

## Empirical Study of Consumption Pattern of Petrol and Diesel According to Regions in India

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### Abstract

The amount of petroleum products India consumes yearly makes it one of the world's top users. Petrol and diesel are the two principal fuel types utilised as transportation fuels in India. The use of these fuels in India is affected by various factors, including economic growth, the number of vehicles on the road, fuel prices, and policies of the Indian government and the evolving energy and public transportation infrastructure. According to the data that was available in 2021, India's consumption of petrol and diesel fuel has been climbing at a consistent rate over the course of the past several years. During FY 2020-21, the consumption of petrol and diesel in India was **27.6** million metric tonnes and **82.3** million metric tonnes respectively. It is important to note that the end use consumption patterns also change as the energy infrastructure system evolves in the country. For the most recent and accurate information on petrol and diesel consumption in India, It would recommend referring to the latest reports from reliable sources such as the Ministry of Petroleum and Natural Gas, the Petroleum Planning and Analysis Cell (PPAC). The present research aims to the consumption of petrol and diesel in five different regions of India. The researcher also attempted to study the relationship between the region's population and the region's petrol and diesel consumption. Secondary data is obtained from the authenticated sources, and SPSS software is used for the analysis of data.

**Keywords:** *Consumption of Petrol, Consumption of diesel, Region, Population*

### Introduction

#### ***Fuel Transportation to meet regional demand:***

Petrol and diesel are the major fuels, which are used in India and mainly used as transportation fuels. Both Petrol and Diels contributes to about 54% of petroleum product consumption in the country. While Petrol is almost 100% used as a transportation fuel (used in Internal combustion engines) , ~ 93% of the diesel consumption in the country is as transportation fuel.

Diesel and Petrol are produced in refineries and transported to regions for further distribution to end consumers. The primary distribution is to major Terminals and depots, which is called primary distribution. During primary distribution of Diesel and Petrol, the products moves in bulk and gets stored in various regions/hinterlands. The mode of transportation during primary and secondary distribution depends on distance, volume of fuel to be transported, infrastructure availability and logistics efficiencies. Some of the key aspects in this regards are :i) Distance: Longer distances require more energy for transportation. ii) Mode of transportation: Energy consumption during primary and secondary distribution of petroleum products depends on mode of transportation. To put in perspective, trucks, trains,

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ships, and pipelines all use energy differently. For long-distance transport, pipelines are more fuel-efficient than vehicles, but trucks are more adaptable for last-mile delivery. iii) Vehicle Efficiency: Fuel usage depends on vehicle fuel efficiency. Advanced engine technologies and alternative fuels cut energy usage in automobiles. iv) Infrastructure: Roads, rail wagons and water transport systems affect the energy consumption while distributing petroleum products. Due to congestion, diversions, and inefficiency, poor infrastructure may increase the energy usage. v) Logistics Management: Routing, optimization of loads and scheduling both primary and secondary distribution affects the energy consumption. Optimizing transportation routes and eliminating empty trips can save energy. Transporting fuels from their production or importation to retail outlets, industrial facilities or residential areas requires energy and resources.

### ***Regional Consumption of Petrol***

The amount of petrol consumed in each region also varies depending on various factors. Consumption patterns can differ considerably from country to country, state to state, and city to city. This research provides an overview of the elements influencing petrol consumption in a certain region. i) Population Density: Locations with more people per square mile typically have a greater need for transportation, resulting in a greater demand for petrol. ii) The development of the economy: Developed countries often have more automobiles and a greater reliance on personal mobility, which results in higher petrol consumption. On the other hand, less developed areas might have lower petrol consumption since fewer people live there and use their cars less frequently. iii) Infrastructure and Public Transportation: Regions with well-developed public transportation systems tend to have lower per capita petrol consumption. People in these regions rely more on public transit to commute, such as buses, trains, or subways. iv) Urban and rural area: The use of petrol in urban areas is often higher than in rural areas because of the greater number of business operations, the lengthier commutes, and the increased traffic congestion. Consumption is typically lower in rural areas because there are fewer automobiles and shorter distances to travel. v) Pricing and Policy of the Government policies: Policies of government such as taxes and subsidies on gasoline, can affect the amount of petrol consumed in a certain location. When fuel prices are higher, consumers are more likely to reduce their usage, while increasing subsidies may encourage more consumption. vi) Factors Related to Culture and Behavior: Individual cultural preferences and attitudes towards various modes of transportation might affect the amount of petrol used in a particular region. For instance, areas with a greater cultural focus on private automobiles tend to have a higher consumption rate than areas with a greater emphasis on public transport or cycling. It is essential to remember that these elements interact in various intricate ways and that consumption patterns vary considerably even within the same nation or state. It is recommended that people visit their local energy or transportation authorities, statistics agencies, or research studies relevant to their region to receive reliable and up-to-date information regarding the regional use of petrol in a particular location.

### ***Regional Consumption of Diesel***

In a manner analogous to petrol consumption, diesel consumption in a particular location might fluctuate for several reasons. The following is a list of elements that have the potential to influence diesel consumption in a region: i) Economic Activity: Regions with high levels of industrial and commercial activity, such as manufacturing hubs or logistics centers, tend to have higher diesel consumption due to the usage of diesel-powered machinery, vehicles, and generators. This is because diesel fuel is more affordable than petrol. ii) The Transportation Industry: Heavy-duty vehicles, including trucks, buses, and trains, typically use diesel as their primary fuel source. Diesel consumption is likely to be higher in areas that contain either a

sizable transportation industry or extensive shipping and logistics operations on a large scale. The Agricultural Sector Diesel is utilized extensively in the agricultural sector for various equipment, including tractors, harvesters, and irrigation pumps. Diesel consumption may be higher in areas with a high concentration of agricultural operations, such as farming or animal production. iii) Power Generation: Diesel generators are frequently utilized in areas with restricted access to electrical power and during high electricity demand. Diesel generators might be necessary for places with unreliable power grids or distant areas not connected to the grid. This would lead to an increase in energy usage. iv) Construction and Mining: Areas that experience major construction or mining activity frequently use diesel-powered machinery and equipment, increasing fuel consumption. v) The Policies and Regulations of the Government: Government policies, such as tax incentives or regulations supporting diesel vehicles or alternative fuels, can affect the amount of diesel consumed in a particular location. For instance, areas that encourage diesel-powered automobiles by policy may have a greater consumption rate compared to those that encourage electric vehicles through policy. vi) Energy Mix: The quantity and price of other energy sources, such as natural gas or electricity, might affect the amount of diesel consumed in a particular location. There is a possibility that areas with an abundance of alternatives to diesel that are also reasonably priced have lower use. It is recommended to consult energy or transportation authorities, statistics agencies, or research studies specific to a region to receive accurate and up-to-date information regarding the regional use of diesel in that area. These sources can provide specific statistics on diesel consumption patterns, usage on a sector-by-sector basis, and any regional characteristics that influence consumption patterns.

## **Review of Literature**

Abhijit Phukon and Mitali Konwar (2019) have undertaken an empirical Investigation of the Causal Relationship amongst Energy Consumption, Net Fixed Capital Stock and Economic Growth in India. The study suggests that energy consumption and economic growth are bidirectional and net fixed capital stocks are unidirectional. The analysis found that India pays a significant oil import cost each year since it is a net energy importer, notably petroleum. Thus, utilizing oil more effectively and replacing petroleum and gas with coal and electricity wherever possible may be a beneficial idea.

Musa Manneh, Mikhail Kozhevnikov & Tatyana Chazova (2020) studied the determinants of consumer preference for petrol consumption. The study points that Petrol stations should adopt and implement strategic outlet placements as well as promotional activities aimed at ensuring business superior product quality delivery and image or brand building. This will assist to promote client loyalty while decreasing consumer switching behaviour.

H. Christopher Frey et al. (2007), The VSP technique, which combines speed, acceleration, and road grade into a single measure, can explain much fuel consumption variability. AATA buses in the US and Porto diesel buses in Portugal had identical VSP-based modal average fuel consumption. Diesel buses have greater fuel consumption variability than hydrogen fuel cell buses. As technology improves, fuel cell buses must be characterized. The VSP modal technique yielded trip fuel consumption estimates within 10%. If available, passenger load stratification can improve the modal strategy. The VSP-based modal method characterizes bus trips and fuel usage. This method should be tested on more vehicles and fuel and propulsion systems. The VSP-based approach can also assess how driving patterns affect

total fuel consumption, which could aid policy analyses to improve real-world fuel efficiency and air quality. More bus data is needed to confirm these conclusions.

Sunarya et al. (2021), This experiment examined gasoline physicochemical properties and diesel engine performance from zero to full load in seven categories. Waste plastic oil has higher caloric and cetane numbers than diesel fuel and identical physiochemical properties. WPO-diesel fuel ratios typically boost engine power and torque by 5% and 3%. WPO cuts BSFC by 15% at full load, but diesel is cheaper. Engine load increases thermal brake efficiency, and WPO has higher thermal efficiency at full load than diesel fuel at zero loads. WPO can be used as a diesel engine fuel substitute with other processes and additive research.

Robert "Bobby" Grisso et al. (2004), This article will discuss three different approaches to estimating the fuel a tractor uses. When estimated fuel consumption is compared to measured fuel consumption, it is discovered that the fuel consumption estimated by employing the "specific" model agrees with the observed fuel consumption the most. This model can predict the amount of fuel consumed by the tractor, whether it is loaded to its maximum capacity or a partial capacity, and when the engine speed is decreased from its maximum.

### ***Research Methodology***

This research is based on secondary data. In this research consumption of petrol and diesel in different regions of India is studied. These regions are North, North-East, East, West, and South. The classification of states according to cities is as follows.

#### ***North region***

Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Ladakh, Punjab, Rajasthan, Uttar Pradesh and Uttarakhand

#### ***North-East region***

Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim, Tripura and Mizoram.

#### ***East region***

Andaman & Nicobar, Bihar, Jharkhand, Odisha and West Bengal.

#### ***West region***

Chhattisgarh, Maharashtra, Goa, Gujrat, Madhya Pradesh, Dadra & Nagar haveli and Daman & Diu.

#### ***South region***

Andhra Pradesh, Karnataka, Kerala, Lakshadweep, Puducherry, Tamil Nadu and Telangana.

The source of the information of consumption is from the website of Petroleum Planning & Analysis Cell. The data for consumption is obtained for April 2008 to March 2022. The source of the information of population is from the India census report. The estimated population for year 2023 is considered for the study. The analysis of the data is done using Excel and IBM SPSS software. To study the relationship between Average petrol consumption and population of regions Pearson's correlation test is used. To study the relationship between Average diesel consumption and population of regions Pearson's correlation test is used.

## Objective 1

*To study the relationship between the average petrol consumption and population of India according to region.*

**Table:** Average petrol consumption in (‘000 Metric Tonnes) of different regions of India for past 5 years.

Region	Petrol Consumption in (‘000 Metric Tonnes) in various Regions					Average petrol consumption (‘000 Metric Tonnes)	Population 2023 (estimated)
	Y2018-19	Y2019-20	Y2020-21	Y2021-22	Y2022-23		
North	8361.9	8837.6	8231.3	9194.3	10336.2	8992.26	42,51,10,390
Nort-East	751.5	814.1	753.2	872.3	1068.3	851.88	5,31,44,769
East	2978.1	3227.9	3155.2	3457.3	3897.6	3343.22	31,69,95,629
West	7492.1	7830.6	7115.1	7930.9	8910.6	7855.86	31,44,81,363
South	8700.8	9265.2	8705.4	9394.1	10763.3	9365.76	31,95,68,248

**Source:** Petrol consumption: Website of Petroleum Planning & Analysis Cell.

**Population: India census report.**

The above table indicates the Average petrol consumption in (‘000 Metric Tonnes) and population of India according to the region for the past 5 years.

The above table shows that Average petrol consumption is highest in the south region of India. The second highest average petrol consumption is in the north region of India. The least average petrol consumption is in the North-East region of India. It also indicates that population is largest in the North region of India. The second largest population is in the South region of India. The North-East region of India has the least population.

**Null hypothesis H<sub>01</sub>:** There is no impact of population on the average petrol consumption of India according to region.

**Alternate hypothesis H<sub>11</sub>:** There is an impact of population on the average petrol consumption of India according to region.

To study the above null hypothesis Pearson’s correlation test is applied and the results are as follows.

Correlations			
		Average petrol consumption	population
Average petrol consumption	Pearson Correlation	1	.812
	p-value		.095
	N	5	5
population	Pearson Correlation	.812	1
	p-value	.095	
	N	5	5

### Interpretation

The above result indicates Pearson correlation value is 0.812. The p-value is 0.095. It is greater than the standard p-value of 0.05. Therefore, correlation test is accepted. Hence null hypothesis is accepted.

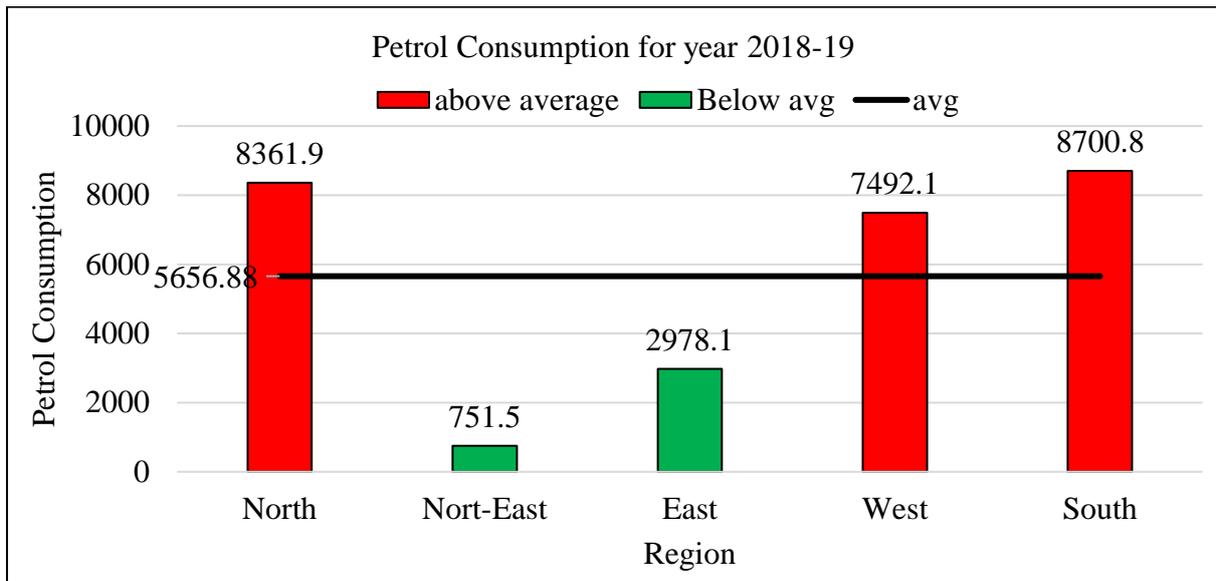
**Conclusion**

There is no impact of population on the average petrol consumption of India according to region.

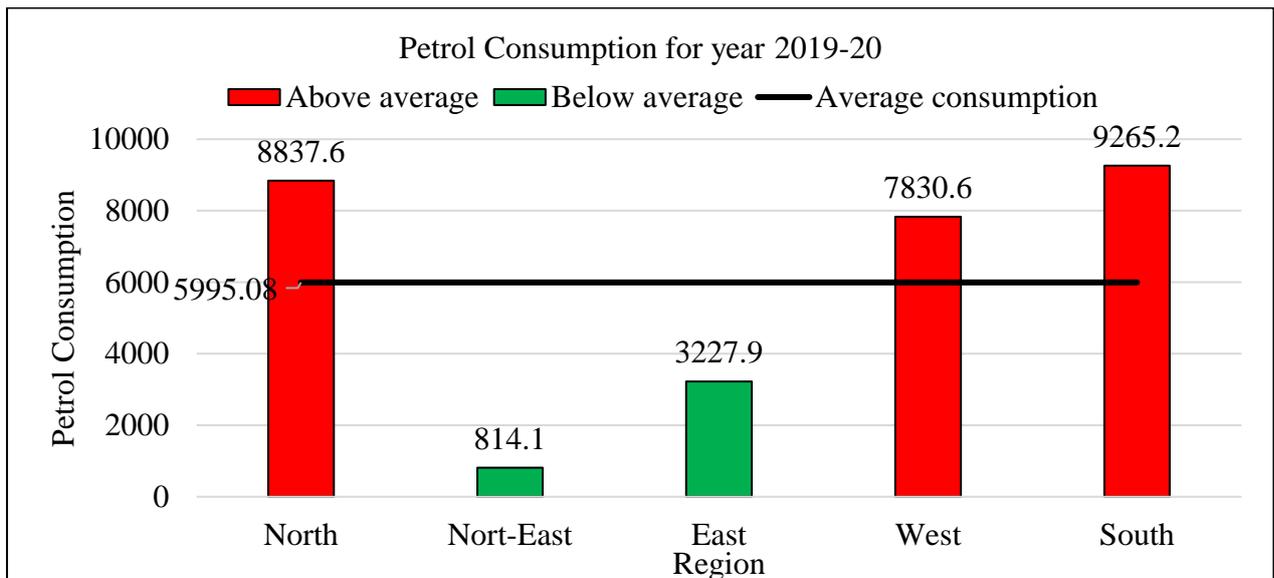
**Findings**

The above result indicates that population has no impact on the average petrol consumption for different regions of the India. That means change in population does not have any impact on the average petrol consumption for different regions of the India.

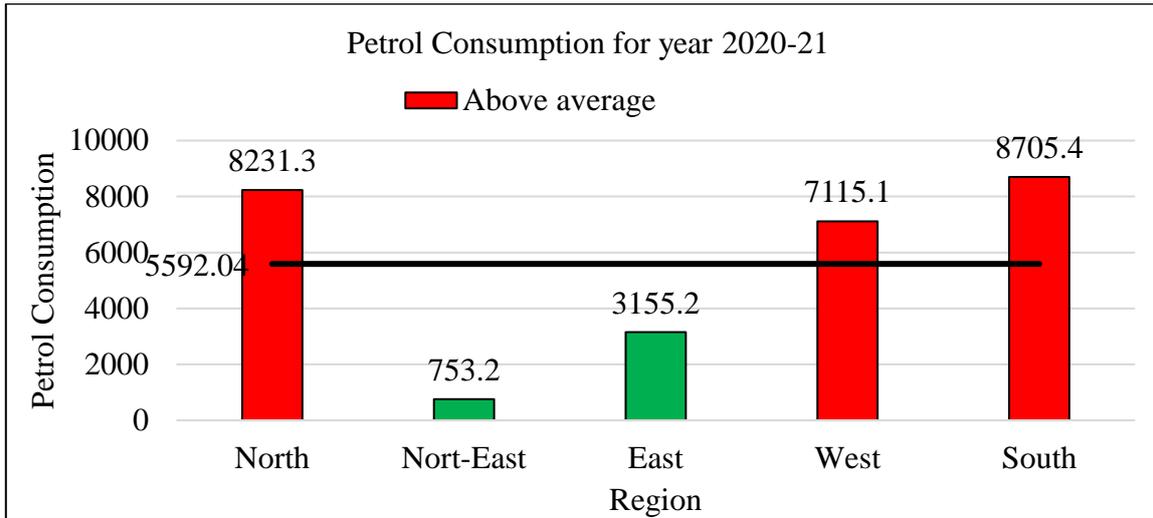
The petrol consumption in (^000 Metric Tonnes) for year 2018-19 is represented in the form of bar diagram shown below.



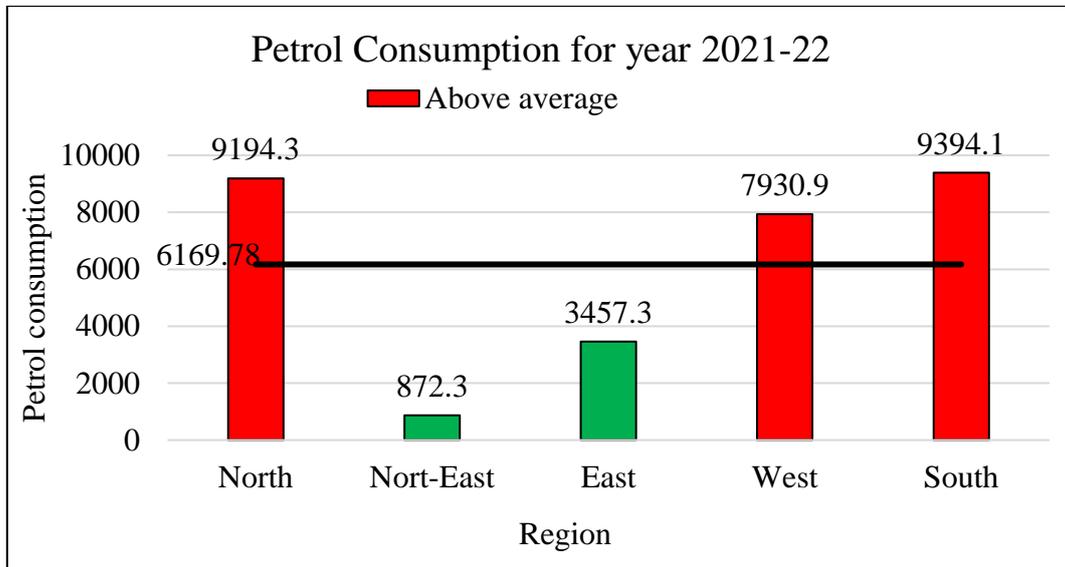
The petrol consumption in (^000 Metric Tonnes) for year 2019-20 is represented in the form of bar diagram shown below.



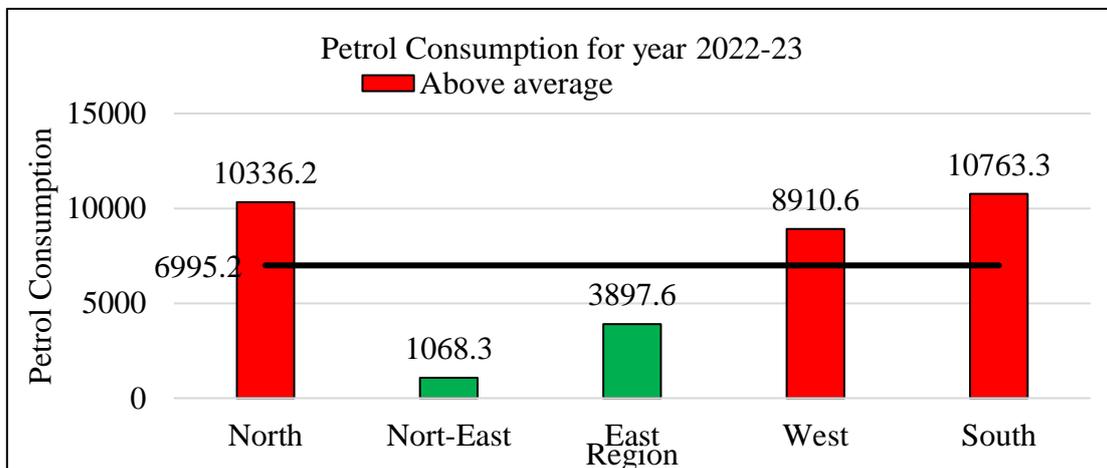
The petrol consumption in (^000 Metric Tonnes) for year 2020-21 is represented in the form of bar diagram shown below.



The petrol consumption in (‘000 Metric Tonnes) for year 2021-22 is represented in the form of bar diagram shown below.



The petrol consumption in (‘000 Metric Tonnes) for year 2022-23 is represented in the form of bar diagram shown below.



## Objective 2

*To study the relationship between the average diesel consumption and population of India according to region.*

**Table:** Average diesel consumption in (‘000 Metric Tonnes) of different regions of India for past 5 years.

Region	Diesel Consumption in (‘000 Metric Tonnes) in various Regions					Average diesel consumption (‘000 Metric Tonnes)	Population 2023 (estimated)
	2018-19	2019-20	2020-21	2021-22	2022-23		
<b>North</b>	26276.3	25812.4	23423	24522.7	25960	25198.88	42,51,10,390
<b>Nort-East</b>	1915.5	1989.6	1775.7	2118.1	2504	2060.58	5,31,44,769
<b>East</b>	10554.4	10592.8	9553	9413.6	10742	10171.16	31,69,95,629
<b>West</b>	20824.9	20979.2	18492.8	19585.7	22539.9	20484.5	31,44,81,363
<b>South</b>	23863.5	23111.4	19389.7	20980.1	24085.4	22286.02	31,95,68,248

**Source:** Diesel consumption: Website of Petroleum Planning & Analysis Cell.

**Population: India census report.**

The above table indicates the Average diesel consumption in (‘000 Metric Tonnes) and population of India according to region for past 5 years.

The above table shows that Average diesel consumption is highest in the North region of India. The second highest average diesel consumption is in the South region of India. The least average diesel consumption is in the North-East region of India.

It also indicates that population is largest in the North region of India. The second largest population is in the South region of India. The North-East region of India has the least population.

**Null hypothesis H<sub>02</sub>:** There is no impact of population on the average diesel consumption of India according to region.

**Alternate hypothesis H<sub>12</sub>:** There is an impact of population on the average diesel consumption of India according to region.

To study the above null hypothesis Pearson’s correlation test is applied and the results are as follows.

Correlations			
		population	Average petrol consumption
population	Pearson Correlation	1	.878
	p-value		.050
	N	5	5
Average petrol consumption	Pearson Correlation	.878	1
	p-value	.050	
	N	5	5

**Interpretation**

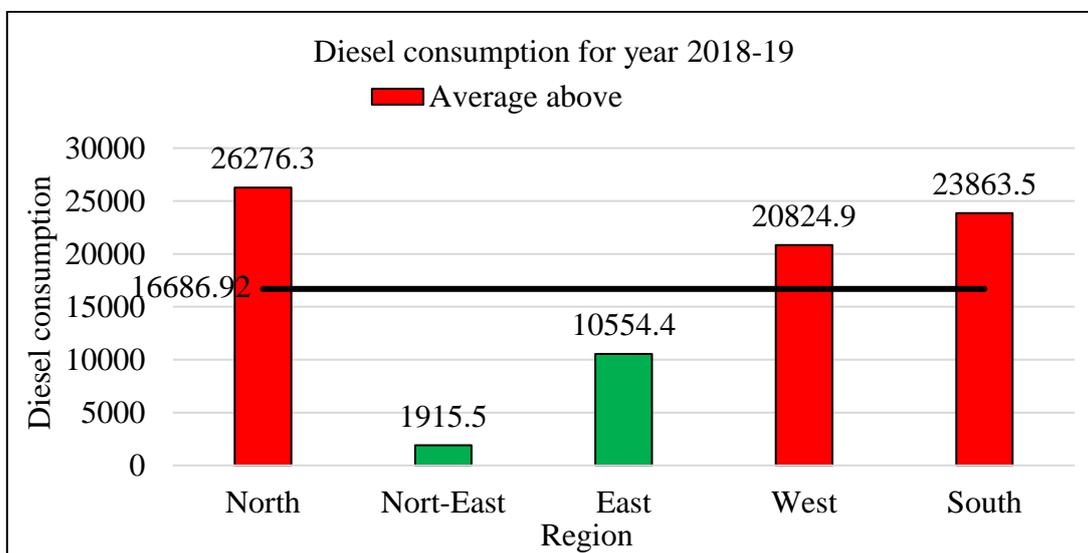
The above result indicates Pearson correlation value is 0.878. The p-value is 0.050. It is equal to the standard p-value of 0.05. Therefore, the correlation test is rejected. Hence null hypothesis is rejected.

**Conclusion**

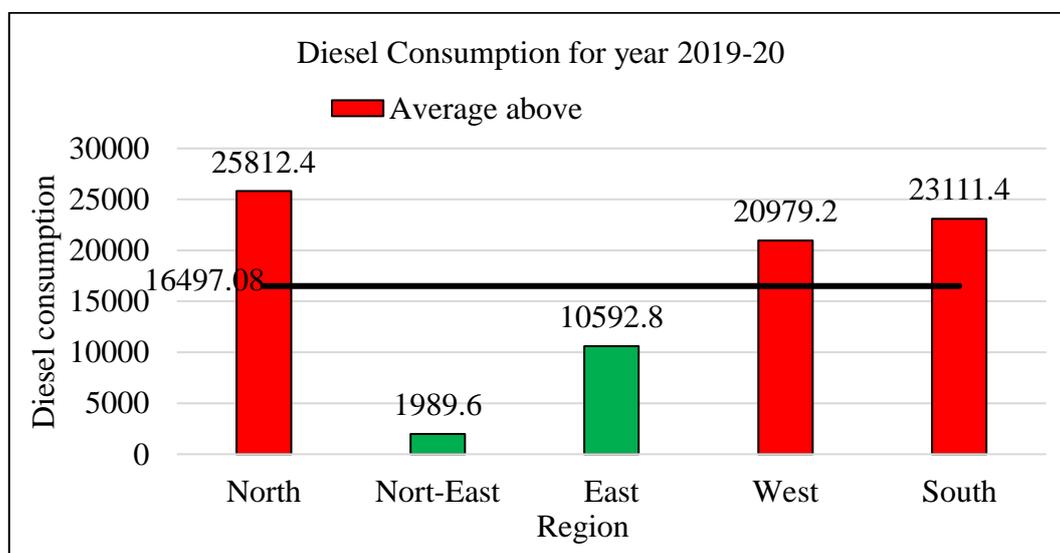
There is an impact of population on the average diesel consumption of India according to region.

**Findings**

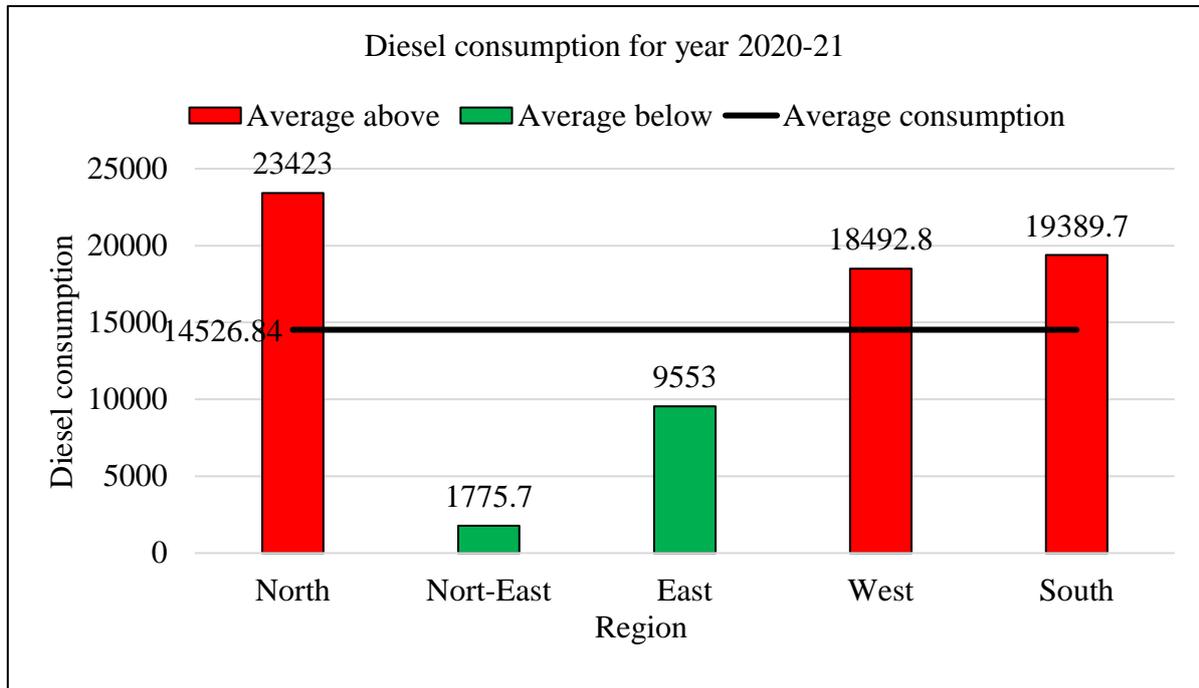
The above result indicates that population has a significant positive impact on the average diesel consumption for different regions of the India. That means increase in population will result in the increase of the average diesel consumption for different regions of India. The diesel consumption in (000 Metric Tonnes) for the year 2018-19 is represented in the form of a bar diagram shown below.



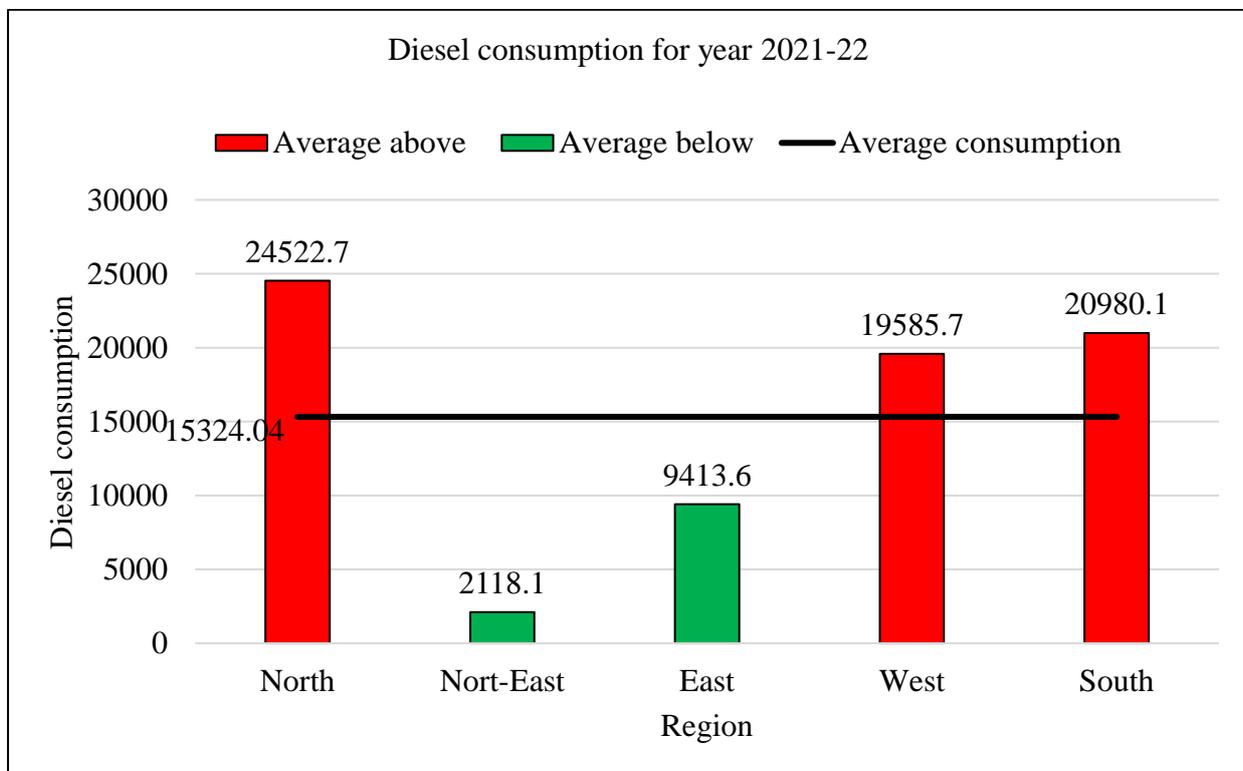
The diesel consumption in (000 Metric Tonnes) for year 2019-20 is represented in the form of bar diagram shown below.



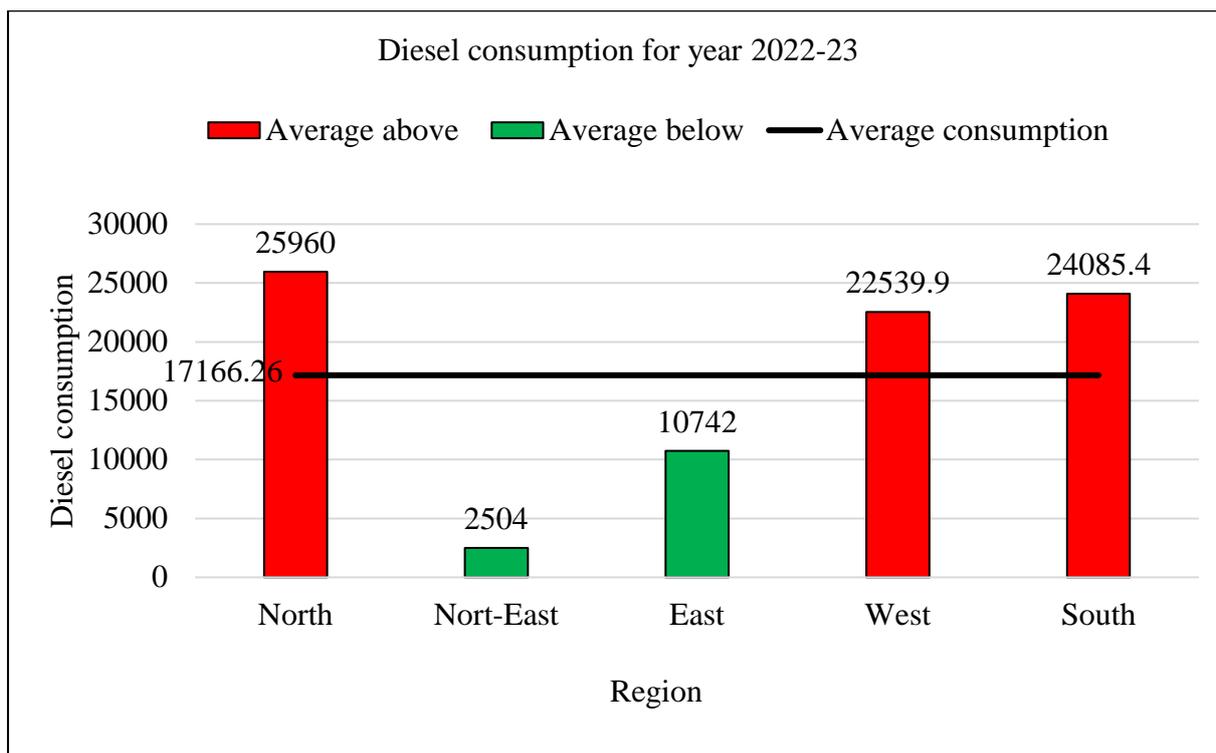
The diesel consumption in (‘000 Metric Tonnes) for year 2020-21 is represented in the form of bar diagram shown below.



The diesel consumption in (‘000 Metric Tonnes) for year 2021-22 is represented in the form of bar diagram shown below.



The diesel consumption in (‘000 Metric Tonnes) for year 2022-23 is represented in the form of bar diagram shown below.



## Findings and Conclusion

The comprehensive study of diesel consumption revealed that diesel consumption is highest in the south region, immediately followed by the north region. The least consumption is in the north-east region. The study of the relationship between diesel consumption and the region's population indicates a positive relationship. Statistically, it is not significant. Still, the larger the region's population is, the higher the diesel consumption. Findings for petrol consumption indicate that it is highest in the north region, immediately followed by the south region. Petrol consumption is least in the north-east region. To study the relationship between the population of a region and petrol consumption, Pearson's correlation is applied. Results indicate there is positive correlation.

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