1.1 Research Background

Why heavy dependency on Crude Oil Imports is a big problem to our Economy?

About Crude Oil.

Crude oil is regarded as an influential natural resource in the economy worldwide. In most countries, the import of crude oil is treated as a major economic issue. It is identified that fluctuation in the price of crude oil also becoming an emerging topic worldwide. Oil exporting countries take the opportunity for the purpose of considering their economic power. It is observed that fluctuation in the pricing of crude oil not only affected importing and exporting oil to other countries. In the year 2020, the prices of crude oil decreased drastically. Due to the continuous spread of the coronavirus, demand from consumers declined and directly influenced the economy's growth (Baisane, 2023).

It is considered that crude oil prices keep changing in the global markets, as it depends on various factors such as geo-political situation, policies of crude oil producing countries, and demand and supply in the market. It is observed that the Indian Basket of crude oil averaged $23 per barrel at the time of dismantling of APM in the year 2002 March. In addition to this, the average price of crude oil in India during 2014-15 to 2019-2020 was recorded at $84.16/ bbl, $47.56/bbl, 56.43/bbl, 69.88bbl and $60.47bbl (Baisane, 2023). The price of crude oil in India fell below $20 per barrel in April 2020 as the lockdown resulted in a historic dip in transportation fuel demand in the country. In the month of June, in India refiners imported 2.17 million barrels per day from Russia crude which also accounted for 45 percent of total imports in India. It is evaluated that in India average import of Russian oil in the month of June was higher compared with a peak season as in May. Russia is considered the biggest source of crude oil in New Delhi (Sharma, 2023).

India is regarded as the third largest oil consumer & importer after US and China. It is identified that oil is the largest source of the country’s energy supply after coal and is considered the largest in terms of final consumption (Times of India, 2023). Oil demand in the market increasing rapidly. In India, the oil and gas segment is the sixth core industry and most traded commodity. It is determined that oil has both attributes commodity and financial. A rise in the price of oil increases firms operating cost

which further lead to depressed prices of stock treated as a financial asset. For India, crude oil financial attribute is significant and operating. It is estimated by the Reserve Bank of India (RBI) that 10 percent above the baseline of USD 100 per barrel for prices of crude oil globally (Times of India, 2023).

It is determined that oil prices always haunted the economy of India. Costs of an oil shock tend in messing up macroeconomic variables in India. Prices of oil started moving into uncomfortable zones. It is observed that the prices of crude doubled and there has been huge volatility in the prices of oil. Moreover, the prices of energy and fuel cascading affect prices pushing up costs at different stages of production (Ray & Pal, 2023). Increasing oil prices drop subsequently due to higher inflation rates. For controlling the rising inflation rate, the government absorbs the increase in international crude prices by the reduction in taxes on diesel and petrol. Crude oil is irreplaceable in the international economy as the prices of crude oil are volatile considering option pricing, portfolio allocation, and the creation of strategies (Liang et al., 2020).

It is evaluated that oil and gas energy's main alternative sources are solar power, ethanol, wind power, and nuclear power. In the international energy markets, fossil fuels are considered the most adopted energy source by industries. In the modern era, industries are shifted toward sustainability and adopting green business practices (Ross, 2022). It is identified that fossil fuels mainly comprise of energy sources through oil, propane, coal, and natural gas. It is evaluated that at the year-end of 2020, in the US there are 94 operating nuclear power reactors which provided an estimation of 20% of all domestic electrical output (Ross, 2022). Other countries are having a large amount of nuclear energy. It is identified that France is the best example as it uses the world’s highest nuclear power and generates 70% of the electricity from it.

Underutilization of Resources in India.

Furthermore, it is analyzed that India is considered as the largest oil reserve situated in Western offshore with 37% and 27% in Assam. In the deployment of PSUs used in the deployment, regulation, and management of oil and using its power sector are ONGC, Oil India, and IOC. In the Indian power sector, oil is mainly used to generate electricity. It is the second largest source of electricity generation in India. It is

identified that the oil and gas industry contribute around 34.4% of the primary consumption of energy and fuels (Sharma, 2023). In India, oil is used by different industries and is considered an important material for the power sector. It is used in kerosene, fuel for vehicles, and LPG. Indian government allowed 100% FDI in the projects for oil.

It is determined that in economically developing countries such as India, different factors affected the demand for resources for social development, generation of income, and serious issues of health which arise because of the use of fuelwood and charcoal. India is treated as a tropical country, which is having an abundance of solar energy. The geographical regions allow in a large amount of radiation from the sun throughout the year (Raina & Sinha, 2019). In addition to this, photovoltaic solar and other renewable energy sources, are also plenty; the Ministry of Non-conventional Energy Sources was changed to the Ministry of New and Renewable Energy (MNRE). For the promotion of R&D in the sector of photovoltaics government set up a commission for Additional Sources of Energy in the Science and Technology department (Raina & Sinha, 2019).

Origin of Crude Oil

Crude oil is mainly comprised of thick black liquid obtained from the ground through oil rigs. The nickname of crude oil is black gold and is considered as naturally occurring fossil fuel as it comes from dead organisms. It is determined that crude oil is made from a mixture of hydrocarbons including carbon atoms and hydrogen. It mainly exists in the form of liquid in underground reservoirs by having tiny spaces within sedimentary rocks. It is found near the oil sands surface (Howden, 2023). It is also found concerning saline water and natural gas. It is also known as petroleum because it comprises both refined as well unrefined petroleum products. It is a non-renewable energy source that cannot be replaced easily. Crude oil is mainly formed from the remains of dead organisms including algae and zooplankton which existed million years ago in the environment. Based on the recent data received from IEA an average of 100 million barrels of oil were produced in the year 2018 worldwide. It involves 32 million barrels of crude oil only and 68 million barrels of crude oil received from non-conventional sources. It is observed top oil-producing countries are mainly responsible for half of the production of crude oil (Howden, 2023).

In the current fiscal year, India is set to cross the $100 billion mark in importing oil. Already, $94.3 billion was spent in the first ten months. By the end of the financial year, the total import of oil is expected to touch $105-110 billion. India with 1.4 billion people in the country, imports around 84% of crude oil needs. With increasing prices, imports, and declining production of domestic oil. In India, the demand for total gas was one-fourth, and import was also done to a larger extent. In the Indian economy, there is growing demand for oil. 84% of crude oil is imported into India and it further rises after a year passes (Groww, 2023). Compared with demand in the country there is a deficiency in the production of crude oil at the domestic level. With respect to this, the government is taking measures to reduce the high price of oil because of the huge amount of imports—the total amount spent on imports expecting to be $110 billion (Groww, 2023).

It identified that crude oil is considered a vital fuel resource that is obtained through sedimentary rocks of marine origin. It is treated as a naturally occurring product of petrol containing hydrocarbon and other organic compounds. Sedimentary rocks did not contain crude oil and were mainly found in the tertiary period. In the tertiary period, the formation process of crude oil began. In different forms of flora and fauna marine life was abundant (Iassite, 2023). For oil formation, conditions were favorable and as time progressed this underwent chemical changes because of heat and pressure which also resulted in the crude oil formation and natural gas after millions of years. There are two types of oilfields comprises of on-shore and off-shore. It is identified that on-shore oil fields in India are situated in the Brahmaputra valley, the Gujarat coast, and the Barmer area of Rajasthan. While offshore oil fields in India were located on the western coast and eastern coast oilfields (Iassite, 2023).

It is evaluated that the oil and gas segment is mainly responsible for the emission of greenhouse gases. Emissions arise considering the transportation, processing, extraction, and distribution of fuel and combustion in different applications such as heat, transportation, and energy. It is determined that international seaborne transportation of crude oil takes place mainly on tankers with annual seaborne crude flows of an estimated 12 billion barrels (Greene et al., 2020). Taking into account, the carbon footprints of crude oil from the international distribution sector utilizing a dataset at the micro level having more than 28,000 individual shipments for

estimating emission of carbon. Carbon emission at the country level for importers and exporters considering the size of the vessel (Greene et al., 2020).

Crude oil mainly comprises a complex mixture involving hydrocarbons. There is a difference in the composition and traits of crude oil which vary based on its origin. It also involves saturates, resins, aromatic and asphaltenes. The saturates with hydrocarbon have 20 carbon chains known as paraffin wax. The temperature of crude oil decreases along with considering the production line in the crude oil production system. This situation causes flow-in assurance issues and the shutdown of pipelines (Zamri & Husin, 2023). Here, the major challenge associated with wax and paraffin and deposition mainly occurs in the inner walls of transportation and production. In some situations, the deposition of wax caused the formation of plugging at the time of treatment of stimulation. The process of wax deposition mainly reduces the internal diameter of tubular, perforations, pump strings, pipelines, and rods. The production and transportation costs increased because of the handling problem of wax deposition. It creates issues in regions in which the temperature is low seasonally (Zamri & Husin, 2023).

It is determined that crude oil prices are mainly driven by supply. The Organization of the Petroleum Exporting Countries (OPEC), which controls 60% of worldwide oil commerce and 40% of the world's crude oil production, in particular, sets production targets to control supply. It is observed that production is reduced by OPEC targets of production, and prices of crude oil tend to rise. Oil prices are also affected by changes in the production by largest producer named as OPEC. In early 2023 April, an announcement was done with respect to the addition of production of oil cuts down by 1.16 million barrels per day. This attempt in stabilizing and supports the markets of oil during the recession. Oil prices have fallen by $70 in the year 2022 April compared with $139 in March 2022 (Emran, 2023). Falling in the price of crude oil is also driven by turmoil in the banking sector. It is identified that a reduction in production is considered a reliable method for the purpose of restoring prices.

Further, India is looking for bringing diversification in the sources of crude oil and considering a purchase of oil from Canada, Guyana, Colombia, and Brazil. Presently, the country looking towards Guyana, Gabon, Colombia, and Canada. It is observed

that countries like Gabon, Colombia, and Brazil supply crude oil to India as the quantity is not significant and India is looking for increasing imports from these countries. From the data received from the Ministry of Commerce India imported crude oil worth $722.54 from Brazil in April-July in the year 2022. The oil supplied by Colombia was worth $717.40 million. Similarly, considering Guyana supplied $106.06 million in crude oil. On the other side, countries like Colombia, Brazil, and Gabon accounted for contributing 1.27%, 1.13%, and 0.16% of imports of oil made by India in the financial year 2023 (Baruah, 2023).

It is identified that after Iraq Russia become the largest source of crude oil. Till February, India's total crude oil imports were around 2% which mainly comes from Russia. Contracts in India stand at around 66.5 million barrels based on the data received from Kpler. Since the beginning of the Ukraine war, it is spotted that Russia has been spotted as the war began in Western countries with sanctions on the country. Refineries in India are eager for supplies of Russian oil reported major aspects from Rosneft and Bloomberg. Importing India helps in fulfilling 85% of the requirements of oil. In the year ending the country spent $119.2 billion in the previous year (Verma, 2023).

Moreover, it is determined that economies faced several implications for foreign and domestic investors impacted by shocks in the oil market. Over the last two decades, there has been abundant literature that provides knowledge regarding the interconnection between the stock market and oil. On the contrary, some studies depicted that responses of stock markets to oil mainly depend on the net positioning of the country in the global market. It is observed oil markets represent the alternative destination for most investors and financial institutions with respect to the correlation between traditional assets and prices of oil (Youssef & Mokni, 2019). Studies also claim that prices of oil shocks affected the stock markets considering macroeconomic variables including economic growth and inflation. Rising in the prices of oil is expected in having a positive influence on oil-exporting countries as the income of the country will increase. A rise in income is expected to rise in expenditure which creates greater unemployment and productivity. Prices of oil increase positively influencing responses towards stock markets (Youssef & Mokni, 2019).

Critical Analysis of Crude Oil Imports & its overdependence

Numerous economic, environmental, as well as technological factors are causing significant changes in the world's energy landscape. An exhaustible fossil fuel called crude oil has long been the main energy source for the global economy. However, due to its inherent drawbacks and unfavorable effects on the environment, research into alternative energy sources has increased. In the context of the Indian economy, this critical analysis seeks to explore the function of crude oil and alternative energy sources. The nation's energy security and economic stability face significant challenges as a result of its heavy reliance on foreign oil sources. Volatile oil prices, which have fluctuated significantly over time, can strain the Indian economy by increasing its current account deficit, causing instability in fiscal balances, and limiting long-term growth prospects (Kuehl et al., 2021).

Burning fossil fuels including crude oil has negative environmental effects that are a growing source of concern worldwide. Significant amounts of greenhouse gases (GHGs), primarily carbon dioxide (CO2), are released into the atmosphere during the burning of fossil fuels. These emissions contribute to climate change and global warming, which has negative effects like sea level rise, extreme weather, and ecological disruptions. India, one of the biggest CO2 emitters in the world, is under increasing pressure to reduce its carbon footprint and switch to cleaner and renewable energy sources.

The investigation and production of elective energy sources have sped up all around the world in light of these issues. Sun-based power, wind power, hydropower, biofuels, and geothermal energy are instances of environmentally friendly power advances that can be utilized to enhance energy portfolios, cut ozone-harming substance discharges, and further develop energy security. The meaning of moving to a cleaner and more maintainable energy blend has likewise been recognized by India. The country has defined aggressive objectives, expecting to reach 450 GW of environmentally friendly power limit by 2030, to build the extent of environmentally friendly power in its all-out energy utilization.

While switching to alternative energy sources has many benefits, there are also many significant drawbacks. In order to ensure a dependable and uninterrupted power

supply, for example, the nature of renewable energy necessitates the development of strong energy storage systems and grid infrastructure (Bhuvaneshwari et al., 2019). Economic obstacles include the high upfront costs connected with installing renewable energy sources and the requirement for ongoing technological advancements.

This analysis aims to offer useful insights into the opportunities, challenges, and trade-offs associated with the transition away from crude oil by critically analyzing the existing literature, data, and expert opinions. Ultimately, this research lays the groundwork for wise policy choices and strategic planning in the energy sector by deepening our understanding of how crude oil and alternative energy sources affect the Indian economy.

The analysis of crude oil and alternative energy sources is influenced by the geopolitical environment in addition to economic and environmental factors. Because of the geographic concentration of crude oil reserves, there are frequent geopolitical tensions and conflicts over who controls and has access to these valuable resources. India's reliance on imported crude oil puts it at risk of supply interruptions brought on by geopolitical unrest or armed conflicts in areas where oil is produced (Hoang et al., 2021). The Indian economy may suffer greatly as a result of these disruptions, which may also result in higher energy costs, lower industrial productivity, and a decline in overall economic growth.

India has the chance to lessen its reliance on foreign oil and improve its energy security by switching to alternative energy sources. India can lessen the risks posed by geopolitical unrest and changes in the world oil markets by diversifying its energy mix and encouraging renewable energy sources. The vulnerability to external shocks can be decreased by developing domestic renewable energy sources, which can offer a more reliable and sustainable energy supply.

Also, the use of alternative energy sources may encourage job growth and economic expansion. New job opportunities are provided by the renewable energy industry, which also includes infrastructure manufacturing, installation, and maintenance. India can support the development of domestic industries and produce a skilled workforce that meets the requirements of the developing energy sector by investing in renewable

energy projects. The advancement of renewable energy technologies can also advance technological innovation, R&D, and research, establishing India as a leader in the transition to clean energy on a global scale.

The switch to alternative energy sources is not without difficulties, though. The high up-front costs related to renewable energy infrastructure are one of the major obstacles. Although the cost of renewable technologies like solar cells along with wind turbines has significantly dropped recently, significant initial investments are still needed for large-scale renewable energy projects. Government incentives, subsidies, and public-private partnerships are just a few of the financing tools that can help with the transition and make renewable energy more economically viable.

Another significant problem for alternative energy sources is intermittency (Gajjar et al., 2019). Renewable energy production is influenced by weather patterns and other natural variations, in contrast to fossil fuels, which offer a consistent and predictable energy supply. For instance, the use of solar and wind power depends on the sun's rays and the direction of the wind. Energy storage technologies and grid infrastructure must be created to balance the erratic nature of renewable energy sources in order to guarantee a steady electricity supply. Advances in technology to store energy, like batteries, pumped hydro storage, and other new solutions, are crucial for overcoming this challenge.

The existing infrastructure and expertise built around the fossil fuel industry also present obstacles to the transition. The fossil fuel sector has extensive supply chains, refining facilities, and distribution networks that have been established over decades. Shifting towards alternative energy sources requires significant investments in infrastructure upgrades and the retraining of workers to adapt to new technologies and processes. Additionally, the potential displacement of workers in traditional energy sectors may necessitate the implementation of social safety nets and reemployment programs to mitigate any negative impacts on affected communities.

The pursuit of alternative energy sources aligns with India's commitment to sustainable development and climate change mitigation. The country has taken significant steps to promote renewable energy, including policy initiatives, regulatory frameworks, and financial incentives. The government has taken a target to produce

450 GW of renewable energy & taking steps in transitioning toward a cleaner and more sustainable energy future (Quitzow et al., 2021).

The critical analysis of crude oil and alternative energy sources in the context of the Indian economy reveals both challenges and opportunities. The heavy dependence on imported crude oil exposes India to economic vulnerabilities and geopolitical risks. Transitioning towards alternative energy sources, such as renewable energy, offers the potential for enhanced energy security, reduced greenhouse gas emissions, and economic growth. However, the high upfront costs, intermittency, and the need to transform existing infrastructure pose significant challenges. By carefully navigating these challenges and leveraging the available opportunities, India can strive towards a sustainable and resilient energy future.

To successfully transition to alternative energy sources, a multi-faceted approach is necessary. Policymakers need to implement supportive regulatory frameworks, provide incentives for renewable energy investments, and streamline the approval processes for renewable energy projects. The joint effort between the public authority, confidential area, and global accomplices is essential for sharing accepted procedures, innovation moves, and drawing in interest in the environmentally friendly power area.

In order to promote innovation in renewable energy technology, storage systems for energy, & grid integration, efforts to conduct research and development should also be stepped up. Interests in scholastic coordinated efforts and research organizations can advance mechanical turn of events and address the specialized issues connected with the arrangement of sustainable power sources (Majid, 2020).

Promoting energy conservation, the use of renewable energy sources, and energy efficiency at the individual and community levels requires public awareness and education campaigns. Encouragement of sustainable practices and behavioral shifts can result in significant energy savings and lower overall energy demand.

Also, international collaboration and cooperation are essential in addressing the global issues related to the energy transition. The development, as well as application of sustainable energy technologies, can be accelerated by the international sharing of best practices, information, and resources. Countries have the chance to work together

on solar energy projects through platforms like the International Solar Alliance (ISA), which encourages international cooperation in renewable energy.

It is critical to think about the social and economic effects of the energy transition as India sets out on its path to a future powered by sustainable energy sources. A just transition should be prioritized in policies, and this includes social safety nets, retraining programs, and job creation, as well as taking into account the needs of the affected communities. India can navigate the complexities of the energy transition and maximize the potential benefits for its citizens by giving inclusive growth and sustainable development priority.

Because of the assessment of raw petroleum and elective energy sources according to the Indian economy, obviously embracing sustainable power sources, enhancing the energy blend, and decreasing dependence on imported raw petroleum is pivotal. Although there are obstacles like high upfront costs, unpredictability, and the need for infrastructure transformation, there are also significant opportunities for increased energy security, economic growth, and climate change mitigation. India can pave the way for a sustainable and prosperous energy future by taking a comprehensive approach that includes policy support, technological innovation, public awareness, and international cooperation.

The social and health impacts of crude oil and alternative energy sources should be taken into account during a critical analysis along with the economic, environmental, and geopolitical factors. Local communities, particularly those close to oil refineries, pipelines, or drilling sites, may suffer negative effects as a result of the extraction, transportation, and combustion of crude oil. These areas frequently experience environmental pollution, such as contaminated air and water, which can have a negative impact on health (Rynska, 2022). These health risks can be reduced, and communities' general well-being can be enhanced, by the move towards cleaner and renewable energy sources.

Economics impact such as Trade deficits & balance of payments also becomes an issue with the economy of our country, because of huge amount of imports of crude oil from the international markets the trade deficit is always in negative even if we are exporting enough of other goods, this still makes it look as if we are not exporting

enough & the entire economy is dependent on imports only. Even the fluctuation of prices in the international markets, as OPEC controls the prices of crude oil in the international markets, the average cost of production of one barrel of crude oil is about in the range of $20 to $30 but still the prices go all the way up to $110 sometimes & sometimes it is a bit ok with the prices coming low to $60. But this fluctuation causes a slot of financial instability in our economy as it is difficult to plan the amount of FOREX reserves to be maintained. So all together the prices & the fluctuation in prices creates huge issues in the Trade balance & the balance of payments.

Since the entire crude oil cargo has to be bought from Middle east countries & other countries there is lot of cost on transportation, this increases the cost of the final product, in turn increasing the cost of every product in our country as each product have to be moved from the producer to the consumer. Since the dependency is on petrol & diesel vehicles and not on EV vehicles the cost is added to the final product & the final consumers of the product have to pay the price for the monopoly OPEC has on the international crude oil prices.

Maintaining FOREX reserves is another major issue due to over dependence of international crude oil as the payments have to made in dollars to procure the crude oil, this also bring us to the next problem that is the fluctuation in the currency prices, because if Indian currency becomes weaker then we have to pay more & more of Indian rupees to procure US dollars, during the time of independence 1USD to INR was 7 Rupees now it has become approx. 83 INR, look at the amount of increase in the currency fluctuation, this is also causing a lot of issue & load on the Indian financial economy.

As the cost in the international markets for the crude oil becomes more & more to keep the local prices of petrol & diesel the government have to reduce prices to the end customer by reducing the taxes levied on these products. This causes impact on the revenue of the government, because of which the government social causes towards the people of the country cannot be achieved to the expected levels. These additional expenses also causes the government to lose on new investment opportunities where the government could invest this money given as a subsidy & earn interest from that money.

Economic Impact

Energy Import Bill and Trade Balance: India's energy needs are largely met by importing crude oil, making it susceptible to changes in the price of oil on a global scale. High oil prices increase the cost of importing energy, which has an effect on the nation's trade balance and foreign exchange reserves. Businesses in a variety of industries face uncertainties due to the fluctuating price of oil, which has an impact on investment choices, inflation rates, and overall economic stability.

Fiscal Balances:

Fiscal Balances are directly impacted by oil prices, particularly in an oil-importing nation like India. Oil prices have an impact on the government's spending on oil subsidies and tax receipts from the oil industry. Fluctuating oil prices can disrupt fiscal planning, leading to challenges in maintaining fiscal deficits and meeting development goals.

Energy Security:

The heavy reliance on imported crude oil poses significant challenges to India's energy security. Geopolitical tensions and conflicts in oil-producing regions can disrupt oil supplies, leading to supply shortages and price volatility. Diversifying the energy mix by incorporating alternative energy sources can enhance energy security, reduce dependence on foreign oil, and mitigate geopolitical risks.

Environmental Impact

Climate Change Mitigation:

The burning of fossil fuels, including crude oil, contributes to greenhouse gas emissions, exacerbating climate change. India, as a part to international agreements like the Paris Agreement, has committed to reducing its carbon footprint and transitioning towards a low-carbon economy (Kassem et al., 2020). By promoting alternative energy sources that emit fewer greenhouse gases, India can contribute to global efforts to mitigate climate change.

Air Pollution and Health Impacts:

The combustion of crude oil releases pollutants into the air, leading to air pollution and associated health risks. India has been grappling with severe air pollution levels in major cities, causing respiratory illnesses, cardiovascular diseases, and other health issues. Transitioning to cleaner and renewable energy sources can help improve air quality, reduce pollution-related health risks, and lower healthcare costs.

Alternative Energy Sources

The global energy landscape is undergoing a profound transformation as countries around the world recognize the pressing need to address the challenges of climate change, environmental degradation, and energy security. Central to this shift is the critical analysis of the impact of crude oil and alternative energy sources on the Indian economy. India's economy has long relied on crude oil as its main energy source because it is a finite fossil fuel. However, its drawbacks and detrimental effects on the environment have spurred research into and use of alternative energy sources (Pareek et al., 2020). This thorough analysis aims to assess the economic, environmental, and social effects of crude oil dependence as well as the potential advantages and difficulties connected with India's move towards alternative energy sources.

The Indian economy has historically been significantly shaped by crude oil. India's import bill increases in response to an increase in oil prices, widening the trade deficit and taxing foreign exchange reserves. Due to the nation's heavy reliance on imported crude oil—which supplies more than 80% of its oil needs—these effects are especially pronounced. Additionally, the erratic nature of oil prices makes it difficult to plan for the future of the economy and breeds uncertainty for companies operating in a variety of industries, including manufacturing, transportation, and agriculture. The Indian economy is greatly impacted by the environmental effects of crude oil consumption. Carbon dioxide (CO2) and other greenhouse gases (GHGs) are released into the atmosphere during the burning of fossil fuels, including crude oil, which contributes to climate change and global warming. India, one of the major contributors to global CO2 emissions, is under increasing pressure to reduce its carbon footprint and switch to cleaner, more sustainable energy sources. Extreme weather events and rising sea levels can cause ecological disruptions, health effects, and economic losses if environmental concerns are not addressed.

The examination and reception of elective energy sources present likely solutions for lessening the dangers to the economy and climate welcomed by reliance on raw petroleum. A cleaner, more reasonable energy future is guaranteed by sustainable power innovations like sun-oriented power, wind power, hydropower, biofuels, and geothermal energy. India has put forth aggressive objectives to build the extent of environmentally friendly power in its energy blend since it perceives the significance of doing the change to sustainable power sources. By 2030, the country desires to have 450 GW of environmentally friendly power limit introduced, delineating its devotion to feasible development and environmental change moderation.

Alternative energy sources have a wide-ranging and intricate effect on the Indian economy. The potential decrease in oil imports and increased energy security are two important benefits. India's exposure to price volatility and geopolitical risks can be reduced by decreasing its reliance on imported crude oil and increasing its share of renewable energy. As a result, there may be more economic stability, fewer trade imbalances, and better financial health. Adopting alternative energy sources can also encourage economic expansion and job creation. The manufacturing, installation, as well as upkeep of renewable energy facilities, are examples of domestic industries that can benefit from the renewable energy sector (Sultana et al., 2021). India can promote technological advancement, strengthen its research & development capabilities, and draw both domestic & foreign investment by funding renewable energy projects. Particularly in rural areas, where decentralized renewable energy solutions can provide access to electricity and help alleviate poverty and promote inclusive development, the growth of the renewable energy sector may create employment opportunities.

The move to alternative energy sources has the potential to support sustainable growth and tackle social issues in India. It is essential for socio-economic development, including advancements in healthcare, education, and agriculture, to get dependable and energy at lower cost. By bridging the energy access gap and empowering communities, alternative energy sources like off-grid solar systems and mini-grids can deliver electricity to isolated and underserved areas. This can then have a domino effect on healthcare, education, and employment opportunities, reducing poverty and improving quality of life. The transition away from crude oil towards alternative

energy sources is not without difficulties, though. The initial investment needed for renewable energy infrastructure is a major barrier. Despite recent reductions in the price of renewable technologies, significant upfront capital is still needed for large-scale installations. To facilitate the adoption of renewable energy technologies and draw investments from the private sector, it is necessary to develop financial mechanisms like government incentives, subsidies, and advantageous financing options.

Another significant issue with alternative energy sources is intermittent. Renewable energy production is influenced by weather patterns and other natural variations, in contrast to fossil fuels, which offer a consistent and predictable energy supply. Due to the intermittent nature of renewable energy, smart grid infrastructure and energy storage systems must be developed in order to guarantee a steady and dependable power supply. For this problem to be solved and the grid integration of renewable energy, technological advancements in storing energy , like batteries, pumped hydro storage, and new solutions like hydrogen, are essential. Furthermore, the infrastructure and human resources already in place in the fossil fuel industry must be carefully taken into account as we switch to alternative energy sources (Cloutier et al., 2020). The fossil fuel industry has developed extensive distribution networks, refining facilities, and supply chains over many years. The transition to renewable energy sources necessitates both infrastructure redesign and worker retraining to accommodate cutting-edge procedures and technologies. In order to minimize any negative effects on impacted communities, it is crucial to develop strategies that facilitate a just transition for workers in the fossil fuel sector by offering reemployment opportunities and social safety nets.

To sum up, the effects of crude oil and other forms of energy on the Indian economy are complicated and multifaceted. India is subject to economic vulnerabilities, geopolitical risks, and environmental difficulties as a result of its heavy reliance on imported crude oil. However, the use of alternative energy sources, like renewable energy, has the potential to increase energy security, have a smaller negative impact on the environment, and promote inclusive economic growth. A comprehensive strategy that incorporates policy support, technological innovation, financial mechanisms, and social considerations is needed to make the switch to renewable

energy sources. India can create the conditions for a prosperous, resilient, and sustainable energy future by skillfully managing the challenges and utilizing the opportunities. For the purpose of guiding policy choices, strategic planning, and fostering the transition to a cleaner and more sustainable energy system, a critical analysis of how crude oil and alternative energy sources affect the Indian economy is essential.

An important area of research as the world struggles to address issues like global warming, and energy scarcity; sustainable development is the effect of crude oil along with other forms of energy on the Indian economy. For a very long time, India's main energy source was crude oil, a limited fossil fuel that was used to run businesses, transport systems, and homes. However, the drawbacks and unfavorable effects of using crude oil have prompted research into and use of alternative energy sources. This thorough analysis aims to assess the economic, environmental, social, and technological effects of crude oil dependence as well as the potential advantages and difficulties of switching the Indian economy over to alternative energy sources (Chabhadiya et al., 2021).

Social Impact

Energy Access:

A significant portion of India's population still lacks access to reliable and affordable energy. Alternative energy sources, like energy not through the main grid, or smaller grids or roof top solar systems , can provide electricity to remote and underserved areas, bridging the energy access gap. Access to energy empowers communities, enabling them to improve their living conditions, access education and healthcare services, and engage in income-generating activities.

Employment and Economic Opportunities:

The transition to alternative energy sources can generate employment opportunities and contribute to economic growth. The renewable energy sector requires skilled labor for the manufacturing, installation, and maintenance of renewable energy infrastructure. Investments in renewable energy projects can stimulate job creation and support the growth of domestic industries, fostering technological innovation and research and development (Watari et al., 2019).

Technological Impact

Technological new adoptions:

The adoption of alternative energy sources necessitates technological innovation to improve the efficiency, reliability, and affordability of renewable energy technologies. Research and development efforts in the renewable energy sector can drive technological advancements, leading to breakthroughs in energy storage, grid integration, and renewable energy technologies. These advancements can further enhance the competitiveness and viability of alternative energy sources in the Indian market.

Synergies with Other Sectors:

Alternative energy sources can have synergistic effects on other sectors of the economy. For instance, bioenergy derived from agricultural waste or dedicated energy crops can provide a renewable source of energy while promoting agricultural productivity and rural livelihoods. The adoption of renewable energy-powered electric vehicles can help the transportation sector become less reliant on fossil fuels, resulting in lower emissions and better air quality.

The economic, environmental, social, and technological aspects of the impact of crude oil & alternative energy sources on the Indian economy are all interconnected & complex issues. India is subject to economic vulnerabilities, geopolitical risks, & environmental difficulties as a result of its heavy reliance on imported crude oil. Alternative energy use, however, may bring about advantages like increased energy security, decreased greenhouse gas emissions, improved air quality, more job opportunities, as well as inclusive economic growth (Majid, 2020).

A comprehensive strategy is needed to transition to alternative energy sources successfully. This entails putting in place beneficial laws and regulations, encouraging the advancement of new renewable energy technologies, easing access to funding and investment, and educating people about the advantages of renewable energy. The difficulties of the transition must also be addressed, including the high initial costs of renewable energy infrastructure, the erratic nature of renewable energy sources, and the necessity of reorganizing the workforce and existing infrastructure.

India may prepare the way for an environmentally friendly, resilient, and successful energy future by successfully controlling the effects of crude oil & welcoming alternative energy sources. Policymakers, researchers, and stakeholders can use the critical analysis of the effects of crude oil & renewable energy sources on the Indian economy in order to create strategies, make well-informed decisions, and advance the nation's transition to a more ecologically friendly & sustainable energy system.

Policy Implications

Policy Support:

The move to renewable energy sources is greatly aided by governmental regulations and policies. Feed-in tariffs, renewable purchase responsibilities, tax breaks, & grants are examples of supportive policies that can encourage investment in energy-efficient projects & foster the expansion of the renewable energy industry. For the market for sustainable energy to attract private sector investments & promote innovation, clear & consistent policies that offer long-term certainty & stability are crucial.

Infrastructure Development:

Infrastructure development is crucial for the switch to alternative energy sources. This covers the construction of energy storage facilities, networks for distribution as well as transmission, & power plants using renewable energy sources. To ensure the successful integration of energy from renewable sources into the current power system, policymakers should prioritize investments in grid infrastructure and smart grids. Additionally, the creation of a strong charging infrastructure for electric vehicles is essential to support the wide-scale uptake of environmentally friendly transportation (Rynska, 2022).

Research and Development:

Interests in innovative work (Research and development) are fundamental for driving mechanical advancement in the sustainable power area. State-run administrations ought to designate assets for Research and development programs pointed toward working on the productivity and cost-adequacy of sustainable power innovations. Cooperation between the scholarly world, research foundations, and the confidential area can encourage development, speed up innovation headways, and advance the commercialization of sustainable power arrangements.

International Collaboration:

International cooperation and collaboration play a significant role in addressing the global challenges associated with the energy transition. Sharing best practices, knowledge, and resources among nations can accelerate the development and deployment of renewable energy technologies. Platforms such as the International Solar Alliance (ISA) provide an opportunity for countries to collaborate on solar energy projects, share expertise, and promote global renewable energy cooperation. India should actively engage in international partnerships to leverage global expertise, attract foreign investments, and promote the exchange of technology and knowledge.

The impact of crude oil and alternative energy sources on the Indian economy encompasses economic, environmental, social, and technological dimensions. The heavy dependence on imported crude oil exposes India to economic vulnerabilities, geopolitical risks, and environmental challenges. The utilization of elective energy sources, in any case, presents critical opportunities for expanded energy security, diminished ozone-harming substance emanations, further developed air quality, and comprehensive monetary development.

An exhaustive methodology that incorporates steady strategies, interests in Research and development, foundation improvement, and global participation is expected to do the change to elective energy sources. The production of a strong strategy climate that empowers interest in environmentally friendly power undertakings and offers long-haul security ought to be a first concern for policymakers. To ensure a productive and reliable stock of sustainable power, framework improvement is fundamental, including network mix and energy stockpiling. For mechanical advancement to happen and for environmentally friendly power innovations to turn out to be more productive and practical, innovative work speculations are pivotal. International cooperation can also quicken the energy transition by promoting knowledge exchange, attracting investments, and sharing best practices (Quitzow et al., 2021).

India may prepare the way for an environmentally friendly, resilient, & prosperous energy future by effectively managing the effects of crude oil as well as embracing alternative energy sources. For policymakers, researchers, and participants, the critical analysis of the effects of crude oil & alternative energy sources on the Indian

economy offers priceless insights. It assists in the creation of strategies, informs decision-making processes, and directs the nation's transition to a more sustainable and clean energy system. India can overcome the obstacles and take advantage of the opportunities presented by the energy transition with concerted efforts and strategic planning, ultimately promoting sustainable development and a greener future.

1.2 Research Problem

The present research aims in providing knowledge related to the influence of overdependence on crude oil imports and its alternative energy sources on the Indian economy. It seeks in highlighting the economic impact of India's dependency on crude oil along with including the effect on inflation and trade deficit. In addition to this, the study emphasizes analyzing the benefits and issues linked with shifting to alternative energy sources such as renewable energy. Information related to alternative energy resources is not identified properly by the researchers so there is a need to carry out the present research to see how Indian Economy is impacted by the crude Oil markets

1.3 Aim and Objectives

The study's main aim is to analyze the influence of crude oil and its alternative energy sources on the Indian economy.

Objectives

RO1 to critically analyze the impact of over dependence Crude Oil Imports on our national economy

RO2 To compare and analyze alternative sources of energy & reduce dependency on international crude oil imports

1.4 Contribution of the Study

The research emphasizes contributing to providing an understanding of the influence of over dependence of crude oil imports along with alternative energy sources on the economy of India. It provides a critical analysis of economic consequences considering India's over dependence on crude oil along with highlighting challenges with respect to inflation and trade deficit. It contributes to providing knowledge associated with the origin of crude oil and its importance for the Indian economy.

Additionally, it contributes to identifying alternative energy sources with respect to crude oil affecting the economy of India.

1.5 Thesis structure

Introduction: - In the first chapter of the thesis background of the research will be provided along with the aim and objectives of the research. Further, the problem statement will be discussed considering the contribution of the study.

Literature review: - This chapter involves various themes which will be discussed by considering existing literature on the basis of the topic selected. The theoretical framework will be taken into consideration and aligned with the research topic.

Research Methodology: - The chapter provides various methods and techniques for the completion of the study. Different techniques will be involved such as research approach, research design, research philosophy, and data analysis method.

Data analysis and interpretation: - Statistical analysis will be done concerning the formulation of graphs and tables. Further, interpretation will be discussed based on the tables and graphs provided.

Results and Discussion: - In this chapter, results gained from the statistical analysis will be discussed here.

Conclusion and recommendation: - In the last chapter, short summary of the overall research will be discussed. Moreover, suggestions will be provided based on the issues identified in the research.