

Petroleum Economics and Management
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Module - 01
Introduction
Lecture - 04
North-South conflict, Way to future

Hi everyone, I am Dr. Anwasha Aditya your instructor for the course Petroleum Economics and Management. So, we are on the first module week one of this course. So, the purpose of module one is to introduce the course. In this introductory module we are discussing the issues to be covered in the course, the relevance of having a course on petroleum economics and management and the broad concerns, the what is the purpose of studying the course.

So, if you remember just a brief recapitulation whatever we have discussed so far if we summarize we have discussed the use of oil, the advantages of oil, over other sources of energy, why oil has become so important over time, what is the benefit of using oil as compared to other solid sources of energy. Then we had some historical perspective of the development of oil industry and use of oil.

Next we discuss the very important issue of role of oil in governing the direction of world politics. So, we started from Nineteen seventies onward we discussed about the oil crisis, oil wars and we discussed about the Gulf wars and we also continued till a very recent time so the COVID-nineteen pandemic and the Russia- Ukraine War, the Paris Agreement. So, we discussed how oil has been acting as a triggering force behind deciding the direction of the geopolitics.

Next we discussed a burning issue of energy and sustainability. So, for economic growth and development, for improving the standard of living and maintaining the standard of living we are nowadays so much dependent on energy. But we cannot use energy the way we have been using because that is posing a threat of energy security, because as we are becoming more and more dependent on the fossil fuel, coal which is a fossilized vegetation.

So, we are running out the resources of the past. So, we have to use the resource from the point of view of sustainability. So, we discussed this very important issue of energy use from the point of view of sustainability, we distinguish between the renewable and non-renewable resources or what we call exhaustible and non-exhaustible resources.

Now, not only that we are running out of the fossil fuels that is the exhaustible resources, but another major issue of greater dependence on the fossil fuel is regarding the issue of environment. So, climate change nowadays is a major concern of the economies around the globe.

So, we see that the global temperature is rising over time the sea levels are increasing and that is posing huge threat on human civilization and overall ecological balance. So, we need to take into account the energy used from the perspective of sustainability and from the point of view of environmental concerns. So with this we also discussed what is the future.

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The slide features a dark blue header with the text "Concepts Covered" in white. Below the header, a list of three items is displayed: "• North-South Conflict", "• Way to future", and "• Ethanol Blending". The background of the slide is light blue and contains several faint icons: a gear, a tree with circular nodes, a molecular structure, a hard hat, and a laboratory flask. At the bottom, there is a dark blue footer bar with the Indian Institute of Technology Kharagpur logo on the left, the text "Indian Institute of Technology Kharagpur" in the center, and another logo on the right.

So, in today's class we are going to discuss the issue of energy and sustainability from the point of view of the developed and developing countries. Because so far we discussed overall, so what do we mean by sustainability and what are the sustainable resources, how we moved see, when the human civilization started. So, we are dependent on more traditional sources of energy like for example, cow dung or wood.

Those are sustainable because they are dependent on the continuous flow of sunshine that is we know that the plants use photosynthesis process or the animals are dependent on plants, so we are dependent on the plants and animals, so indirectly we are also dependent on sun.

So, these are the continuous sources of energy which will not be exhausted at least in the near future as long as sun is there. But industrial revolution which changed the process of manufacturing production or industrial production in the advanced countries, so it started in the Great Britain and then it spread to other parts of Europe and the US also.

So, it started from seventeen sixty and it lasted around eighteen twenty to eighteen forty. So, industrial revolution made a huge change as far as the use of resource is concerned the energy resources is concerned. So, we shifted from using the traditional sources to the more new sources of energy which are the non-renewable sources. So, industrial revolution was marked by the use of steam engine.

So, we started becoming dependent on coal and then gradually petroleum products took over. Because of its advantage that its weight to energy ratio is high it is fluid, it reduces transport cost, petroleum has become so important in international transportation and that is why it plays a very important role in international trade because in international trade we have to shift the products not only the final product.

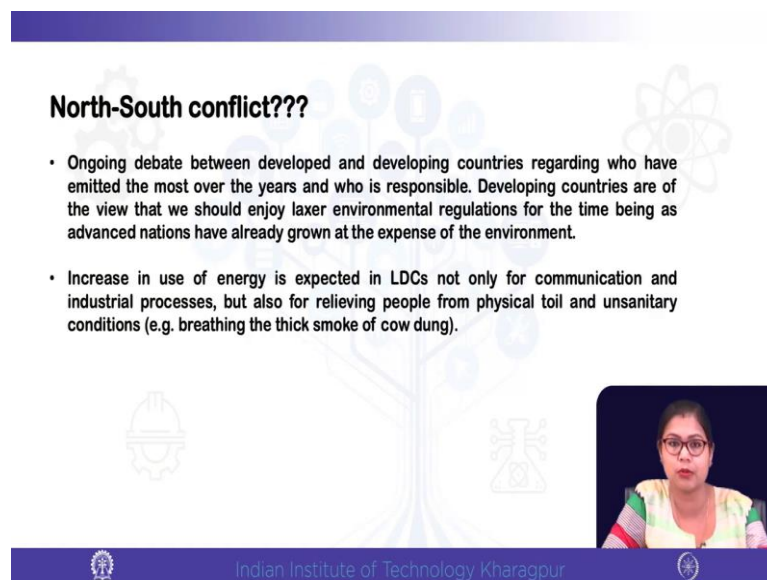
Now, that we have huge amount of trade in intermediate products. So, we have to also transport the raw materials, we have to transport the final goods to the consumers and the production process is spread across countries. So, that is why petroleum has become so important in reducing the transport cost as far as international trade is concerned because if transport cost increases, it may not be advantageous to buy the raw materials from some foreign location.

So, with this we discussed about the transition that we had from the traditional sources of energy to more non-renewable sources of energy or fossil fuel. But that also posed a huge threat of energy security because we are running out of the resource, the rate at which petroleum and coal is currently being formed that is very less compared to the rate at which we are currently using.

And we have also seen with empirical data that the fossil fuels cause huge amount of greenhouse gas emissions the carbon dioxide emission and those are responsible for climate change. So, we have to use the energies from the point of view of environment and sustainability and here comes a debate between the developed and developing countries.

So, the first concept covered in today's class will be the bone of contention between the developed and developing countries as far as sustainable use of energy resources are concerned. Then we will have a futuristic view what should be our future, how should we take care of the problem of energy security in a more sustainable way. So, these are the major contents to be discussed in today's class.

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North-South conflict???

- Ongoing debate between developed and developing countries regarding who have emitted the most over the years and who is responsible. Developing countries are of the view that we should enjoy laxer environmental regulations for the time being as advanced nations have already grown at the expense of the environment.
- Increase in use of energy is expected in LDCs not only for communication and industrial processes, but also for relieving people from physical toil and unsanitary conditions (e.g. breathing the thick smoke of cow dung).

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So, with this we now start discussing about the North-South conflict. So, what do we mean by north-south? So, in general terms north refers to the developed the advanced rich countries. And the southern countries are generally the countries which have been colonies, so these are typically the developing and the less developed poor countries.

So, there are lot of contentions or lack of level playing field as far as major international issues are concerned between the developed and developing countries as this is an allegation brought by the developing countries. Why is it so, why there is a lack of level playing field between the developed and developing countries. Because see we do not have global government.

If we had a global government that government would have been maximizing the global welfare from the point of view of the aggregate world economy, but we do not have global government. So, the individual country governments are interested in maximizing their own benefits, whether it is international trade or whether it is environment. Now, the countries which are rich, they obviously, dominate the poor countries, so here comes the a debate between the northern and the southern countries.

So, what the northern countries say that? The northern countries the rich countries say that a large part of global warming is being done by the developing countries the less developed countries because they are increasingly getting dependent on fossil fuel their energy consumption is higher so they are creating environmental pollutions. Now, see the what the developing countries argue, the developing countries argue that this may not solely be true.

Why? Because the developed countries already started entering into the path of industrializations since the industrial revolution started. So, just now I mentioned that industrial revolution started in the Great Britain from seventeen sixty onwards and then it spread to other parts of Europe and again to the US. And we know that the basis of rapid industrialization and growth of US economy has been oil, the petroleum products or which is known as gasoline inside US.

So, the developing countries say that the developed countries have already been industrialized. So, they have already used huge amount of fossil fuel and they have reached a more advanced standard of living not only they are experiencing faster GDP growth, but they also have higher levels of human development as measured in terms of the human development index.

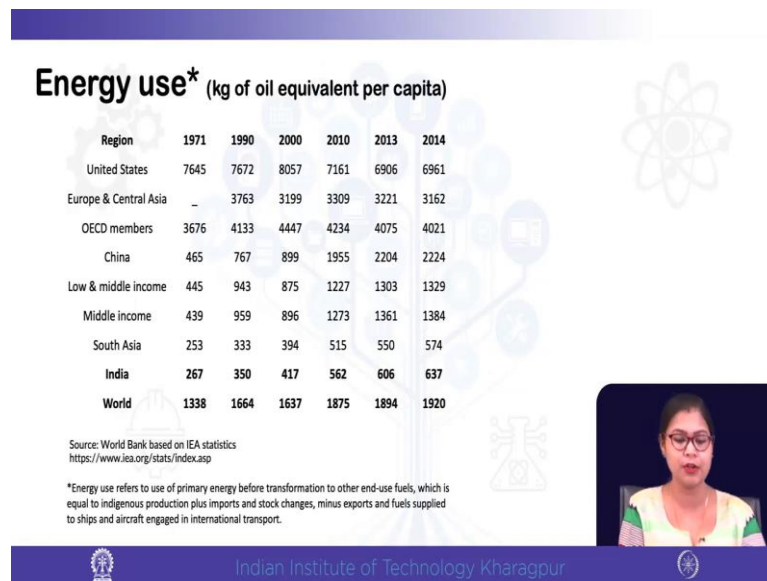
So, development is a broader concept of growth where we take into account the aspects of health, education, the rule of law. So, the developed countries the rich countries have already entered the stage of development. So, they have already used huge amount of fossil fuel for completing their transition from a primary sector based economy to a manufacturing economy and they have also moved to the third stage where they are more dependent on the tertiary or the service sector.

And because they have already developed their manufacturing sector, but for the developing countries or the less developed countries especially say for example, the

African countries or the poor countries of Asia. So, they have started entering into the path of industrialization only from late twentieth century onwards.

So, from say nineteen eighty or nineteen ninety onwards, so obviously, their energy consumption will be higher as compared to the developed countries. But not only that we can show with data that this may not be true.

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Because if we look at the empirical evidences, even though the developing countries are nowadays industrializing, so they need energy consumption more than the developed countries. But till now the developed countries dominate as far as the energy use is concerned.

So, here we have some data collected from the World Bank and this data is based on the IEA statistics, International Energy Agency statistics. So, this data can be downloaded also you can check the different data sources and because of time constraint we cannot put lot of data is there. So, if someone is interested we have mentioned the source, so one can browse through and get a more detailed idea of this energy use developed versus developing countries.

So, here we plot our sample data on energy use the variable is the kg of oil equivalent per capita. Now, here what do we mean by energy use? This energy use refers to the primary energy before transforming the energy to the final use or end use fuels. this is equal to

the domestic production plus import and change in stock and this is now subtracted by export and fuel supplied to ship and aircraft engaged in international transport.

I hope that you know what is import and export. So, import is what we buy from Abroad and export is what excess supply domestically will sell Abroad. So, energy use is domestic production plus import and stock change minus export and fuel supplied for international transportation. So, if we look at the energy use data per capita see it is again the developed countries they dominate.

So, we show the data from nineteen seventy onward to two thousand fourteen and what we see is that? The developed countries are the dominating energy users. And as compared to the middle income countries, low middle income countries and we also presented individual data of some of the individual developing countries like India for example, or China.

So, overall you see the first row correspond to US, which is the largest energy user followed by Europe and Central Asia and the third row correspond to the OECD member countries. OECD refers to the Organization of Economic Cooperation and Development the members are mainly the developed countries the rich countries. So, overall you see, the developed countries dominate the per capita energy use as compared to the developing countries.

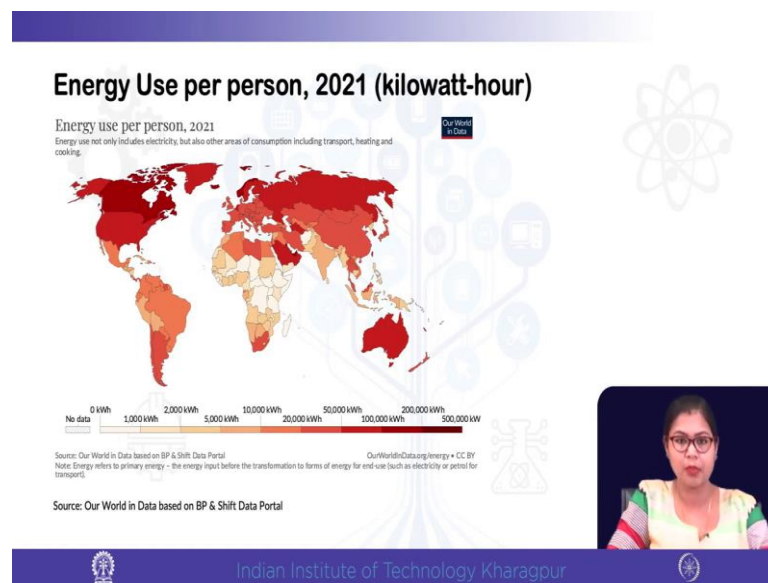
So, the allegation made by the developed countries that the developing countries are polluting the environment by using more of fossil fuel may not be true as shown in this data. Now, one interesting observation here is that, if we compare over time for the countries or region we see that there is a slight declining trend for US.

So, in US at nineteen seventy one the per capita kg of oil equivalent was seventy thousand six hundred forty five which is reduced to six thousand nine hundred and sixty one in two thousand fourteen so slight declining trend. Again the similar slight declining trend holds for Europe and Central Asia. Whereas, if we see for the developing countries say China and India the energy use is rising. So, rate of growth is increasing for China and India because they are in the stage of development they are developing, their manufacturing sector.

And when manufacturing sector is being developed we know the requirement of physical infrastructure is very high in manufacturing, we need to create road we need better transportation, communication facility, storage facility because for manufacturing we need to buy the raw materials from different parts of country China and India being large countries we need to buy the raw materials from different parts of the country, we need to finally, sell the end product.

So, for this our energy requirement also goes high, as well as for setting up the physical infrastructure. So, overall the developed countries dominate, but in the developed countries the values are falling, whereas for the less developed countries because they are in the stage of development of the manufacturing sector their use is increasing. But if we see an absolute term, in terms of value till the developed countries have much larger share of energy use as compared to the developing countries.

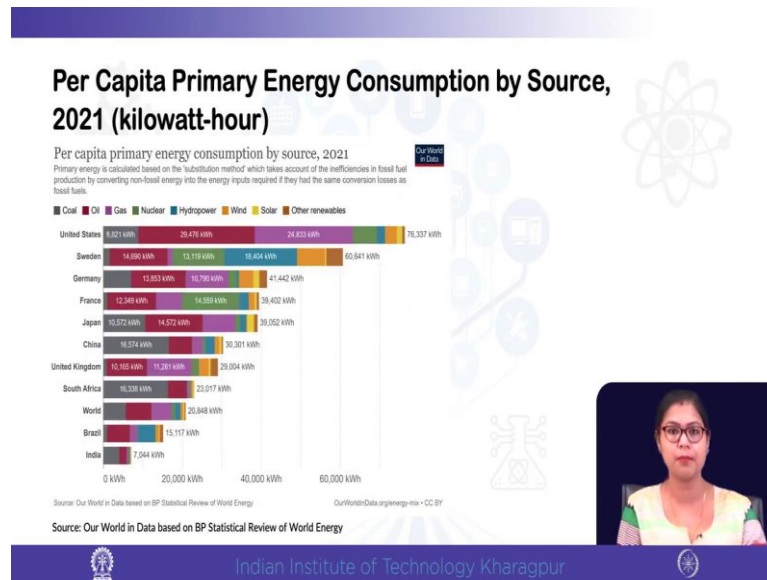
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Now, this world map is plotting the energy use per person in two thousand twenty one and you see the earlier data was still two thousand fourteen. So, similar more or less trend also are prevails in two thousand twenty one where the energy used per person in kilowatt hour is presented. So, the data source is our world in data based on BP and shift data portal.

So, what we can see is that the darker red regions means that use more energy the kilowatt per hour is greater and again you see that it is the developed countries which dominate as compared to the developing countries.

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So, the allegations brought by the developing countries that it is the developed countries who have already done lot of pollution. So, the developed countries should not only blame the developing countries. So, we can see this point in greater detail if we now arrange the countries in descending order.

So, we plot the country wise data of primary energy consumption by source, means the source means the fuel type or the source type, it is not only fuel, but also this figure plots the renewable sources of energy data, that means, the wind solar energy, hydroelectric power plants, nuclear power plants.

So, we see that again as far as the total kilowatt per hour energy is concerned it is again the developed countries. So, the countries are ranked in terms of their energy use and you see the order is US, Sweden, Germany, France, Japan so all the developed countries. And Brazil and India two developing countries they are even less than the world average. So, the last third row is the world average.

So, Brazil and India is even below the world average. And China, South Africa they are just above the world average. So, it is the developed countries which are using much

more of fossil fuel and overall energy. And another interesting observation is that, the use of renewable energy sources are also very much concentrated in the developed country region.

You see that the use of wind energy, solar, hydroelectric power, other renewables and nuclear also its almost non-existent in countries like see India very less, very less as compared to the developed countries. So, it is again true that the developed countries are more dependent on fossil fuel for completing their process of industrialization. But in absolute value the developed countries till now use huge amount of energy not only energy, but also both fossil fuel and the renewable sources of energy.

So, its high time that the developing countries also get access to the renewable sources of energy because the developing countries often lack the fund and human capital and the technology also to implement the renewable sources of energy like hydroelectric power, solar energy, tidal power, wind energy and of course, nuclear energy.

Because we discussed in one of the classes that nuclear energy requires huge technological advancement and huge fund, which may not be available in the developing countries. So, that is why the developing countries are more dependent on the fossil fuel. So, they have to complete their process of industrialization until and unless they move to the more advanced stages of economic development.

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North-South conflict???

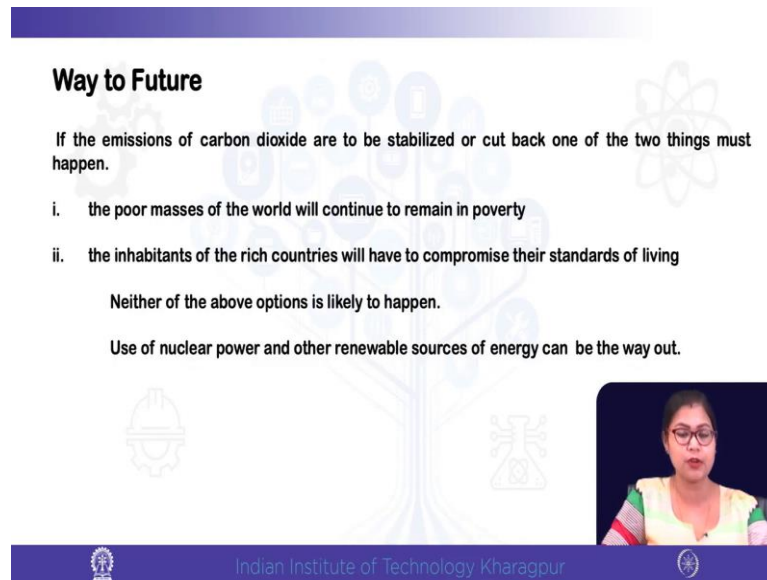
- Industrialized and post-industrialized nations are the major contributors of historical carbon emissions (Ülgen, 2021). For instance, US and the EU are responsible for the 47 percent historical emissions, while Brazil, China and India share is only around 17 percent.
- The global North have higher per capita emissions, energy use. For instance, Use of primary energy per capita in 1990 was 7.6 tonnes oil equivalents in USA and 3.76 in Europe & Central Asia, but 0.35 in India, 0.33 in South Asia.
- Since the global north are responsible for historical emissions yet the larger burden is borne by the poorer nations (Poverty-Environment Nexus) in tackling extreme weather events.

<https://carnegieeurope.eu/2021/10/06/how-deep-is-north-south-divide-on-climate-negotiations-pub-85433>



So, what we can broadly conclude is that the global north the responsible for historical emissions. But the larger burden is borne by the poorer nations. So, we have a nexus between the poverty and environment.

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Way to Future

If the emissions of carbon dioxide are to be stabilized or cut back one of the two things must happen.

- the poor masses of the world will continue to remain in poverty
- the inhabitants of the rich countries will have to compromise their standards of living

Neither of the above options is likely to happen.

Use of nuclear power and other renewable sources of energy can be the way out.

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So, we definitely need to address this. So, this is the need of the hour. So, now if we have futuristic view what we can say. So, what should be our ideal way to move to the future? So, if we need to tackle the problem of climate change by reducing the increase in global mean temperature we have to cut back the carbon dioxide emission or the greenhouse gas emission.

So, we have **two** possibilities then either the poor people of the developing countries and the less developed countries should remain in poverty in many countries in many primitive societies the poor people are till dependent on very primitive sources of fuel for their cooking purpose say cow dung or wood. So, that should not happen, because this is environmentally offensive and also this may not be very hygienic also.

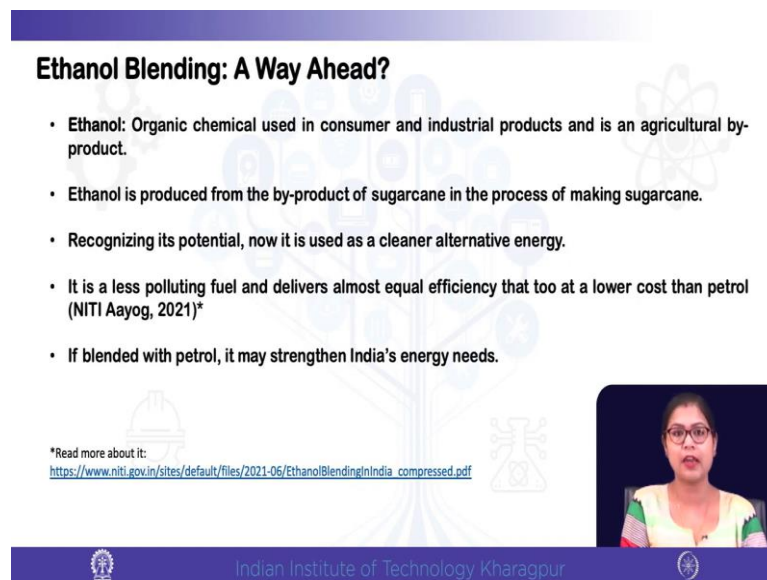
So, we need to bring out the poor people from this unsanitary conditions we have to improve the standard of living in the developing countries. So, we cannot allow the developing countries or the poor countries people to live in utter poverty and unhygienic conditions. So, what is the other option? The other option is the developed countries should cut back their energy consumption.

Now, that is also not possible because the developed countries they have a very advanced automated way of living where they are more dependent on technology and hence energy. So, we already saw with data. So, the developed countries dominate in terms of energy use as well as fossil fuel and renewable sources of energy.

So, these two possibilities that the poor's will remain poor in the developing countries and the rich people of the developed countries will cut back their standard of living, these are not possible. So, that means, then what should be our way forward. So, way forward is to find out and rely on more sustainable and renewable sources of energy like nuclear power, but we already discussed the constraints that nuclear power is also environmentally offensive and it creates huge amount of radioactive wastage.

So, it often poses security threats also. So, we have to think about more renewable sources of energy like biogas, wind, solar energy, hydroelectric power plants which depend on the continuous flow of sunshine or the gravity powers not on exhaustible resources.

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Ethanol Blending: A Way Ahead?

- Ethanol: Organic chemical used in consumer and industrial products and is an agricultural by-product.
- Ethanol is produced from the by-product of sugarcane in the process of making sugarcane.
- Recognizing its potential, now it is used as a cleaner alternative energy.
- It is a less polluting fuel and delivers almost equal efficiency that too at a lower cost than petrol (NITI Aayog, 2021)*
- If blended with petrol, it may strengthen India's energy needs.

*Read more about it:
https://www.niti.gov.in/sites/default/files/2021-06/EthanolBlendingInIndia_compressed.pdf

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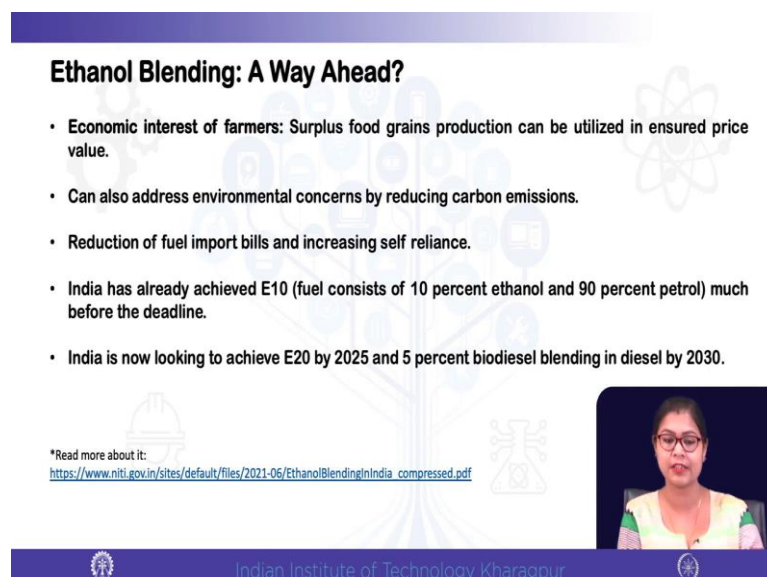
Another way out can be using ethanol in petrol. So, that India already started doing, so can it be a feasible solution to take into account our energy concern. Now see we have already discussed in the very first lecture of the course that India is a major importer of energy and India's energy use mainly is dominated by petroleum products, fossil fuels.

And that poses huge amount of outflow of foreign currency leading to balance of payment constraint because our import spending is often greater than the our export earning. So, in this situation if we can mix in the fossil fuel, if we can mix some amount of ethanol which is a agriculture by product that can to some extent solve our problem of energy security and not only that it has less greenhouse gas emissions because it is agriculture by-product.

So, it is more environment friendly it is concerned as a better source of cleaner technology. What do we mean by cleaner technology? A cleaner technology means the technology, which leads to less environmental pollution, whereas the dirty technology means, a technology which leads to more environmental pollution.

So, what is ethanol ethanol is organic chemical which is used in consumer and industrial products and this is agriculture by-product this is basically produced in making the sugarcane. So, it can definitely be used as an alternate source of energy. A NITI Aayog report of two thousand twenty-one the link is given here it mentions that it is a less polluting fuel and it delivers almost equal efficiency and at a lower cost than petroleum products.

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Ethanol Blending: A Way Ahead?

- **Economic interest of farmers:** Surplus food grains production can be utilized in ensured price value.
- Can also address environmental concerns by reducing carbon emissions.
- Reduction of fuel import bills and increasing self reliance.
- India has already achieved E10 (fuel consists of 10 percent ethanol and 90 percent petrol) much before the deadline.
- India is now looking to achieve E20 by 2025 and 5 percent biodiesel blending in diesel by 2030.

*Read more about it:
https://www.niti.gov.in/sites/default/files/2021-06/EthanolBlendingInIndia_compressed.pdf

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So, it can strengthen the India's energy needs and it can also address the environmental concerns. So, this is not the only benefit that is environmental concerns solving it to some extent and reduction of the import bill and increasing the self reliance. So, apart

from these two advantages another advantage of ethanol blending is that, the surplus food grain can be utilized in ensured price.

Often we know that if the farmers end up producing more that increases the market supply and the per unit price falls. So, it is ultimately the farmers who are adversely affected. So, use of petrol ethanol in mixing with petroleum can create a more profitable opportunities for the farmers because they can supply their excess sugarcane and ethanol in mixing with petrol.

So, India has already achieved the E-10 target. What is E-10 target? That is the fuel consist of ten percent of ethanol and ninety percent of petrol. So, before the deadline India has achieved this, now India has set a target of achieving E-20 that means twenty percent of ethanol and eighty percent of petrol by two thousand twenty five. And we also plan to mix five percent of ethanol with ninety five percent of diesel by two thousand thirty.

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Ethanol blending program in India

- Project started on a pilot basis in 2001.
- Ethanol Blended Petrol (EBP) Programme launched in 2003.
- It faced severe challenges in the early phases and it did not meet success due to high taxation of ethanol, procurement challenges and limited availability of feedstock (raw material).
- In 2014, it was reintroduced and the process were simplified. Governments also directed Oil PSEs to set up bio-refineries.

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So, we started the project on a pilot basis in two thousand one, the ethanol blended program was launched in two thousand three , but initially there were challenges like the taxes were high, there are procurement challenges, there was less availability of the raw material. Since two thousand fourteen onward we have started putting more emphasis on this issue and the process have become very simplified there was a major boost done by

the two thousand eighteen tax policy, where the GST the Goods and Services Tax on ethanol was reduced from eighteen to five percent, so it gave a major boost.

So, the national policy on bio-fuel considers all the stakeholders and it led to reduction of the GST. The industrial development and regulation act amendment in two thousand sixteen it brings a clarity on the role of the central and state government.

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Ethanol Statistics

- For instance, India achieved 10 percent ethanol blending (E10) and saved foreign exchange amounting to INR 41,000 crores in last few years.
- Reduction of 192 lakh tonnes of carbon emissions in last 7 years.*
- India aims to achieve 20 percent ethanol blending (E20) and can save USD 4 billion per annum (INR 30,000 crores).
- Farmers of the country have earned Rs 40,600 crore in the last eight years due to increase in ethanol blending.
- Ethanol production capacity doubled in last 4 years.*

* Ministry of Petroleum and Natural Gas, Govt

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So, these are the statistics which show that India can achieve E-10 and that can lead to huge benefit in terms of monetary value it saved India's foreign exchange of around forty one thousand crore in the last few years ok. So, we have doubled our ethanol production capacity and in the coming years we want to use twenty percent blending of ethanol and that can save around US dollar four billion per year.

So, ethanol use can be one future move which can to some extent tackle India's problem of energy security, as well as the problem of greenhouse gas emission because it is less environmentally offensive as compared to the fossil fuel.

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Conclusion

- Debates between the developed and developing countries or North-South conflict
- The future ahead: more sustainable sources of energy

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So, with these we come to the end of our module one. So, in today's lecture we have discussed about the debates between the developed and developing countries or the conflict of interest between the developed and developing countries. And we show with empirical observation that the developed countries are creating huge amount of environmental pollution by using more of fossil fuel.

So, we need a more sustainable ways of creating energy not only for the developed countries those are till available for the developed countries, but the developing countries are lacking. So, the sustainable ways of energy should be made available to the developing countries. So, one of the option can be use of ethanol as we show that it proved helpful for India in tackling its constraint with respect to foreign exchange reserve. So, with this we end our first module.

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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. Sarwal, R., Kumar, S., Mehta, A., Varadan, A., Singh, S. K., Ramakumar, S. S. V., & Mathai, R. (2021). Roadmap for Ethanol Blending in India 2020-25: Report of the Expert Committee.
4. Ülgen, S. (2021). How Deep Is the North-South Divide on Climate Negotiations?.

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And these are the references. So, we will be following two major books on Petroleum Economics and then there will be some additional papers, research papers and reports the references are all provided here. So, those who are interested can go through the references in more detail to have more insight.

Thank you. So, we will see you from the next lecture, where I will be starting the module two.