WORKING PAPER

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Stricter standards for better trade

India's tractor exports and relative emission standards

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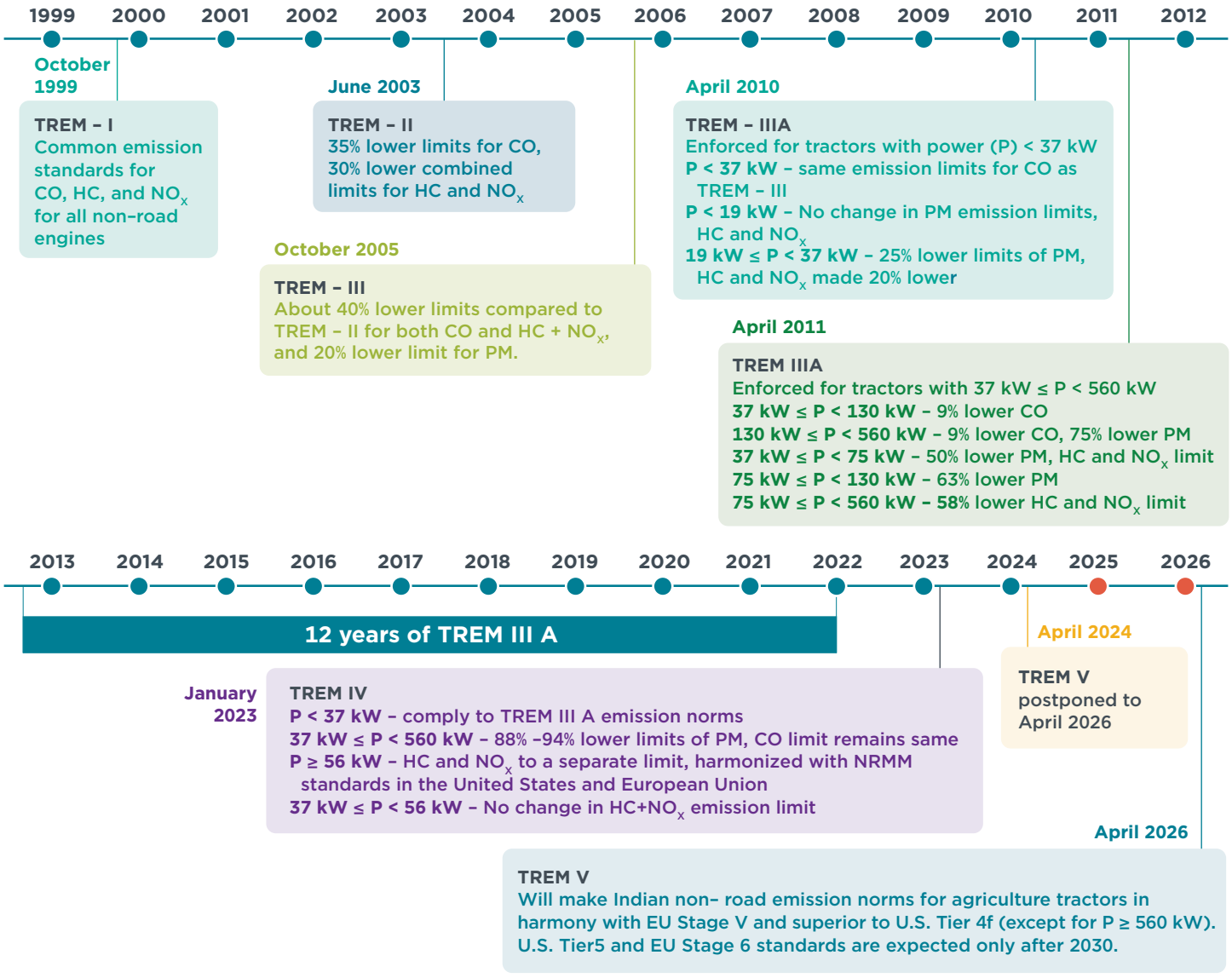
SUMMARY

India manufactures about a million agricultural tractors annually, 15% of which are exported. As tractors mostly operate on diesel and have less stringent emission regulations compared to on-road vehicles, their use has a considerable environmental impact. This study assesses agricultural tractor exports from India from 2008–09 to 2024–25 and compares the emission standards in India with the standards at export destinations.

India's TREM IV emission standards apply to tractors with engine power above 37 kW, while TREM IIIA emission standards (MoRTH, 2020) apply to tractors with engine power of less than 37 kW. The Government of India plans to introduce the next phase of standards, TREM V, by April 2026 (MoRTH 2024). Figure ES1 shows the timeline of TREM emission standards in India. In 2026, India's emissions standards for all tractors with power less than 560 kW will be more stringent than those in the United States and on par with those in the European Union. Current U.S. and EU standards are expected to remain in effect until at least 2030.

Figure ES1

Timeline of TREM emission standards in India



The United States is the largest export market for Indian tractors, accounting for 21% of exports in 2024–25. Indian tractor exports to the United States dropped 40% year-over-year in 2023–24 and another 10% in 2024–25. However, U.S. demand for large Indian tractors (75–130 kW), a segment where Indian and U.S. standards are generally aligned, increased over that period. In the 37–75 kW tractor segment where standards are not aligned, India is losing U.S. market share.

About 16% of Indian tractor exports in 2024–25 were to the EU. Among EU Member States, exports to Belgium increased by almost eightfold after India enforced TREM IV standards in January 2023. Belgian exports increased particularly for 75–130 kW tractors, where Indian emission standards were more aligned with EU standards.

Similarly, Brazilian demand for Indian tractors rose steeply after Brazil enforced MAR-I emission norms in 2017 and 2019. India's tractor exports to Brazil have increased tenfold from 2018–19 and accounted for 8% of the Indian tractor export market in 2024–25.

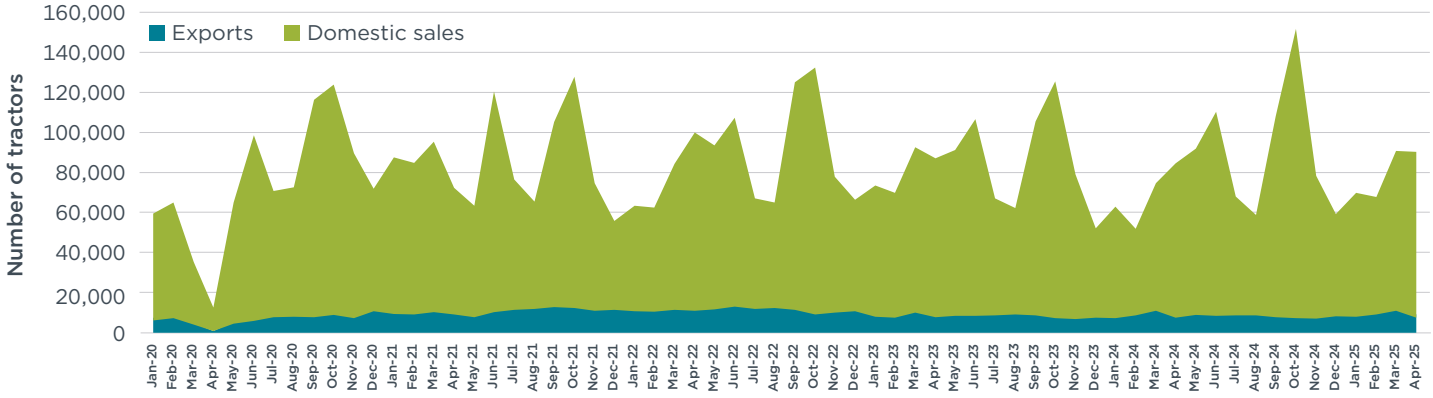
India's exports to countries with no emission standards for tractors (e.g., Bangladesh, Mexico, South Africa, and Thailand) have been consistent or increasing.

By keeping with the current schedule of TREM V enforcement starting in April 2026, Indian emission standards will be in harmony with those in the EU and more stringent than U.S. standards, which could facilitate the continued expansion of Indian exports. As many countries are establishing zero emission regulations, incentivizing domestic manufacturing of e-tractors could further strengthen India's global strategic advantage as a tractor supplier.

BACKGROUND

Previous research by the International Council on Clean Transportation projected that emissions from the non-road vehicle segment in India, which includes agricultural tractors and construction vehicles, will exceed that of on-road vehicles in 2025 for particulate matter ($PM_{2.5}$) and in 2030 for nitrogen oxides (NO_x) (Shao, 2016). About 60% of emissions from the non-road segment are attributable to agriculture tractors. Tractors also consume about 2.9% of India's high-speed diesel (MoPNG, 2023). Apart from being widely used in agriculture, tractors are also crucial for India's economic growth from trade; India produces about a million diesel tractors annually, about 15% of which are exported (Figure 1) (TMA 2025).

Figure 1
India's monthly tractor production, January 2020 to April 2025

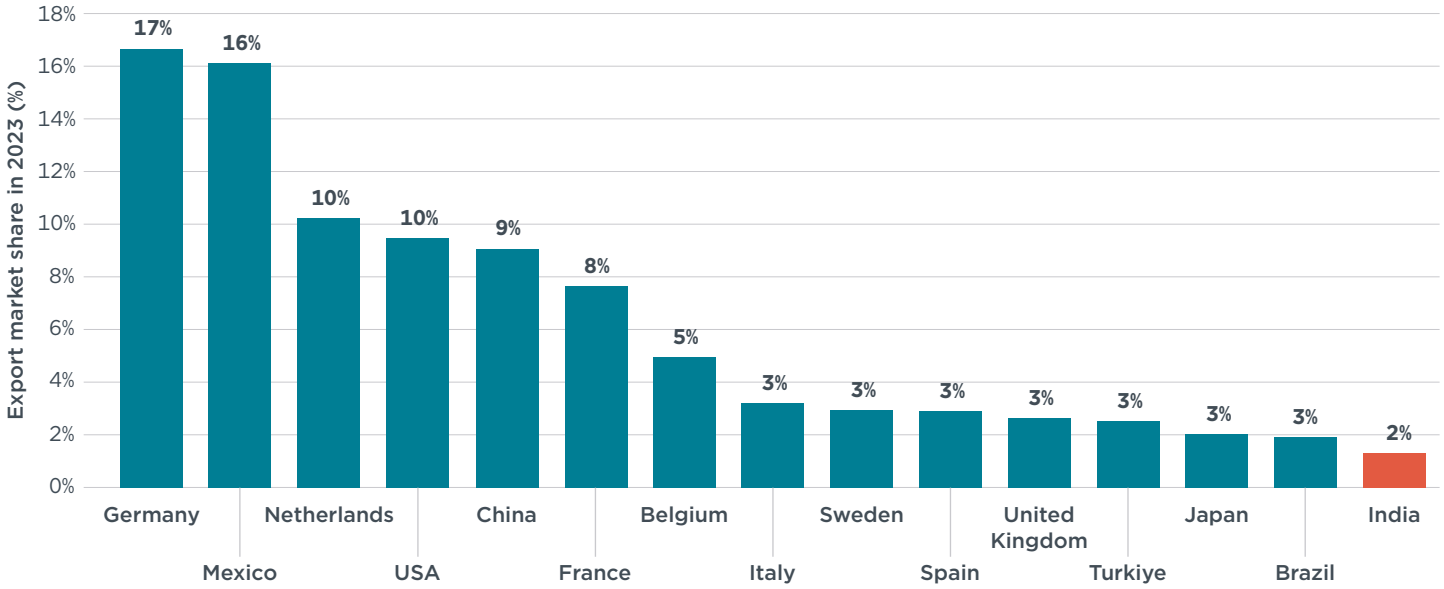


Source: Tractor Manufacturer's Association (2025)

Figure 2 shows the top 15 global exporters of tractors, led by Germany, Mexico, the Netherlands, and the United States. The United States is also the top importer of tractors globally (United Nations Statistics Division, n.d.). India is the 15th largest global exporter of tractors, accounting for 1.3% of exports in 2023 (United Nations Statistics Division, n.d.). India exported tractors to 162 countries in 2024–25 (Figure 3), an increase from 96 countries in 2008–09 (MoCI 2024).

Figure 2

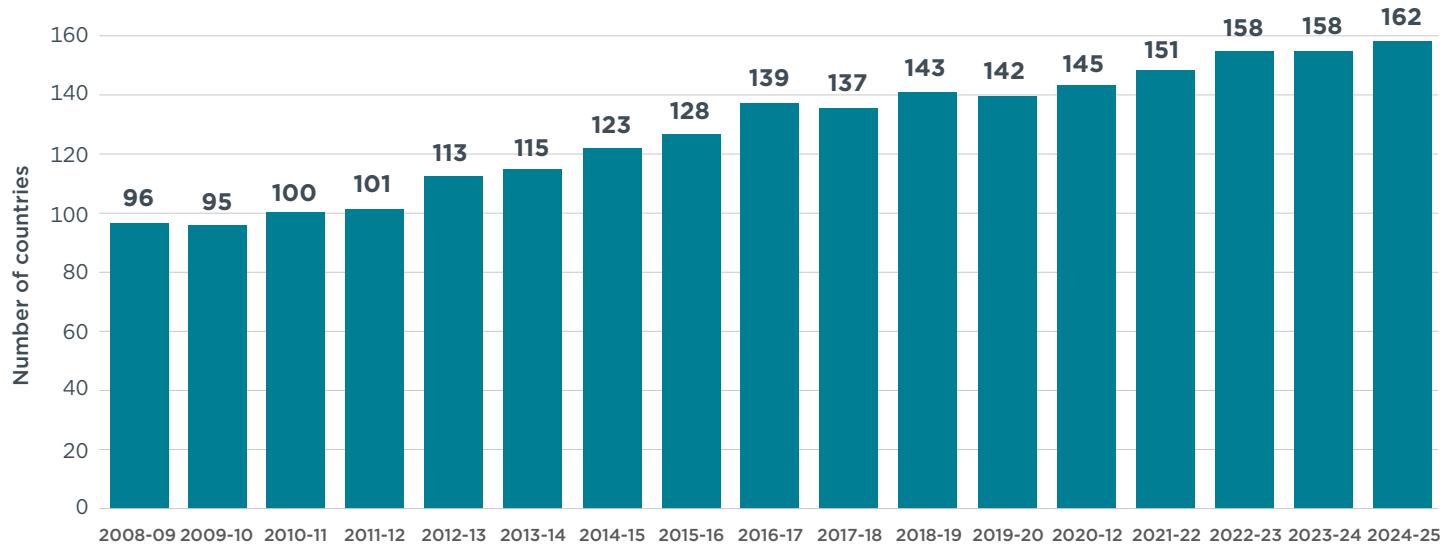
Global market shares of the top 15 exporters of agriculture tractors in 2023



Source: UN Comtrade data (2023)

Figure 3

Number of countries importing Indian tractors, 2008–09 to 2023–24



Source: Ministry of Commerce and Industries (2025)

This study explores export trends for Indian agricultural tractors and compares India's emission standards with the standards of export destinations. Although this study does not infer statistical causality between emission standards and exports, the results of this analysis can inform tractor manufacturers and policymakers about the potential utility of globally harmonized standards.

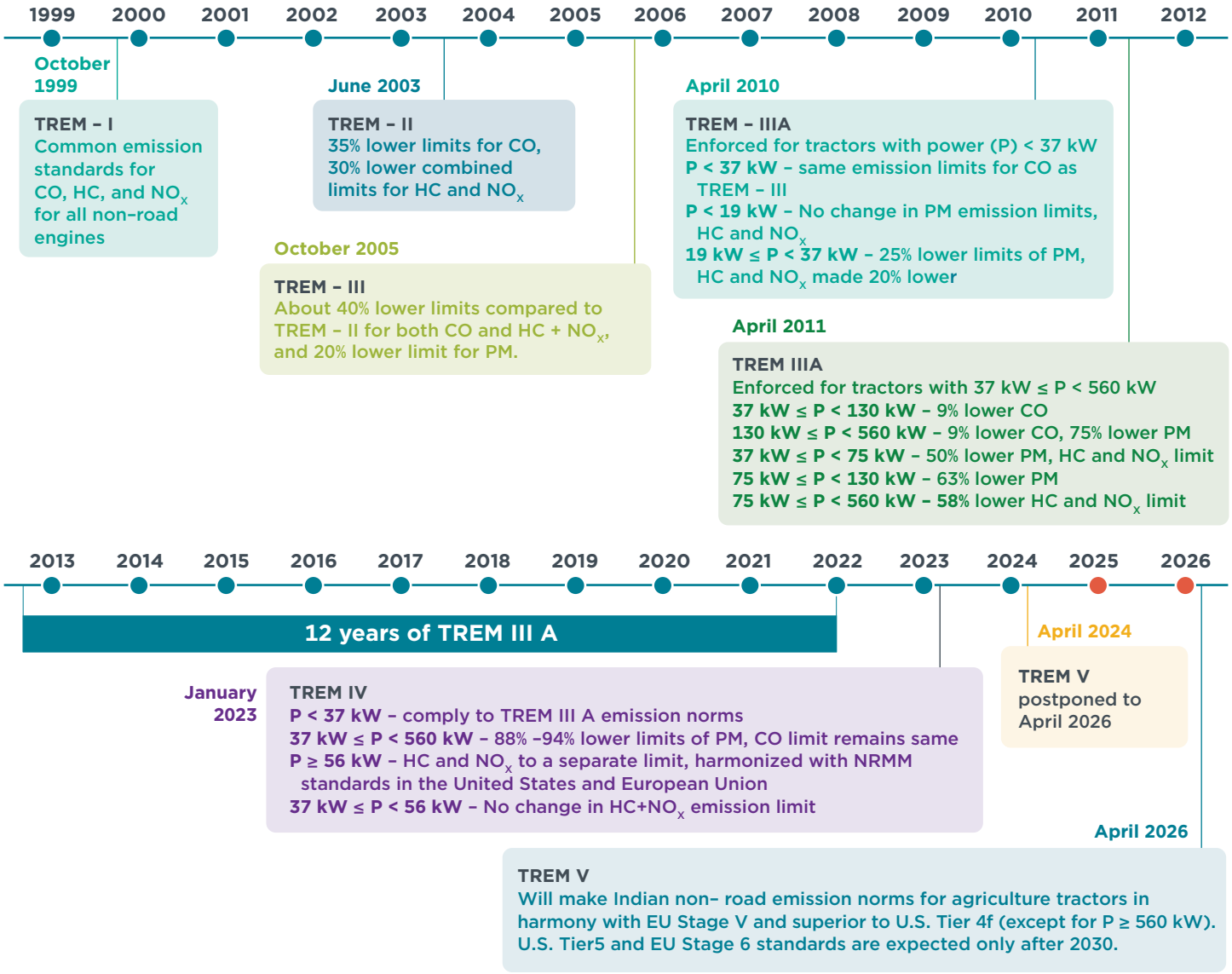
INDIA EMISSION STANDARDS

Within the non-road segment, India has separate emission standards for agricultural tractors. As of April 2025, agricultural machinery in India is generally subject to TREM Stage IV standards, while tractors with power under 37 kW, which make up most tractors in India, must comply with TREM Stage IIIA. TREM Stage V standards are expected to be enforced by April 2026. This section details the past, present, and future emission standards for agricultural tractors in India. Table 1 shows the emission limits values of India's TREM standards; Figure 4 summarizes the policy timeline of the same.

Table 1
India TREM emission standards

Stage	Date	Engine power (kW)	Emission limits (g/k/W)					
			CO	HC	NO_x	HC+NO_x	PM	PN
I	October 1999	All	14	3.5	18	-	-	-
II	June 2003	All	9	-	-	15	1	-
III	October 2005	All	5.5	-	-	9.5	0.8	-
IIIA	April 2010	<8	5.5	-	-	8.5	0.8	-
		8 to <19	5.5	-	-	8.5	0.8	-
		19 to <37	5.5	-	-	7.5	0.6	-
	April 2011	37 to <75	5	-	-	4.7	0.4	-
		75 to <130	5	-	-	4	0.3	-
		130 to <560	3.5	-	-	4	0.2	-
IV	January 2023	<8	5.5	-	-	8.5	0.8	-
		8 to <19	5.5	-	-	8.5	0.8	-
		19 to <37	5.5	-	-	7.5	0.6	-
		37 to <56	5	-	-	4.7	0.025	-
		56 to <130	5	0.19	0.4		0.025	-
		130 to <560	3.5	0.19	0.4		0.025	-
V	April 2026	<8	8	-	-	7.5	0.4	-
		8 to <19	6.6	-	-	7.5	0.4	-
		19 to <37	5	-	-	4.7	0.015	1 x 1012
		37 to <56	5	-	-	4.7	0.015	1 x 1012
		56 to <130	5	0.19	0.4	-	0.015	1 x 1012
		130 to <560	3.5	0.19	0.4	-	0.015	1 x 1012
		>560		0.19	3.5	-	0.045	-

Figure 4
Timeline of TREM emission standards in India



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PAST EMISSION STANDARDS: TREM I THROUGH TREM IIIA

TREM I standards, which set the first emission limits for agricultural tractors, came into force in October 1999. The standards applied the same carbon monoxide (CO), hydrocarbon (HC), and NO_x emission limits for all non-road engines. The next phase of standards, TREM II, came into force in June 2003, again with common emission standards for all weight/engine power categories of non-road engines, but with a 35% lower limit for CO and a 30% lower combined limit for HC and NO_x . Additionally, a limit for PM emissions was introduced. TREM III came into force less than 2 years later, in October 2005, with limits about 40% lower than TREM II for both CO and HC+NO_x emissions, and 20% lower limit for PM.

In April 2010, TREM IIIA was introduced with varied emission standards for agriculture tractors based on engine power. In TREM IIIA, tractors with engine power of less than 37 kW had the same emission limits for CO as TREM III. The standards had no change in PM emission limits for tractors with power less than 19 kW, but 25% lower limits for those

with power of 19–37 kW. The combined limit of HC and NO_x was made 10% lower for tractors with power less than 19 kW and 20% lower for those with power of 19–37 kW.

In April 2011, TREM IIIA came into force for tractors with power of up to 560 kW. It applied 9% lower CO emission limits for those with power of 37–130 kW, and 25% lower limits for those with power of 130–560 kW. TREM IIIA also lowered the combined limit for HC and NO_x by 50% for those with power of 37–75 kW, and 50% for 75–560 kW. Limits for PM emissions were lowered by 50% for 37–75 kW tractors, 63% for 75–130 kW tractors, and 75% for 130–560 kW tractors.

PRESENT EMISSION STANDARDS: TREM IV

In January 2023, TREM IV emission standards were introduced. However, the new standards changed limits only for tractors with engine power of 37–560 kW. Tractors with power under 37 kW must still comply to TREM IIIA standards. In TREM IV, CO emission limits remain the same as TREM IIIA for tractors within this power range, while PM emission limits in TREM IV were lowered by 88%–94% to 0.025 g/kW. Tractors with power of 37–56 kW saw no change in combined HC and NO_x emission limits, while those with power above 56 kW saw a shift from combined limits for HC and NO_x to a separate limit for each pollutant, a change towards harmonizing with standards in the United States and the EU.

FUTURE EMISSION STANDARDS: TREM V

Implementation of TREM V emission standards, originally scheduled for April 2024, has been postponed by the Government of India to April 2026. For tractors with power of 37–560 kW, TREM V standards retain the TREM IV limits for CO, HC, and NO_x . However, the PM limits for these tractors will be lowered by 40% to 0.015 g/kW.

Carbon monoxide emission limits will be loosened in TREM V compared with the previous standard, increasing by 45% for tractors with power under 8 kW and 20% for those with power of 8–19 kW, harmonizing with U.S. and EU standards. Carbon monoxide limits for tractors with power of 19–37 kW will be reduced by 9%, harmonized with EU Stage V standards and more stringent than U.S. Tier 4f standards. Combined limits for HC and NO_x will be lowered by 12% for tractors with power under 19 kW and 37% for those with power of 19–37 kW, harmonizing with EU Stage V and U.S. Tier 4f standards. Limits for PM will be lowered by 50% for tractors with power under 19 kW and by 98% for those with power of 19–37 kW, harmonized with EU Stage V standards and more stringent than U.S. Tier 4f standards.

TREM V will introduce emission limits for tractors with power over 560 kW. These standards are aligned with U.S. Tier 4f (except for PM limits) and EU Stage V (except for NO_x limits).

Overall, TREM V standards harmonize Indian non-road emission standards for tractors with EU Stage V standards and are more stringent than U.S. Tier 4f standards except for tractors with power over 560 kW. U.S. Tier 5 and EU Stage 6 standards are expected only after 2030. Figure 5 compares TREM VI and TREM V standards with U.S. Tier 4f and EU Stage 5 standards.

Figure 5

TREM IV and TREM V emission standards relative to U.S. Tier 4f and EU Stage V standards

		TREM IV (Since January 2023)				TREM V (April 2026 onwards)			
		CO	HC+NO_x	PM		CO	HC+NO_x	PM	
P < 8 kW	US Tier 4f	69%	113%	200%		100%	100%	100%	
	EU Stage V	69%	113%	200%		100%	100%	100%	
8 kW < = P < 19 kW	US Tier 4f	83%	113%	200%		100%	100%	100%	
	EU Stage V	83%	113%	200%		100%	100%	100%	
19 kW< = P < 37 kW	US Tier 4f	100%	160%	2000%		91%	100%	50%	
	EU Stage V	110%	160%	4000%		100%	100%	100%	
37 kW < = P < 56 kW	US Tier 4f	91%	100%	83%		91%	100%	50%	
	EU Stage V	100%	100%	167%		100%	100%	100%	
		CO	HC	NO_x	PM	CO	HC	NO_x	PM
56 kW < = P < 75 kW	US Tier 4f	100%	100%	100%	125%	100%	100%	100%	75%
	EU Stage V	100%	100%	100%	167%	100%	100%	100%	100%
75 kW < = P < 130 kW	US Tier 4f	100%	100%	100%	125%	100%	100%	100%	75%
	EU Stage V	100%	100%	100%	167%	100%	100%	100%	100%
130 kW < = P < 560 kW	US Tier 4f	100%	100%	100%	125%	100%	100%	100%	75%
	EU Stage V	100%	100%	100%	167%	100%	100%	100%	100%
P > =560 kW	US Tier 4f	*NA*				100%	100%	100%	113%
	EU Stage V					100%	100%	875%	100%

EXPORTS AND EMISSION STANDARDS

The United States and EU together account for 37% of India's exports of agricultural tractors. Brazil, Mexico, Bangladesh, Thailand, and South Africa account for another 30%. This section explores tractor segment export trends to these countries and corresponding timelines of their emission standards relative to Indian emission standards. Tractor export data over 16 years (2008–09 to 2024–25) was sourced from the export-import data bank maintained by India's Ministry of Commerce and Industries (MoCI, 2025).

This study uses Harmonized System (HS) codes by the World Customs Organization (WCO) to extract data on exports and imports of tractors (WCO, n.d.). The HS classifications are slightly broader than the classifications used in the emission

standards, limiting nuance in interpretation of standards on certain export trends. Data on tractors with engine power exceeding 130 kW was dropped from this analysis due to their negligible volumes (0.02%) in India's tractor exports. Table 2 shows the classification of tractor exports in the MoCI dataset and the corresponding emission standards classification considered in this study.

Table 2
Tractor classifications by engine power in export data and emission standards

HS Code	Tractor classification in dataset		Corresponding emission standard classification
8701	All non-road tractors	Tractors (other than tractors of heading 8709)	NA
870191	<18 kW	Other tractors, of an engine power not exceeding 18 kw	8 kW
			8–19 kW
870192	18–37 kW	Other tractors, of an engine power exceeding 18 kw but not exceeding 37 kw	19–37 kW
870193	37–75 kW	Other tractors, of an engine power exceeding 37 kw but not exceeding 75 kw	37–56 kW
870194	75–130 kW	Other tractors, of an engine power exceeding 75 kw but not exceeding 130 kw	56–130 kW
No data considered			130–560 kW
			>560 kW

This study analyses export data of tractors classified under HS 8701. The same dataset was used for the export data of tractors classified under HS codes 870191, 870192, 870193, and 870194 over 6 years (2017–18 to 2024–25). This study also uses a UN Comtrade dataset (United Nations Statistics Division, n.d.) for information on the global tractors as well as for data on tractor imports by the United States.

Indian tractor exports have increased with a compound annual growth rate (CAGR) of 7% from 2008–09 to 2024–25 (Figure 6). The classification of exports by segment is available only from 2017–18 onwards. More than half the tractors exported between 2017–18 and 2024–25 are classified as having a power rating of 37–75 kW (Figure 7).

Figure 6
Indian tractor exports, 2008–09 to 2024–25

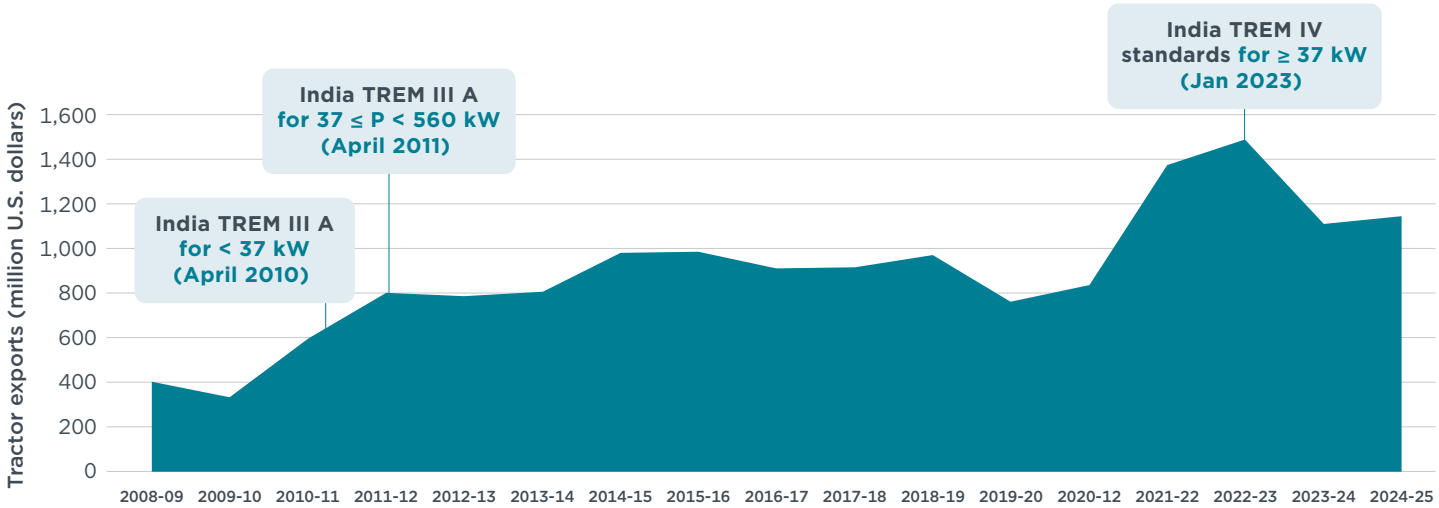
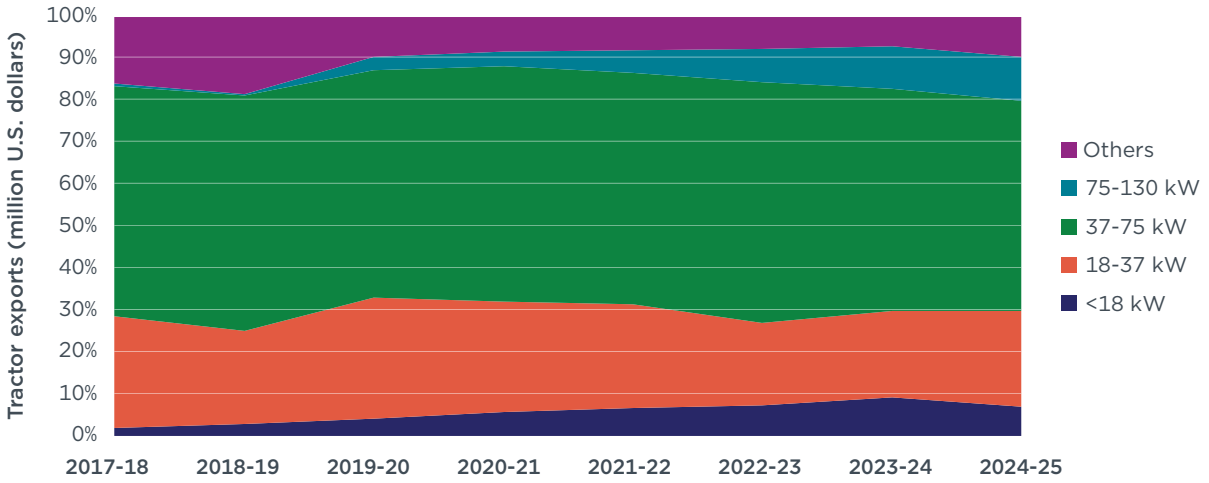


Figure 7

Market share of Indian tractor exports by segment, 2017–18 to 2024–25



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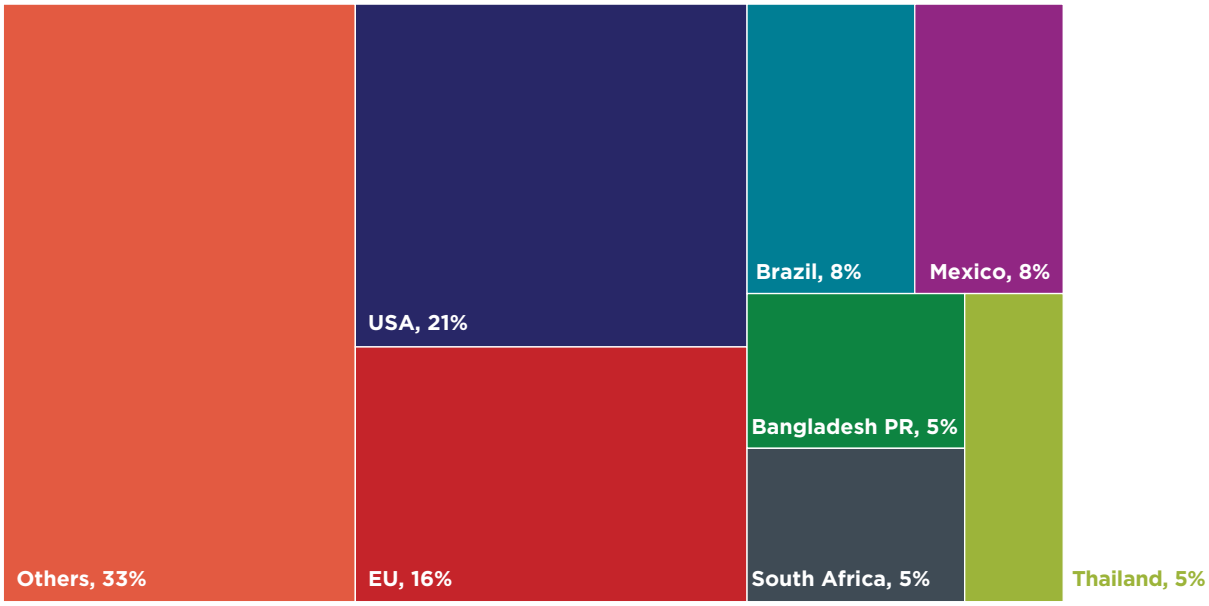
The smallest (<18kW) and largest (75–130 kW) tractors had export shares of 9% and 10%, respectively, in 2023–24, up from a combined share of 3% in 2017–18. In fiscal year 2023, exports of 37–75 kW and 18–37 kW tractors fell by more than 30% and exports of the smallest and largest categories fell by less than 5%. India's tractor exports to the top seven markets, covering 67% of India's export market, are shown in Figure 8.[1]

Figure 8

Distribution of Indian tractor exports in 2024–25 by market



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The U.S. market share of Indian tractor exports decreased from 32% in 2008–09 to 21% in 2024–25, but it continues to be biggest market for exporting Indian tractors (Figure 8). Tractor imports to the United States are steadily increasing, but India, China, and Japan are losing market share to France, Austria, Germany, Mexico, and Brazil. Mexico is the largest tractor supplier to the United States, with 62% market share in 2023.

1 The EU is considered a single market in this analysis since emission standards are common across all the EU Member States.

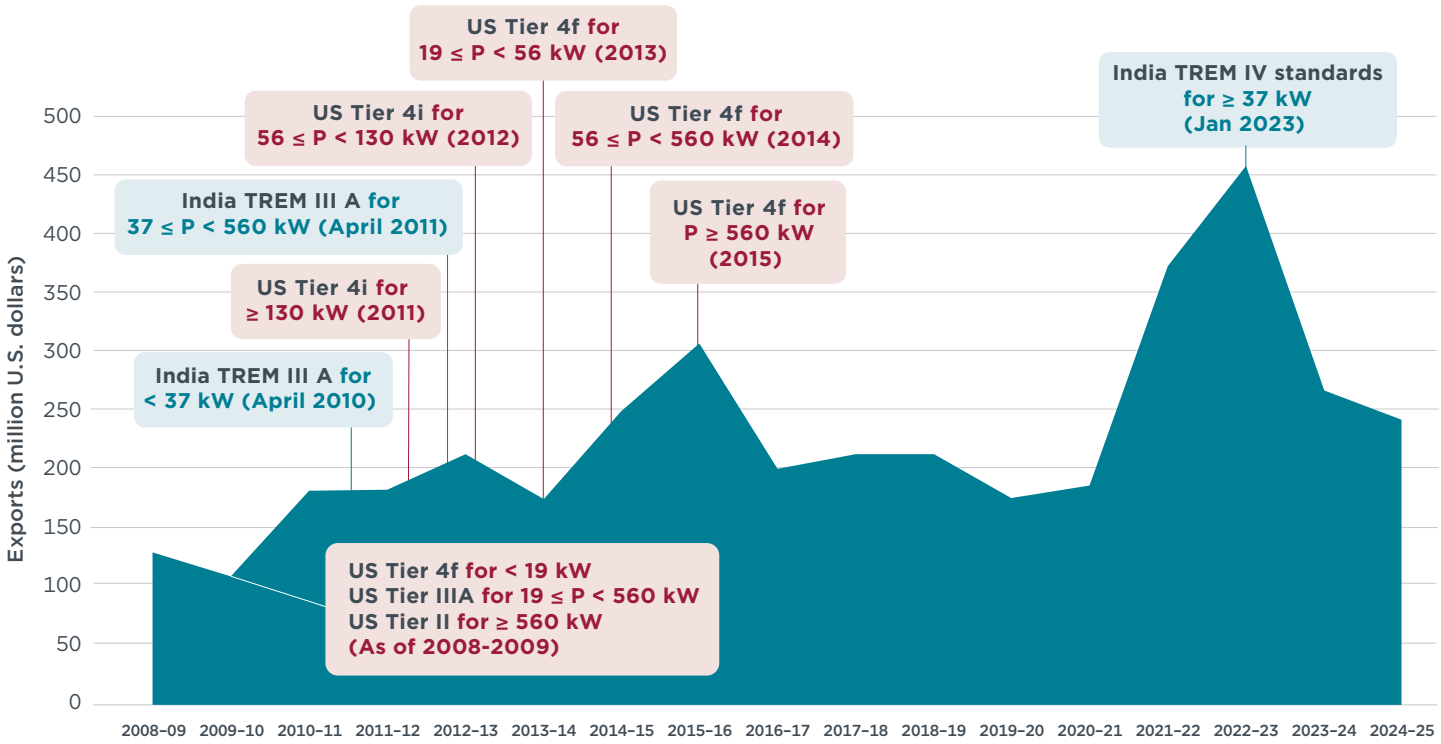
The EU market share of Indian tractor exports increased from 9% to 16% in the same period (2008–09 to 2024–25). Belgium, Italy, Germany, and France account for more than 60% of India's tractor exports to the European Union in 2024–25. Exports to Belgium increased by almost 8 times after India enforced TREM IV standards in January 2023, especially for tractor segments where Indian emission standards are more aligned with EU standards.

Similarly, the demand for Indian tractors increased after Brazil implemented MAR-I emission standards in 2017 and 2019. Indian tractor exports to Brazil have increased tenfold from 2018–19 to account for 8% of the Indian tractor export market in 2024–25. Mexico, Bangladesh, Thailand, and South Africa were responsible for 22% of India's tractor exports in 2024–25 with more than half the demand being for medium sized (37–75 kW) tractors. These four importing countries have no emission regulations for non-road machinery, including tractors, and have continued to increase their demand for Indian tractors with a CAGR of 10%–15% between 2018–19 and 2024–25.

EXPORTS TO THE UNITED STATES

In 2008–09, India's tractor exports had a total value of US$130 million, accounting for 32% of Indian tractor exports under HS classification 8701. Since then, U.S. exports have a CAGR of 5% (a value of US$270 million), accounting for a 21% of tractor exports in 2024–25 (Figure 9).

Figure 9
Indian tractor exports to the United States, 2008–09 to 2024–25



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As of 2008–09, the United States already implemented Tier 4f emission standards for tractors with power under 19 kW, Tier IIIA standards for tractors with power of 19–560 kW, and Tier II for tractors with power over 560 kW (Figure 9). At the same time, India had implemented TREM III standards, with uniform emission limits applicable to all tractor segments. At that point, Indian TREM standards were less stringent than U.S. standards across tractor sub-segments. India's exports to the United States fell by 16% between 2008–09 and 2009–10.

In April 2010, India introduced TREM IIIA standards for tractors with power of under 37 kW, making the limits for 19 kW–37 kW tractors equivalent with U.S. norms for CO and combined HC+NO_x emission limits, but twice the limit for PM emissions in this category. In April 2011, India introduced TREM IIIA standards for 37–560 kW tractors as well. This regulation made Indian emission standards equivalent to U.S. standards for 37–56 kW tractors. In 2011, U.S. Tier 4i emission standards for tractors with power of under 130 kW were introduced. India's exports to the United States increased by 68% in this period (2009–10 to 2011–12).

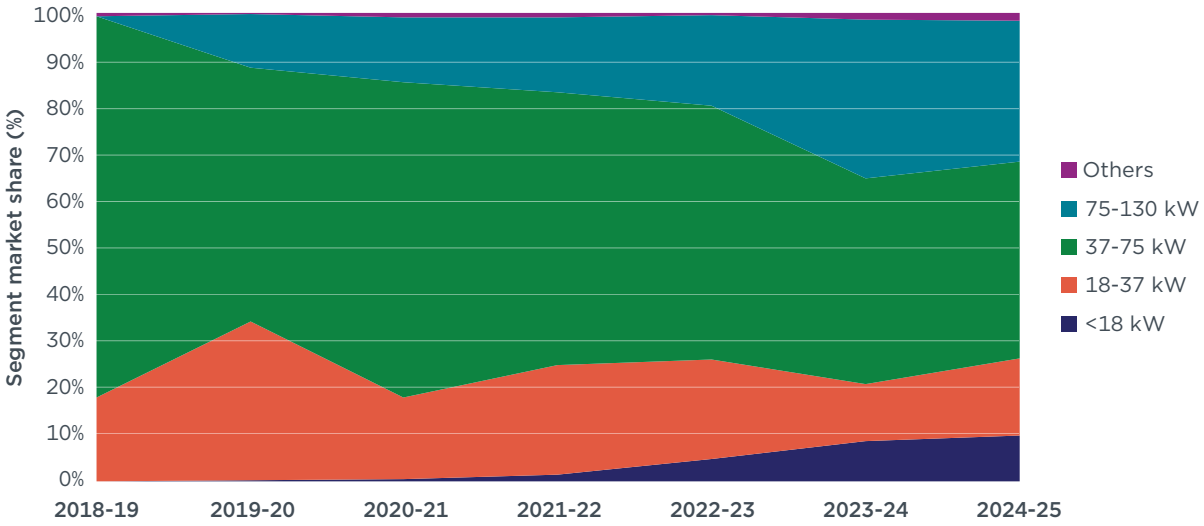
From 2012–2015, U.S. Tier 4i standards were in effect, and subsequently Tier 4f emission norms for all tractor sub-segments. In the same period, Indian tractor exports grew by 68%, peaking in 2015–16 with an export value of US$300 million. Between 2015–16 and 2019–20, tractor exports to the United States declined by 43%. However, from 2019–20 to 2022–23, when markets were disrupted by COVID-19, Indian tractor exports to the United States almost tripled to US$460 million in 2022–23.

In January 2023, India introduced TREM IV emission standards for 37–560 kW tractors, aligning Indian standards with U.S. norms (except for PM limits). Indian tractor exports to the United States fell by 42% from 2022–23 to 2023–24, and by 10% in 2024–25 (Figure 9).

The demand for large (75–130 kW) and small (<18 kW) Indian tractors is increasing in the United States, while the demand for the medium segments is decreasing. However, most Indian tractor exports to the United States in 2024–25 continue to be in the 37–75 kW category, with a 42% market share, followed by 75–130 kW segment with a 30% market share (Figure 10).

Figure 10

Market share Indian tractor exports to the United States by segment, 2017–18 to 2024–25



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Exports of Indian tractors to the United States have increased in those segments with more closely aligned emission standards (Table 3). Exports of the 75–130 kW segment have grown from US$0.7 million in 2017–18 to more than US$90 million in 2023–24. There was also a marginal increase in exports of this segment between 2022–23 and 2023–24, while there was a 40% drop in overall tractor exports to the United States. Indian and U.S. emission standards are also better aligned for this segment. Table 4 shows that in the 75–130 kW category, India's TREM Stage IV emission limits are on par with U.S. Tier 4f standards (except for PM limits).

Table 3

Indian and U.S. relative emission standards and export trends

75–130 kW – Standards aligned except PM, exports rising
37–75 kW – Standards aligned for all except for PM in 56-75 kW, exports falling
18–37 kW – Standards not aligned for HC+NO_x and PM (by a factor of 20), exports falling
<18 kW – Standards not aligned for HC+NO_x and PM, exports rising

Between 2017–18 and 2024–25, exports of 18 kW and 75–130 kW tractors increased by CAGRs of 122% and 118%, respectively. Exports of 18–37 kW and 37–75 kW tractors decreased by CAGRs of 9% and 5% respectively. Table 4 interprets the relative U.S. emission standards and shows how exports of small and large sub-segments of tractors are rising but the medium segments are losing market share.

Table 4

Indian tractor emission standards relative to U.S. standards since January 2023

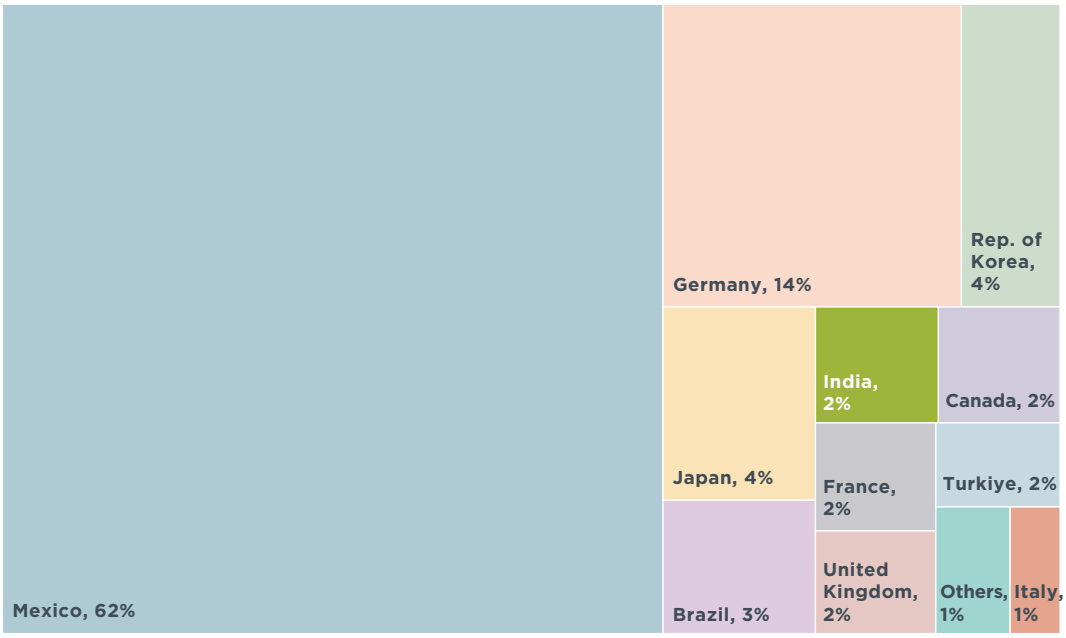
Power (kW)	CO	HC	NO_x	HC+NO_x	PM	PN	CAGR (2017–18 to 2024–25)
P<8	0.69			1.13	2		122%
8≤P<19	0.83			1.13	2		
19≤P<37	MATCH			1.60	20		-9%
37≤P<56	0.91			MATCH	0.83		-5%
56≤P<75	MATCH	MATCH	MATCH		1.25		
75≤P<130	MATCH	MATCH	MATCH		1.25		118%
130≤P<560	MATCH	MATCH	MATCH		1.25		
P≥560	NA						

Note: Values for TREM IV standards shown as factor of U.S. Tier 4f standards, i.e., India ES/ U.S. ES.

According to the UN Comtrade database (United Nations Statistics Division, n.d.), the pattern of overall U.S. tractor imports does not follow the same pattern as India's tractor exports to the country. Tractor imports to the United States increased year-over-year in 2022–23 and 2023–24. Mexico dominates U.S. tractor imports with 62% market share, followed by Germany (14%), South Korea (4%), Japan (4%), and Brazil (3%), while India had a 2% market share (Figure 11).

Figure 11

Market share of tractor imports to the United States by exporting country in 2023



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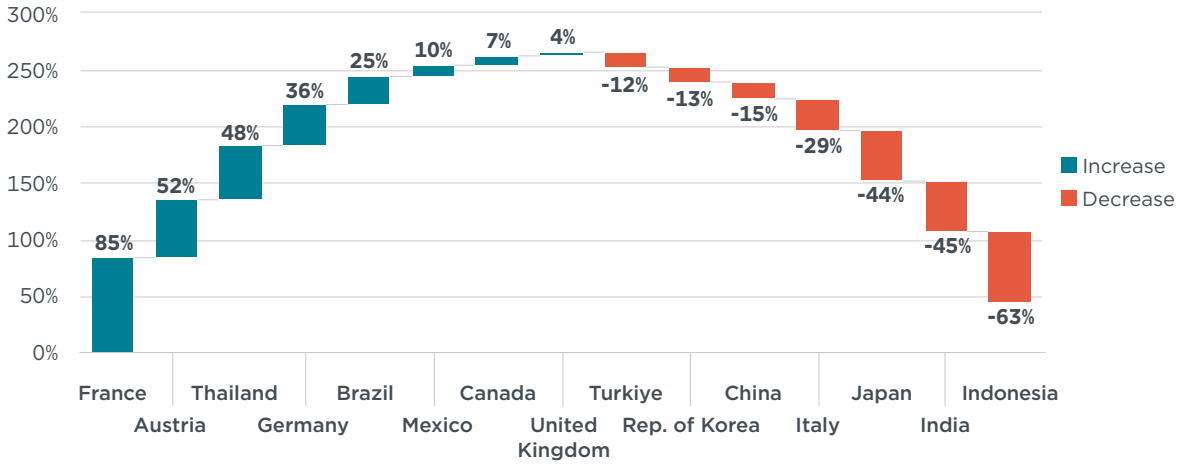
We further analyzed this data to understand which countries gained or lost market share from 2022–2023. In this period, U.S. tractor imports from major tractor producing countries like India, China, and Japan fell, while imports from countries like France, Austria, Germany, Mexico, and Brazil rose. India is losing U.S. market share primarily to countries with less stringent standards than India's (like Mexico and Brazil) and EU countries with stricter standards (Figure 12).

Figure 12

Year-over-year growth of U.S. tractor imports by major tractor exporting countries in 2023



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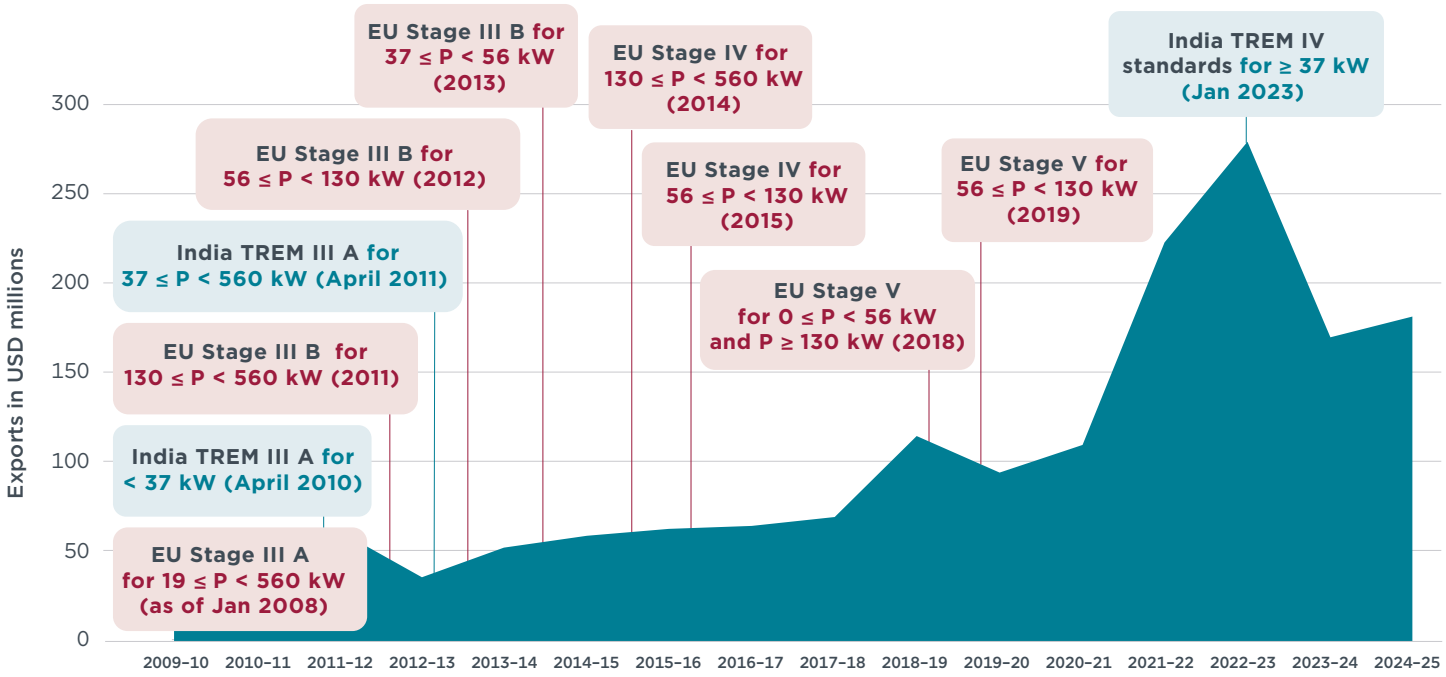
Overall, the United States remains the major market for Indian tractor exports. While medium tractors (37–75 kW) remain the major segment of export, the U.S. market for small (<18 kW) and large (75-130 kW) tractor segments is rising rapidly. This trend is expected to be positive for the Indian market as the TREM V (slated for 2026 implementation), will make Indian tractors cleaner and more attractive for U.S. consumers.

EXPORTS TO THE EUROPEAN UNION AND EU MEMBER STATES

In 2008–09, India exported tractors to the EU with a value of US$38 million, accounting for about 9% overall tractor exports from India under the HS classification 8701. Since then, exports to EU Member States have a CAGR of 11% and a value of US$181 million, accounting for a 16% of tractor exports in 2024–25 (Figure 8 and Figure 13).

Figure 13

Indian tractor exports to the European Union, 2009–10 to 2024–25



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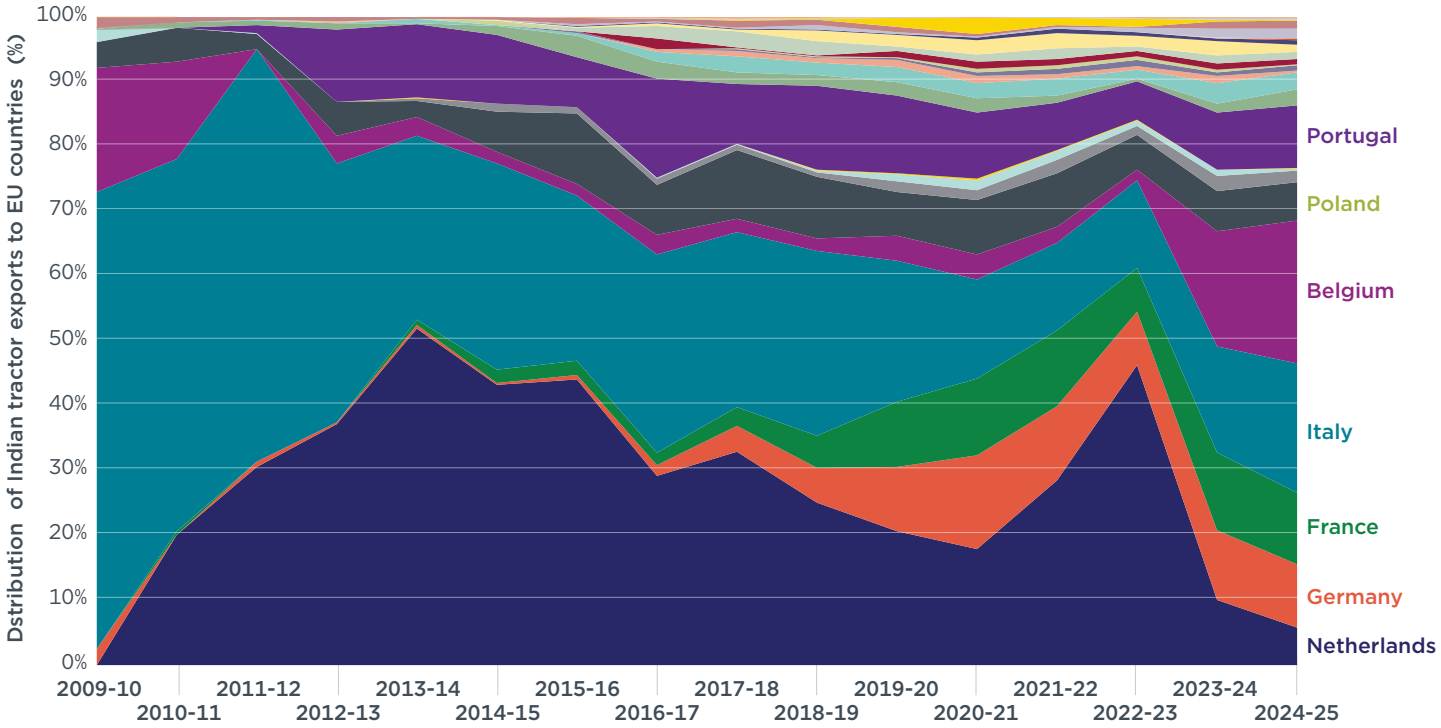
As of January 2008, the EU had Stage IIIA standards in place for tractors with engine power of 19–560 kW. Tractors with power of under 19 kW had no standards until the implementation of Stage V standards in 2018. India had TREM IIIA in place for tractors with power of under 37 kW from April 2010 onwards. This means that Indian tractors with power of under 19 kW followed more stringent standards than EU-manufactured tractors between 2010 and 2018. This could explain why 80% of India's exports of under 18 kW tractors are to EU countries. Similarly, standards for tractors with power over 560 kW were introduced in 2018 (EU Stage V). Between 2011 and 2019, the EU sequentially enforced EU Stage III B, EU Stage IV, and EU Stage V standards, which were more stringent than Indian standards. After the implementation of TREM IV in January 2023, India standards for 37–560 kW tractors were aligned with EU standards for all pollutants except PM. Standards for tractors with power under 37 kW in India remain less stringent than EU standards (Figure 5).

India's tractor exports to the EU increased by 11% CAGR between 2008–09 and 2024–25. Belgium, Italy, France, and Germany are the major EU importers of Indian tractors, accounting for about 60% of imports (Figure 14). Like U.S. exports, EU exports fell 40% year-over-year in 2023–24 (Figure 21). This decrease can mainly be attributed to a 90% reduction in imports of Indian tractors by the Netherlands, primarily in the 37–75 kW segment. However, there was an eightfold rise in exports to Belgium in the same period, compensating for some lost trade (Figure 14). Demand for Indian tractors increased in Belgium after India announced TREM IV standards in 2023. In 2024–25, exports increased even more in segments with aligned standards.

Figure 14

Market share of Indian tractor exports to EU Member States



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Belgium

Before January 2023, TREM and EU standards for 37–75 kW tractors were not aligned. After notification of TREM IV standards in January 2023, Indian standards for the 37–75 kW segment matched EU Stage V standards for all pollutants except for PM (which is 1.7 times that of EU standards) (Table 5). The impact of this is visible in exports to Belgium (Figure 15). India's tractor exports of this segment to Belgium in 2024–25 were almost 100 times that of exports in 2018–19. Similarly, after closer alignment of standards since 2023, India exported tractors in the 75–130 kW segment with a value of US$28 million in 2024–25, compared with negligible exports between 2018–19 and 2022–23 (Figure 15). Similarly, exports of 37–75 kW tractors in 2023–24 was almost 200 times that of 2022–23, when TREM IV was enforced in India.

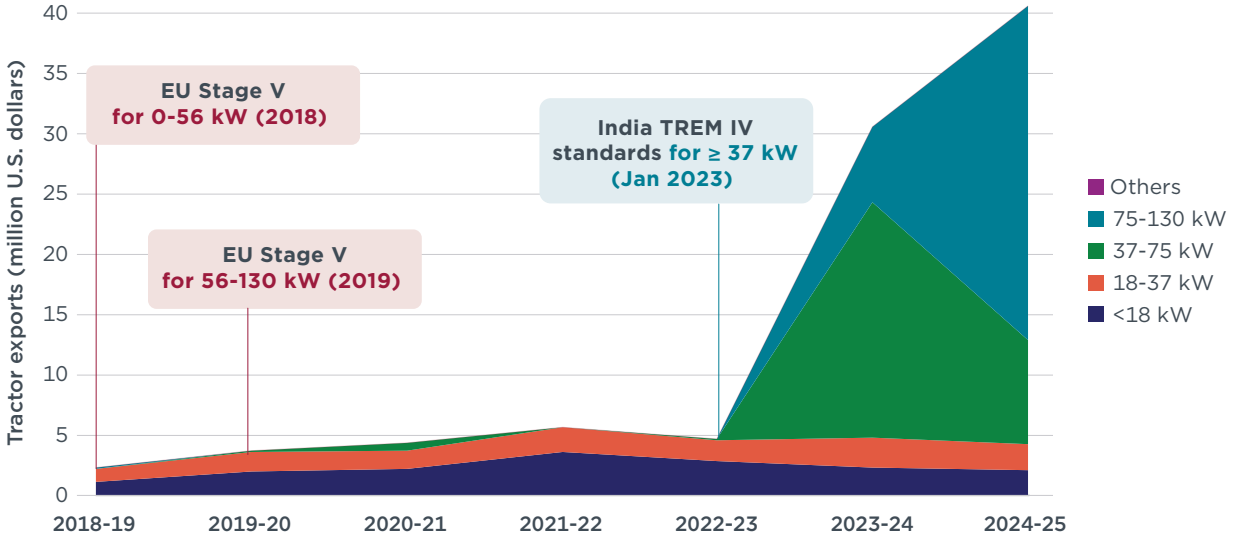
Table 5

Indian tractor emission standards relative to EU standards since January 2023 and export growth to Belgium

Power (kW)	CO	HC	NO_x	HC+NO_x	PM	PN	CAGR (2017–18 to 2024–25)
P < 8	0.69			1.13	2		11%
8 ≤ P < 19	0.83			1.13	2		
19 ≤ P < 37	1.1			1.60	40.0		13%
37 ≤ P < 56	MATCH			MATCH	1.7		114%
56 ≤ P < 75	MATCH	MATCH	MATCH		1.7		
75 ≤ P < 130	MATCH	MATCH	MATCH		1.7		NA
130 ≤ P < 560	MATCH	MATCH	MATCH		1.7		
P ≥ 560							

Figure 15

Indian tractor exports to Belgium by segment, 2018–19 to 2024–25



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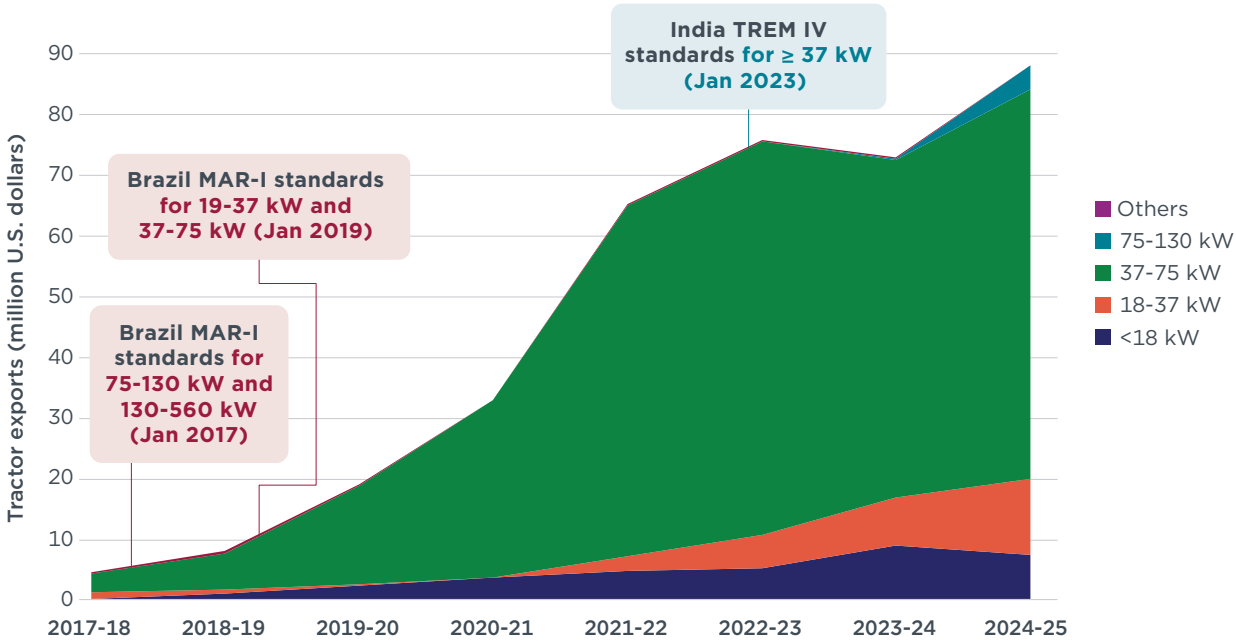
EXPORTS TO BRAZIL

In contrast to Belgium where exports increased after India tightened standards, Brazil has emerged as a major market for India tractors after Brazil enforced its MAR-I emissions standards (DieselNet 2011). After Brazil started phasing in emission norms for tractors, India's tractor exports to Brazil increased by 65% CAGR from 2017–18 and 2024–25, increasing from a value of US$4.5 million to US$88 million (Figure 16).

Figure 16

Indian tractor exports to Brazil by segment, 2017–18 to 2024–25



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Brazil introduced MAR-I standards for 75–560 kW tractors in January 2017 and for 19–75 kW tractors in January 2019. At that time, TREM IIIA was applicable to all tractors with power below 560 kW in India. MAR-I standards for 56–560 kW tractors have

combined limits for HC and NO_x, while India has had separate emission limits for HC and NOx since TREM III. Hence, India's emission standards remained more stringent than Brazil's, even after the introduction of MAR-I in 2019. Since the introduction of TREM IV in January 2023, Indian standards remain more stringent than Brazil's (Table 6). Exports of Indian tractors to Brazil substantially increased after the introduction of MAR-I standards. More than 75% tractor exports to Brazil in 2023–24 were 37–75 kW, the same segment that experienced falling exports in the United States.

Table 6

Indian tractor emission standards relative to Brazil's emission standards since January 2023

Power (kW)	CO	HC	NO_x	HC+NO_x	PM	PN	CAGR (2017–18 to 2024–25)
P < 8							150%
8 ≤ P < 19							
19 ≤ P < 37	MATCH			MATCH	MATCH		49%
37 ≤ P < 56	MATCH			MATCH	0.1		66%
56 ≤ P < 75	MATCH	0.1	MATCH		0.1		
75 ≤ P < 130	MATCH	0.1	0.2		0.1		101%
130 ≤ P < 560	MATCH	0.1	0.2		0.1		NA
P ≥ 560							

EXPORTS TO COUNTRIES WITHOUT EMISSION STANDARDS FOR TRACTORS

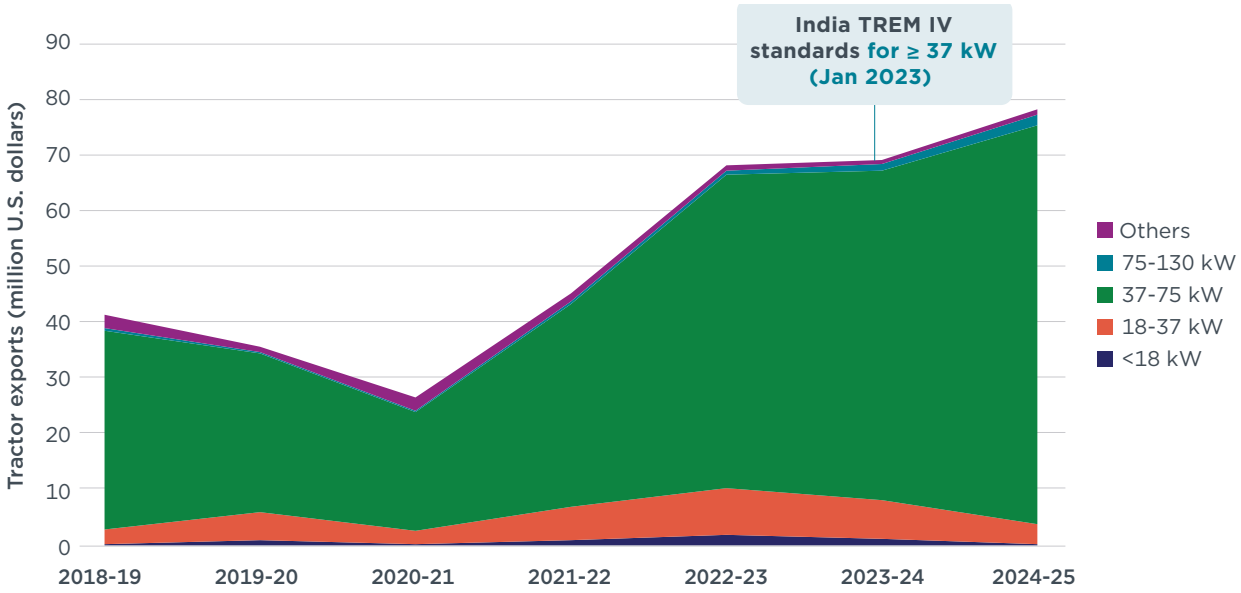
Another 22% of India tractor exports are to countries with no emission regulations for tractors, including Mexico (7% of exports), Bangladesh (5%), Thailand (5%), and South Africa (5%). Exports of Indian tractors to these destinations continue to rise.

Mexico

India's tractor exports to Mexico increased by 27% CAGR in 15 years, from US$2 million in 2008–09 to US$77 million in 2024–25 (Figure 17). Indian exports to Mexico increased year-over-year in 2023–24 as well, when most other markets (e.g., the United States and EU) shrank. Tractors in the 37–75 kW category constituted 91% of tractor exports to Mexico in 2024–25. Moreover, while India's exports to Mexico are rising, and Indian exports to the United States are falling, Mexico's own exports to the United States are rising. Mexico is slowly replacing the United States as the market for India's 37–75 kW tractors and simultaneously exporting their own tractors to meet rising demand in the United States, currently meeting 62% of U.S. demand.

Figure 17

Indian tractor exports to Mexico by segment, 2017–18 to 2024–25



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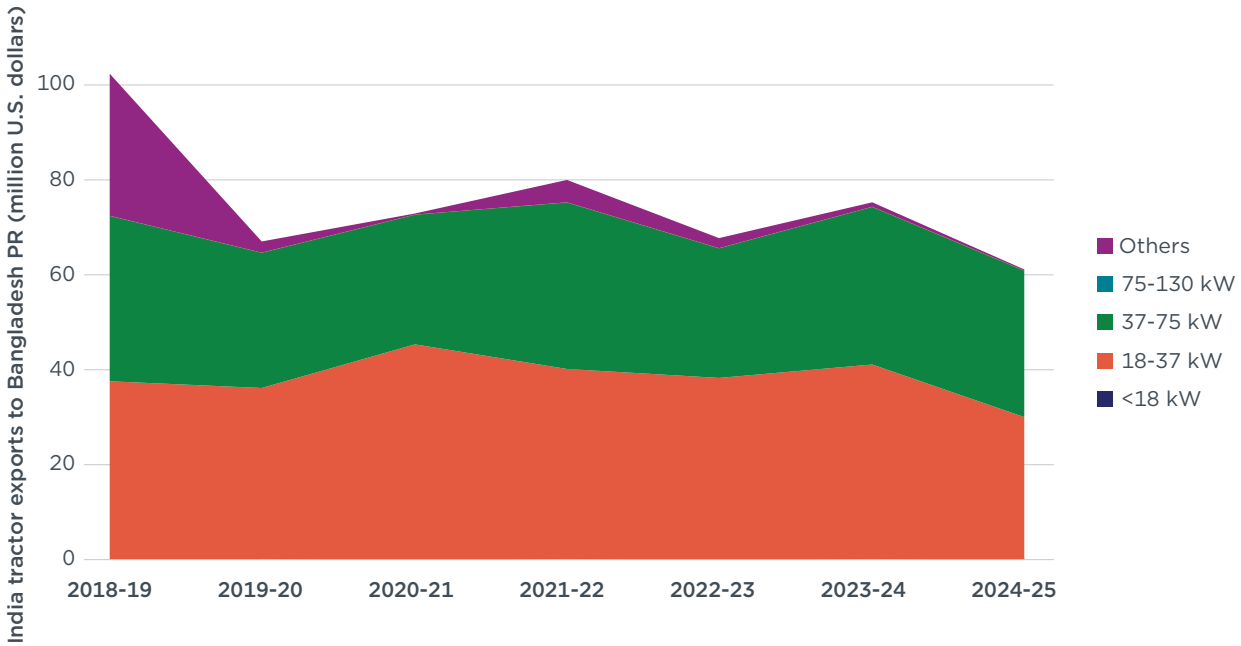
Bangladesh

Bangladesh is a steady consumer of medium-sized Indian tractors, accounting for an average of 6% of exports from 2009–09 to 2024–25. India's tractor exports to Bangladesh increased by 11% CAGR over these 16 years, from US$13 million to US$61 million. Tractors with power of 18–37 kW and 37–75 kW make up 49% and 51% of the export market share, respectively. The trend reveals that tractor exports to Bangladesh have been relatively stable. While India's overall exports in 18–37 kW and 37–75 kW had a year-over-year dip of more than 30% in 2023–24, the exports of the same to Bangladesh increased by 8% and 21%, respectively (Figure 18).

Figure 18

Indian tractor exports to Bangladesh by segment, 2017–18 to 2024–25



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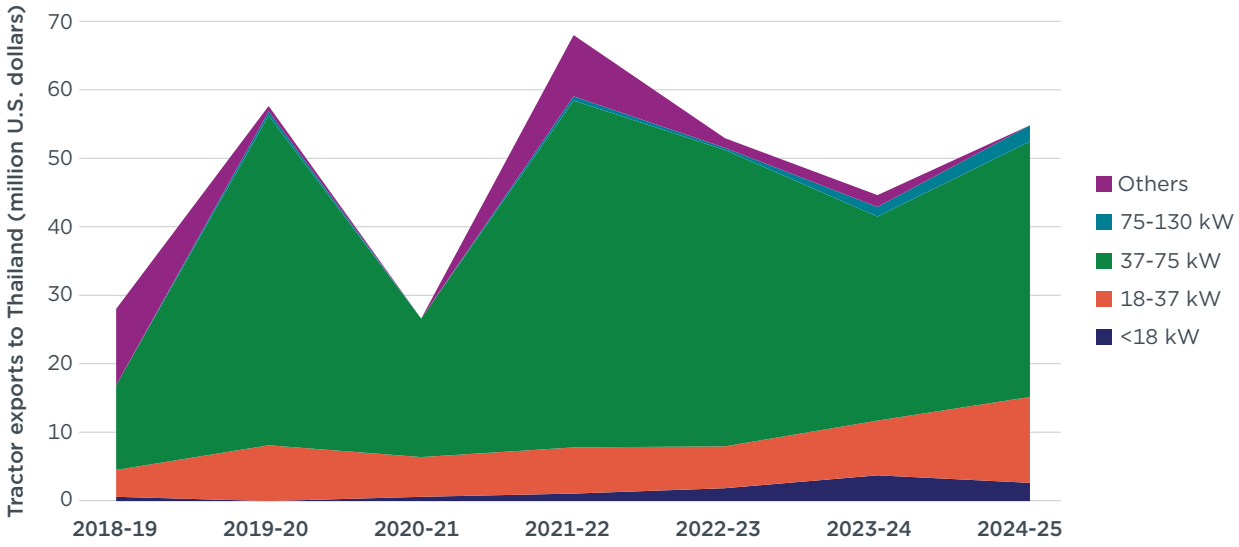
Thailand

Much like Bangladesh, Thailand has been a steady importer of Indian tractors, accounting for 1% of exports in 2008–09 and 5% in 2024–25. India's tractor exports to Thailand increased by 16% CAGR over those 16 years, from US$6 million in 2008–09 to US$55 million in 2024–25 (Figure 19). Tractors in the 37-75 kW constitute 68% of tractor exports to Thailand.

Figure 19

Indian tractor exports to Thailand by segment, 2017–18 to 2024–25



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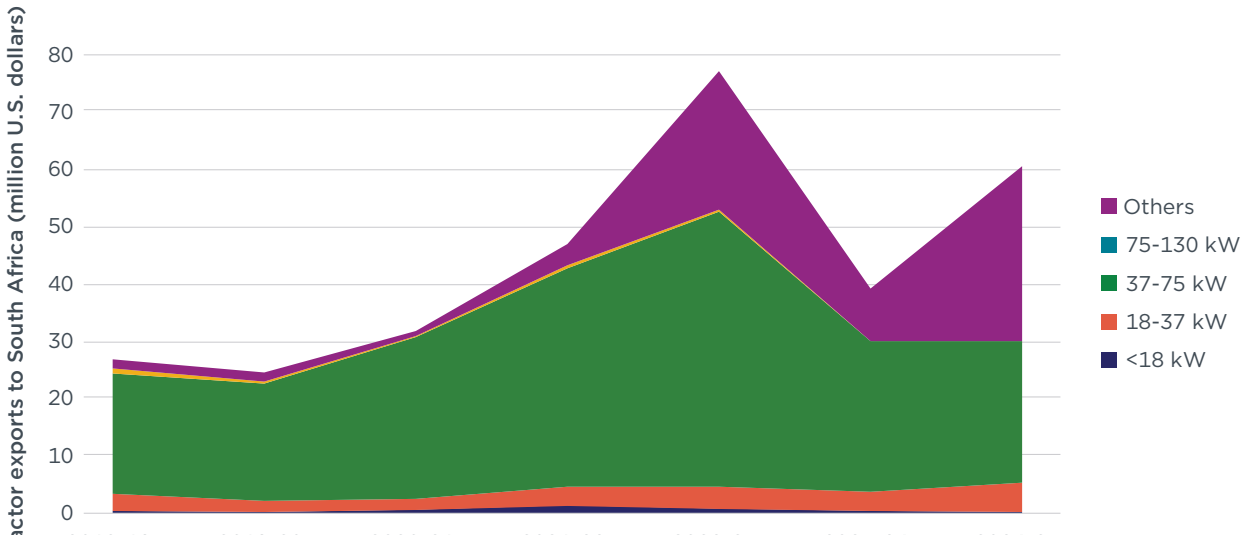
South Africa

India's tractor exports to South Africa increased by 13% CAGR over 16 years, from US$6 million in 2008–09 to US$60 million in 2024–25. Like Bangladesh and Thailand, tractors in the 37–75 kW category constitute a major portion of tractor exports to South Africa, with a 41% share in 2024–25 (Figure 20).

Figure 20

Indian exports to South Africa by segment, 2017–18 to 2024–25



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CONCLUSION

This study explored India's tractor exports and emissions standards and drew inferences on their relationship. Since a multitude of factors influencing global tractor trade, this study did not infer statistically causality between emission standards and exports. However, this study presented case studies of the growth of exports and relative emission standards by tractor segments and by countries to inform tractor manufacturers and policymakers in India.

Our analysis of India's top seven tractor export markets (constituting 67% of exports) and the relative emission standards of India with importing countries shows that tractor exports increased with greater alignment of emission standards, either by enforcement of stringent norms in India or by the importing country. The United States remains the biggest market for Indian tractors, though overall export volumes have been falling. However, in contrast to other segments, the demand for large Indian tractors (75–130 kW) is increasing in the United States. This is also the segment where Indian standards are aligned with U.S. standards (except for PM). In the segments where standards are not aligned (37–75 kW), India is losing its U.S. market share. While countries like India, China, and Japan have decreasing exports to the U.S. tractor market, countries like Mexico, Germany, and France have expanded tractor U.S. exports. While Mexican tractors dominate the U.S. market, Indian tractor exports to Mexico are on the rise. Except for Mexico, the domestic emission standards of major emerging suppliers of tractors to the United States are more stringent than U.S. standards.

Similarly, exports to Belgium increased after India enforced TREM Stage IV emission standards in January 2023. In Brazil, demand for Indian tractors also increased after Brazil introduced MAR-I emission standards. Mexico, Bangladesh, South Africa, and Thailand do not regulate tractor emissions but remain strong markets for Indian tractors.

When TREM V enforcement is implemented in April 2026, Indian emission standards will be aligned with EU standards and more stringent than U.S. standards, likely facilitating continued expansion of exports. There are some challenges of stricter standards, such as possible increased costs for domestic consumers. However, India is already witnessing alternative technologies and fuels like electric tractors and tractors fueled by bioethanol. Implementation of TREM Stage V will send a signal to the industry to scale up these alternative technologies. As many countries are considering zero-emission tractor regulations, incentivizing domestic manufacturing of e-tractors can also further strengthen India's global strategic advantage as a tractor supplier.

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