

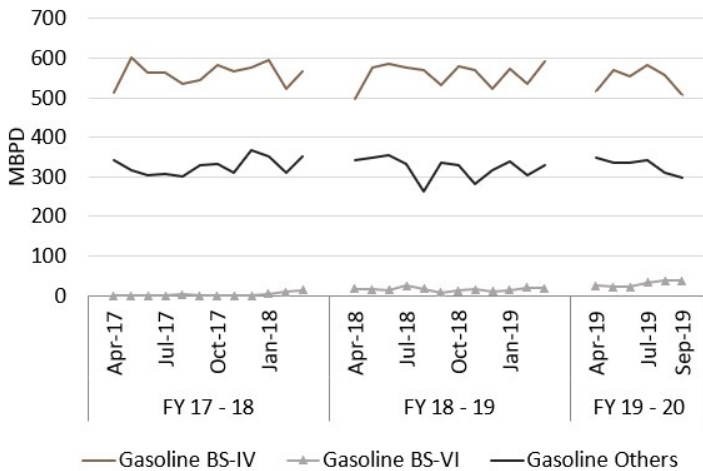
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Indian Refineries Preparedness for BS VI Fuel Implementation from 2020

Stratas Advisors

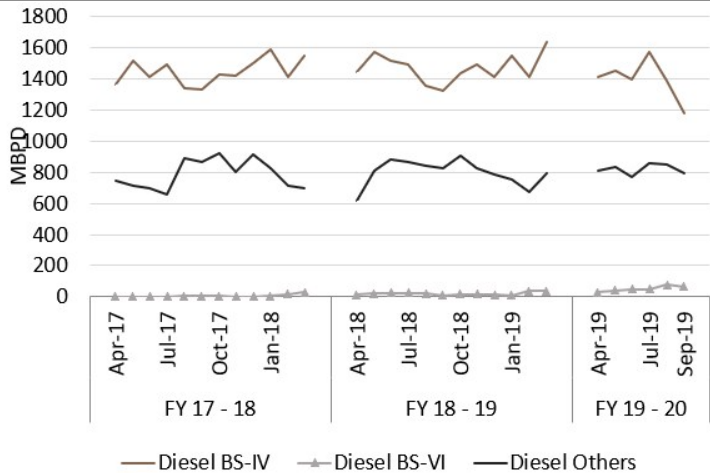
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The government of India has decided to implement BS VI transportation fuel by April 1, 2020. Indian refiners are required to produce BS VI fuel for sale in India by April 2020. Indian refiners are currently making configuration changes. However, BS VI fuel is being supplied in national capital regions. The following chart displays the production of different type of gasoline grade from Indian refineries.



Source: PPAC, Analysis Stratas Advisors
FY stands for Financial Year (Starts from April, Ends in March)

The following chart displays the production of different type of Diesel grade from Indian refineries.



Source: PPAC, Analysis Stratas Advisors
FY stands for Financial Year (Starts from April, Ends in March)

The information in the table below includes the characteristics and implementation dates of different fuel standards in India.

S. No.	Characteristics	Unit	BS II	BS III	BS IV	BS V	BS VI
	Implementation Date →		2001 (NCR, 3 Metro cities) 2005 (nationwide)	2005 (NCR, 13 major cities) 2010 (nationwide)	2010 (NCR, 13 major cities) Apr 2017 (nationwide)	(1)	Apr 2018 (NCT), Apr 2019 (NCR), Apr 2020 (nationwide)
Gasoline							
1	Density @ 15 °C	kg/m ³	710-770	720-775	720-775	(1)	Same as BS IV
2	RON, Min		88	91	91	(1)	91/95 ⁽²⁾
3	Sulphur, Total, Max	ppmw	500	150	50	(1)	10
4	Aromatics, Max	Vol %	-	42	35	(1)	35
5	Olefins, Max	Vol %	-	21/18 ⁽²⁾	21/18 ⁽²⁾	(1)	21/18 ⁽²⁾
Diesel							
1	Density @ 15 °C	kg/m ³	820-860	820-845	820-845	(1)	810-845
2	Sulphur, Total, Max	ppmw	500	350	50	(1)	10

Source: Stratas Advisors

Notes:

(1) Indian Central government mandated compulsory usage of BS-VI vehicles from April 1, 2020, skipping the BS-V regime to curtail the growing pollution from transportation vehicles.

(2) Regular/Premium Gasoline.

(3) NCT: National Capital Territory (Delhi), NCR: National Capital Region (17 Districts & Agra City)

(4) BS stands for Bharat stage emission standards (BSES); emission standards instituted by Government of India to regulate the output of air pollutants.

Effects of BS IV to BSVI fuel transition are as follows:

- Reduces air pollution.
- An opportunity for Indian refiners to export gasoline and diesel in the global market, where Euro 6 fuel is accepted. In 2018 -19, India exported 34% of gasoline of its production (109 million barrels export), and 25% of diesel (high speed diesel, 208 million barrels export).
- The addition of a new sulfur unit for this transition will open more sulfur production as a value-added product. As per

Stratas Advisors' Global Refining & Products, Refinery Sulfur Recovery Outlook In 2019, India's refinery sulfur recovery market is 12,980 TPD (tons per day).

- There will be a threat to the refining margin. A switch to upgraded fuel would make diesel US \$1.6-2 per barrel (Rs 0.7-0.9 paise a liter) more expensive, while gasoline will be US \$2.7–3.4 per barrel (Rs 1.2-1.5 a liter) costlier, which will help refiners recover investment costs in upgrading its refineries to produce the cleaner fuel. However, the final decision on a price increase will be subjected to the government's approval as a clean fuel duty or special cess.

The following table includes configurational changes in few Indian refineries for upgrading transportation fuel from BS IV to BS VI. Most of these projects will be complete between December 2019 and January 2020. IOCL refineries in Panipat and Mathura have started supplying BS VI grade petrol and diesel before the original target date, April 2020. The total investment for this transition in India is US \$4.3 billion.

State	Location	Company	Configurational Changes
Madhya Pradesh	Bina	Bharat Oman Refineries Ltd. (BPCL -76%, Oman Oil 24%)	1. Debottlenecking project for fuel upgradation
Maharashtra	Mumbai	Bharat Petroleum Co. Ltd.	1. New Gasoline Hydrotreater. 2. Replacement of catalyst in DHDS unit
Kerala	Ambalamugal / Kochi	Bharat Petroleum Corp. Ltd.	1. New NSU, NHT/CCR and ISOM units
Tamilnadu	Cauvery Basin/ Nagapattinam	Chennai Petroleum Corp. Ltd. (IOCL- 51.88%, (NIOC - 15.4%), Rest Public sharing)	1. Revamp and increase capacity of DHD from 34.2 to 45.6 MBPD 2. Addition new SRU unit 3. Addition of gasoline desulfurization unit
Andhra Pradesh	Visakhapatnam	Hindustan Petroleum Corp. Ltd.	1. Upgrade of the NHT downstream of the refinery's FCC
Maharashtra	Mumbai	Hindustan Petroleum Corp. Ltd.	1. New Hydrogen Generation Unit (HGU), 2. Revamping and capacity expansion of existing units, augmentation of Utilities, Offsite and other associated facilities.
Assam	Bongaigaon	Indian Oil Co. Ltd.	1. Addition of Diesel Upgradation unit licensed by EIL
Assam	Digboi	Indian Oil Co. Ltd.	1. Revamp of existing plant
Assam	Guwahati	Indian Oil Co. Ltd.	1. Revamp of existing plant 2. Revamp of hydrogen unit by Honeywell's Polybed PSA technology.
Bihar	Barauni	Indian Oil Co. Ltd.	1. Upgradation and capacity addition of diesel hydrotreating unit, naphtha splitting unit and Prime -G unit 2. Installation of three new units-Prime-G, Naphtha Hydro Treater/Continuous Catalytic Reactor Unit & Naphtha Splitter Unit
Gujarat	Koyali	Indian Oil Co. Ltd.	1. Addition of Diesel Upgradation unit licensed by EIL 2. New Hydrogen Unit (PSA) by Honeywell, Revamp of Hydrogen unit by Honeywell's Polybed PSA technology.
Odisha	Paradip	Indian Oil Co. Ltd.	1. Revamp of Diesel Hydrotreating Unit. 2. Addition of Hydrogen Generation unit, Kerosene hydro desulfurization unit, 3. Addition of refinery off gas pressure swing adsorption unit
West Bengal	Haldia	Indian Oil Co. Ltd.	1. Addition of Diesel Upgradation unit licensed by EIL 2. Distillate yield improvement project of Coker 3. Revamp of Hydrogen unit by Honeywell's Polybed PSA technology.
Haryana	Panipat	Indian Oil Co. Ltd.	1. Revamp of existing plant 2. New Hydrogen Unit (PSA) by Honeywell
Uttar Pradesh	Mathura	Indian Oil Co. Ltd.	1. Revamp of Prime G unit (gasoline de-sulfurization) 2. New Hydrogen Unit (PSA) by Honeywell
Karnataka	Mangalore	Mangalore Refinery & Petrochemicals Ltd.	1. Switched to newer grade fuel, started flushing out BS IV grade fuel in 25 tanks
Assam	Numaligarh	Numaligarh Refinery Ltd. (BPCL - 61.65%, Government of Assam- 12.35%, Oil India Limited- 26%.)	1. Installing a new DHT 2. Minor debottlenecking of existing MS block

Source: Stratas Advisors

Abbreviations:

DHDS Diesel Hydro De-sulphurisation

SRU Sulphur Recovery Unit

NSU Naphtha Splitter Unit

NHT/NHDT Naphtha Hydrotreater

DHDT/DHT Diesel Hydrotreater

MS Motor Spirit

HGU Hydrogen Generation Unit

CCR Continuous Catalytic Regeneration

ISOM Isomerisation Unit