Impact of BS-VI and Strategies for 2Ws Development
ECT - 2017

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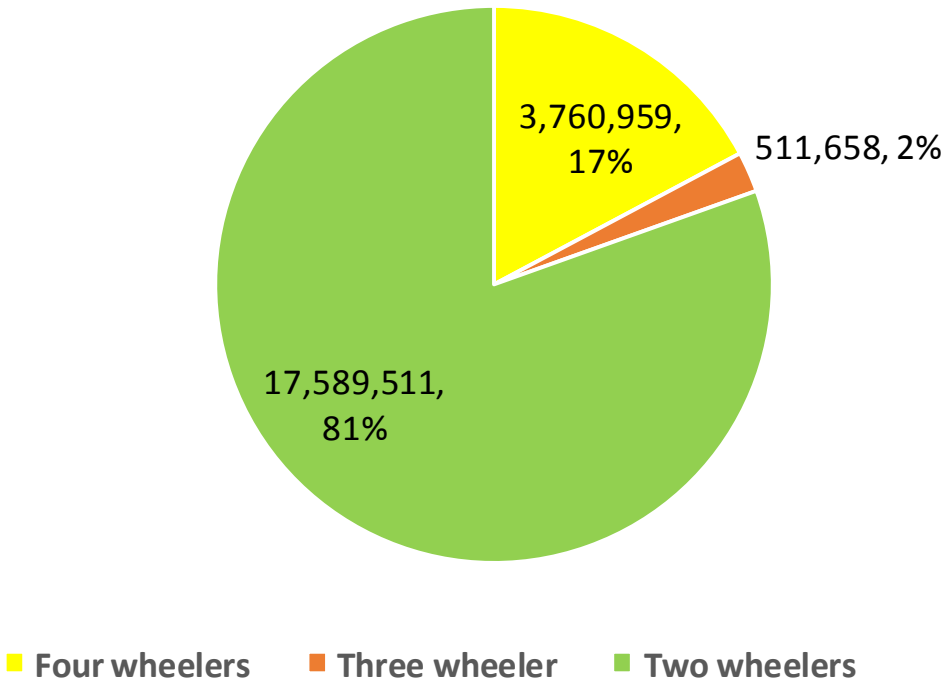
Content

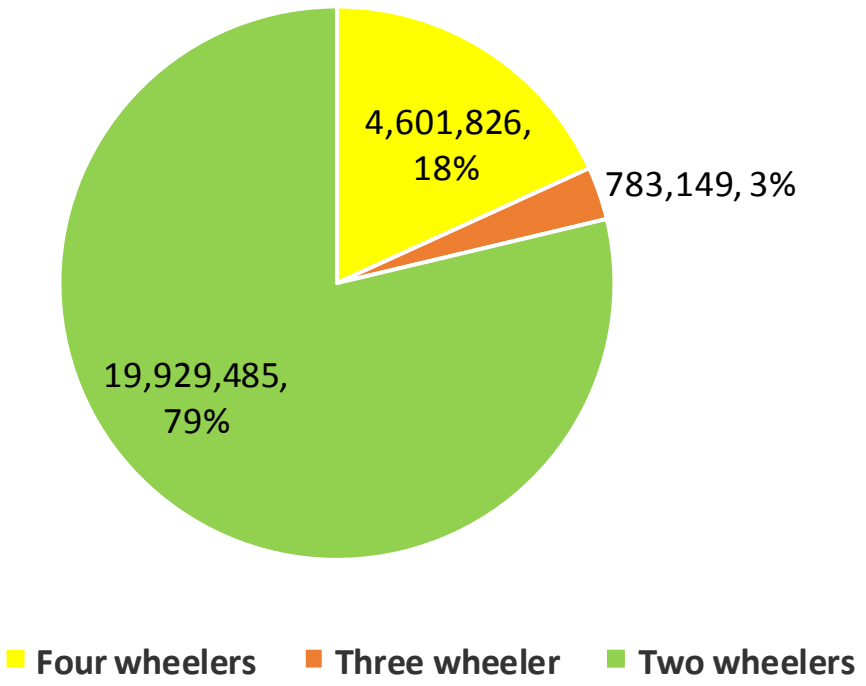
- **Over View of Indian Two Wheelers Industry**
  - Categorization of passenger vehicles
  - Two wheelers production and sales overview
  - Categorization of Two wheelers sales and production
- **Emission Regulations in India**
  - Emission norm progression of 2Ws
  - Moving from BS-IV to BS-VI
  - Background of BS-VI
  - Comparison of BS-VI vs. EU-5
  - Challenges for BS-VI

Over View of Indian Two Wheelers Industry

CATEGORIZATION OF PASSENGER VEHICLES



Domestic Sales (FY 16-17)



Production (FY 16-17)

Source: SIAM Statistical Service

VEHICLE PRODUCTION (TWO - WHEELERS)

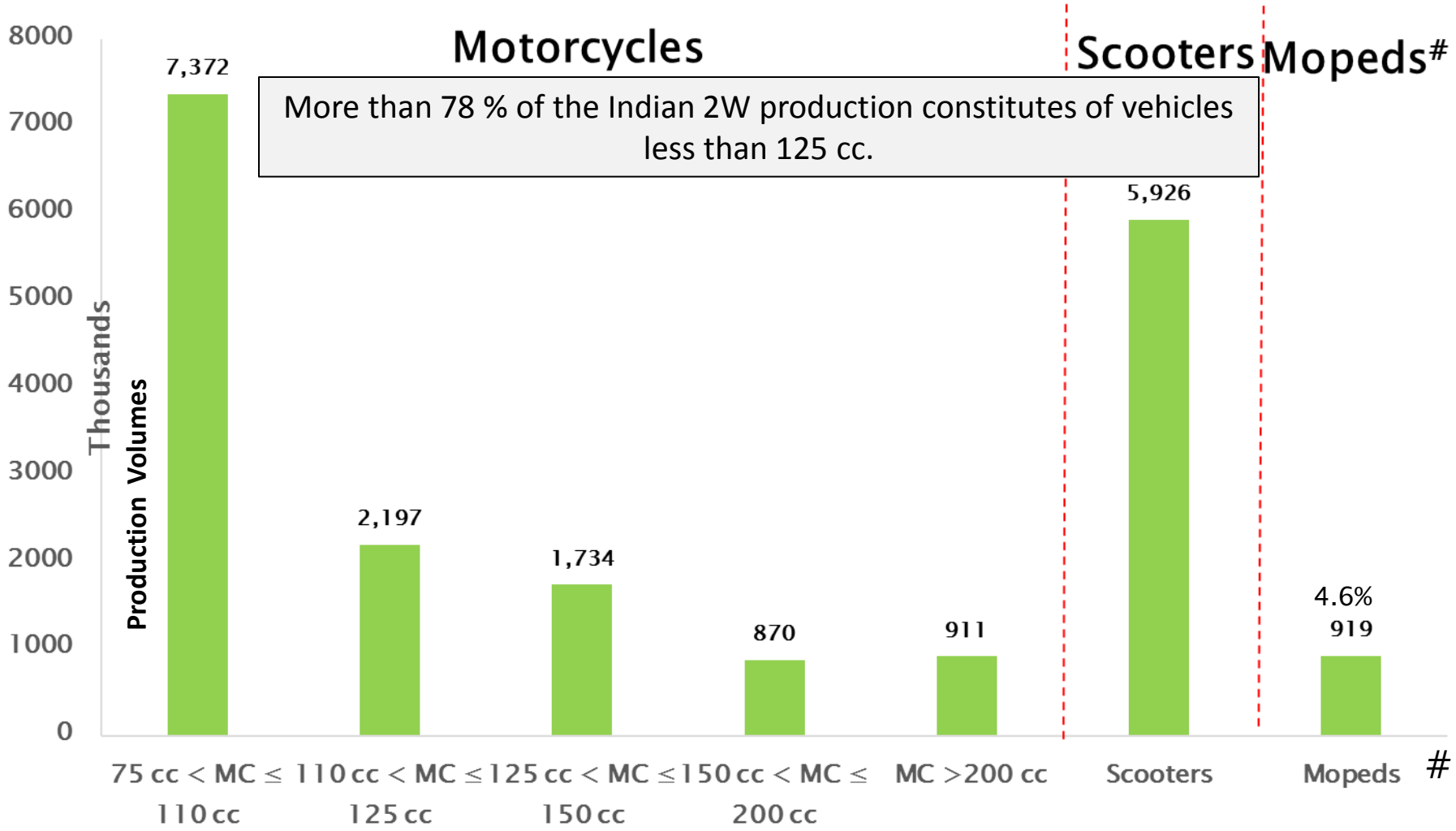
CAGR = 9.1%

	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Motorcycle	6.2	7.1	6.5	6.8	8.4	10.5	12.0	11.9	12.5	13.0	12.8	13.1
Scooters	1.0	0.9	1.1	1.2	1.5	2.1	2.7	3.0	3.7	4.7	5.3	5.9
Mopeds												
Total	7.6	8.4	8.0	8.4	10.5	13.3	15.5	15.7	16.9	18.5	18.8	19.9

*All Figures in Million

Source: SIAM Statistical Service

TWO – WHEELERS CATEGORISATION (Prod. Vol.-FY 2016-17)

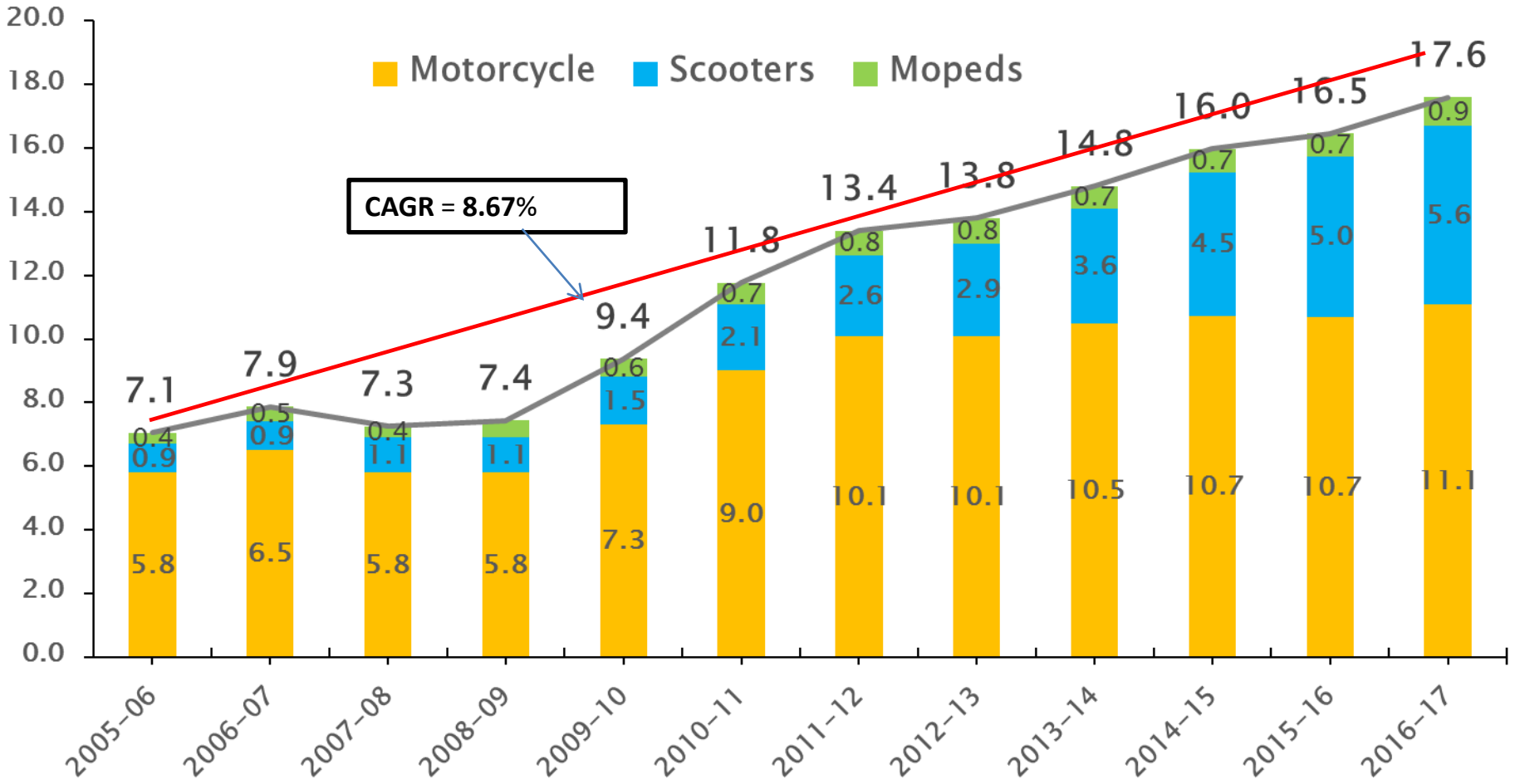


Vehicle categorisation

***All Figures in Thousands**

<75 cc , fixed transmission, big wheel size >12”

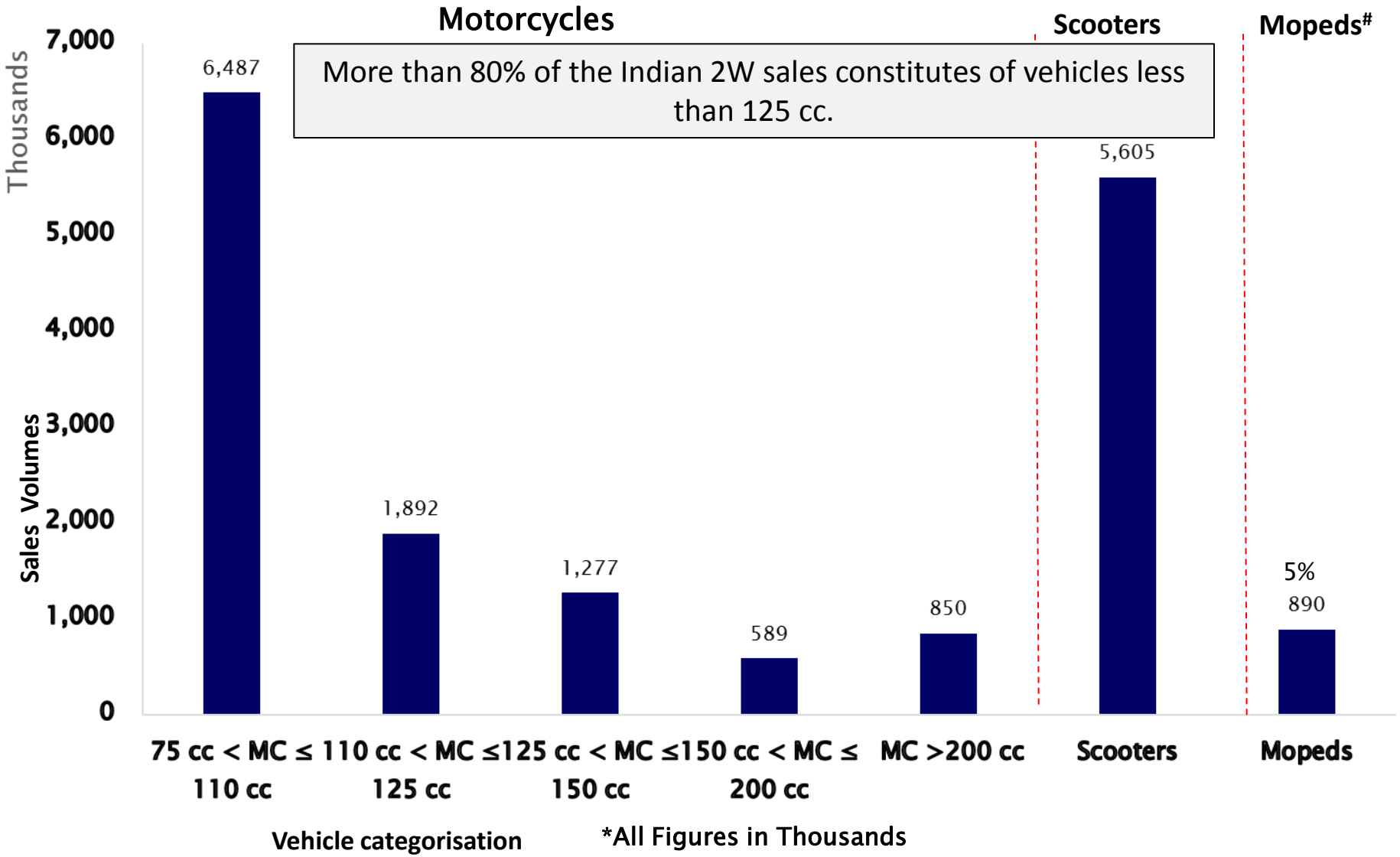
DOMESTIC SALES



*All Figures in Million

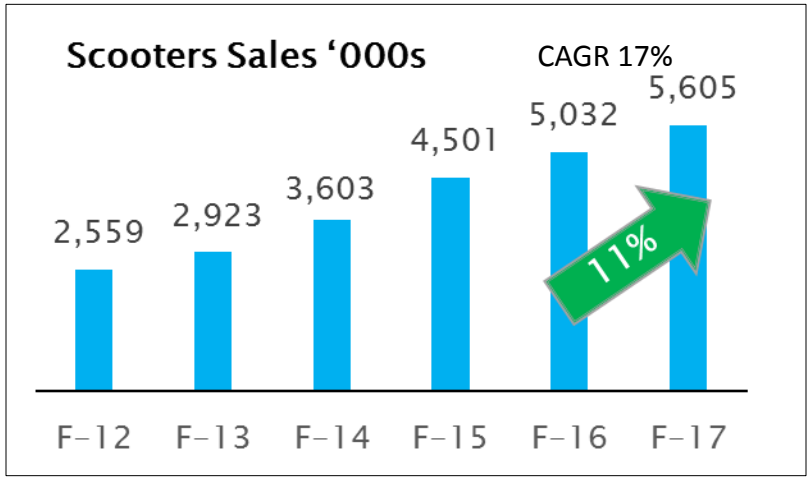
Source: SIAM Statistical Service

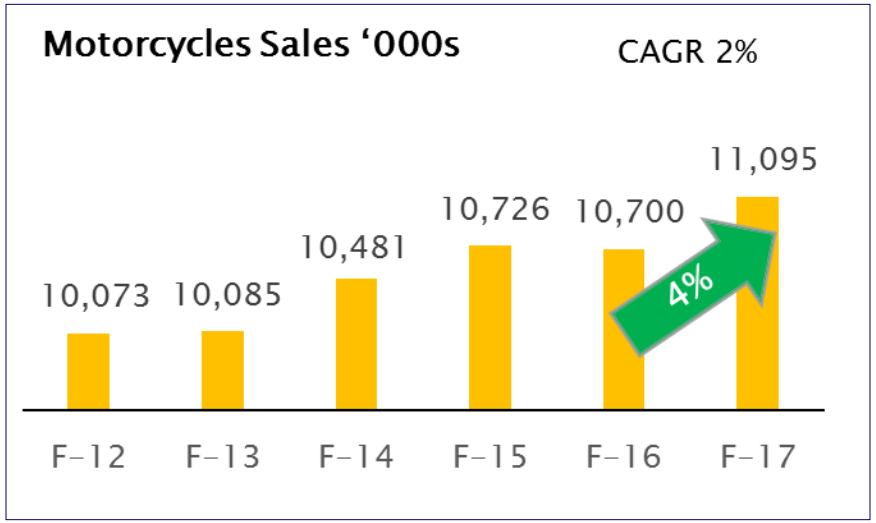
TWO – WHEELERS CATEGORISATION (Sales Vol. FY 2016-17)

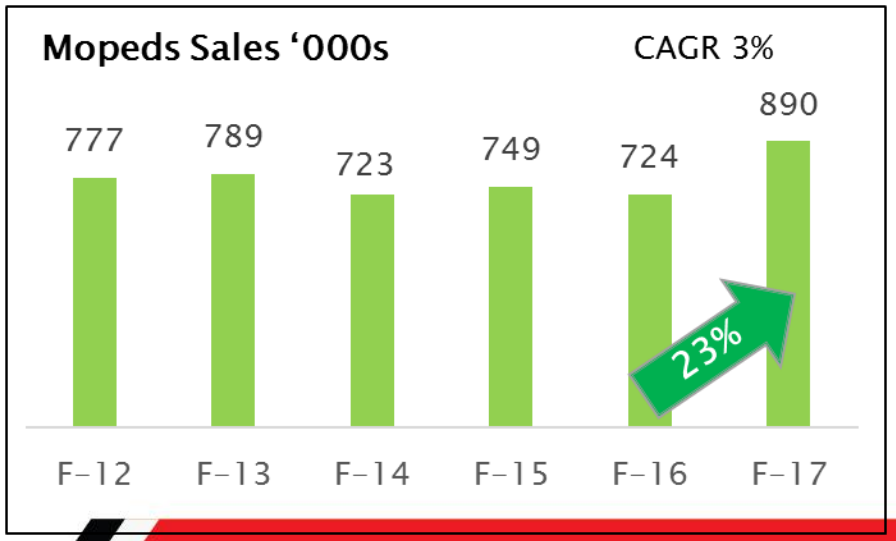


<75 cc , fixed transmission, big wheel size >12”

YEARLY PERFORMANCE OF TWO WHEELERS SUBSEGMENTS







Source: SIAM Statistical Service

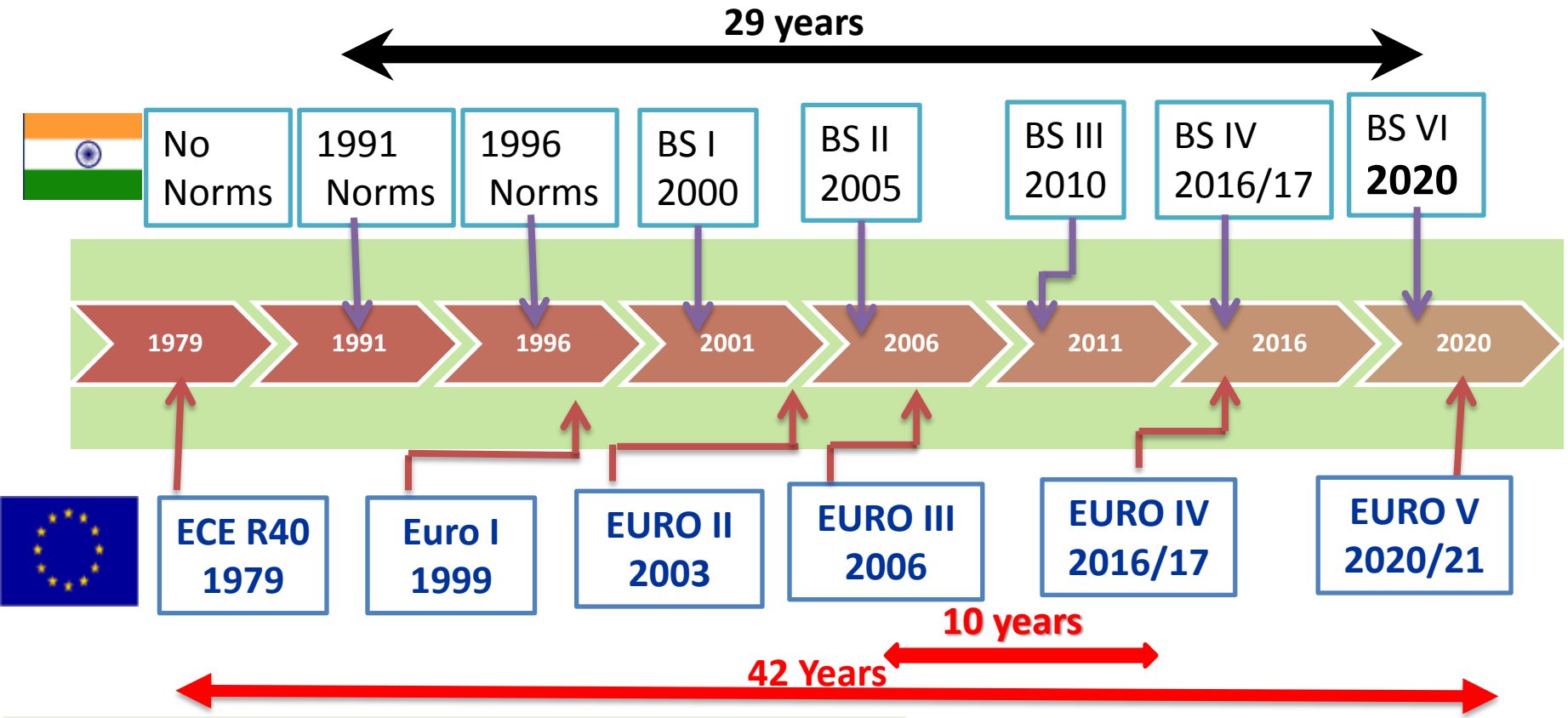
SUMMARY

- Two wheeler industry ~80 % of the total passenger vehicle.
- Two wheelers growth over the last decade is CAGR of 9.1 %
- Two Wheeler growth expected to continue primarily because of
  - Low Penetration
  - Poor Public Transport
  - Growing Economy & Infrastructure
- Two wheeler in India are majorly used for daily commuting hence low powered and lower performance and high on Fuel Efficiency.
- Indian Two Wheelers are being exported to many countries
- All major global players are either having manufacturing facility in India or present in Indian market.

Emission Regulations in India

BS-VI Scenario

Emission Progression of 2 Wheelers

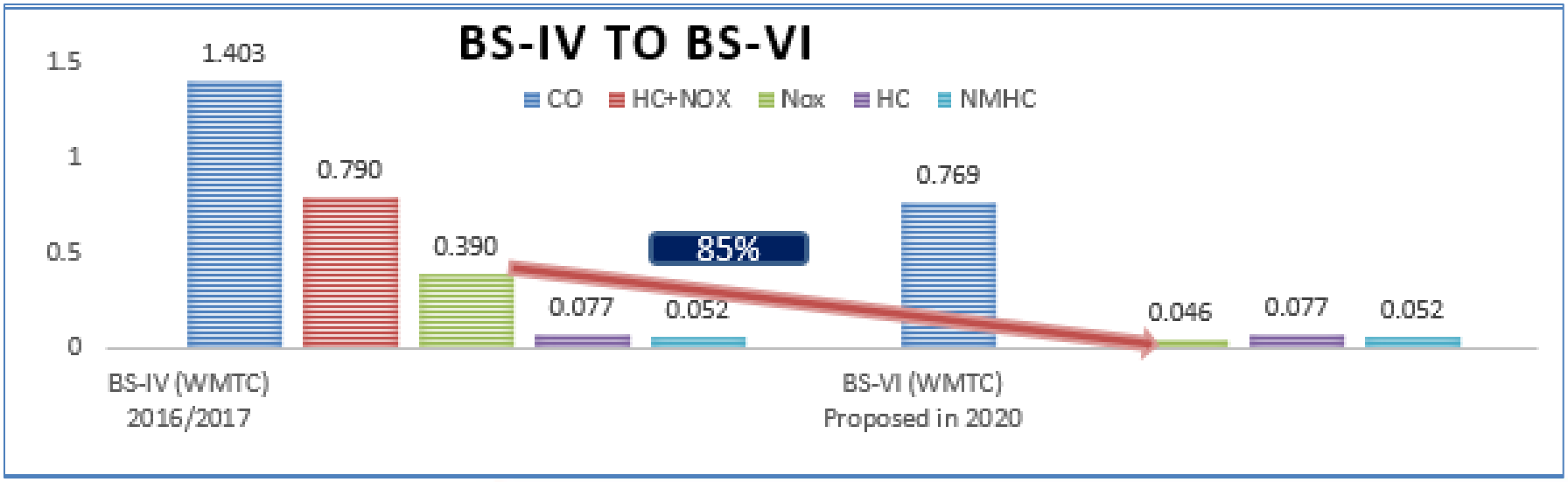


- Indian emission norms for 2 Wheelers has been tighten periodically every 5 years.
- Indian 2 W are used for commuting purposes and hence Fuel Economy is very important.
- Indian Emission norms are made to keep the high level of fuel efficiency in tact.

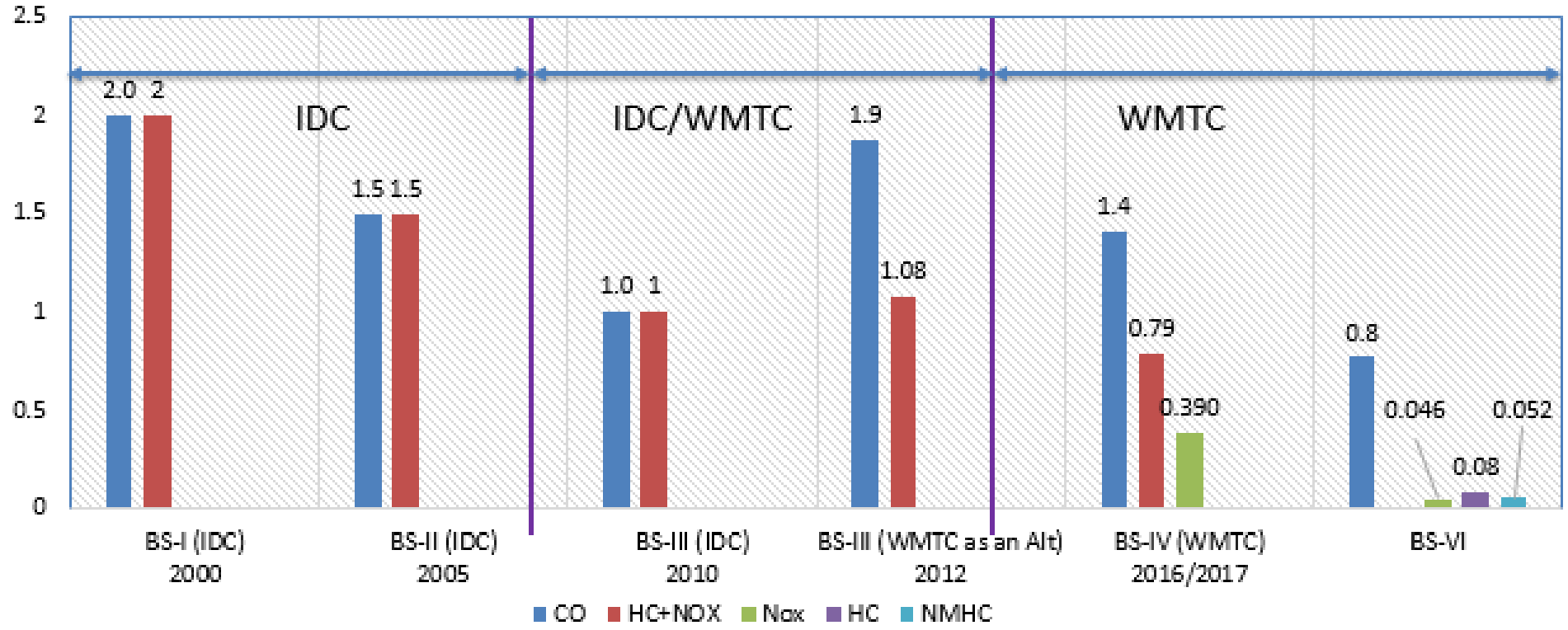
- EU has taken 37 years to reach EURO IV standards starting from year 1979.
- European 2 W are primarily used for leisure purposes and no specific focus of Fuel Economy.

Moving from BS-IV to BS-VI

- 88% Reduction in NOx
  - 0.39g/km → 0.046g/km
- 40% reduction in SHED test limit
  - 2g/test → 1.2g/test
- Introduction of OBD
  - In use performance ratio monitoring
  - Catcon Monitoring
  - Misfire Detection



India Emission Norm Progression



- Indian 2W emission norms have been progressively tightened every 5 yrs.
- Indian Emission norms are made to keep the high level of fuel efficiency till BS-IV hence…
- Till BS-IV, limits for combined HC + NOx was specified, for retaining superior FE.
- Indian 2 W are used mainly for commuting purposes and hence Fuel Economy is an important factor.

BS-VI (Package) Emission Norm GSR 889(E) dt 16th Sep 2016 (Gasoline)

	CO (mg/km)	HC (mg/km)	NMHC (mg/km)	NOx (mg/km)	PM* (mg/km)	Durability (km)	Evapo (mg/test)
Class1&2	1000	100	68	60	4.5	20,000	1500
Class 3	1000	100	68	60	4.5	35,000	1500
DF	1.3	1.3	1.3	1.3	1	---	300**

Vehicle should equipped with OBD .
*PM is applicable to gasoline DI engines.
** Additive DF

- Proposed date of implementation is 1st April 2020 for all models.
- OBD implemented in two stages.
  - OBD-I, 1st April 2020
  - OBD-II, 1st April 2023 with threshold limits

BS-VI (Package) OBD requirements for BS-VI

Monitoring Items	OBD Stage I (BS VI) 1st April, 2020	OBD Stage II (BS VI) 1stApril, 2023
Circuit continuity for all emission related power train component (if equipped)	√	√
Distance travelled since MIL(Malfunction indicator lamp) ON	√	√
Electrical disconnection of Electronic evaporative purge control device (if equipped and if active)	√	√
Catalytic converter monitoring	X	√
EGR system monitoring	√	√
Misfire detection	X	√
Oxygen sensor deterioration	X	√

OBD-II Threshold Limit				
	CO (mg/km)	NMHC (mg/km)	NOx (mg/km)	PM* (mg/km)
Class 1, 2 and 3	1900	250	300	50

EU-5 changes

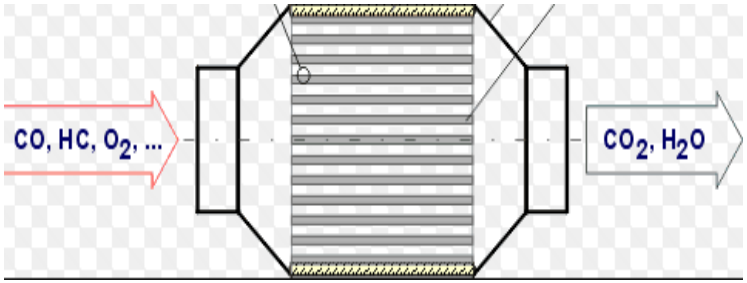
- BS-VI date of implementation is one year ahead of EU-5
- BS-VI is aligned with EU-5.
- EU-5 is under review and many changes are expected due to technological constraints.

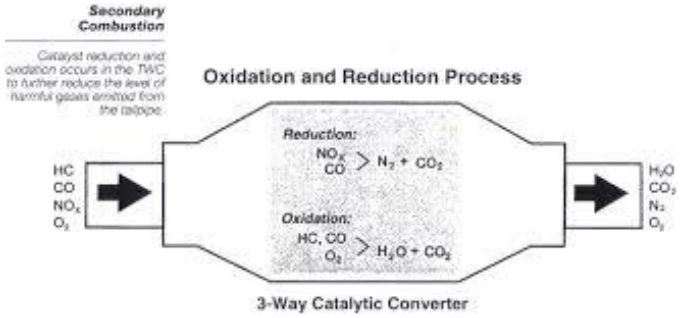
EU Change	Proposed New Dates (EU5)		EU-5 Finalization Date	BS-VI Notified Dates
	New Models	Existing Models		
Weighing Factor 50:50 changed to 30:70 for Class 1 & 2	2020	2021	Dec 2017	2020
Durability AMA cycle Retained for Class 1&2	2020	2021	Dec 2017	2020
Engine Mis-fire region	2020	2021	Dec 2017	2023
OBD Cat Con Monitoring	2024	2025	1st quarter 2019	2023
EU-5 Threshold (OBD-II)	2024	2025	1st quarter 2019	2023
Fixed DF deletion from	2025	2025	1st quarter 2019	--
IUPRM	2024	2024	1st quarter 2019	2023

Strategies and challenges for BS-VI

- Possible strategies
  - Moving from carburetor system to closed loop FI system

  - Moving from Two way to three way catalytic converter





  - Strict control on Evaporative emission

Conclusion (Challenges for BS-VI)

1. India is skipping BS-V and leapfrog from BS-IV to BS-VI
2. India is continuously upgrading emission norms after every 5 years while Europe has taken EU3->EU4 , 10 years and EU4->EU5 , 4yrs
3. EU5 has Phasing of New and All models by one year , BS-VI all models in 2020
4. BS-VI aligned with EU5 , which is still not final and based Euro Commission, it will be finalized Dec 2017 / Early 2019.
5. India is predominantly at Carbureted Engine with 2ways Cat ,where as EU has migrated to FI , hence India's challenge is much bigger.
6. OBD first time on 2Ws
7. Additional Control on NMHC.
8. Indian 2Ws Engines are lean burn hence most Fuel Efficient in the world , but with BS-VI will have major impact on FE as as NOx is very low , hence Engines have to be calibrated to Stoichiometric ratio.
9. BS-VI Gasoline Octane Number continues to be 91 (EU-6 Fuel 95 Octane), hence low hanging solution to recover Fuel Economy is not available.
10. Large Volume of 2Ws and all supply chain updation, needs dev time as readymade solution not available even in EU
11. Last BS-VI Fuel availability is ??

Thank you