

CHANGING PATTERN OF TRADE OF CRUDE OIL AND PETROLEUM PRODUCTS IN INDIA

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Abstract

The paper discussed the pattern of crude oil and petroleum products trades in India. It has found that offshore fields are contributing a significant portion in crude oil production in India. The gap between production and imports of crude oil has increased continuously since 1987-88. Majority of production of crude oil is arising from Western Offshore and Western Onland, Assam & Assam Arakan basin, Cauvery basin, Krishna Godavari basin, and Krishna-Godavari Offshore basin. Import bill of oil and gas has increased more than two times in the last five years. Import of petroleum products was increased during 2017-18 to 2022-23, but export of such products was reduced during the period. Gross turnover by Central Public-sector Enterprises is increasing continuously, but decreased during 2019-2021 for the corona pandemic. FDI in petroleum and natural gas sectors was increased continuously but declined later due to the corona pandemic. Demand for crude oil in India is always higher than the self-production. Cost of petroleum products imported is increasing continuously. During the Russia-Ukraine conflict, imports of crude oil were suddenly increased from Russia. Russia remains the top seller of oil in India during the war period. India is the third largest energy consumer. Therefore, the government should take major initiatives for increasing crude oil and petroleum products in India that will reduce its dependents on imports.

Keywords: Business, Crude Oil, Export, Import, Petroleum Products, and Trade.

INTRODUCTION

Crude oil is a vital source of energy in the 21st century. Its importance has been increasing since the middle of 1950. It is a blooming industry which employs millions of workers (Rahiman & Kodikal, 2019). It is an indispensable raw material for many industries e.g. aspirin, wind turbines, cardiac valves, furniture, cosmetics, computers, smartphones, fertilizers, varnishes, paints etc. (Wani et. al., 2015). Crude oil and its refined products are used in multiple industries, such as manufacturing, transportation, and chemical processing. and more (Punati & Raghavender, 2017). Oil is a raw material for production of chemical products, e.g. plastics, Polyethylene, Transparent polycarbonate etc. Oil and petroleum products industry is a multi-trillion-dollar industry (Sharma, 2018). Crude oil prices depend on the pattern of the oil, e.g. light crude oil or heavier crude oil. Light crude oil has more demand in the market. Heavier and denser crude oil is referred to as bitumen. Sulphur content in oil determines its quality (Dalei et. al., 2017).

Energy production are generally classified as renewable energy (e.g. tidal, wave, wind, solar, hydropower, geothermal, biomass), nuclear energy (e.g. uranium), and Fossil energy (e.g. natural gas, crude oil, coal etc.). Energy supplies can be classified as raw energy resources and refined forms of energy (Kumar & Anand, 2023). The United States, Russia, Saudi Arabia, and Canada are the leading global crude oil producing countries. The Iran, United States, Russia, and Canada are the key natural gas producing countries (Mehta, 2019). Environmental pollution and greenhouse gas emissions are the key difficulties with energy consumption and production. There is association between GDP per capita and energy consumption per capita

OBJECTIVES

The general objective of this article is to study the changing pattern of trade of crude oil and petroleum products in India. The specific objectives of this paper are:

- (a) To study the production of crude oil and natural gas in India.
- (b) To examine the production and imports of crude oil and petroleum products in India.
- (c) To clarify the volume and value of import /export of crude oil and petroleum products in India.
- (d) To observe the foreign direct investment in the petroleum and natural gas sector in India.
- (e) To study the relation between foreign direct investment in petroleum and natural gas sector and all sectors in India, and
- (f) To study the relation between total energy consumption and gross domestic product of India.

METHODOLOGY

The Study Area

India is the largest and most populous country in South Asia. It got Independence from the United Kingdom on 15th August 1947. India has an international border with Pakistan, China, Nepal, Bhutan, Bangladesh and Myanmar. Maldives and Sri Lanka are the neighbouring island countries of India in the Indian Ocean. Hindi and English are the official languages. The nation has 3,287,263 km² geographical land and 1.21 billion populations according to census 2011. New Delhi is the capital and Mumbai is the largest city. Hinduism is the largest religion followed by Islam and Christianity. It is a federal union structure with eight union territories and 28 states. India is the third-largest economy by purchasing power parity.

Hypothesis

Considering the objectives, we can reshape the hypothesis as-

H₀₁: There is no relation between foreign direct investment in the petroleum and natural gas sector and all sectors in India.

H_{1a}: There is a relation between foreign direct investment in the petroleum and natural gas sector and all sectors in India.

H₀₂: There is no relation between total energy consumption and gross domestic product of India

H_{1b}: There is a relation between total energy consumption and gross domestic product of India.

Designs and Approach

This study is descriptive in design and has utilized qualitative and quantitative approaches. Secondary data for the study has been collected from the website of the Ministry of Petroleum and Natural Gas, Government of India, report of international agencies, and research papers. To reveal the trade of crude oil and petroleum products in India in general and export/import perspectives in particular, descriptive analysis, content text analysis, and regression analysis have been performed.

Method of Analysis

There are two variables in simple regression study between foreign direct investment in the petroleum and natural gas sector and foreign direct investment in all sectors in India. Foreign direct investment in all sectors is the dependent variable and foreign direct investment in the petroleum and natural gas sector is the independent variable. Regression analysis is calculated on information of gross foreign direct investment during 2017-2023. There are also two variables in regression study between total energy consumption and gross domestic product of India. Gross domestic product is the dependent variable and total energy consumption is the independent variable. Regression analysis is calculated on information of gross domestic product and total energy consumption in India during 2010-2023.

RESULTS AND DISCUSSION

There are significant crude oil reserves and production in several areas in India, including western offshore, Brahmaputra Valley, Rajasthan, Gujarat, Mumbai High, Gujarat Coast, Bilaspur (UP), Jawalamukhi (Punjab), Godavari and Krishna river basins. Globally, India is the 3rd largest crude oil and energy consumer. ONGC is the leading oil and natural gas producer in India. Mumbai Offshore basin is situated between Saurashtra basin in NNW and Kerala Konkan in the south. Rajasthan has four petroliferous basins which cover over 14 districts. Mangala Area in the Barmer Basin is a key oil field in the state. Mangala area has three largest fields, namely Aishwariya, Bhagyam, and Mangala. Navgaon, Kalol, Koyali, Ankleshwar, Lunej, Dholka, Mehsana, and Kosamber are the key oilfields in Gujarat.

Table 1: State-wise Crude Oil Production including Condensate in India

State/Area	2017	2018	2019	2000	2021	2022
Offshore	18369	17163	16111	15625	14699	14544
Rajasthan	7876	7832	7024	5859	5964	5335
Andhra Pradesh	322	299	252	206	198	231
Gujarat	4597	4622	4676	4668	4646	4783
Assam	4341	4353	4113	3951	3949	4113
West Bengal	-	-	-	-	0.10	0.01
Tamil Nadu	341	375	415	413	383	335
Arunachal Pradesh	52	43	52	55	50	46
Tripura	-	-	-	-	2	3
TOTAL	35898	34687	32642	30777	29891	29388

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 29. Note: Production in Million Metric Tonnes (MMT).

Table 1 discussed about crude oil production, including condensate, in different states of India. It shows that Rajasthan, Gujarat, and Assam are leading in crude oil production. Other states like Tamil Nadu, Andhra Pradesh, Arunachal Pradesh, Tripura, and

West Bengal also contribute to the production. In 2017, Rajasthan produced 7876 TMT of crude oil, which dropped to 7024 TMT in 2019 and further to 5335 TMT in 2022. Gujarat's production was 4597 TMT in 2017, increased slightly to 4676 TMT in 2019, and then rose to 4783 TMT in 2022. Assam produced 4341 TMT in 2017, which fell to 4113 TMT in 2019 and remained the same in 2022. Crude oil is also being produced from offshore fields, which play an important role. The total crude oil production in India has been going down steadily since 2017.

Table 2: State-wise Natural Gas Production in India

State	2017	2018	2019	2000	2021	2022
Assam	3219	3263	3239	2979	3251	3536
Rajasthan	1373	1472	1721	2007	2633	2304
Tripura	1455	1507	1584	1520	1529	1653
Tamil Nadu	1163	1213	1121	968	1011	1117
Gujarat	1669	1424	1356	1184	1051	951
Andhra Pradesh	921	1090	950	847	818	739
Madhya Pradesh	126	345	344	344	300	270
Arunachal Pradesh	28	31	37	55	57	56
Jharkhand	4	3	5	2	3	8
West Bengal	554	380	312	302	380	399
Offshore	22186	21883	21373	18286	22184	23186
TOTAL	32699	32612	32043	28493	33218	34218

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 32. Note: Production in Billion cubic meters (BCM). Table 2 shows the natural gas production by state in India. It was found that Assam, Rajasthan, Tripura, and Tamil Nadu are the main states producing natural gas in the country. Other states that contribute to natural gas production include Gujarat, Andhra Pradesh, Madhya Pradesh, Arunachal Pradesh, Jharkhand, and West Bengal. In Assam, the total production of natural gas was 3219 BCM in 2017, 3239 BCM in 2019, and 3536 BCM in 2022. Rajasthan produced 1373 BCM in 2017, 1721 BCM in 2019, and 2304 BCM in 2022. Tripura's production was 1455 BCM in 2017, 1584 BCM in 2019, and 1653 BCM in 2022. Offshore fields also play a major role in the country's natural gas production. Over the past six years, the production of natural gas in India has seen a slight increase.

Table 3: Imports and Output of Crude Oil and Petroleum Products in India

Year	Output*		Imports*	
	Crude oil	POL products	Crude oil	POL products
1987-88	32	45	18	6
1992-93	27	50	30	12
1997-98	34	65	34	23
2002-03	33	109	82	7
2007-08	32	150	122	22
2011-12	36	204	172	16
2015-16	35	232	203	29
2018-19	32	262	226	33
2019-20	31	263	227	44
2020-21	29	234	196	43
2021-22	28	254	212	39
2022-23	28	267	233	45

Source: Handbook of Statistics on Indian Economy, Reserve Bank of India, Note: *Million Metric Tonnes (MMT).

Table 3 looked at how much crude oil and petroleum products were produced and imported in India. It shows that the amount of crude oil produced has gone down over the past 25 years. In 1987-88, the production was 32 million metric tonnes, and by 2019-20, it dropped to 31 million metric tonnes. By 2022-23, it further fell to 28 million metric tonnes. On the other hand, the production of petroleum products has gone up during the same period. In 1987-88, it was 45 million metric tonnes, and by 2015-16, it had risen to 232 million metric tonnes. By 2022-23, it reached 267 million metric tonnes. Imports of both crude oil and petroleum products have also increased over the past 25 years. In 1987-88, India imported 18 million metric tonnes of crude oil, which went up to 203 million metric tonnes by 2015-16 and then to 233 million metric tonnes in 2022-23. For petroleum products, the imports started at six million metric tonnes in 1987-88, increased to 29 million metric tonnes in 2015-16, and reached 45 million metric tonnes in 2022-23. As a result, the difference between what India produces and what it imports for crude oil has been growing steadily since 1987-88.

Table 4: Basin-wise Production of Crude Oil in India*

Basin	State	2017-	2018-	2019-	2020-	2021-	2022-
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		18	19	20	21	22	23
Western Onland	Gujarat	4452	4492	4574	4484	4388	4484
Western Offshore	Maharashtra	16231	14950	14517	14236	13604	13527
Krishna Godavari	Andhra Pradesh	322	285	202	154	159	202
Cauvery	Tamil Nadu	262	303	328	331	291	254
Assam & Assam Arakan	Assam	975	993	987	964	994	1009
Krishna-Godavari Offshore	Andhra Pradesh	8	18	19	13	14	17
TOTAL		22249	21042	20627	20183	19451	19493

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 31. Note: Production in Million Metric Tonnes (MMT); * under ONGC.

Table 4 shows the crude oil production across different basins in India. It shows that most of the oil is produced from the Western Offshore and Western Onland regions, including the Assam & Assam Arakan basin, Cauvery basin, Krishna Godavari basin, and Krishna-Godavari Offshore basin. Maharashtra is the top contributor to crude oil production in the country. However, the total oil production in India is going down. In 2017-18, the Western Offshore of Maharashtra produced 16,231 MMT, but this dropped to 13,527 MMT in 2022-23. The Western On-land of Gujarat produced 4,452 MMT in 2017-18 and slightly increased to 4,484 MMT in 2022-23.

Table 5: Basin-wise Supply of Natural Gas in India

Basin	State	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Frontier	Rajasthan	6	4	0	0	0	0
Western Offshore	Maharashtra	17243	18005	17645	16660	15681	15,117
Western Onland	Gujarat	1532	1332	1274	1074	951	837
Cauvery	Tamil Nadu	1194	1182	1066	877	1037	1082
Krishna Godavar	Andhra Pradesh	959	1077	897	814	794	695
Krishna Godavari Offshore	Andhra Pradesh	548	1037	931	426	262	208
Assam & Assam Arakan	Assam	508	483	460	387	373	355
	Tripura	1440	1554	1473	1634	1531	1675
TOTAL		23429	24675	23746	21872	20629	19969

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 34. Note: Production in BCM; * under ONGC.

Table 5 discussed the basin-wise supply of natural gas in India. It has found that the majority of natural gas in India is produced from Western Offshore of Maharashtra. It is followed by Cauvery basin, Western Onland, Krishna Godavar basin and Krishna Godavari Offshore. Total production of Western Offshore of Maharashtra was 17243 BCM in 2017-18 and 15,117 BCM in 2022-23. Total production of the Cauvery basin of Tamil Nadu was 1194 BCM in 2017-18 and 1082 BCM in 2022-23. Total production of Western Onland of Gujrat was 1532 BCM in 2017-18 and 837 in 2022-23. Total production of Krishna Godavar basin of Andhra Pradesh was 959 BCM in 2017-18 and 695 in 2022-23. Total production of natural gas in India has declined continuously since 2017-18.

Table 6: Oil and Gas Trade in India and its Share in India

Year	Exports	Imports	Trade Balance	% variation		% in total trade of India	
				Exports	Imports	Exports	Imports
2017-18	225388	707191	-481803	15.6	21.5	11.5	23.6
2018-19	267697	970736	-703040	18.8	37.3	11.6	27.0
2019-20	254018	911209	-657192	-5.1	-6.1	11.4	27.1
2020-21	157168	627537	-470369	-38.1	-31.1	7.3	21.5
2021-22	331801	1178618	-846817	111.1	87.8	10.5	25.8
2022-23	458729	1613435	-1154707	38.3	36.9	12.7	28.1

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 129. Note: value in INR Crores.

Table 6 discussed the oil and gas trade in India and its share in India. It has found that export revenue and import bill of oil and natural gas is increasing continuously during 2017-18 to 2022-23, but import bill of oil and natural gas has increased rapidly than the increase of export revenue. Export revenue of oil and crude oil was 2.25 lakh crores in 2017-18 and was 4.58 lakh crores in 2022-23. Export revenue has increased two times in the last five years. Import bill of oil and natural gas was 7.07 lakh crores in 2017-18 and was 16.13 lakh crores in 2022-23. Import bill of oil and gas has increased more than two times in the last five years. Therefore, the percentage share of export and import of oil and gas in total trade of India was 12.7 and 28.1.

Table 7: Volume of Export/ Import of Petroleum Products and Crude Oil in India

Export/Import	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
LNG Imports	20177	21545	24417	25055	23417	19852

Crude Oil Import	220433	226498	226955	196461	212382	232700
Petroleum Product Import	35461	33348	43788	43248	39017	44598
Export of Petroleum Products	66833	61096	65685	56769	62755	61015
Net Import	209238	220295	229474	207995	212061	236136
Net Petroleum Product Export	31372	27747	21898	13521	23738	16417

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 131. Note: Volume in Million Metric Tonnes (MMT).

Table 7 discussed about how much petroleum products and crude oil were exported and imported in India. It shows that the amount of petroleum products imported went up from 2017-18 to 2022-23, but the amount exported went down during that time. In 2017-18, India imported 35.46 thousand million metric tonnes of petroleum products, and by 2022-23, this had gone up to 44.59 thousand million metric tonnes. On the other hand, the amount exported dropped from 66.83 thousand million metric tonnes in 2017-18 to 61.01 thousand million metric tonnes in 2022-23. The net import of crude oil and petroleum products increased from 2.09 lakh million metric tonnes in 2017-18 to 2.36 lakh million metric tonnes in 2022-23. Meanwhile, the net petroleum product export fell from 31.37 thousand million metric tonnes in 2017-18 to 16.41 thousand million metric tonnes in 2022-23.

Table 8: Value of Import /Export of Petroleum Products and Crude Oil in India

Import/Export	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
LNG Imports	52366	73888	68467	58329	100521	137210
Crude Oil Import	566450	783183	717001	459779	901262	1260372
Export of Petroleum Products	225388	267697	254018	157168	331801	458729
Petroleum Product Import	88374	113665	125742	109430	176835	215854
Net Import	481803	703040	657192	470369	846817	1154707
Net Petroleum Product Export	137014	154031	128276	47738	154966	242875

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 131. Note: Value in INR crores.

Table 8 talks about the value of exporting and importing petroleum products and crude oil in India. It shows that the import of crude oil, LNG, and petroleum products, as well as the export of petroleum products, all went up between 2017-18 and 2022-23. In 2017-18, the value of crude oil imports was 5.6 lakh crores and increased to 12.6 lakh crores by 2022-23. LNG imports started at 52.36 thousand crores in 2017-18 and rose to 137.2 thousand crores in 2022-23. The value of petroleum product imports went from 88.37 thousand crores in 2017-18 to 215.85 thousand crores in 2022-23. On the export side, the value of petroleum products increased from 2.25 lakh crores in 2017-18 to 4.58 lakh crores in 2022-23. The net import of petroleum products was 4.81 lakh crores in 2017-18 and rose to 11.54 lakh crores in 2022-23. Meanwhile, the net export of petroleum products went from 1.37 lakh crores in 2017-18 to 2.43 lakh crores in 2022-23.

Table 9: Gross Turnover by CPSEs under the Ministry of Petroleum and Natural Gas

Name of CPSEs	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Engineers India Ltd.	1788	2444	3203	3105	2870	3,284
Oil & Natural Gas Corp.	85004	109655	96214	68141	110345	1,55,517
Balmer Lawrie Ltd	1830	1854	1612	1593	2105	2,383
Chennai Petroleum	44135	52177	48624	41814	60402	90,801
ONGC Videsh Ltd.	12910	17577	17164	12931	18274	11,874
Oil India Ltd.	10656	13735	12129	8618	14530	23,273
GAIL India Ltd.	53690	74808	71730	56529	91426	1,43,976
Indian Oil Corp. Ltd.	5,07,751	6,08,510	5,74,077	5,21,051	7,37,480	9,38,560
Hindustan Petroleum	243227	295713	286250	269243	372642	4,64,684
Bharat Petroleum Corp.	276401	336384	326393	300830	431285	5,32,105
Mangalore Refinery Ltd	63067	72283	60728	50739	86067	1,24,686
Numaligarh Refinery	15922	18509	14072	18548	23546	29,786
TOTAL	13,16,380	16,03,649	15,12,196	13,53,143	19,50,971	25,20,929

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 169. Note: value in INR Crore. Note: CPSEs: Central Public Sector Enterprises.

Table 9 represented gross turnover by Central Public Sector Enterprises under the Ministry of Petroleum and Natural Gas. It has found that gross turnover by Central Public Sector Enterprises increased continuously, but decreased during 2019-2021 for corona pandemic. Indian Oil Corp. Ltd. has the highest turnover followed by the Bharat Petroleum Corporation, Hindustan Petroleum, Oil & Natural Gas Corporation and Mangalore Refinery Ltd. On the other hand, least turnover contributed by Balmer Lawrie Ltd. preceded by Engineers India Ltd, ONGC Videsh Ltd. and Oil India Ltd.

Table 10: Foreign Direct Investment (FDI) in Petroleum and Natural Gas Sectors

Year	Oil Refinery	Oil Exploration	Others (Fuels)	Total*	All Sectors*
2017-18	278	1690	602	2570	2888885
2018-19	334	5726	4114	10174	3098667
2019-20	3168	895	55592	59654	3535584
2020-21	361	667	6642	7669	4425688
2021-22	289	135	3778	4202	4371881
2022-23	-	1247	7515	8762	3674349

Source: IPNG Statistics 2022-23, Ministry of Petroleum and Natural Gas, p. 139. Note: *FDI inflow value in INR million.

Table 10 depicted the foreign direct investment in petroleum and natural gas sectors. It has found that FDI in petroleum and natural gas sectors increased continuously but declined later due to the corona pandemic. Total investment in this sector was 2570 million rupees in 2017-18, and 59654 million rupees' in 2019-20, and finally 8762 million rupees in 2022-23. So it has increased three times in the last five years. FDI inflow in all sectors was 28.88 lakhs million rupees' in 2017-18 and was 36.74 lakhs million rupees in 2022-23.

Table 10 (a): Summary Output

Regression Statistics	
Multiple R	0.096235814
R Square	0.009261332
Adjusted R Square	-0.238423335
Standard Error	707028.0301
Observations	6

Source: Calculated by authors.

Table 10 (b): ANOVA Analyses

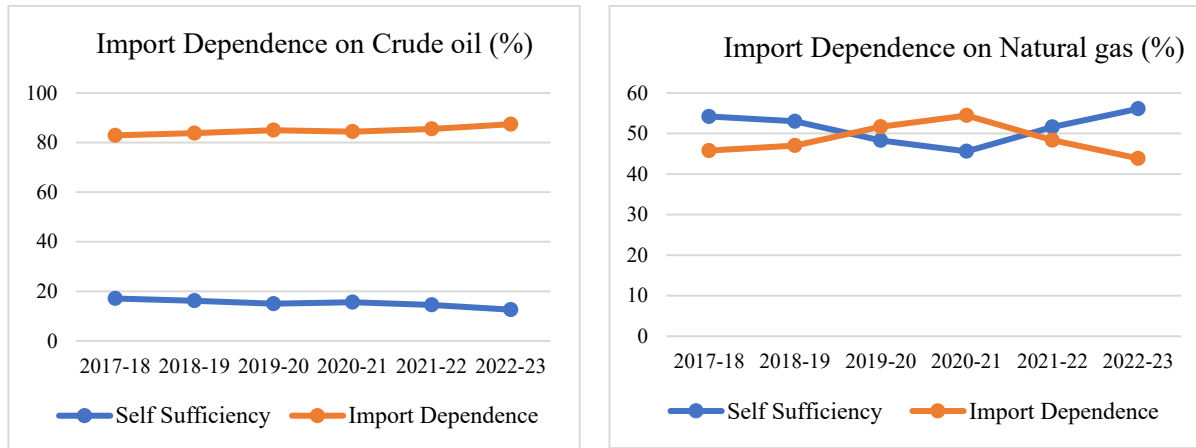
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	18691647663	18691647663	0.037391624	0.856091915
Residual	4	1.99955E+12	4.99889E+11		
Total	5	2.01825E+12			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	3709299.126	365814.9069	10.13982497	0.000532576
FDI in P & Ng Sectors	-2.80272983	14.49419416	-0.193369138	0.856091915

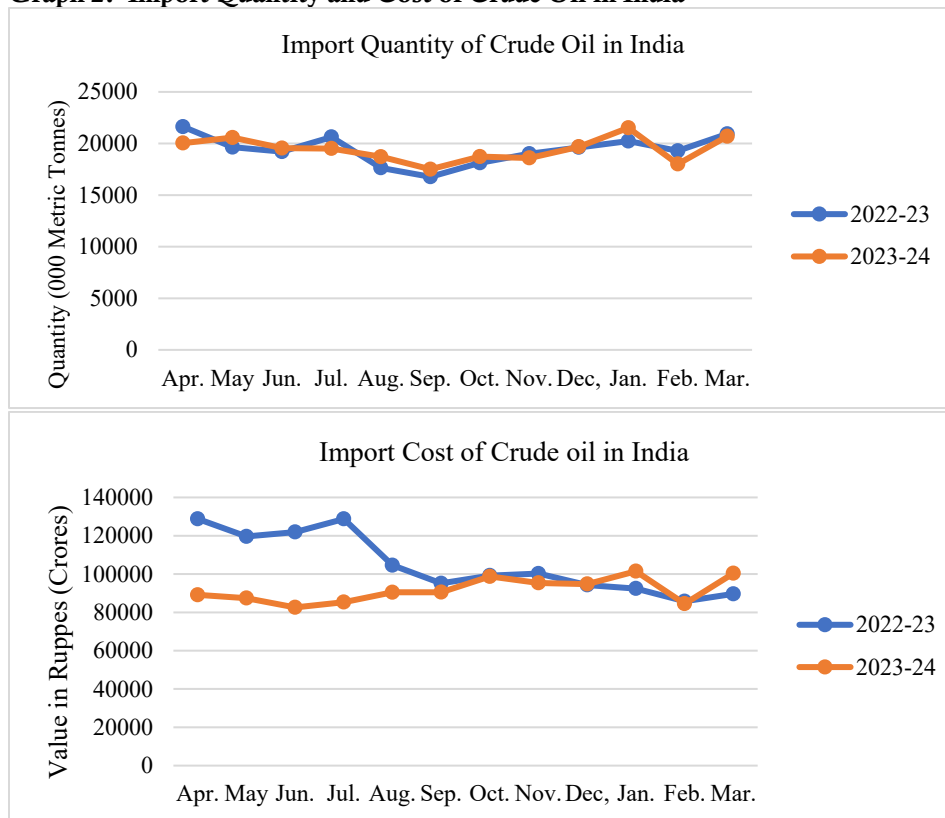
Source: Calculated by authors.

The table (10-a) shows that R square is found to be 0.00926, showing, that the degree of relation between the independent variable X, i.e. foreign direct investment in petroleum and natural gas sector, and the dependent variable Y, i.e. foreign direct investment in all sector is very weak. Table (10-b) shows that p value (0.45609) is higher than critical value at 5% level of significance ($p > 0.05$), therefore we will accept the null hypothesis-1. So, it is concluded that there is no relation between foreign direct investment in the petroleum and natural gas sector and all sectors in India.

Graph 1: Import Dependence of Crude oil and Natural gas of India



Graph 2: Import Quantity and Cost of Crude Oil in India



Source: <https://ppac.gov.in/import-export>

Graph 1 shows the relation between import dependence of crude oil and natural gas of India. It has found that demand for crude oil in India is always higher than the self-production. Therefore, there is high import dependence of crude oil in India. Production of natural gas in India and its demand are relatively stable. Graph 2 discussed the import quantity and cost of crude oil in India. It has found that the import volume of crude oil is nearly stable during 2022-23 to 203-24. Crude oil import quantities are low during August to October months in the year. The import cost bill of crude oil was declined in 2023-24.

Table 11: Value of Petroleum Products imported in India

Year	Value	Year	Value	Year	Value
2011	4822.82	2016	5404.05	2020	9251.68
2012	7430.75	2017	5832.17	2021	6113.53
2014	9978.85	2018	7003.21	2022	12078.03
2015	8428.74	2019	9862.75	2023	16824.75

Source: <https://www.statista.com/statistics/625218/import-value-of-petroleum-india/>, Note: In billion Indian Rupees.

Table 11 discussed the value of petroleum products imported in India. It has found that the value of petroleum products imported is increasing continuously. The value of petroleum products imported was 4822.82 billion rupees in 2011 and was 5404.05 billion rupees in 2016 and finally 16824.75 billion rupees in 2023. Therefore, the import bill of petroleum products increased more than three times during the period. Aviation Gas, Petroleum Jelly, Motor Spirit, Naphtha. Paraffin wax, MTBE, and Reformate are the major petroleum products imported by India.

Table 12: Changing scenario of Crude Oil Import from Russian Federation

Year	Price*	Year	Price
2012	0.12	2018	1.22
2013	0.82	2019	1.40
2014	0.16	2020	0.92
2015	0.71	2021	2.31
2016	0.84	2022	25.00
2017	1.31	2023	48.68

Source: <https://tradingeconomics.com/india/imports/russia/crude-oil-petroleum-bituminous-minerals>, Note: quantity is in billion USD.

Table 12 represents the cost of crude oil imported from the Russian federation. It is found that India's crude oil imports from Russia were suddenly changed due to the Russia-Ukraine which was started in February, 2022. Russia remains the top supplier of crude oil in India during the war period. Crude oil imports from middle east countries have declined since the war started. Russia alone supplies more than one-third of crude oil imports of India. Cheaper imports of crude oil from Russia have helped the economy of India. India is the third largest energy consumer. Indian oil companies purchased Russian crude oil at a discount rate.

Table 13: Total Energy consumption vs. Gross Domestic Product of India

Year	Total Energy Consumption*	GDP of India#	Year	Total Energy Consumption*	GDP of India#
2010	658794	1708.46	2017	945572	2651.47
2011	693783	1823.05	2018	983557	2702.93
2012	743759	1827.64	2019	988106	2835.61
2013	769847	1856.72	2020	941144	2674.85
2014	828923	2039.13	2021	1012817	3167.27
2015	861458	2103.59	2022	1080590	3353.47
2016	898115	2294.80	2023	1135277	3572.08

Source: Indian energy information (<https://www.enerdata.net/estore/energy-market/india/>) and Statista (<https://www.statista.com/statistics/263771/gross-domestic-product-gdp-in-india/>). Note: *in kote and # in billion USD.

Table 13 (a): Summary Output

Regression Statistics	
Multiple R	0.969786497
R Square	0.940485849
Adjusted R Square	0.935526337
Standard Error	155.6009906
Observations	14

Source: Calculated by authors

Table 13 (b) ANOVA Analysis

	df	SS	MS	F	Significance F
Regression	1	4591324.475	4591324.475	189.6327185	1.02899E-08
Residual	12	290540.0193	24211.66828		
Total	13	4881864.494			

Source: Calculated by authors

	Coefficients	Standard Error	t Stat	P-value
Intercept	-1238.721651	272.670434	-4.542926172	0.000674404
Total Energy Consumption	0.004142421	0.000300814	13.77071961	1.02899E-08

Source: Calculated by authors

The table (13-a) shows that R square is found to be 0.940485849, showing that there is a strong degree of relation between the independent variable X, i.e. total energy consumption and the dependent variable Y, i.e. gross domestic product of India. Table (13-b) shows that p value (1.02) is higher than critical value at 5% level of significance ($p > 0.05$), therefore we will accept the null hypothesis-2. So, it is concluded that there is no relation between total energy consumption and gross domestic product of India.

CONCLUSION

India has large reserves and production of crude oil in various regions. Rajasthan, Gujarat, and Assam are key states for crude oil production. The total crude oil production in the country has been dropping steadily since 2017. Maharashtra is the biggest producer of crude oil in India. Most of the natural gas in the country comes from the Western Offshore region of Maharashtra. The cost of importing oil and gas has gone up more than double in the past five years. The revenue from Central Public Sector Enterprises has generally risen, but it dropped during 2019 to 2021 because of the coronavirus pandemic. Foreign Direct Investment in the petroleum and natural gas sectors has been growing, but it later fell due to the pandemic. India's demand for crude oil is always higher than what it can produce on its own.

The country heavily relies on imports for crude oil. The production and demand for natural gas in India are fairly steady. India imports several petroleum products, including Aviation Gas, Petroleum Jelly, Motor Spirit, Naphtha, Paraffin Wax, MTBE, and Reformate. India's crude oil imports from Russia changed suddenly after the Russia-Ukraine war started in February 2022. Even during the war, Russia remained the main supplier of crude oil to India. The government has introduced policies to reduce the country's reliance on imports, such as improving refinery processes, promoting energy efficiency, encouraging the use of bio-fuel and renewable energy, and boosting domestic production.

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