Energy Resources, Economics and Environment
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Lecture 3 P3
Energy Security

We have looked at various dimensions of energy, we have talked about energy and environment, energy and development, energy and quality of life, and in the last class we also talked about energy and equality. The last dimension that we need to cover before we go into the subject of energy economics is Energy Security. You must have read in the newspapers, many different issues related to energy security. So, let us try and find out what do we understand by energy security.

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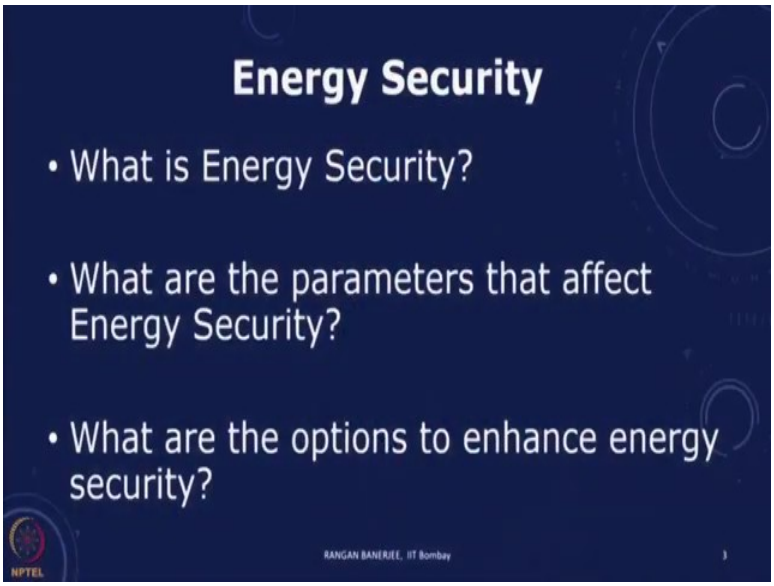

What is energy security? What are the parameters that affect energy security? What are the options to enhance energy security and we can look at energy security from the point of view of a country or of a state or a city or a region, normally we always talk about this at a country level or a national level.

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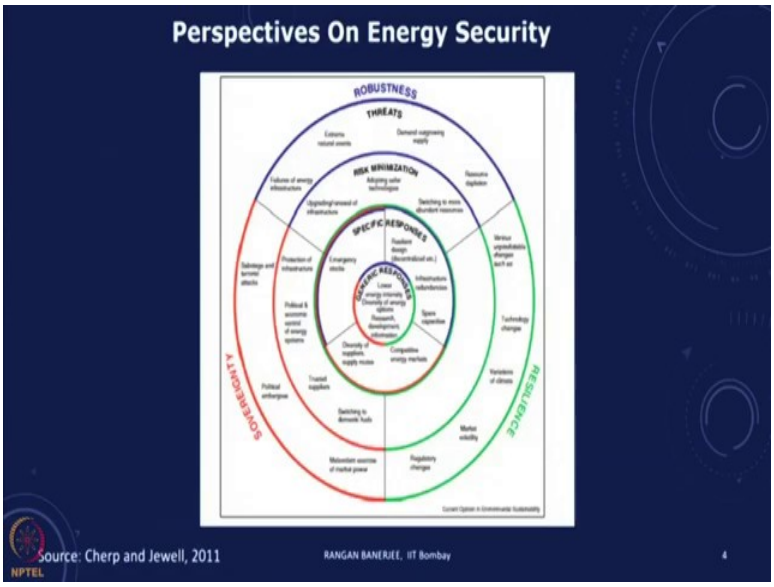

So, let us define what is energy security? This is a graphic which shows different dimensions of energy security and we will talk about this in part by part.

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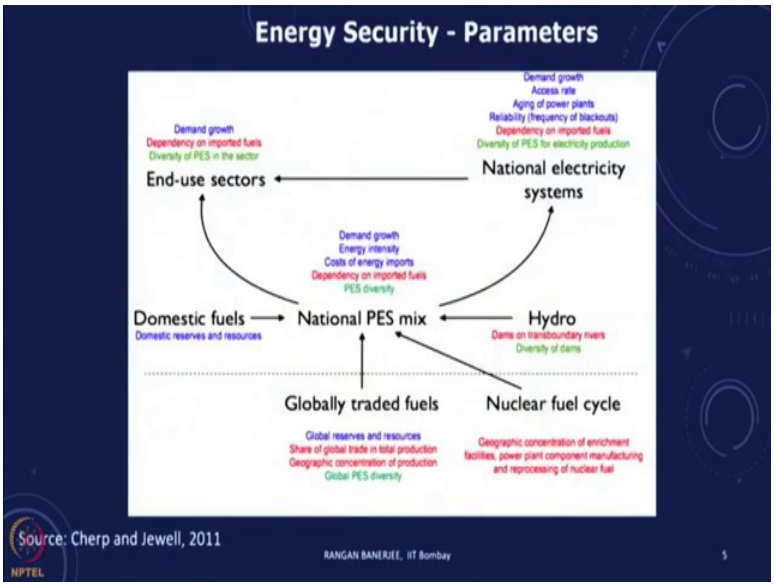

So, when we talk of the energy security, the parameters that could, we could look at the security in terms of the induce sectors. That means the different kinds of demands that we have, the national electricity system, we can also look at what is the mix of the national

energy use, the domestic or the fuels that we have, we can have imported fuels, we can use hydro, we can look at the nuclear fuel cycle and then we can have globally traded fuels. So, all of these dimensions need to be thought of.

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When we talk of a definition of energy security, a simple definition is that we would like to see that, we have uninterrupted provision of the vital energy services. And this is of course, a priority for every country. So, we would like to make sure that we, whatever energy we need for all our activities, we have access to that and that there is no interruption in that. There are different dimensions of this, this has been classified into three different parameters. One is the robustness, the second is the sovereignty and the third one is the resilience, let us discuss each one.

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Robustness involves the sufficiency of resources, reliability of the infrastructure and stable and affordable prices. So, in the case of robustness that means, if there are some fluctuations, if some changes are there, we should still be able to provide the energy. Sovereignty means that the country has control over the energy use.

So, we need to have protection from potential threats from external agents. And Resilience means the ability to withstand diverse disruptions. So, in the case of sovereignty, if all of us, if the country is highly dependent on oil imports, and those imports are all coming from a particular region, if there is some problem which happens within that region and our oil supply is affected, then we have a problem in terms of security.

So, we have various strategies in which we can try to enhance and increase the sovereignty and the in the case of resilience, recently there have been a large number of different kinds of disruptions, like floods, we have different kinds of you have a tornado you have some extreme event in which the energy infrastructure gets affected.

And resilience means that how quickly can we bounce back, do we have a diversity in terms of things.

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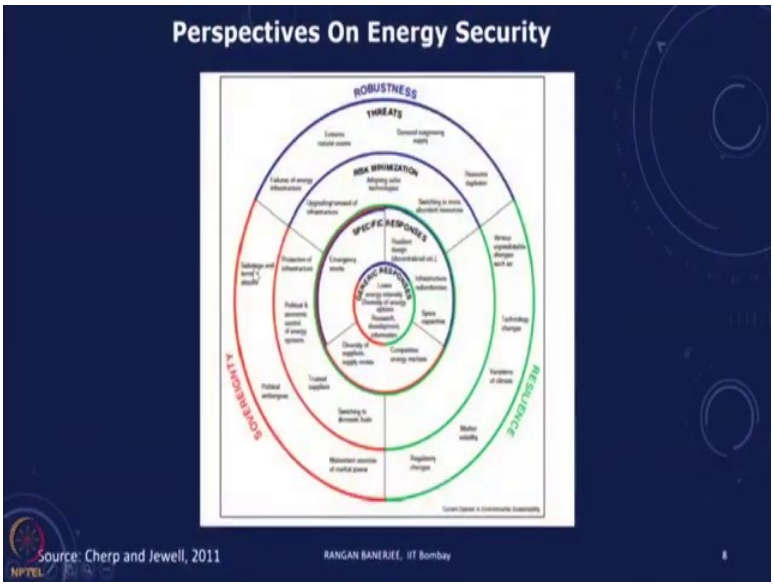

So, in all of this, if you look at this graph, this chart it shows us the kind of different possibilities. So, in the case of robustness, we can try to minimize the risks and we can have a diversity in terms of the different kinds of supply, we can also try and see that whether we can manage and have flexibility within the demand, in the case of sovereignty, one of the things that we can do is we can try and axe, we can diversify the supply.

So, if we are getting imported oil, we can make sure that we are getting this oil from different regions of the world, we can have long-term contracts, we can also see in this case, we have a situation where ONGC through its wing has been actually buying different resources and mines in different parts of the world.

So, one of the things is you can acquire facilities in different parts of the world. And so, these are some of the kind of specific responses that we have. In the case of resilience, we can try to see we can have redundancy, that means we can have more sources of supply, we can try and see that we can modify some of the demands and so there are a whole host of different things that we can do.

If we want to talk about the energy security of any particular country, one of the indicators that we can do is we can understand and see what percentage of our supply

comes from comes from outside. So, whether we can have domestic supply and so we can look at the percentage of our, if you look at India, and we look at oil, a significant proportion of our energy use is based on oil and our oil production has more or less stagnated between 30 to 40 million tons per year.

Most of the growth which is there in oil is coming from imports. And if you look at the percentage of energy that is imported as a proportion of our total primary energy supply, you plot that over time and I will show you that plot, you will find that our dependence on energy sources outside has actually been increasing and this is not a very good situation.

So, we need to think in terms of substitutes, we have been looking at the possibility of using biofuels, we are looking at renewables, we are looking at domestic fuels, and this and so, this is the other thing that has been when we talk of energy security globally there is this whole, if you look at oil and oil prices, many of the developing countries have actually been affected by the fluctuation in oil prices.

Until recently, oil prices have only been increasing, in the last decade or so, we have seen drops in the oil prices.

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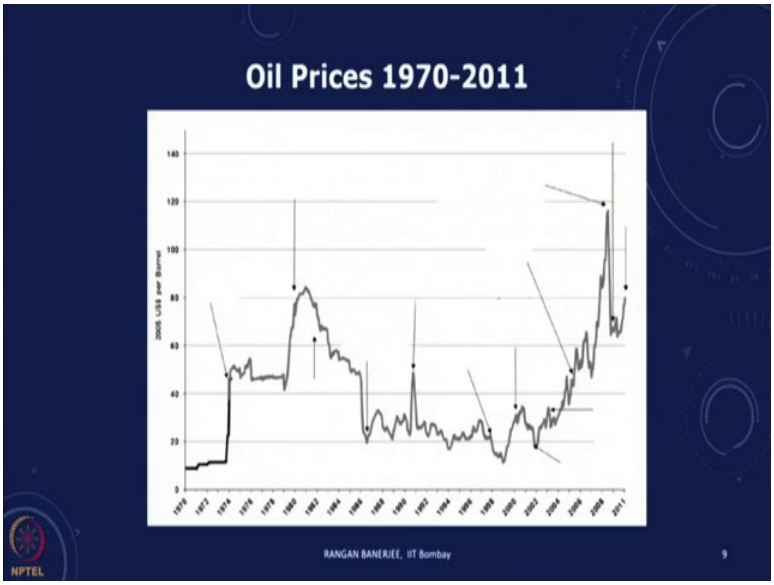

Now, if you look at this plot, this plot shows the trend in oil prices with time and you can see there is no, there are no very clear cut patterns, but if you look at all of these arrows, which are there, these arrows all relate to actual political events.

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And those events have an implication, there are some particular blockage, there are wars and these have always had an impact in terms of oil prices, sudden spurts in the prices result in adverse impacts to economies which are dependent on imports. So, when we think in terms of any strategy for energy security, we need to make sure that our country is sort of immune to some of these and this is the these are the kind of things that we look at this.

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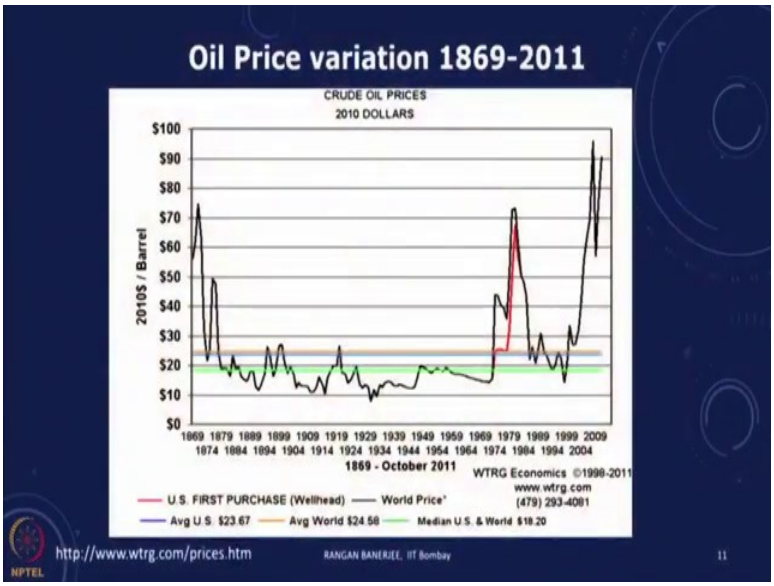

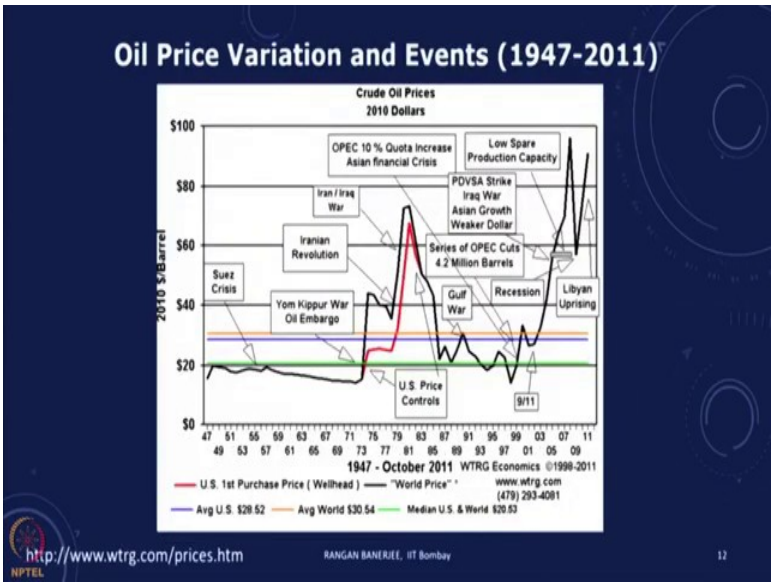

On a shorter time frame, on a longer time frame, if you see these are the kind of oil price variations which are there and you can see oil price variation. Many of them get linked to political events, and you can see that this automatically has an impact on the economy.

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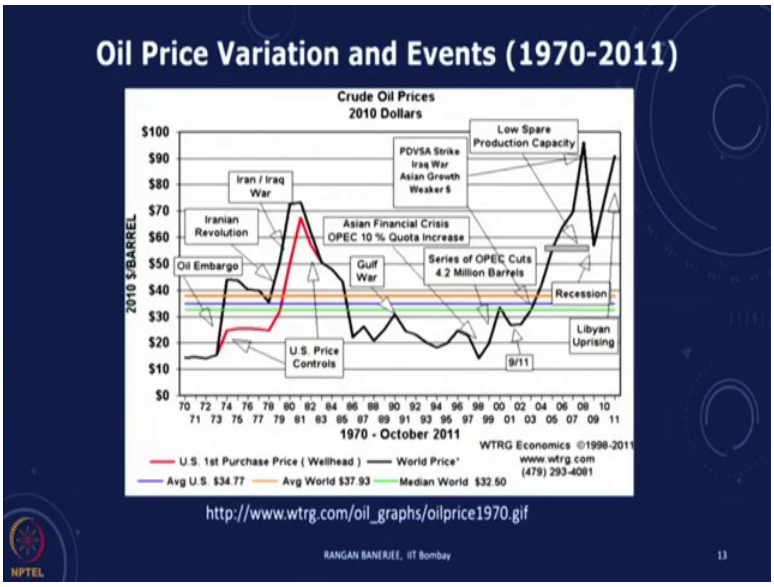

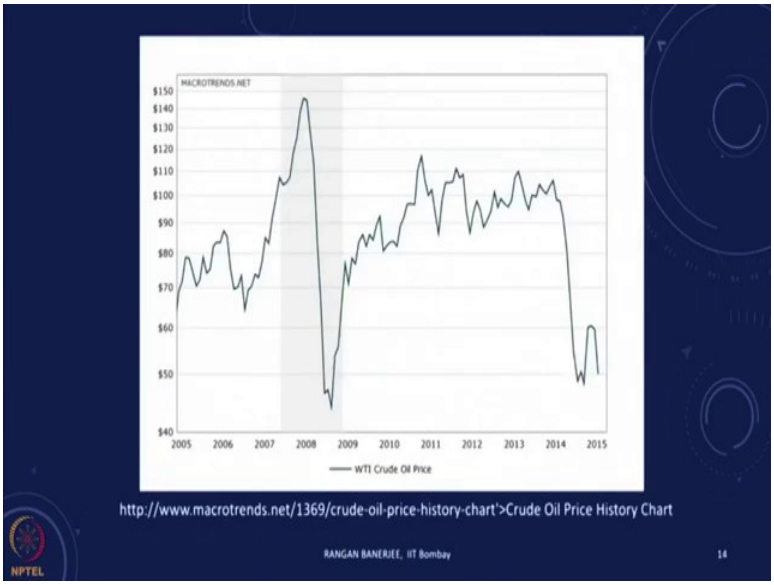

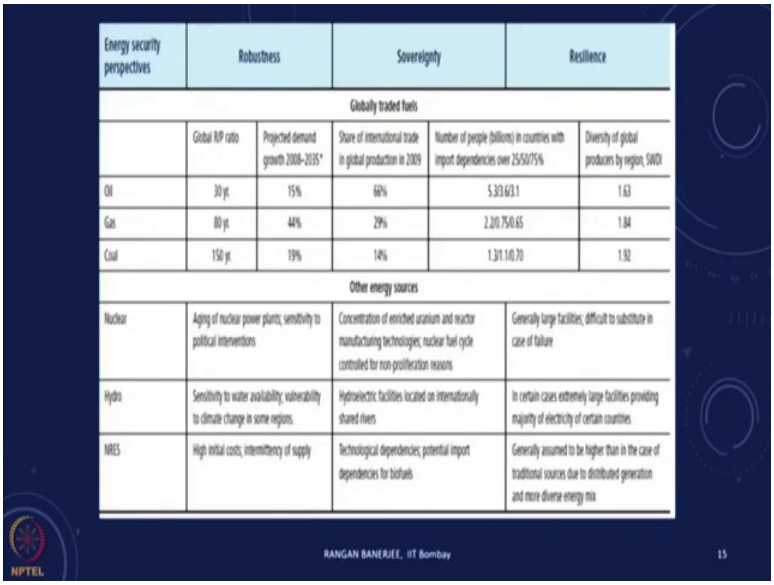

And you can look at some of these trends in more detail, I leave that to you, but basically what you will find is that when we think in terms of this, we talked about these three pillars the robustness, the sovereignty and the resilience. And in looking at this, you can see what kind of supply do we have, what proportion, a large proportion of the fuel, oil and gas is globally traded and this obviously will contribute to the problems of security for many of the other countries, for many of these countries, in the case of nuclear also in many cases, we are dependent on imports for the nuclear fuel.

And in the case of hydro also there may be issues in terms of water availability and in renewables, of course, the variability of renewables. So when we think in terms of in a regional context, when you look at a context where there is a disruption and the resilience, we have to see what proportion of our energy supply is coming from near the region, because in case the centralized infrastructure is cut off, how do we provide that? So, these are some dimensions that we can analyze when we think in terms of looking at different aspects of the energy system.

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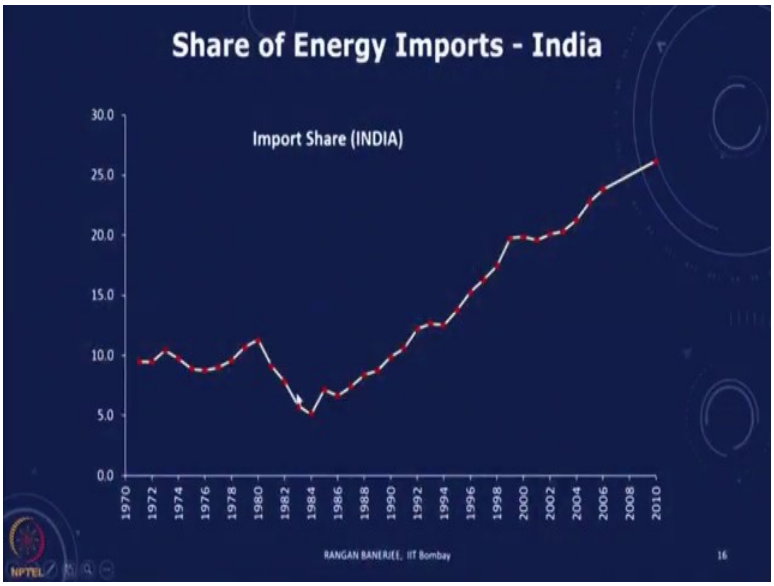

I talked to you earlier about this import share and you can see that over the last from the 1990's onward, if you look at the percentage share of imports in our overall energy supply, you can see that this is sort of monotonically increasing and this is not a very nice trend. This is something that we need to see how do we get substitutes for oil and we are recently we have been also importing some proportion of coal.

One of the things that we may also see that even in the case of one of the strategies that we have adopted is where we have gone for renewables, but even in the case of renewables when we look at the kind of solar photovoltaics that we are, we are actually installing, a significant proportion almost 90 percent of this cells and modules that we are installing are coming from imports and this also can have implications in terms of energy security.

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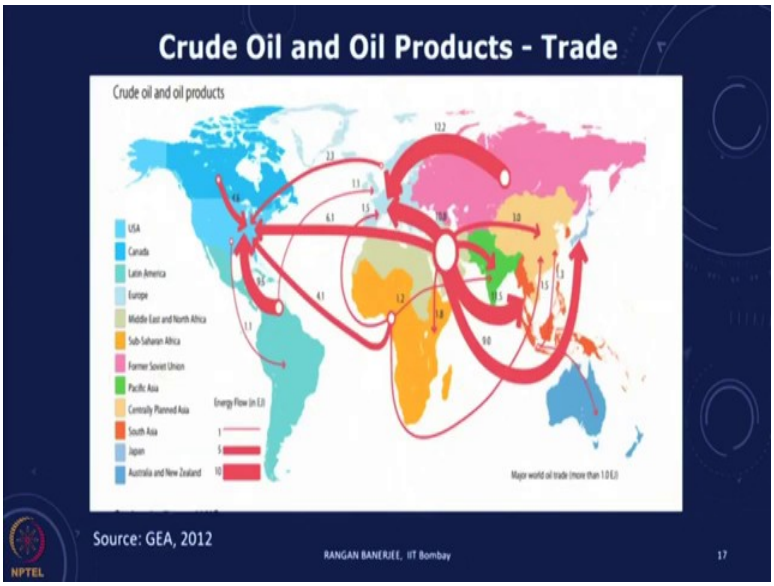

We are in a interconnected world, and if you see this is showing you sort of is the, this shows the trade in oil and oil production and you can see very clearly the magnitude of these arrows shows the volumes and you can see that almost all the oil is coming from the Middle East.

And you find that the of course, there are geopolitical issues related to this because of this, this is a region which is under in turmoil often when there are problems, this affects the availability of oil, it affects the prices, and it affects the economies in many parts of the world. So, as we plan our energy systems for the future, we would like to shelter from these kind of impacts and we would like to see a what are the kind of options that we could not do.

So, we have looked at the dimension of energy security, and we said that every country would like to have a strategy where you would like to have robust, sovereign and resilient energy infrastructure so that we can provide uninterrupted supply of energy for the nation's development.

So, with this we cover all the different dimensions and the linkages between energy and the rest of the economy. In the next class, we will start with talking about energy

economics and looking at how we can assess different projects in terms of the economic viewpoint. Thank you.