

**Petroleum Economics and Management**  
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**Indian Institute of Technology, Kharagpur**

**Module - 01**  
**Introduction**  
**Lecture - 02**  
**Role of Oil**

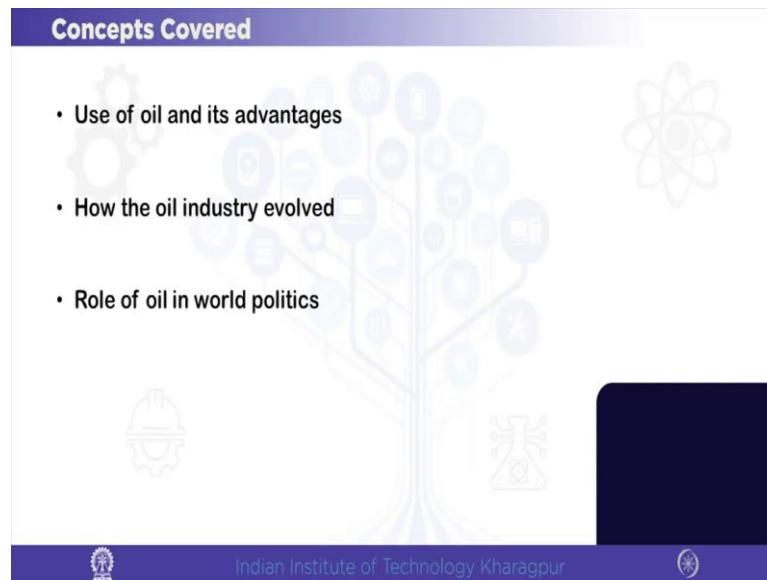
Hi everyone. I am Dr. Anwasha Aditya, Assistant Professor in the Department of Humanities and Social Sciences of IIT, Kharagpur. I am the instructor of your course, Petroleum Economics and Management that is offered in the NPTEL online certification program.

Now, in the very first lecture we have already discussed about the motivation, the relevance of having a course, which is entirely dedicated for a resource which is in scarcity like petroleum. So, why do we need a course which is dedicated to petroleum and the management of the resource?

So, we discussed the importance of having a course on petroleum economics. We saw the importance of oil in global economy with empirical evidences. We discussed about the indispensable nature of oil, and we also discussed about the nature of phenomenal price movement of oil which is just incomparable with any other goods or services.

After that in the very first lecture of our first module, we also outlined our course. Now, if you see the course structure, so in module 1, after the introductory lecture, we are going into the core of our syllabus that is we start with the second lecture of module 1 which is on the Role of Oil, ok.

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In today's class, we are going to discuss how oil is used and we have seen in motivating our course the indispensable nature of oil in our day-to-day life. We can nowadays hardly imagine our daily life without using petrol and other related products with petroleum. So, what is the importance of use of oil and what is the advantages of oil?

Because why oil has gained so much importance compared to other sources of energy like coal or natural gas. So, today in the first lecture we are going to discuss about the use of oil and the advantages of oil over other sources of energy. The second topic covered in today's lecture will be a historical perspective on the development of oil industry, how the oil industry has evolved over time and the historical perspective of use of oil.

We will see that oil is there in use since a very ancient time, though the development of modern oil industry is a relatively recent phenomenon. And lastly we will discuss about the importance of oil in world politics for quite some time oil has been one of the triggering forces that decide the direction of world politics. So, we are going to discuss the geopolitics associated with oil. So, with this we start our first lecture.

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**Oil: Its Vital Role**

- Just like blood flows in human body, oil flows through pipelines carrying energy required for functioning of modern civilization.
- It allows wheels in machines and transportation equipment to move and makes our dwellings more comfortable in extreme weather.
- Disruption in oil supply led to immediate inconveniences and spiraling effects across different spheres of daily life.

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So, our daily life is nowadays so much dependent on oil and that is one of the reason of having a course on petroleum economics and management because we have to manage the resource very prudently. So, our day-to-day life we cannot think about replacing oil at least in the near future.

We have seen that in the very first lecture, in the previous lecture, if you listen to that we have already discussed the indispensable nature of oil especially with respect to transportation. Transportation is greatly dependent on oil. As we proceed, we will discuss we will show with data also.

The sector wise substitution possibility in oil and we see that in the energy sector from mid-1980s oil was gradually being replaced to some extent by other sources of energy. For example, say hydroelectric power plants, tidal power plants, solar energy. But transportation is entirely dependent on oil and that is also one of the reason why during the pandemic there was restriction on movement of goods and services and lockdown restrictions were imposed, almost all over the world, almost in every countries.

So, that created huge demand side shock in the oil industry because transportation to a large extent is heavily dependent on oil. So, we can say that just like blood flows in our body. So, oil also flows through the pipeline which carries the energy required for functioning the human civilization, modern civilization. So, from you wake up in the morning to the time we go to bed, we are dependent on oil in the directly or indirectly.

We are using energy, we are using transportation, we are using the goods and services which are also transported. If we directly do not use transport we work from home then also we are dependent, we are consuming the goods and services which come to the market. Even the raw materials come to the market using transport.

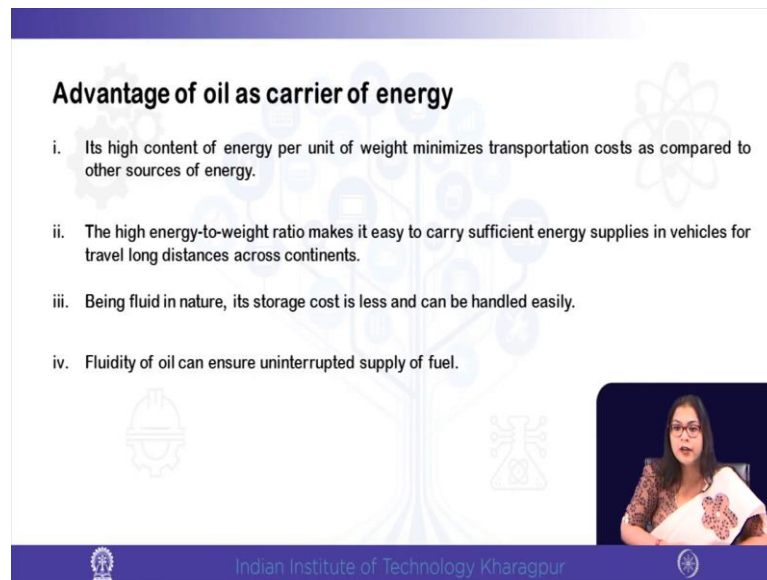
And that is why you see whenever there is a oil price shop increase in oil price, our transportation becomes costly. And that increases the cost of production also and there is overall inflationary pressure. Therefore, oil is extremely important in many things in our daily life. Now, say machines, machines and transportation equipments are entirely dependent on oil as we are discussing.

So, in transport in near future, we do not have any ready substitute of oil. Oil is also used to make our dwellings more comfortable in extreme weather condition. For example, ceiling fan, air condition, air cooler in the summers, room heater in the winter so, for everything we are dependent on oil.

That is why whenever there is a disruption in supply of oil that leads to immediate spiraling effect across different spheres of our daily life. There is huge impact on, just like I was saying impact on inflation then there will be impact on exchange rate, we will discuss everything, there will be unemployment.

So, there will be lot of disruptions political unrest. So, that is why oil is so important. Now, why, there are other sources of energy also, so why oil has become so important? How oil has replaced all other sources of energy? That means, there must be some advantages of oil as a source of energy.

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**Advantage of oil as carrier of energy**

- i. Its high content of energy per unit of weight minimizes transportation costs as compared to other sources of energy.
- ii. The high energy-to-weight ratio makes it easy to carry sufficient energy supplies in vehicles for travel long distances across continents.
- iii. Being fluid in nature, its storage cost is less and can be handled easily.
- iv. Fluidity of oil can ensure uninterrupted supply of fuel.

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If we compare oil with other sources of energy, let us say coal or natural gas, so the first advantage of oil is its high content of energy per unit of weight. So, for each unit of weight the energy content is high as compared to other solid forms of energy and that minimizes the transport cost, when we compare it with coal or other sources of energy.

The second advantage is also related to this because the high energy to weight; that means, the per unit energy to weight ratio that is very high for oil and that reduces not only the transportation cost, but it allows us to carry oil for long distances. So, why it is important?

That it is easy to carry oil in long distances as compared to coal. Why is it so important? Because you see international trade mostly depends on air transport and sea transport, especially on sea transport because apart from some medicines or goods of very strategic importance, mostly international trade is dependent on sea transport. Now, for sea transport when we are crossing the continents.

So, we have to travel a long distance, now if it so happens that the source of energy is itself very heavy. So, you compare a fluid source of energy with respect to a solid source of energy. So, per unit energy production will be greater in fluid source and the transportation cost is very less.

Now, historically, we know that the places which have a coastal line or which are near to the river those were developed. Because it is easy for those places to be connected with the rest of the world or at least rest of the country, ok as compared to the land lock countries. What do we mean by land lock? Land lock means you are not connected directly with the coastal line. So, you are dependent on some other country, ok for transporting your goods or services.

So, the countries which have a direct coastal line or port areas they are participating in world trade for a long time at a much larger extent to the countries which are landlocked. So, in respect to international trade oil become so important. So, you now imagine if you are using say near transport, you are using coal in place of oil.

So, what will happen? The energy to weight ratio will be less. So, we know in air transport we already have lot of restrictions on our luggage. So, they have a capacity, maximum capacity baggage allowance is there. So, if you if the energy source itself is very heavy, it will not be cost effective right.

So, if we compare oil with other sources of energy, we see that being fluid in nature, it can be transported very easily at a much lower cost. And that is the reason why international trade is so much dependent on oil. And nowadays we can hardly find out a country which is not integrated with the rest of the world, which is not open.

The degree of openness can vary one country can be less open, other country can be more open. But all the countries in the world all the economies are open are integrated with the rest of the world. They, we cannot produce everything; we have to buy the important goods from other countries which we cannot produce.

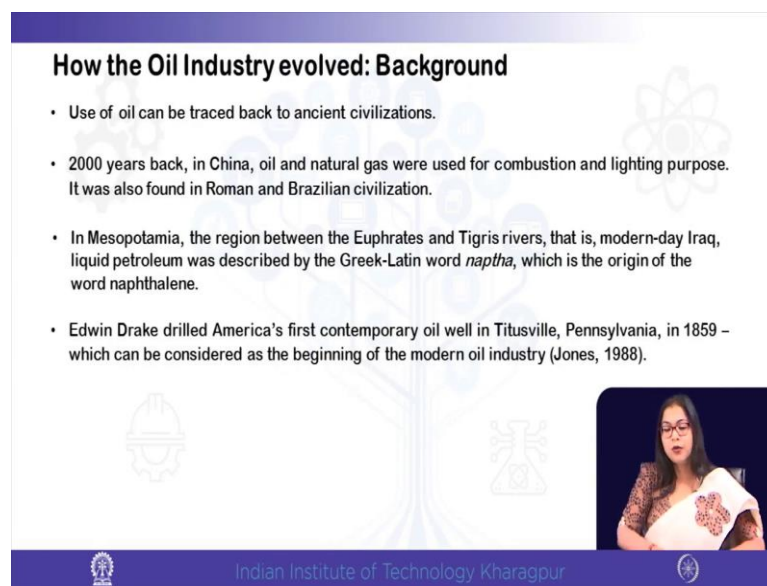
And for international trade export and import, oil is extremely important. And export gives us the foreign exchange which is required to finance our import. And that is why whenever there is a disruption in oil supply that creates disturbance with respect to the exchange rate market also.

So, we will discuss all these things in very detail, the linkage between exchange rate and oil market, oil price shock, we will discuss everything in very detail. So, now, we are just comparing oil with other sources of energy. So, the third advantage of oil over other

sources of energy is, it is fluid in nature. So, its storage cost is less and it can be handled very easily.

Fourth is because it is fluid we can ensure uninterrupted supply of the fuel as compared to the other solid sources, where the storage cost is high, transportation cost is high. And if there is some political unrest or war or natural calamity, the supply can be easily disturbed compared to oil. So, these are the four major advantages of oil, why oil has become so indispensable in nature, in our modern civilization.

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**How the Oil Industry evolved: Background**

- Use of oil can be traced back to ancient civilizations.
- 2000 years back, in China, oil and natural gas were used for combustion and lighting purpose. It was also found in Roman and Brazilian civilization.
- In Mesopotamia, the region between the Euphrates and Tigris rivers, that is, modern-day Iraq, liquid petroleum was described by the Greek-Latin word *naphtha*, which is the origin of the word naphthalene.
- Edwin Drake drilled America's first contemporary oil well in Titusville, Pennsylvania, in 1859 – which can be considered as the beginning of the modern oil industry (Jones, 1988).

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Now, with this, we now go to our next topic of today's class. We now need to have a historical overview of how the oil industry has developed. Mainly, what we can say is that oil industry in the modern form is developed in nineteen, sorry in eighteen fifty nine in Pennsylvania, ok. But the use of oil has been there for a very long time, from the ancient days.

Two thousand years back, in China, oil and natural gas were used for combustion and lighting purposes. It was also used in ancient civilizations like Roman civilization and Brazilian civilization. So, use of oil has been there since ancient time, though the modern oil industry in the current form it is a relatively recent phenomena, which started in US and the major driving force behind the industrial process in US has been petroleum or which is also referred to as gasoline in US.

The origin of the word naphtha comes from the Greek letter this naphtha is the origin of the word naphthalene, so which is a Greek-Latin word. So, we see that oil use of oil is not a new phenomena, it has been there since long, but the importance has grown over time. As our modern livelihood, our lifestyle gets dependent more and more on energy, transportation gets entirely dependent on oil. But the oil industry is there, use of oil is there since the ancient times.

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**Oil and World Politics**

- The world's crude oil reserves are not evenly distributed. It is preserved in the Middle East in huge share. Hence, since the early 20th century, this region has attracted both global powers and global money.
- Controlling oil supply became important in military strategy after steam engines in warships were replaced with diesel ones, which was crucial in the outcome of World War II.
- Oil garnered enormous media attention once coal's hegemony began to decline in the middle of the 1950s and its significance to contemporary economies expanded significantly, playing a significant role in various energy crises.

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Now, because of its importance and indispensable nature, oil has been a triggering factor which dictates the direction of world politics in which way the world politics will be driven. Why? Because at one side it has indispensable impact on our daily life, we are totally dependent on it.

On the other side, the distribution is not even. It is in scarcity, it is in fixed amount and we also are uncertain about how much is exactly there, and the main constraint regarding oil is the distribution is not even around the globe. It is highly dominated, the endowment is highly dominated in the area of in the region of Middle East.

Now, unfortunately when oil was discovered in Middle East, those regions in the Middle East like say Saudi Arabia it was a poor province in the Ottoman region. So, there was hardly any use of oil within Saudi Arabia. So, what Saudi Arabia did? Saudi Arabia found that there was huge demand for oil in the rest of the world, but there was not much use of oil within Saudi Arabia. So, Saudi Arabia started exporting oil, ok.

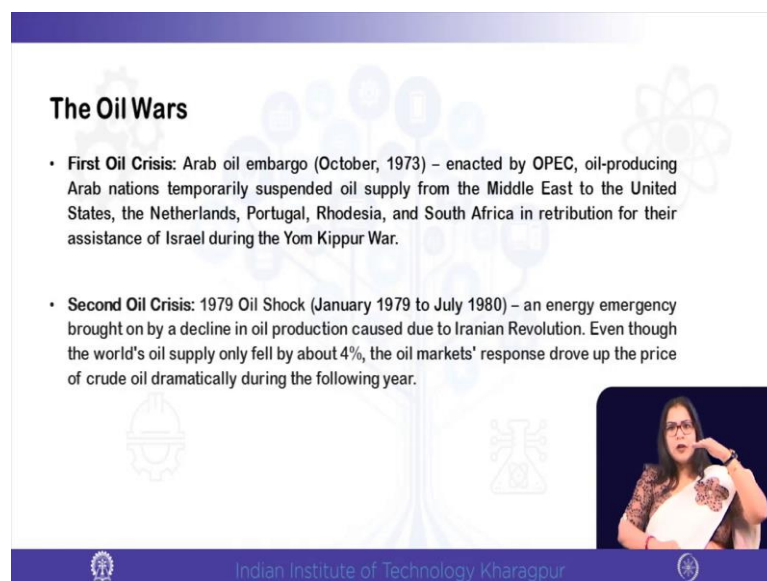


So, from that time onward Middle East has attracted the attention of the global powers. So, the major countries of the world, the major power superpowers of the world since the early twentieth century onward, they are attracted to the Middle East, who will dominate the Middle East.

So, global powers and global money has gone toward that direction. So, controlling the supply of oil have become very important, as part of the military strategy after the steam engine and the war were replaced with the diesel engines which was the outcome of Second World War.

So, the superpowers tried to dominate the Middle East and that is the major reason behind the geopolitics that we have with regard to oil. So, it started from the 1970s mostly and it is still there. So, in the remaining lecture, I am going to discuss about the role of oil in geopolitics. Oil garnered enormous media attention because coals importance started declining from the 1950s, ok.

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**The Oil Wars**

- **First Oil Crisis:** Arab oil embargo (October, 1973) – enacted by OPEC, oil-producing Arab nations temporarily suspended oil supply from the Middle East to the United States, the Netherlands, Portugal, Rhodesia, and South Africa in retribution for their assistance of Israel during the Yom Kippur War.
- **Second Oil Crisis:** 1979 Oil Shock (January 1979 to July 1980) – an energy emergency brought on by a decline in oil production caused due to Iranian Revolution. Even though the world's oil supply only fell by about 4%, the oil markets' response drove up the price of crude oil dramatically during the following year.

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So, after that, mainly we see that from 1970 onward, we have oil price shocks. We have many crises related to oils. We will discuss the price movement of oil, but before that let us see the oil wars. What are the oil wars? We in our one of the topic is the movement of oil price, there we will discuss in detail about the impact of the oil wars, but today let us see what were the oil wars.

So, the first oil war was on in October 1973, where an OPEC, the organization of petroleum exporting country, I will also discuss about OPEC in one of the lectures in one of the modules where we will discuss about the structure of OPEC, the function of OPEC. So, for now we are just discussing the oil war.

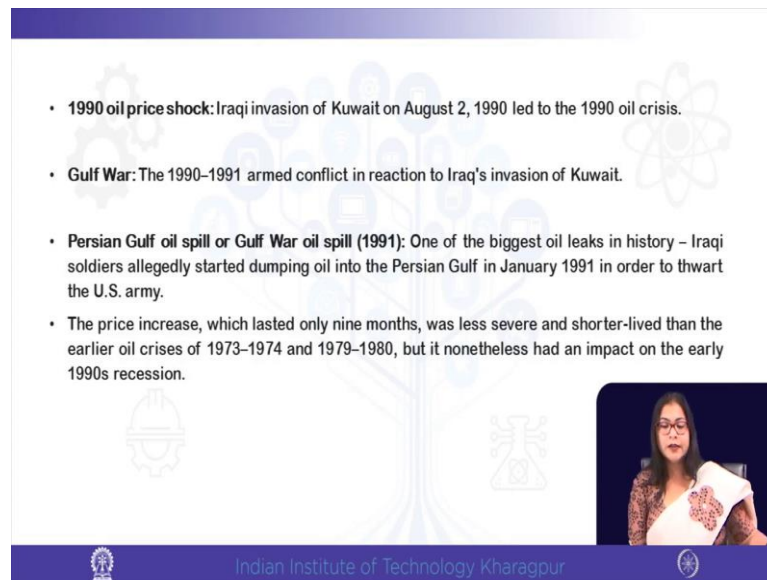
So, the organization of petroleum exporting countries in 1973, they imposed an oil embargo by which this oil producing Saudi Arabian countries and other countries in the Middle East, they restricted the supply of oil to the US, Netherlands, Portugal, Rhodesia and South Africa in retribution for their assistance of Israel during the Yom Kippur war.

So, that was the first oil crisis starting from 1973 onward. And from that time onwards oil price started showing a rising trend which is still there. Though there are, in between dips, but oil price over time from 1976 is rising. The second oil price happened in 1979, July 1979 to July 1980 to be more specific.

This was brought on by a decline in oil production caused by the Iranian revolution. And you see only 4 percent of world oil supply was cut back. But this 1979 crisis had huge impact. The price of crude oil increased dramatically. We will also study this why it happened.

Because in the very short run, when there was a sudden supply side shock, the price and quantity they responded, the equilibrium price and quantity responded drastically. Price increased very much, because there was no substitute, easy substitute of oil both in the demand side and supply side. So, the supply shock led to huge price increase of oil. So, these are the two oil wars of the 1970s.

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- **1990 oil price shock:** Iraqi invasion of Kuwait on August 2, 1990 led to the 1990 oil crisis.
- **Gulf War:** The 1990–1991 armed conflict in reaction to Iraq's invasion of Kuwait.
- **Persian Gulf oil spill or Gulf War oil spill (1991):** One of the biggest oil leaks in history – Iraqi soldiers allegedly started dumping oil into the Persian Gulf in January 1991 in order to thwart the U.S. army.
- The price increase, which lasted only nine months, was less severe and shorter-lived than the earlier oil crises of 1973–1974 and 1979–1980, but it nonetheless had an impact on the early 1990s recession.

Then, 1990 and 1991, these two years again marked as the time span of huge oil price shock which were triggered by few events. So, what was the first event? So, the first event was the 1990 oil price shock, where Iraq invaded Kuwait on 2nd August, 1990 which led to the first 1990 oil price shock.

We will discuss about the oil implication of the 1990 oil price shock which is very important for the Indian economy because this oil price shock is one of the factors behind triggering the balance of payment crisis that Indian economy faced in 1991. So, this oil price shock in 1990 and 1991 was a culmination of these 3-4 events. So, one was the 1990 oil price shock that is the invasion of Iraq on Kuwait.

The second was the Gulf War, the 1990-1991 armed conflict in reaction to Iraq's invasion of Kuwait, but that was not the end. In 1991, we had an unprecedented scenario where we had oil spill in the sea. So, that is referred to as the Persian Gulf oil spill or Gulf War oil spill.

What happened was that the Iraqi soldiers they started dumping the oil into the Persian Gulf in January 1999 to thwart the US army. So, these were the 3 incidences in the Middle East, so that led to the oil crisis in the Gulf region. But apart from the Gulf Wars in 1991, there was another event that also triggered oil price increase.

What was that? That was the breaking down of the then soviet Russia because Russia was also a supplier of oil. And at that time the then soviet Russia broke down which also had repercussions on the world oil supply and as an effect, the oil price also increased. So, the sudden oil price increase affected the Indian economy also.

We will discuss the implication of the oil price shock with respect to the Indian economy; will be discussed in detail towards the end of this course. However, we found that the oil price shock of 1990 and 1991, they had relatively less impact. Means the oil price did not increase that much it increased, but to a lesser extent if you compare with the earlier crisis of 1973 and 1979, especially.

The 1979 crisis are huge impact, compared to that the 1990 and 1991 crisis at lower impact. Why? Because at that time in 1991 Saudi Arabia also slightly increased its oil supply. So, Saudi Arabia which is considered to be the leader within OPEC, often acts as a swing producer.

By changing the quantity supply it can influence the world price because so given huge endowment of oil in Saudi Arabia, it can change, it can swing the oil price. So, because of Saudi Arabia's intervention, in 1991 the oil price increased, but to a lower extent as compared to the 1979 crisis because in 1979 crisis Saudi Arabia also cut back the oil supply. But that was not the case in 1991.

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**Oil and World Politics: Current Scenarios**

- **Pandemic led lockdown:** Double blow of COVID-19 induced lockdown and the oil price shock hit the producers hard when the oil and petroleum industry was already facing a structural decline. For the brief time period, the benchmark price for the US crude oil went negative.
- **Russia-Ukraine War:** Oil prices increased sharply and crossed \$100 per barrel. European nations looked for alternatives after US, EU and UK imposed sanctions on Russia.

On the other hand, Russia found new buyers and sold the production by offering discounts.

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So, this is the historical perspective. But this geopolitics is going on till now. If we see the very recent scenario, we already talked about the pandemic, how the COVID-19 pandemic and the restrictions to combat the pandemic, that is the lockdown measures, how that affected the oil market.

Now, there was the lockdown and the pandemic which led to oil price shock and for some time, we discussed in the first class also. And we will discuss in very detail that the WTI future contract price which is the benchmark of crude oil price in the US, that became negative on twentieth April 2020 and that was just unprecedented.

And it was in a time when the oil industry was already facing a structural decline. What do we mean by the structural decline? Because you see once the global economy started recovering from the global financial crisis, so the economy started recovering, since 2012, the oil price started increasing again.

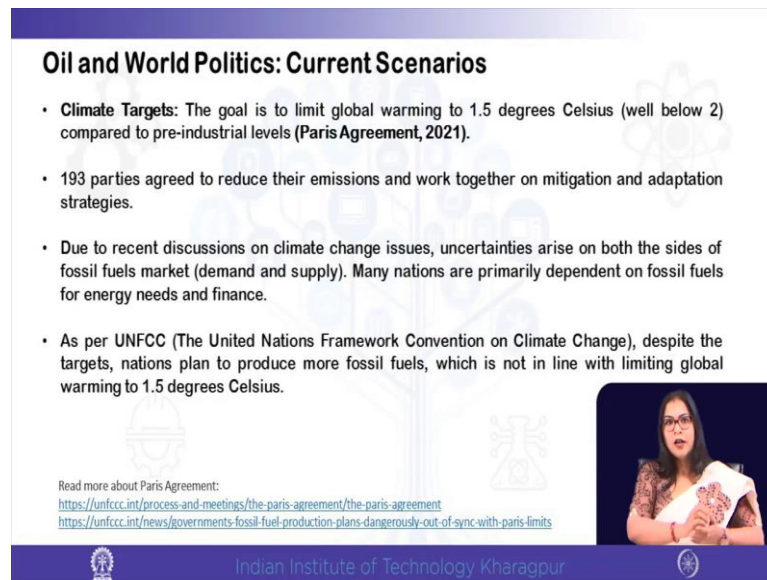
So, many economists predicted that oil price will increase very much and there came a hypothesis which is called the peak oil hypothesis, that oil price will increase very much and use of oil will culminate. So, we will discuss about the hypothesis. But, then again, in 2014, the oil price trend suddenly reverse.

Why? Because of the shale oil revolution in US. So, US came up with some alternate source of oil that is shale oil. We will discuss about shale oil more and more. So, it increased the supply of oil which the economist were not aware of. So, that suddenly increased the supply of oil.

So, with a sudden increase in supply of oil, oil price suddenly reverse. The oil price trend which was rising that experienced a brief decline. So, it was a phase of structural decline and then the pandemic hit us and oil price was adversely affected. Then, came the Russia-Ukraine War, where again we discussed in the first class that during the war oil price again started increasing and crossed hundred dollar per barrel.

Because the European Unions, they also started looking for alternatives after US, EU and UK imposed sanctions on Russia. So, Russia being a major supplier of oil, because if Russia supply of oil is disrupted, so oil price will increase, but Russia also found new buyers and the oil price which increased, then again it was moderated after few months.

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**Oil and World Politics: Current Scenarios**

- **Climate Targets:** The goal is to limit global warming to 1.5 degrees Celsius (well below 2) compared to pre-industrial levels (**Paris Agreement, 2021**).
- 193 parties agreed to reduce their emissions and work together on mitigation and adaptation strategies.
- Due to recent discussions on climate change issues, uncertainties arise on both the sides of fossil fuels market (demand and supply). Many nations are primarily dependent on fossil fuels for energy needs and finance.
- As per UNFCC (The United Nations Framework Convention on Climate Change), despite the targets, nations plan to produce more fossil fuels, which is not in line with limiting global warming to 1.5 degrees Celsius.

Read more about Paris Agreement:  
<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>  
<https://unfccc.int/news/governments-fossil-fuel-production-plans-dangerously-out-of-sync-with-paris-limits>

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Now, another major event in the current context is the Paris agreement. Now, we know that climate change is one of the burning issues in the recent time because the global temperature is increasing. There are lot of natural calamities. So, climate change is one of the concern of the international bodies and the government's, individual governments also.

So, in Paris, in 2021, one hundred ninety three countries agreed to reduce their emissions and work together on medication and adaptation strategies. So, since it was made in Paris, so it was known as the Paris agreement of 2021. The goal was to limit the global warming below 2 degree around 1.5 degree Celsius.

So, due to the recent discussion on the climate change issues and uncertainties arise on both the demand side and the supply side of the fuel market. Many nations are primarily dependent on fossil fuel till now, for energy needs and finance. So, we do not have any suitable alternative of fossil fuel till now.

As per the United Nations framework convention on climate change that is UNFCCC, despite the targets nations plan to produce more fossil fuel. So, even though they agreed to reduce the temperature by lowering the emissions, but they continue to emit more, because they continue to produce use more fossil fuel.

Because they are dependent, most of the nations are dependent. We do not have easy and cheap substitute of oil and easily accessible substitute of oil till now. So, the countries though they are agreeing, but they are not able to meet the requirements. So, you can read more about all these agreements. We have provided the sources and we will also share the sources.

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**Conclusion**

- Oil and its vital role
- Historical perspective on the development of oil industry
- Oil: one of the driving forces of World Politics

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So, in today's class if we summarize, we discussed about the use of oil how oil has become so indispensable in day-to-day life; the advantage of oil over other sources of energy. Why oil has become so important? Because it must have some advantages over other sources of energy.

So, we saw that the energy to weight ratio is very high for oil compared to other sources of energy. It is fluid, it can be stored easily, it can be transported easily at a lower cost. So, it reduces transportation cost. So, it has become so important in international trade. Then, we discussed about the historical perspective of use of oil and how the oil industry developed.

And lastly we discussed about how oil plays a very important role in controlling the direction of world politics. So, we started from 1970s onward to very recent time of the COVID-19 pandemic, the Russia-Ukraine War and the Paris agreement. And in the future classes, we will be discussing about the implication of these events on oil price and the use of the management of the petroleum resources in very detail.

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**References**

1. Petroleum Economics: Issues and Strategies of Oil and Natural Gas Production by Rognvaldur Hannesson, Praeger, 1998.
2. Price of Oil by Roberto M. Aguilera and Marian Radetzki, Cambridge University Press, 2015.
3. Verleger, P. K. (1990). Understanding the 1990 Oil Crisis. *The Energy Journal*, 11(4), 15–33. <http://www.jstor.org/stable/41322669>

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So, these are the references. So, the references will be shared in due course. Those who are interested they can read the additional papers, research papers and the contents, the links which are shared the reports of UNFCC, the IPCC reports, ok. We will share all the materials in due course of time.

So, thank you. So, see you in the next class. We will be discussing the upcoming topics of the first module.