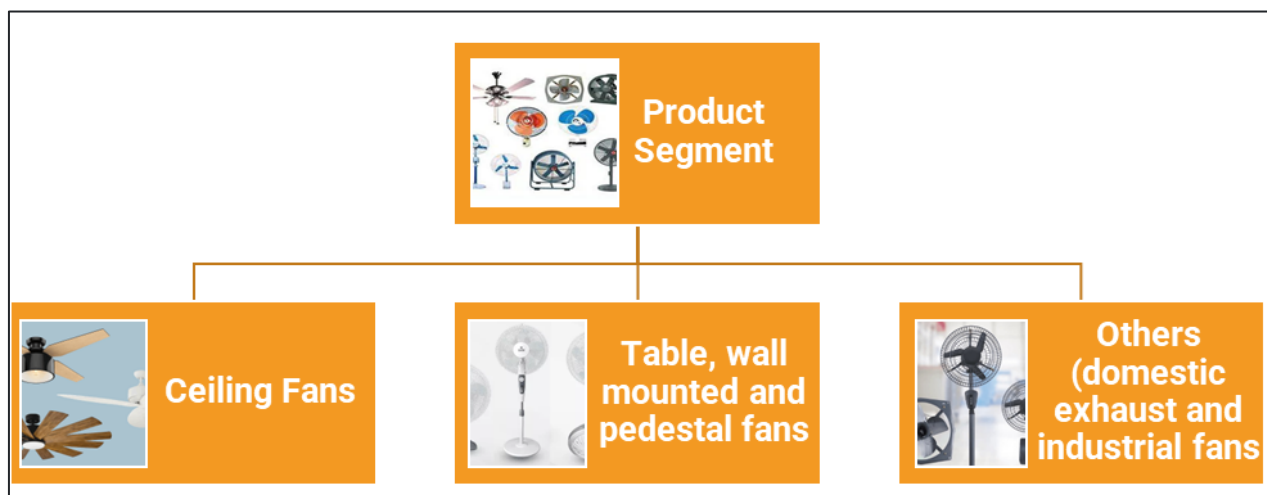


Figure 1: Electric fan product segmentation

India's fan industry is well-established and has grown significantly over decades. The Indian fan industry currently produces over 60 million units per year, and is worth approximately Rs. 8,000 crores (\$1.07 billion; 2018-19). From FY12 to FY17, the industry grew at a 9% CAGR. By 2023, electric fan sales in India are expected to exceed \$2 billion². Figure 2 depicts the Indian Fan Market³ by Product Type.

² Source: India Electric Fans Market by Type, By Distribution Channel, By End User, Competition Forecast & Opportunities, 2013-2023

³ Source: Frost & Sullivan Analysis (Reference year 2021-22)

There are over 500 manufacturers of fans and associated fan components in India, and a nationwide distribution network with over 1.5 lakh retail outlets.

Several factors drive the Indian fan market, including increased rural electrification, rapid urbanization, increased living spaces, expansion of organized retail stores, increased purchasing power, and a growing preference for online sales channels and modular homes.

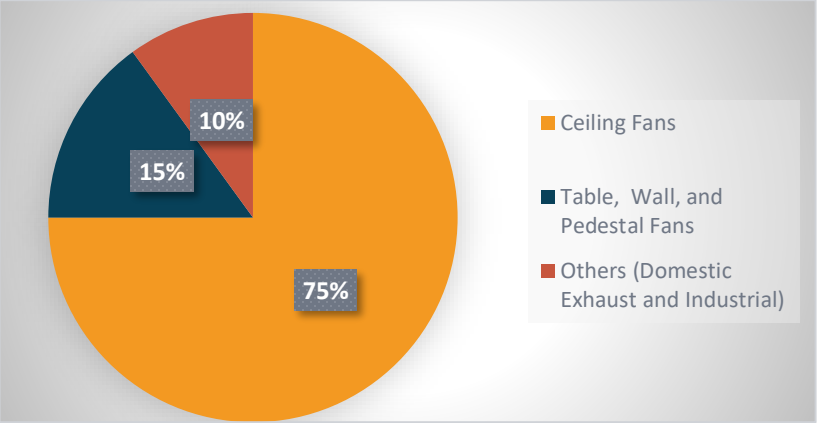


Figure 2 : Indian fan Market by Type of Products

This is backed up by several initiatives launched by the Government of India (GoI) to expand housing projects and develop smart cities across the country. In line with this, increased access to electricity, particularly in rural areas, is catalyzing the market growth. Furthermore, rising disposable incomes and concept of nuclear families both in rural & urban areas are fueling a significant demand for fans with aesthetically pleasing designs and smart features, such as voice control and remote connectivity via smart devices, propelling overall product sales forward.

India's organized and unorganized markets dominate the electric fan market, resulting in a diverse range of electric fans. Because of competition between organized and unorganized businesses, the industry's dynamics have shifted. However, the organized market has grown significantly in terms of both volume and revenue. The unorganized market has largely served the rural market.

Crompton Greaves Consumer Electricals Ltd., Usha International Ltd., Havells India Limited, Bajaj Electricals Ltd., Orient Electric Limited, V-Guard Industries Ltd., Metro Ortem Ltd., Vishva Electrotech Limited, Khaitan Electricals Ltd., Surya Roshni Limited, and others are among the major players in the Indian electric fan market.

1.2 Table- & Wall-Mounted Fans



A table- or wall-mounted fan is one of the most common electrical appliances used in houses, offices, and shops in India. It helps in air circulation and to cool down body temperature. Table- & wall-mounted fans comprise a rotating arrangement of blades or vanes, directly driven by an electric motor, and intended for use with a free inlet and outlet.

It may be a table fan or a bracket-mounted fan for wall or ceiling mounting.

According to consumer behavior research, before purchasing a fan, consumers prioritize three key elements: (i) air delivery (cubic meters per minute or cubic feet per minute); (ii) sweep area (mm); (iii) power consumption (watt). Many of the manufacturers in both the organized and unorganized sectors meet the performance requirements of the Indian Standard, IS 555:1979 while some don't. The table & wall-mounted fan models available in India are classified based on their sweep size (Table 1).

Table 1 : Performance Range of Table- & Wall-mounted Fans

S. No	Sweep Size (mm)
1	200
2	250
3	300
4	400

1.3 Major Components of a Table- & Wall-Mounted Fan

The primary electrical components of table- and wall-mounted fans are a single-phase induction motor and a capacitor that is used for giving the starting torque to the motor. This allows the fan to start and run. The other mechanical and electronic components include fan blades, bottom bulk, front grill, rear grill, cross leg bar, and motor housing. Table 2 summarizes the major table- and wall-mounted fan components and their functions.

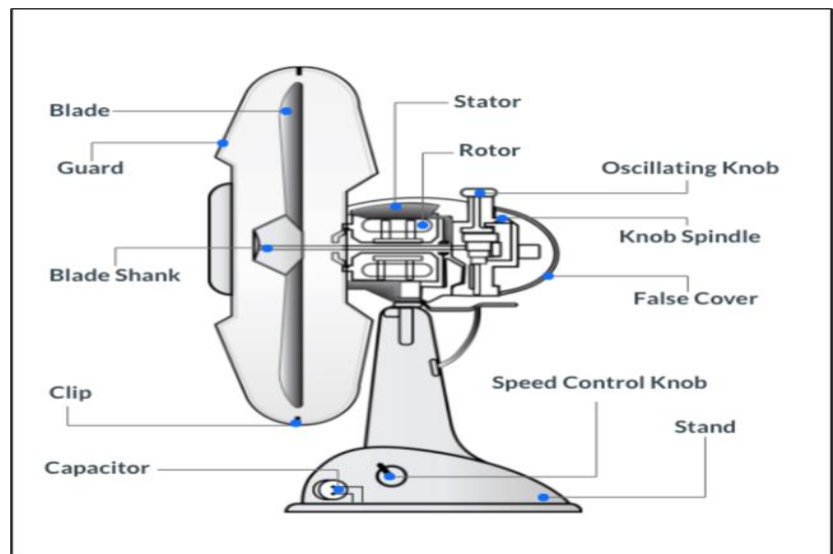


Figure 3: Major Components of Table- & Wall Mounted Fan

Table 2 : Major Components of table & Wall Mounted Fan

Major Components
Motor: it is the heart of the fan as it converts electrical energy into mechanical output energy
Blades: these are connected to the motor and spin, creating airflow
Hub/motor housing: houses the motor which connects a fan blade with the motor
Guard: for protection against personal injury
Mounting/Base: attaching the fan system (motor and blades) & other components to its bottom
Oscillating mechanism: allows the fan to be employed either in stationary or oscillating mode
Supply cord: connects to electric power supply

Comprehensive Market Assessment

2. Comprehensive Market Assessment

A comprehensive market assessment study was conducted through questionnaires, consultation with fan manufacturers' association, interviews of relevant stakeholders, and secondary research.

2.1 Table- & Wall-Mounted Fans Market in India

Information was gathered for this assessment through questionnaires, consultation with the fan manufacturers association, i.e., the Indian Fan Manufacturers Association (IFMA), interviews with fan manufacturers, and market surveys. Through secondary research, production scenario in India, import and export scenario, and a list of significant manufacturers with the commercial products they manufacture, was gathered. Manufacturing of table- & wall-mounted fans has been increased steadily between FY 2018-19 to FY 2019-20. In FY 2020-21 there is a decline due to COVID-19 pandemic. (Figure 5⁴). Figure 4⁵ shows the share of manufacturing of table fans and wall-mounted fans separately from FY 2018-19 to FY 2020-20.

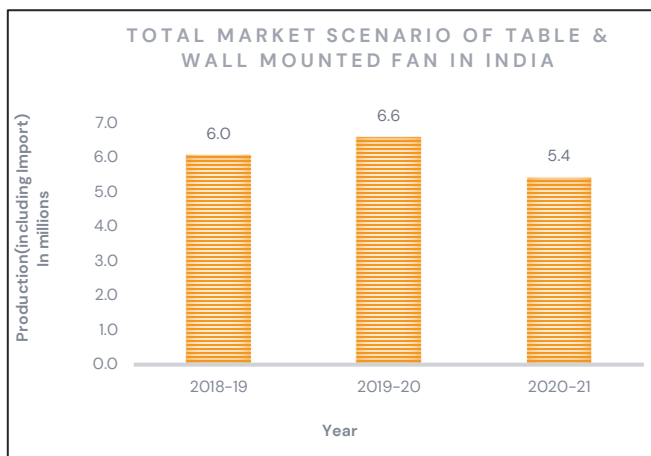


Figure 5: Table- & Wall-Mounted Fan Manufacturing in India of IFMA Members

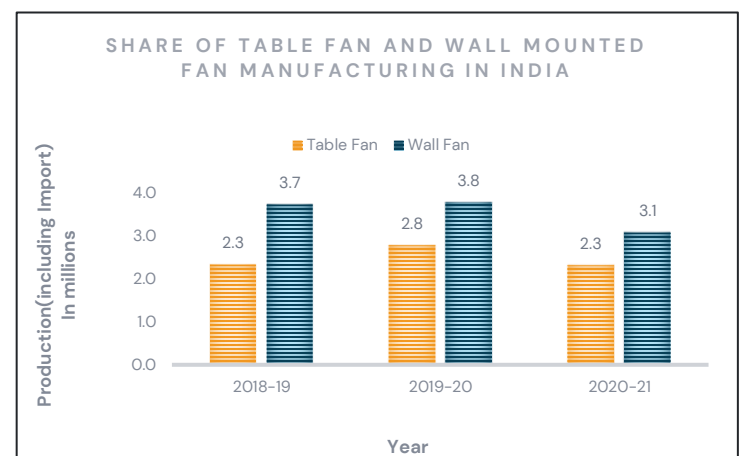


Figure 4 : Table Fan and Wall Fan Manufacturing in India of IFMA Members

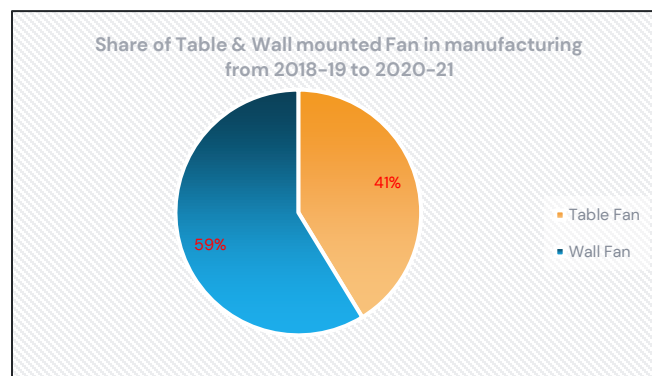


Figure 6: Share of Table- & Wall Fan in Manufacturing from 2018-19 to 2020-21

⁴ As per Indian Fan Manufacturers Association (IFMA)

⁵ As per Indian Fan Manufacturers Association (IFMA)

2.2 Scenario of Domestic Production vs Import in India

Based on primary research, it can be seen that import has a significant proportion in the table- & wall mounted fan market. The reasons for high import numbers based on primary research reveals the following:

- High domestic cost for raw materials such as iron, steel, and other metals.
- High domestic cost of fuels.
- Chinese manufactured fans are 15%-20% cheaper than domestically manufactured fans.

The scenario of domestic manufacturing (including import) and exclusively import only for years 2018-19 to 2020-21 is represented in Figure 7. The share of import in total domestic manufacturing is represented in Table 3⁶.

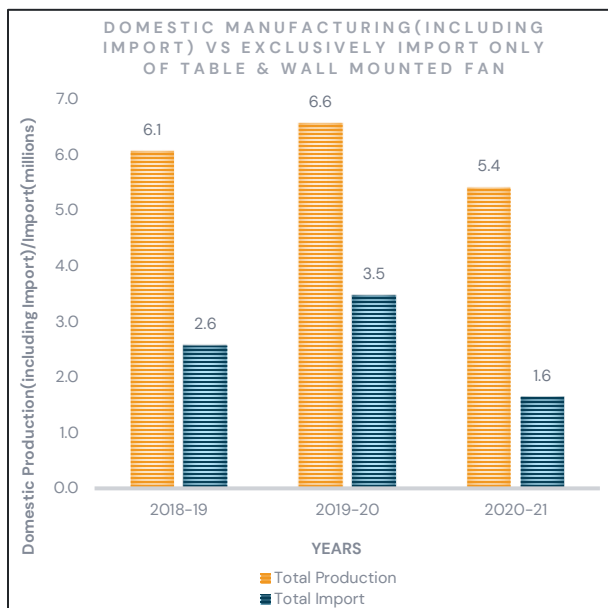


FIGURE 7 : Domestic manufacturing (including import) vs exclusively import

Year	Share of Import in %
2018-19	42%
2019-20	53%
2020-21	29%

TABLE 3 : Share of Import in Domestic Manufacturing of Table Fan & Wall Mounted Fan

⁶ The reduction in import could be attributed to two factors: (i) Production Linked Incentive (PLI) scheme which aims to give companies incentives on incremental sales from products manufactured in domestic units. This scheme invites foreign companies to set up units in India. However, it also aims to encourage local companies to set up or expand existing manufacturing units and also to generate more employment, while cutting down the country's reliance on imports. (ii) Consumer behavior: The behavior of the Indian consumer has been changing and is more focused towards products manufactured in India.

2.3 Import Vs Export Scenario

Based on the market research, import and export data was collected from the Ministry of Commerce for the last 10 years.

- Import for table- & wall-mounted fans has been steadily declining at a CAGR of 10%.
- Export for table- & wall-mounted fans has been increasing steadily at a CAGR of 5%.
- The annual export & import numbers from FY 2012-13 to FY 2021-22 are represented in Figure 8.

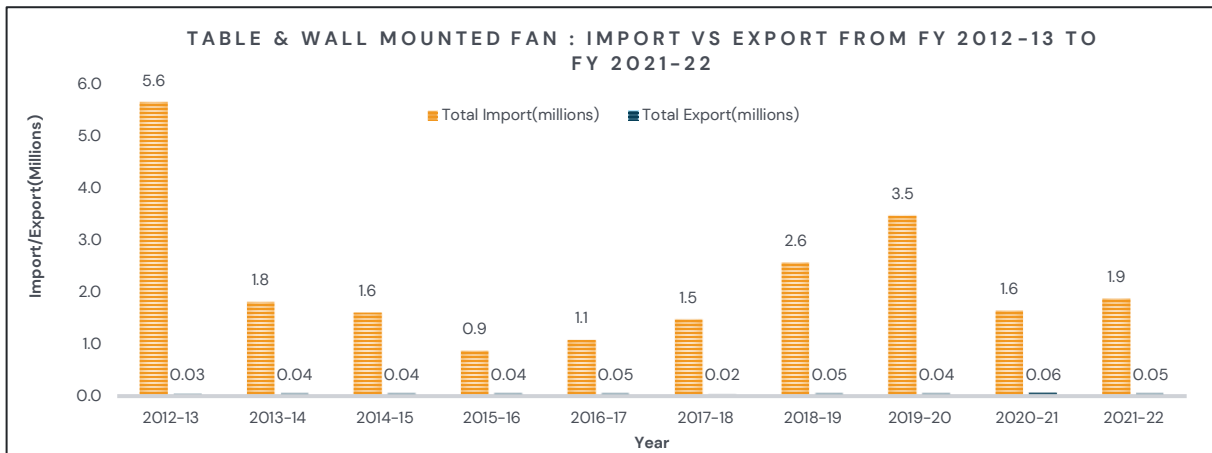


Figure 8 : Import vs Export from FY 2012-13 to FY 2021-22 of table & wall-mounted fan

Analysis shows that over 65 manufacturers with more than 1,000 table- and wall-mounted fan variants of varying sweep sizes are present in the Indian market. (Figure 9⁷).

- Fan models are categorized based on the sweep size. 400 mm sweep size fans make up the product category with the highest market demand/manufacturing/offering (81%), followed by 300 mm (9%), 200 mm (8 %) & 250 mm (2 %).
- The share of brands/organized manufacturers is estimated to be ~80% based on market assessment.

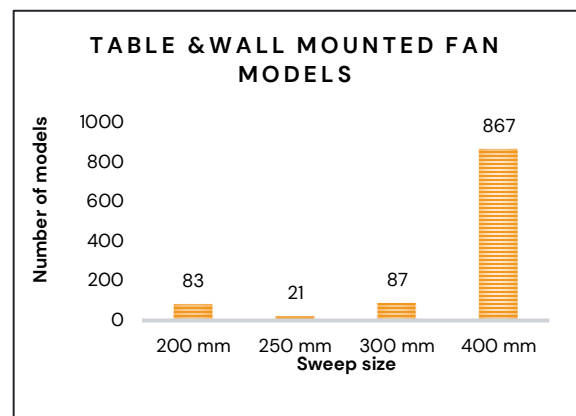


FIGURE 9 : NUMBER OF MODELS BASED ON SWEEP SIZE

⁷ As per findings from market study (consultations, questionnaire-based survey & secondary research)

Review of Performance Standards and Available Test Facilities in India

3. Review of Performance Standards

This chapter reviews and compares the performance test standards for table- & wall-mounted fans. Table 4 below provides the relevant Indian standard.

TABLE 4 : RELEVANT INDIAN STANDARDS FOR TABLE-& WALL-MOUNTED FAN

Standard	Published Year	Title
IS 555	1979	Electric Table Type Fans Regulators

3.1 Assessment of Performance Standards

The table below provides an assessment of the standards of table- and wall-mounted fans i.e., IS 555.

TABLE 5 : RELEVANT INDIAN STANDARDS FOR TABLE & WALL MOUNTED FANS

Parameter	IS 555
Scope	AC capacitor type and non-capacitor type ac table type fans, including the associated speed regulators.
Definition	A propeller-blade fan having two or more blades, directly driven by an electric motor, and intended for use with a free inlet and outlet. It may be a table fan or a bracket-mounted fan for wall or ceiling mounting.
Test Type	<p>a. Type Tests:</p> <ol style="list-style-type: none"> 1. Air delivery 2. Temperature-rise 3. Leakage current 4. High voltage 5. Insulation resistance 6. Starting 7. Fan speed and input 8. Earthing connection 9. Protection against electric shock 10. Moisture resistance 11. Mechanical endurance test (for regulator only) 12. Cord grip 13. Oscillating mechanism (under consideration) 14. Creepage distances and clearances <p>b. Acceptance Tests</p> <ol style="list-style-type: none"> 1. Starting 2. Fan speed and input

	<ol style="list-style-type: none"> 3. Earthing connection 4. Leakage current 5. High voltage <p>c. Routine Tests:</p> <ol style="list-style-type: none"> 1. Flash test 2. Insulation resistance 3. A simple running test
Service Value	The air delivery in cubic meters per minute (m ³ /min) divided by electrical power input to the fan in watts at the rated voltage and frequency specified for the test. In the event of the fan comprising an oscillating mechanism, the electrical input in watts is measured with the fan under normal full speed conditions, that is with an oscillating mechanism in action, whereas the air delivery is determined with the oscillating mechanism out of action

3.2 Comparison of Test Standards

This is a comparison between test standards followed in other countries for table- & wall-mounted fans. Table 6 below provides a comparison of different test standards for table- & wall-mounted fans. Most of the standards adopted by various countries are in-line with the IEC standard.

TABLE 6 : COMPARISON OF TEST STANDARDS ADOPTED BY DIFFERENT COUNTRIES

	India	IEC	Indonesia	Malaysia	China	Vietnam	South Korea
Test Standard	IS 555: 1979	IEC 60879: 2019	SNI IEC 60879:2013	MS 2574:2014 MS 1220:2010	GB/T 13380-2018 GB 12021.9-2008	TCVN 7827: 2007	KS C 9301
Scope	Table Fan, Bracket mounted for wall, Bracket mounted for ceiling	Ceiling fan, table fan, pedestal fan	Desk fan, floor fan, wall fan, ceiling fan, combo fans	Moving louver fan, Ceiling fan, Pedestal fan, Table fan, Wall fan	Ceiling fan, table fan, pedestal fan	Ceiling fan, table fan, pedestal fan	Household electric fan, desktop, or stand
Test parameters	Air delivery Fan speed Power factor & power input	Air flow performance Fan speed Power factor & power input	Air flow performance Fan speed Power factor & power input	Air delivery Input power & power factor Noise RPM	Air flow performance Fan speed Power factor & power input	Air flow performance Fan speed Power factor & power input	Air flow performance Fan speed Power factor & power input

	India	IEC	Indonesia	Malaysia	China	Vietnam	South Korea
Test conditions	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature is not mentioned	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature 20 °C	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature 20 °C	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature 20 °C	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature 20 °C	Chamber for testing total air delivery Measured at rated power & max speed Ambient temperature not specified	Ambient temperature 25 °C

3.3 Comparison of Test Standard Requirements between IS Standard and International Standard (IEC)

Below table gives a comparison between IS & IEC Standard for table- & wall-mounted fans.

TABLE 7 : COMPARISON OF TEST STANDARD REQUIREMENTS BETWEEN IS & IEC

	IS 555	IEC 60879
Test Voltage	<ul style="list-style-type: none"> When a rated voltage is indicated on the nameplate, the test shall be conducted at the rated voltage. If the fan is specified for two or more distinct rated voltages with three or more supply terminals, the tests shall be carried out at all voltages. When a voltage range is indicated on the name-plate-Highest and lowest values of range 	<ul style="list-style-type: none"> Tests shall be conducted at the rated voltage Unless otherwise specified, tests are carried out at a specific test voltage within a voltage range (for example 100 V to 240 V) or at the rated voltage or rated voltages (for example 120 V or 120 V and 240 V).
Running-in of the fan	<ul style="list-style-type: none"> It is essential that it should have been 'run-in' for at least one hour at the highest voltage of the rated voltage range. The measurements shall be carried out with the fan running at full speed at the test voltage with the guard in position 	<ul style="list-style-type: none"> Prior to starting the tests on a new fan, it shall run at its maximum airflow setting with unrestricted air flow and with the oscillating mechanisms, if any, in operation for at least 1 hour to ensure adequate running-in.
Fan power input	<ul style="list-style-type: none"> Power input of the fan operating at its maximum flow rate, measured with the oscillation mechanism, if any, turned off 	<ul style="list-style-type: none"> Power input of the fan operating at its maximum flow rate, measured with the oscillation mechanism and the moving louvre, if any, turned off
Maximum fan flow rate	<ul style="list-style-type: none"> Air flow rate of the comfort fan at its maximum setting [m3/min], measured at the fan outlet with the oscillating mechanism if any, turned off 	<ul style="list-style-type: none"> Air flow rate of the comfort fan at its maximum setting [m3/min], measured at the fan outlet with the oscillating mechanism if any, turned off

Dimension of Chamber	<ul style="list-style-type: none"> Length: 4.50 m, width: 4.50 m, height: 3 m 	<ul style="list-style-type: none"> Length: 4.50 m, width: 4.50 m, height: 3 m
Height of fan	<ul style="list-style-type: none"> The fan shall be mounted with the blade center 1.20 m from the floor and with the front of the blades at least 1.20 m from the back wall and at least 1.80 m from the side walls. 	<ul style="list-style-type: none"> The fan shall be mounted with the blade center 1.20 m from the floor and with the front of the blades at least 1.20 m from the back wall and at least 1.80 m from the side walls and the wall in front.
Air movement	<ul style="list-style-type: none"> Low velocity rotating vane anemometer having an internal diameter of 70 mm, suitable for the range of velocity to be measured. Rotating vane anemometers having a diameter of up to 100 mm may also be used alternatively. 	<ul style="list-style-type: none"> Air movement shall be measured by means of a rotating vane anemometer having an internal diameter not exceeding 100 mm suitable for the range of velocities to be measured
Air velocity	<ul style="list-style-type: none"> Readings shall be commenced at a point 20 mm from the axis of the fan blades and shall progress along the horizontal line in each direction, by increments of 40 mm width. Readings shall be continued in each direction until the true air velocity falls below 24 m per minute. Each reading consists of the time taken by an air movement of 200 mm measured by the anemometer. When such air movement takes more than two minutes, the reading will then consist of time taken by the movement of some convenient and readable quantity of air requiring approximately two minutes to move 200mm. In no case should the duration of the reading be less than one minute. 	<ul style="list-style-type: none"> Air velocity readings shall be commenced at a point 20 mm from the axis of the fan blades and shall progress along the horizontal line in each direction, by increments of 40 mm wide. Readings shall be continued in each direction until the true air velocity falls below 24 m/min. Each reading shall consist of the time taken by an air movement of 300 mm measured by the anemometer. When such air movement takes more than 2 min, the reading will then consist of the time taken by a movement of some convenient and readable quantity of air requiring approximately 2 min to move 300 mm. In no case should the duration of the reading be less than 1 min.

Test methodology in IS 555 and IEC 60879 are aligned except for air delivery, where the time taken for air movement of 200 mm is taken against 300 mm specified in IEC 60879.

3.4 Performance Requirement as per India Standard

The specification of minimum air delivery, minimum service value, and maximum input for electric table- & wall mounted type fans as per IS 555-1979 are given in Table 8.

TABLE 8 : SPECIFICATION FOR ELECTRIC TABLE- & WALL-MOUNTED TYPE FANS IN IS 555-1979

FAN SIZE (mm)	TYPE	Minimum AIR DELIVERY (m ³ /min.)	Minimum SERVICE VALUE (m ³ /min./W)	Maximum INPUT (W)
200	Capacitor AC	14	0.50	28
250	Capacitor AC	20	0.65	31
300	Capacitor AC	30	0.75	40
400	Capacitor AC	65	1.08	61

3.5 Testing facilities in India

There are about eight NABL accredited third-party laboratories for table- & wall-mounted fans which are used for performance testing and quality checks requested by the user.

The tables below show a list of labs with accreditation status of their testing laboratory for table- and wall-mounted fans in India.

TABLE 9 : LIST OF TESTING LABORATORIES FOR TABLE & WALL MOUNTED FANS IN INDIA

S.No.	Name of Laboratory	Accreditation	Location
1.	Akshat Test Lab & Calibration Services	NABL	Ghaziabad, Uttar Pradesh
2.	Classic Testing & Research Centre	NABL	Noida, Uttar Pradesh
3.	URS Products and Testing Pvt. Ltd.	NABL	Noida, Uttar Pradesh
4.	Delhi Test House	NABL	Sonipat Kundli Haryana
5.	Emtac Laboratories Private Limited	NABL	Keesara Hyderabad, Telangana
6.	Poweronic Test & Research Centre	NABL	Greater Noida, Uttar Pradesh
7.	Spectro Analytical Labs Private Limited	NABL	Greater Noida, Uttar Pradesh
8.	Central Power Research Institute	NABL	Bangalore, Karnataka

Comparison of International Labelling Programs for Table- and Wall-mounted Fan

4. Comparison of International Labeling Programs for Table- & Wall Mounted Fans

This section gives an overview of international labeling programs for table- & wall-mounted fans, highlighting the scope, energy efficiency parameters, whether the program is voluntary or mandatory, endorsement, MEPS or comparative labels, and other relevant information.

This would help to develop the Star Labeling program for table- & wall-mounted fans in accordance with best practices across the globe.

4.1 Thailand

The Energy Labeling Scheme in Thailand, also known as Label No. 5, was introduced in 1993 through the state-owned utility – Electricity Generating Authority of Thailand (EGAT). This scheme was part of a larger demand-side management project that started in 1991 and was in line with policies established by the Ministry of Energy including the Energy Conservation Promotion Act (1992). It was entered into force in 2001.

Scope

This labeling program covers tabletop, floor standing, wall-mounted, orbit fan, and ventilation-type electric fans. Ceiling fan is not included in the scope.

Energy Efficiency Level

The energy efficiency levels – which are the same as service values – are given below.

TABLE 10 : Energy efficiency level

Type	Propeller size (inch)	Min. Ventilation rate (m ³ /min)	No. 5	No. 5 (1 star)	No. 5 (2 star)	No. 5 (3 star)
Table-top, floor-standing, wall-mounted wind fan	12(300 mm)	30	1.10 - 1.15	1.16-1.21	1.22 -1.27	≥ 1.28
	16(400 mm)	60	1.30 - 1.39	1.40 -1.49	1.50 -1.59	≥ 1.60
	18(450 mm)	75	1.25 - 1.34	1.35 -1.44	1.45 -1.54	≥ 1.55

4.2 Vietnam

The Ministry of Industry and Trade (MOIT), Vietnam, has introduced mandatory MEPS as well as a comparative label for electric fans.

Scope

The scope of the labeling program covers table fans, stand (pedestal) fans, wall fans, and ceiling fans (henceforth referred to as electric fans) for household and similar purposes. It specifies the minimum energy efficiency and energy efficiency classification of electric fans.

Status

The labeling program was made effective from the year 2007. Later, it was revised in 2015 and the limits for energy efficiency were upgraded. The minimum values of energy efficiency of different sizes of fans were also revised.

Minimum Energy Efficiency Requirements

The minimum energy efficiency for all electric fans under the scope shall be in accordance with Table 11.

TABLE 11 : Minimum energy efficiency for electric fan

Nominal blade diameter, Mm	Minimum energy efficiency m ³ /min/W
D < 230	0.54
230 ≤ D < 250	0.64
250 ≤ D < 300	0.74
300 ≤ D < 350	0.8
350 ≤ D < 400	0.9
400 ≤ D < 450	1
450 ≤ D < 500	1.1

Energy Efficiency Levels

The energy efficiency class of electric fans is specified in Table 12, where grade 5 has the highest efficiency and grade 1 has the lowest efficiency. Energy Efficiency Index (R) is the ratio of Measured Energy efficiency (Service value) to Minimum Energy efficiency (Service value). Energy Efficiency grades have different levels where Grade 1 is the least efficient and Grade 5 the most efficient.

TABLE 12 : Energy Efficiency class of electric fans

Energy Efficiency Grade	Energy Efficiency Index , R
1	1.00 ≤ R < 1.15
2	1.15 ≤ R < 1.30
3	1.30 ≤ R < 1.45
4	1.45 ≤ R < 1.60
5	R ≥ 1.60

4.3 Malaysia

Suruhanjaya Tenaga - ST (Energy Commission), Malaysia, has introduced mandatory MEPS as well as a comparative label for electric fans.

Scope

The scope of the labeling covers the wall, desk, pedestal, and ceiling fans.

Status

The standard that regulates testing and performance of electric fans in Malaysia is MS 1220-2010. The test procedure is very similar to IEC 60879. "Coefficient of Performance (COP)" is used instead of, but is equivalent to, service value.

Minimum Energy Efficiency Requirements

A 2-star rating⁸ is the minimum energy efficiency requirement for electric fans.

Energy Efficiency Level

The energy efficiency class of all electric fans covered under the scope is specified in Table 13, where grade 5 has the highest efficiency and grade 1 has the lowest. Energy efficiency is based on Coefficient of Performance (COP) which is Service value (m³/min/W)

TABLE 13 : Energy Efficiency class of electric fan

Star Rating	Coefficient of Performance (COP) ⁹ m ³ /min/W
1	$0.93 \leq \text{COP} \leq 1.00$
2	$1.01 \leq \text{COP} \leq 1.07$
3	$1.08 \leq \text{COP} \leq 1.11$
4	$1.12 \leq \text{COP} \leq 1.19$
5	$\text{COP} \geq 1.20$

⁸ 1-star rating is freezed (i.e) no model can be registered under 1-star rating.

4.4 China

China has introduced mandatory comparative label for electric fans.

Scope

The labeling program covers electric fans including table fans, rotary fans, wall-mounted fans, pedestal fans, and ceiling fans, with single-phase rated voltage below 250V and other rated voltage below 480V.

Status

The labeling program was made effective from the year 1989 and was first revised in 2008, followed by a second revision in 2021. In the year 2021, China's State Administration for Market Regulation (SAMR) issued a revised version of mandatory national standards (GB standards) called the "Minimum allowable values of energy efficiency and energy efficiency grades for electric fans", which came into effect on November 1, 2022.

Minimum Energy Efficiency Requirements

The energy efficiency level of all electric fans under the scope is divided into 3 levels, of which level 1 has the highest energy efficiency and 3 has the lowest. The energy efficiency value of each grade of product should not be lower than the provisions mentioned in the table below. The new version of the standards revises the criteria for energy efficiency grades of fans as shown in the table. The term "energy efficiency grade" is used instead of, but is equivalent to, service value.

TABLE 14 : Energy Efficiency grades of fans

Dimension (mm)	Energy efficiency grade 1	Energy efficiency grade 2	Energy efficiency grade 3
200	≥ 1.00	≥ 0.70	≥ 0.60
200 < X ≤ 230	≥ 1.10	≥ 0.84	≥ 0.70
230 < X ≤ 250	≥ 1.30	≥ 0.95	≥ 0.79
250 < X ≤ 300	≥ 1.50	≥ 1.05	≥ 0.86
300 < X ≤ 350	≥ 1.65	≥ 1.15	≥ 0.98
350 < X ≤ 400	≥ 1.85	≥ 1.35	≥ 1.06
400 < X ≤ 450	≥ 2.15	≥ 1.50	≥ 1.19
450 < X ≤ 500	≥ 2.40	≥ 1.55	≥ 1.25
500 < X ≤ 600	≥ 2.65	≥ 1.70	≥ 1.40

4.5 Republic of Korea

The Republic of Korea has mandatory MEPS and comparative labels for electric fans.

Scope

The scheme covers household electric fans, desktop, or stand (pedestal), which has a blade sweep of 20-41 cm, and the axial single wing run by induction motor to be used in general: table, pedestal, etc. Ceiling fans are not included in the scope.

Status

The labeling program “Energy Efficiency Grade Label for Electric Fan” and “MEPS for Electric Fan” was introduced by Korea Energy Management Corporation (KEMCO) which entered into force in the year 2009.

Minimum Energy Efficiency Requirements

MEPS of Service value, i.e. P, for electric fans is calculated by the formula given below.

$$P \geq (0.0304A + 0.1518) \times 0.9 \text{ (if diameter(A) is greater than 40 cm)}$$

Where, P = Airflow rate efficiency (m³ /min /W), A = Diameter of blade (cm); multiply the compensation factor of 0.9 if 40cm or more. For MEPS, P is rounded off to two decimals.

The minimum energy efficiency for table and pedestal fans as per the above formula is in Table 15 .

TABLE 15 : Minimum energy efficiency for table and pedestal fans

Diameter of Wing (mm)	Energy Efficiency Ratio (m ³ /min/W)
200	0.76
250	0.91
300	1.06
400	1.25

Energy Efficiency Level

The energy efficiency classes of table and pedestal fans are specified in Table 16, where 5 star rating has the highest efficiency and 1 star rating the lowest. Energy Efficiency Index level (R) is the ratio of Measured Energy efficiency (Service value) to Minimum Energy efficiency (Service value)

TABLE 16 : Minimum energy performance standard for table and standing fan

Level	Energy Efficiency Level Index, R	Standby power (Passive Standby Mode)
1	$R \leq 1.00$	$\leq 1 \text{ W}$
2	$R \leq 1.01$	N/A
3	$1.00 < R \leq 1.40$	N/A
4	$1.40 < R \leq 1.80$	N/A
5	$1.80 < R \leq 2.20$	N/A

Energy Efficiency Metric for Star Labeling of Table- & Wall-Mounted Fans

5. Market Characteristics of Table- & Wall Mounted Fan

Table- & wall-mounted fans are available in different sweep sizes (200 mm, 250 mm, 300 mm & 400 mm) having different power consumption, air delivery, and service values.

The efficiency of a table- & wall-mounted fan is a measure of how efficiently air flow is generated by the fan. It is calculated by determining the fan's service value.

The market assessment report captures the distribution of service value, air delivery and input power of table- and wall-mounted fan models captured in the study. A total of 1058 models were analyzed in this study.

Input Power

The range of the "Input Power" from the models' data analysis for different sweep sizes is provided in Figure 10 and Table 17.

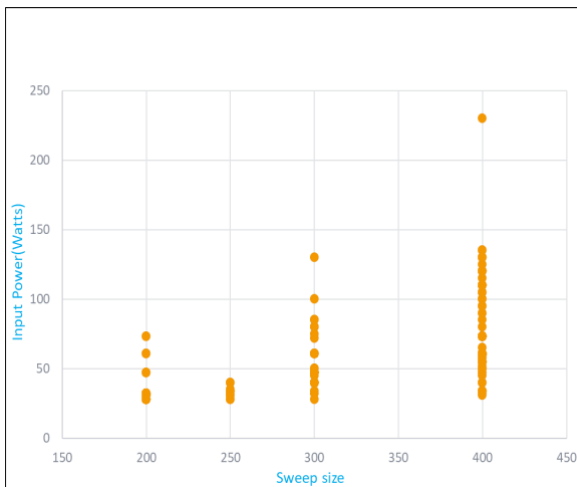


Figure 10 : : Range of Input Power based on sweep size for table & wall mounted fans

S. No	Sweep Size	Input Power		Max Input Power as per IS 555:1979
		Minimum	Maximum	
1	200 mm	28	73	28
2	250 mm	28	40	31
3	300 mm	28	130	40
4	400 mm	31	230	61

Table 17 : Input Power range distribution according to sweep size

Air Delivery

The range of the “Air Delivery” from model data analysis for different sweep sizes is given in Figure 11 and Table 18.



Figure 11: Range of air delivery based on sweep size for table & wall mounted fans

S. No	Sweep Size	Air delivery		Min. Air delivery as per IS 555:1979
		Minimum	Maximum	
1	200 mm	14	52	14
2	250 mm	20	119	20
3	300 mm	14	115	30
4	400 mm	14	230	65

Table 18: Air delivery range distribution according to sweep size

Service value

The service value denotes the efficiency of the fan and is defined as units of power consumed to deliver desired amount of air for human comfort.

Service value is measured as air delivery (m³/min) per Watt i.e., air delivery divided by input power (W) at the voltage and frequency specified for the test.

The range of Service Values from the models’ data analysis for different sweep sizes is provided in figure 10 and table 19.

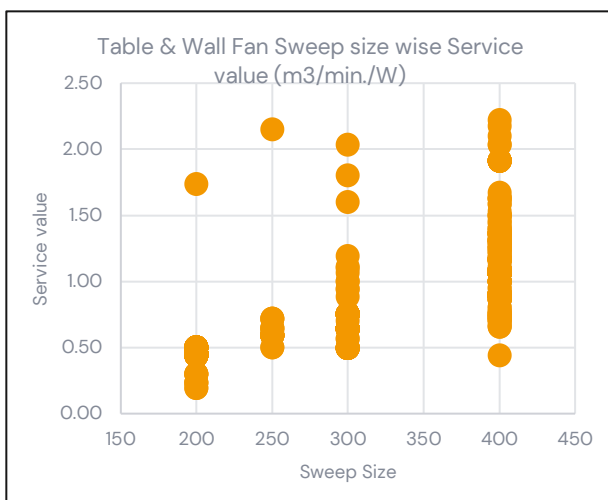


FIGURE 12 : TABLE- & WALL-MOUNTED FAN SWEEP-SIZE WISE SERVICE VALUE (M³/MIN/W)

S. No	Sweep Size	Service value		Min. Service value(IS 555:1979)
		Minimum	Maximum	
1	200 mm	0.19	1.73	0.50
2	250 mm	0.5	2.15	0.65
3	300 mm	0.49	2.03	0.75
4	400 mm	0.44	2.22	

TABLE 19 : TABLE- & WALL-MOUNTED FAN SWEEP SIZE-WISE SERVICE VALUE RANGE

5.1 Energy Efficiency Metric for Star Label of Table- & Wall Mounted Fans

The labeling program for table- and wall-mounted fans in India is based on the minimum and maximum values of service value, power input and air delivery specified in IS 555:1979 with all amendments. Performance data for various parameters were sought from manufacturers through a structured questionnaire and secondary research.

The following testing parameters were requested & collected for table- & wall-mounted fan models:

1. Air Delivery (m³/min)
2. Power Input (Watt)
3. Service value (m³/min/W)

A summary of the performance data analyzed for developing the labeling program is shown below in table 20:

Table 20 : Summary of energy Performance for table & Wall Mounted fan

Type of Fan	No. of models	Service value(m ³ /min/W)		Air Delivery(m ³ /min)		Power Input(W)	
		Min	Max	Min	Max	Min	Max
Table- & Wall Mounted Fan	1,058	0.19	2.22	14	230	28	230

A total of 1,058 data points were collected from the market assessment for the parameters mentioned above. Performance data was analyzed to identify appropriate efficiency parameters for formulation of the labeling program and proposing energy performance metrics.

The energy efficiency of table- and wall-mounted fans is expressed as the Service value. A detailed review of international standards (IEC), national standards (IS) and the global labeling program for table- and wall-mounted fan was performed. Based on the analysis done for 1,058 models, a common Star Rating plan for all sweep sizes, i.e., 200 mm, 250 mm, 300 mm, 400 mm, was proposed.

The scope of the proposed labeling program for table fans will cover the following:

1. Table fan or a bracket-mounted fan for wall or ceiling mounting
2. Capacitor type and non-capacitor type AC and BLDC motor driven fans & AC
3. Sweep sizes of 200 mm, 250 mm, 300 mm and 400 mm
4. Single phase, 50 Hz, AC, rated voltage not exceeding 250 volts suitable for domestic & similar use
5. Test standard IS 555: 1979

Based on the analysis of energy performance data and the minimum service value specified in IS 555, a two star rating plan has been proposed for table- & wall mounted fan for the voluntary labeling program as shown in table 21 and 22. The rating plan specifies the upper and lower thresholds of the service values of each star rating for all sweep sizes. Both options are in line with the performance and service values specified in IS 555:1979 with all amendments.

Table 21 : Proposed star rating table for table- & wall-mounted fan-voluntary phase (option 1)

(Valid from 01 March 2023 to 31 December 2024)	
Star rating band	Service Value (m³/min/W)
1 Star	0.50 ≤ Service Value < 0.70
2 Star	0.70 ≤ Service Value < 0.98
3 Star	0.98 ≤ Service Value < 1.37
4 Star	1.37 ≤ Service Value < 1.92
5 Star	1.92 ≤ Service Value

TABLE 22 : Proposed star rating table for table- and wall-mounted fan-voluntary phase (option 2)

(Valid from 01 March 2023 to 31 December 2024)	
Star rating band	Service Value (m³/min/W)
1 Star	0.50 ≤ Service Value < 0.65
2 Star	0.65 ≤ Service Value < 0.85
3 Star	0.85 ≤ Service Value < 1.10
4 Star	1.10 ≤ Service Value < 1.43
5 Star	1.43 ≤ Service Value

The graphs below (Figures 13 ,14, 15, 16) depict the classification of models into star-rating slabs based on the current market performance level. The number of table- and wall-mounted fan models used in these graphs is 1,058. Models in the non-qualified (NQ) category that do not meet the program's minimum star level i.e., 1 star, are also shown in these figures. These NQ models, however, are permitted to be sold during the voluntary phase of the labeling program and will be disqualified once the program transitions to the mandatory phase.

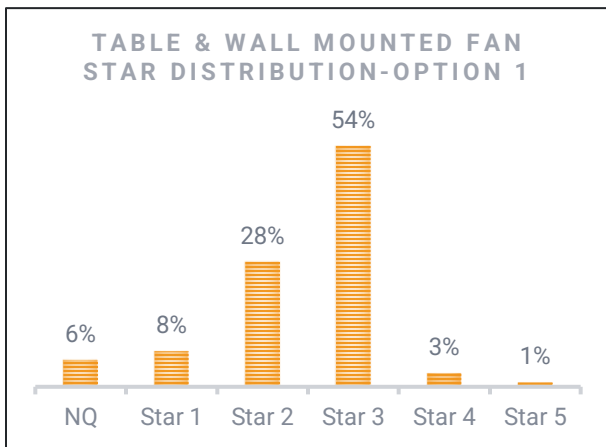


Figure 14: Model wise distribution (%) into star rating-option 1

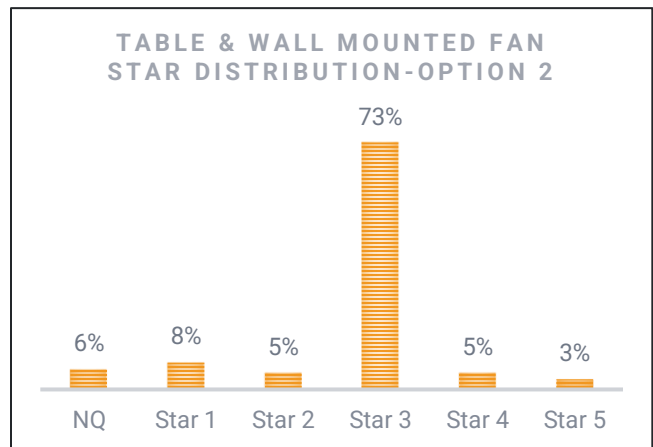


Figure 13: Model wise distribution (%) into star rating-option 2

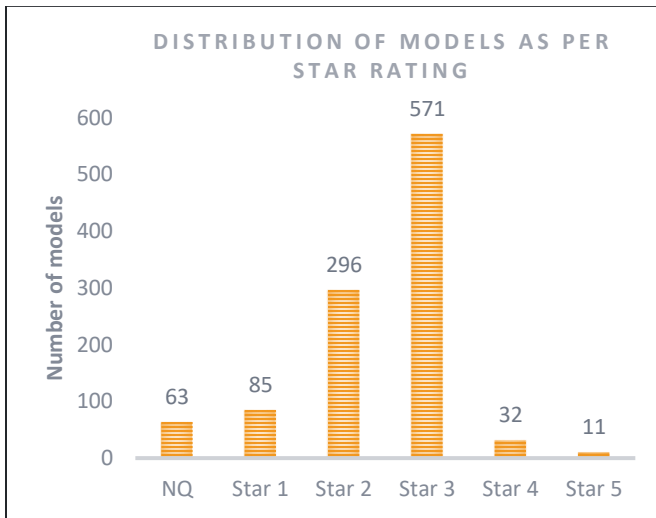


Figure 16 : MODEL WISE DISTRIBUTION INTO STAR RATING-OPTION 1

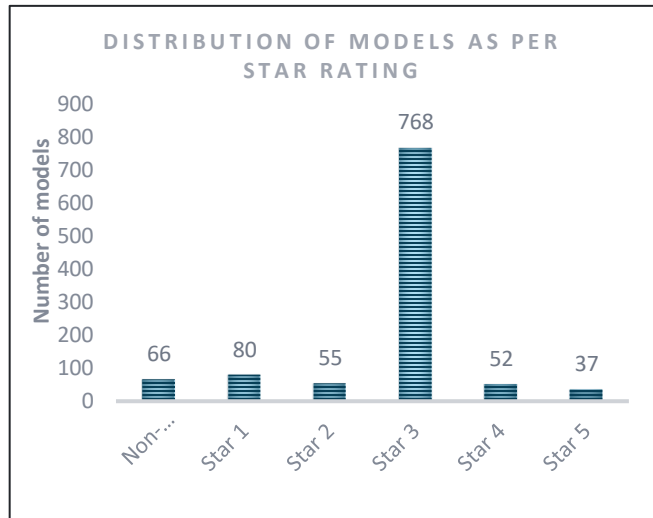


Figure 15: MODEL WISE DISTRIBUTION INTO STAR RATING-OPTION 2

The above star rating plans as shown in Table 22 & 23 were proposed to the BEE's Technical Committee Meeting for Table- & Wall-Mounted fans. Further, the Technical Committee agreed to the Star Rating plan as depicted in Table 23 i.e., Option 2.

**Potential Energy Savings and GHG
Reductions for Table & Wall-Mounted Fans**

6. Potential Energy Saving and GHG reduction

This chapter estimates the energy and Greenhouse Gas (GHG) savings from the labeling program, based on the following assumptions:

- CAGR of 8% assumption is based on production data provided by IFMA.
- It is assumed that voluntary phase of the program is 1 year 9 months after which it would be mandatory, considering the market scenario and penetration level of the fans, hence eliminating the nonqualified (NQ) slab.
- Number of days per year for operation is assumed to be 250 days¹⁰.
- Number of hours per day of operation is 8 hours¹¹.
- Savings calculations are based on average values of performance parameters.

Savings by 2030	Electricity Savings (TWh)	CO2 savings (MT CO2)
Table- & Wall-Mounted Fan	1.8	1.5

Figures 15 and 16 show the GHG and cumulative energy saving potential by 2030 from the table fan labeling program in India.

The cumulative savings as a result of the proposed table- and wall-mounted fan labeling program is estimated to be 1.8 TWh and 1.4 MtCO₂ by 2030.

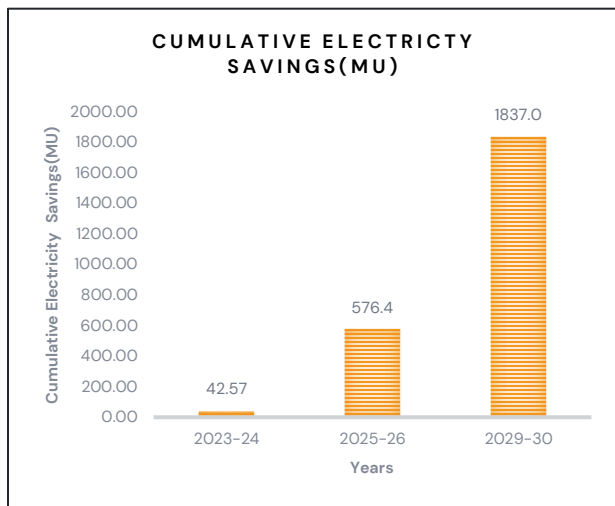


FIGURE 17 : CUMULATIVE ENERGY SAVINGS FOR TABLE & WALL MOUNTED FANS TILL 2030

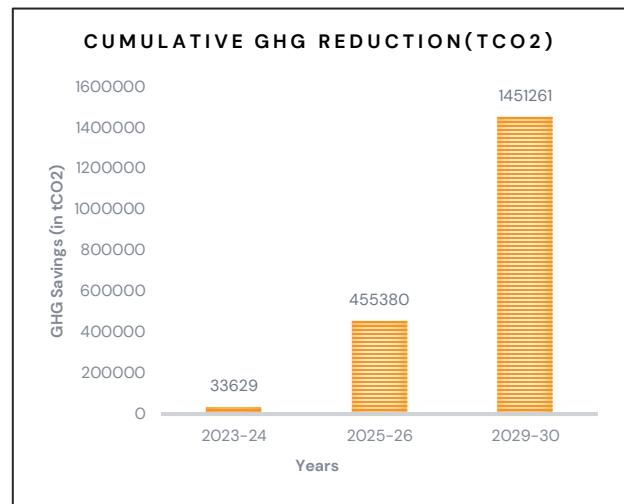


FIGURE 18 : Cumulative GHG reduction for table & Wall mounted fans till 2030

¹⁰ As per BEE's DSM survey, the no.of operating days per year is captured.

¹¹ As per BEE's DSM survey, operating hours per day is captured.

