Tractor Emission Norms

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Background

- Agriculture remains a focus area for the government, employing a significant share of the domestic workforce; sector's health remains critical to meet food security needs
- The Government of India remains focused on promoting mechanisation of farmlands (tractors along with implements)
- The emission standards for agricultural tractors and construction equipment in India are regulated separately from the broader automobile industry. Bharat Trem IIIA and CEV Stage III are currently applicable for agricultural tractors and construction equipment, respectively
- Standards are equivalent or largely adopted from guidelines implemented across developed countries (Europe/USA)
- New emission norms for agricultural tractors would be applicable from October 2020; same would however only be applicable on higher HP tractors (>50 HP), which constitutes ~13% of the domestic tractor industry by volumes

Tractor Industry | Set to implement new emission norms

- International Council on Clean Transportation (ICCT) estimated emissions from non-road vehicles (agricultural tractors and construction equipment) and on-road vehicles in December 2016
- ICCT concluded a need to strengthen emission norm controls for non-road vehicles to curb transportation related air quality impact, as emissions from non-road vehicles were projected to increase substantially
- While significant progress has been made with regards to regulation of on-road vehicles, especially with the expected implementation of BS-VI norms (from April 2020), the emission control regulations for non-road vehicles have been less stringent

Exhibit: Comparative trend - NO_x emission (Historical and Estimated)

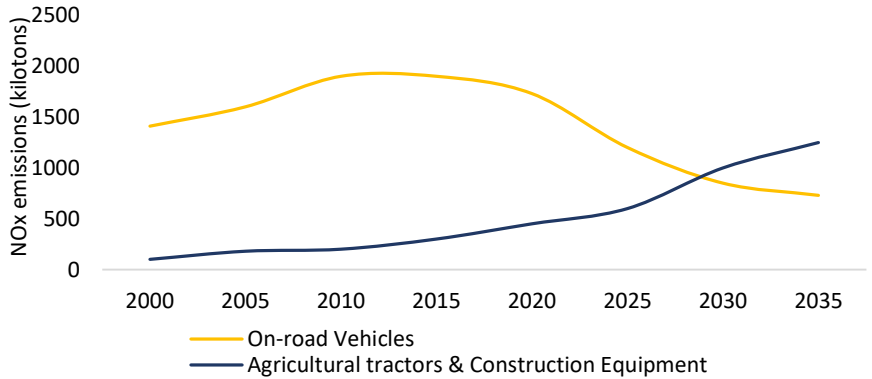
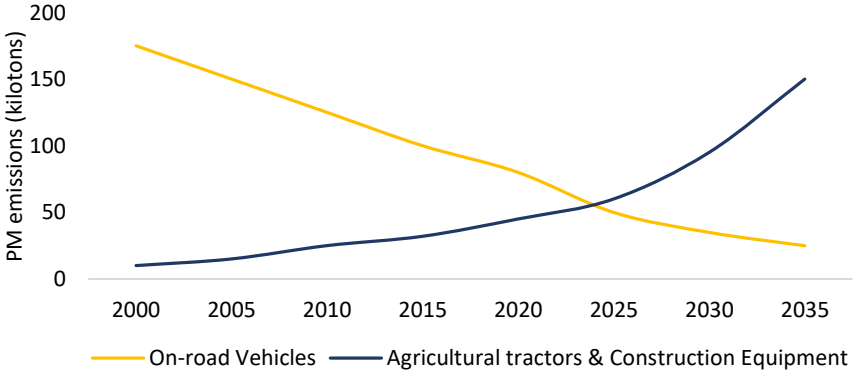


Exhibit: Comparative trend – $PM_{2.5}$ emission (Historical and Estimated)



Source: Evaluation of emission-control scenarios for agricultural tractors and construction equipment in India, ICCT & ICRA Research

Tractor Industry | Evolution of Emission Norms in India

- Currently TREM III A emission norms are applicable for tractors across HP categories in India and were implemented in April 2010/11
- Emission norms to get stringent for >50 HP tractors (~13% of the market by volumes) from October 2020 onwards

Exhibit: Emission Norm specifications from Trem I to Trem V

Stage	Month of Implementation	Engine Power (kW)	Emission (g/kWh)				
			CO	HC	HC+NoX	NOX	PM
I	October, 1999	All	14.0	3.5	-	18.0	-
II	June, 2003	All	9.0	-	15.0	-	1.0
IIIA	April, 2010	0<P<37	5.5	-	7.5-8.5	-	0.6-0.8
	April, 2011	37<P<560	3.5-5.0	-	4.0-4.7	-	0.2-0.4
IV	October, 2020	0<P<37	5.0		4.7(HC+Nox)		0.025
	October, 2020	37<P<560	3.5-5	0.19	-	0.4	0.025
V	October, 2023	0<P<37	5.0		4.7(HC+Nox)		0.015
	October, 2023	37<P<560	3.5-5.0	0.2	4.7-0.4	3.5-0.4	0.045-0.015

Exhibit: CO & PM emission limit trend

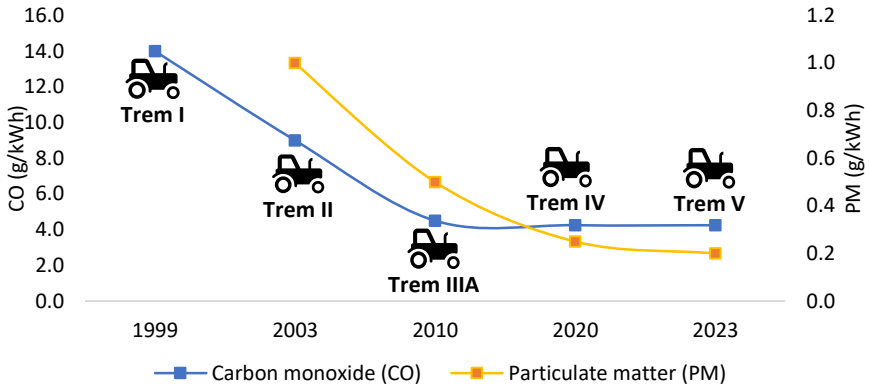


Exhibit: Emission norms timeline for agricultural tractors

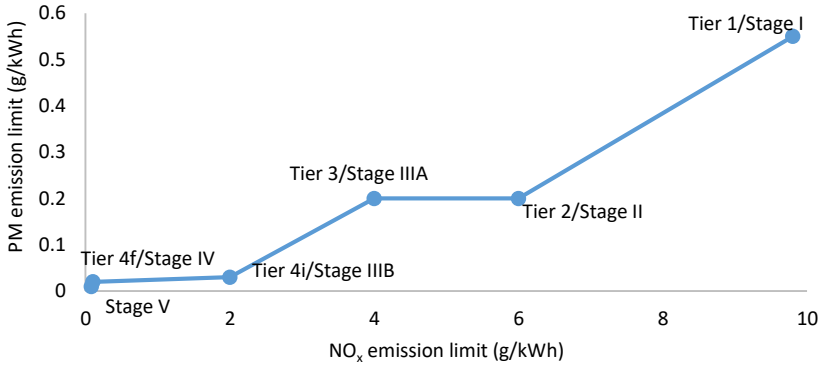
Bharat Trem I October, 1999 → Bharat Trem II June, 2003 → Bharat Trem III October, 2005 → Bharat Trem IIIA April, 2010 & 2011 → Bharat Trem IV October, 2020 → Bharat Trem V October, 2023

Source: Gazette of India, ICCT & ICRA Research

India has lagged behind emission norm evolution in developed markets

- Emission regulations in US and EU largely harmonized; progressed through a series for stringent Tiers or stages
- Most countries have already committed to emission standards followed by either US or EU
- Emission norms in world's two largest markets – India & China lag behind the developed countries, with standard equivalent to US Tier 3 and Euro Stage IIIA respectively

Exhibit: Emission limits in US and EU non-road emission norms (130 kW engine)



Region	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU		Stage I					Stage II				Stage IIIA					Stage IIIB					Stage V		
U.S.	Tier 1						Tier 2				Tier 3, Tier 4 Interim					Tier 4 Final							
Canada									Tier 2		Tier 3					Tier 4							
Japan										2006-2008						2011-2016							
China										Stage I		Stage II					Stage IIIA						
Brazil														PROCONVE MAR-I							MAR-I		
S. Korea							Tier 1			Tier 2			Tier 3				Tier 4 Final						
India			Trem I			Trem II			Trem III					Trem IIIA									

U.S. standard or equivalent

EU standard or equivalent

Source: ICCT, ICRA Research

Major technological changes required to migrate to TREM-IV norms

Exhibit: Emission reduction technologies

Engines

- Fuel injection systems
- Air handling technology
- Exhaust gas recirculation systems

Aftertreatment systems

- Diesel oxidization catalysts
- Selective catalyst reduction systems
- Diesel particulate filters

Exhibit: Technology pathway for emission norms implementation - Tractor

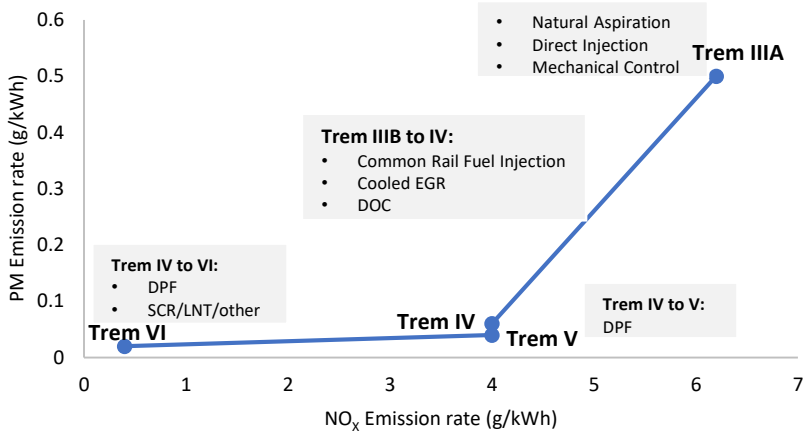


Exhibit: Key technological changes required for graduation to TREM IV norms

Technology likely to be adopted	Description
Common rail Fuel Injection	Involves distribution of fuel to injectors from a high pressure accumulator (rail), fed by a high pressure fuel pump (electronically controlled); allows control over injection timing and injection rate, thereby controlling air pollutant emissions
Exhaust gas recirculation	EGR systems recirculates a portion of the exhaust into the engine's cylinder, which aids in lowering the peak combustion temperature in the engine and reduces NO_x formation • Share of recirculated exhaust gas tailored to engine calibration • High-pressure and low-pressure variants (dependent on whether exhaust gases are fed in before turbocharger or after)
Diesel oxidation catalysts	DOC oxidizes air pollutants – HC, CO and the soluble organic fraction of PM; efficiency of DOC higher in heavy duty diesel engines on account of presence of excess oxygen in exhaust

Source: ICCT, ICRA Research

Incremental cost pass through to farmers will be a challenge

- Technological know readily available with OEMs, with export models already meeting evolved emission norms guidelines
- Incremental cost expected to be insignificant for lower HP category; medium HP segment (25-50 HP) expected to see significant cost increase
- Price hike pass through to farmers would be a challenge and could constrain profitability indicators to an extent
- OEMs expected to rejig their portfolio to an extent in view of upcoming revision in norms (applicable to only >50 HP from Oct 2020)

Exhibit: Indicative cost increase across HP categories

Engine Power (KW)	Engine Power (HP)	Estimated cost increase (Rs.)	Cost increase (% of average selling price)
<19 KW	<25 HP	~1,000-5,000	0-2%
19-37 KW	25-50 HP	~50,000-55,000	10-12%
37-56 KW	50-75 HP	~62,500-67,500	8-10%
>56 KW	>75 HP	~1,20,000-1,30,000	10-12%

Assumptions: Selling price of 2WD tractors

Source: ICCT, tractor.junction.com; ICRA Research

Exhibit: HP wise mix (FY2019)

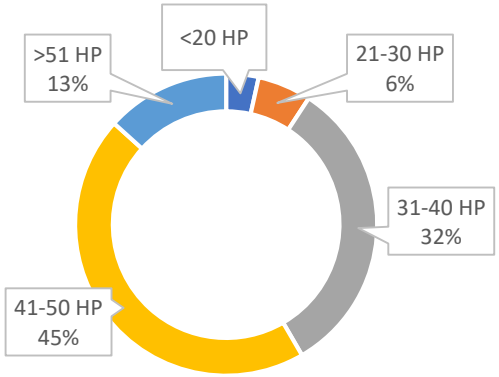
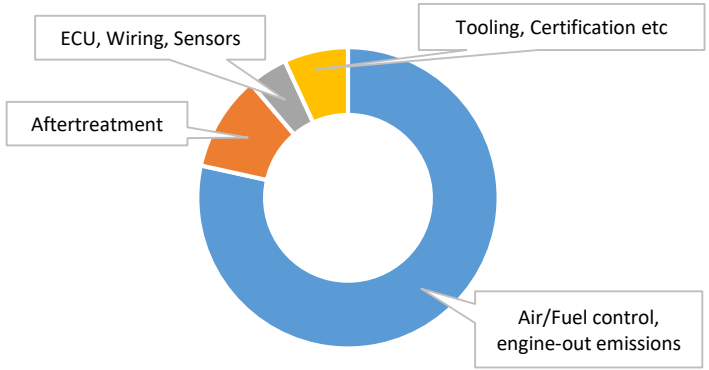


Exhibit: Indicative incremental cost break up – TREM IIIA to TREM IV



Thank You!