Energy Economics and Policy
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Week - 01
Energy as an Economic Resource
Lecture - 05
Problem Discussion on Module 1

Welcome to the last lecture of week 1. In this lecture we are going to discuss a few problems where you are going to get a chance to employ the concepts about the measurement and the energy balance and conversion that you have learnt. So basically, we are again going to cover three topics; classification, measurement and accounting of energy but by solving a couple of problems.

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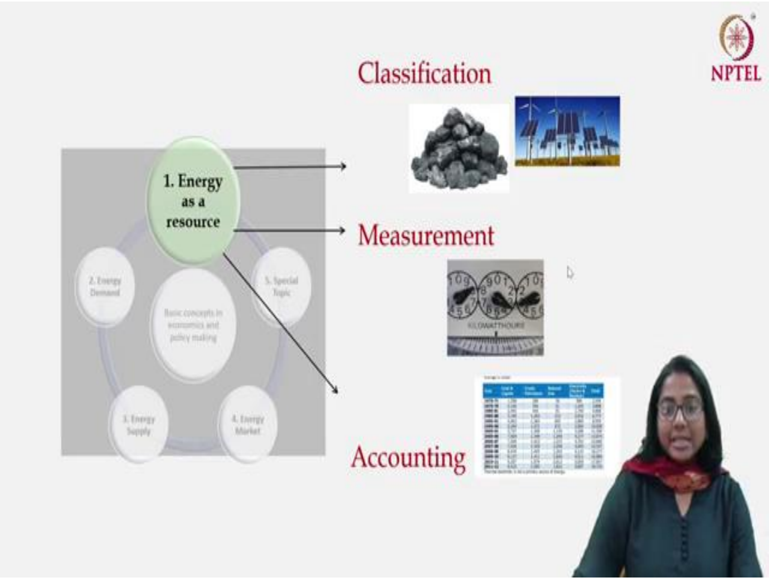

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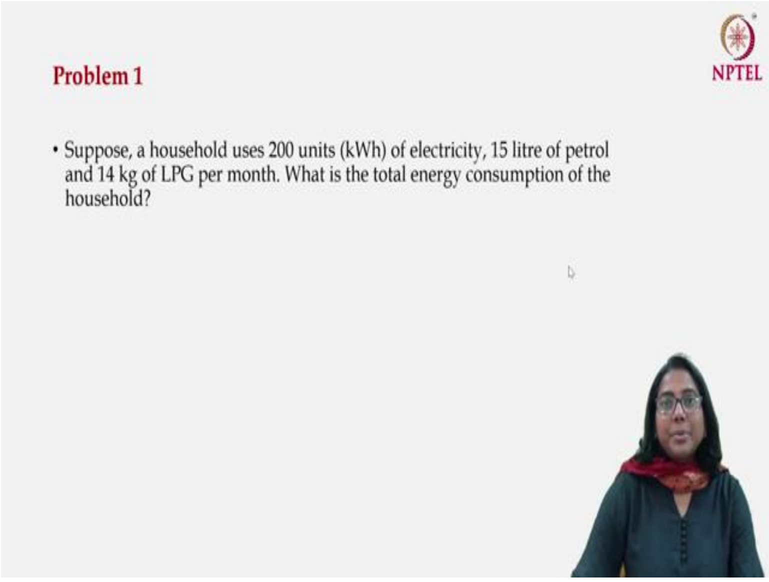

Let us begin with the first problem and the form of this you have already come across. So, you may remember when we were discussing the measurement of energy, we started with a problem and we actually asked you to jot down what are the different forms of energy that you use in your everyday life and whether you can aggregate that or not. Now that we have come across and we already understand what are the different ways to measure energy, and how you can actually convert one energy to different other forms, we are going to solve this problem with the help of that.

So, the problem statement is like this, suppose there is a household which uses 200 units of electricity, 15 litre of petrol and 14 kg of LPG per month. The question is what is the total energy consumption of this particular household? Before we jump on to the solution of this problem, let me make you a few things clear. So, when you get the electricity bill at the end of the month you can see that it's written that 100 units are consumed or 200 units are consumed and so on. So, what does this 'unit' mean? 1 unit is actually equivalent to 1 kiloWatt hour. That is how the electricity bill comes. So, this is one of the observations you can make from the next time onwards when you get the electricity bill.

The second thing that you have to notice, here the consumption of petrol in this household is 15 litre per month. Now 1 litre, we usually take it is equal to 1 kg. So, this conversion is 1 to 1 (this is ofcourse not a realistic/correct assumption always, here we use it for simplicity). This also we have discussed in our previous lectures and the third is 14 kg of LPG per month. When you get the LPG cylinder for domestic use in most of the cases you will see that the weight mentioned there is actually 14 kg. So, this is the amount of LPG that you use in the normal cylinder, it is approximately 14 kg. Now we have to do something in order to convert all of them into one unit of measurement and let us have a look at how we are going to do it.

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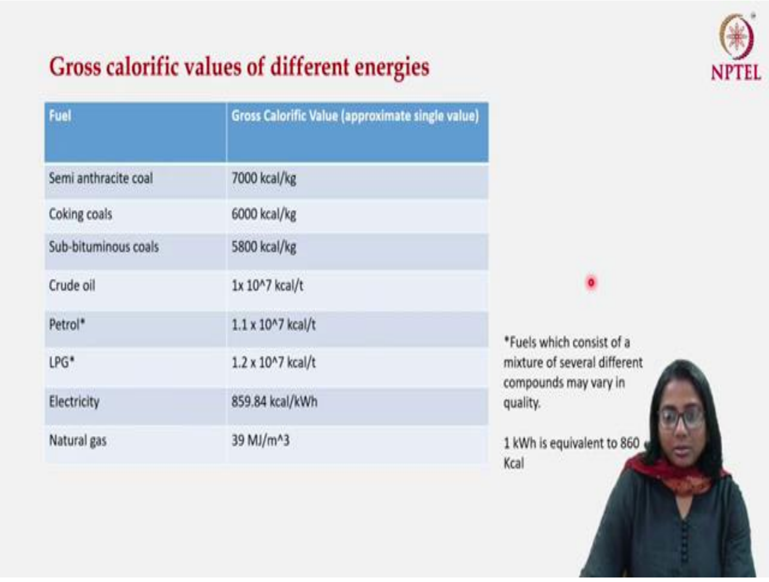

This is the table now all of you are familiar with. So, this is how we actually converted each fuel in a similar kind of unit. So, for each of the fuel, we actually calculated the gross calorific value. Now again to mention that this is not the exact calorific value, but this is the approximate calorific value or the average calorific value that you can get.

So, for example, if you take the, you know, anthracite coal it usually has a range, but this is approximately you can take this figure of 7000 kilo calorie per kg. So, if you burn 1 kg of anthracite coal, you are going to get 7000 kilocalorie of heat. Okay, now see what are the things that we are interested in? So basically, we are interested in petrol- there is a petrol consumption of this household, we are interested in LPG and we are interested in electricity.

So, since we have the amount of petrol and LPG consumed by the household, we can convert both of them. We can also convert the kilocalorie to kiloWatt hour as we know that 1 kiloWatt hour is equivalent to 860 kilocalorie and then we can add them up with electricity. Or the other way of doing it is that you convert everything to kilocalorie. Now, let us have a look at the solution.

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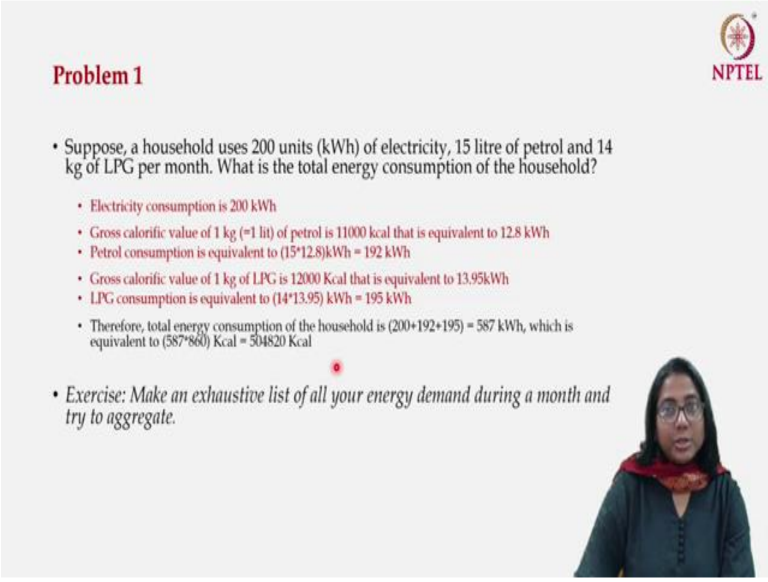

- Electricity consumption is 200 kWh
- Gross calorific value of 1 kg (=1 lit assumed) of petrol is 11000 kcal that is equivalent to 12.8 kWh
- Petrol consumption is equivalent to (15*12.8)kWh = 192 kWh
- Gross calorific value of 1 kg of LPG is 12000 Kcal that is equivalent to 13.95kWh
- LPG consumption is equivalent to (14*13.95) kWh = 195 kWh
- Therefore, total energy consumption of the household is (200+192+195) = 587 kWh, which is equivalent to (587*860) Kcal = 504820 Kcal

So, the consumption of electricity per month, which is given as 200 kiloWatt hour. The gross calorific value of 1 kg that is equivalent to 1 litre of petrol is 11000 kilocalorie. Now, let me go back to the previous slide - here you see the calorific value of petrol is (1.1* 10^7) kilo calorie per ton. Now, we are actually calculating the calorific value per kg. Therefore, it becomes 11000 kilo calorie per kg or per litre of petrol.

So, here we are saying that the gross calorific value of 1 litre of petrol is 11000 kilocalorie. Now this is equivalent to 12.8 kilo Watt hour. We are getting this value 11.8 kilo Watt hour, by dividing 11000 kilocalorie by 860, because that is the conversion factor between kilocalorie and kiloWatt hour. So, the petrol consumption, which is equal to 15 litre is actually equivalent to (15*12.8) kiloWatt hour that is 192 kiloWatt hour. So, what we have done, we have converted 1 litre of petrol to 192 kiloWatt hour equivalent of energy.

Similarly, you look, if you take LPG, then you see that the gross calorific value of 1 kg of LPG is 12000 kilocalorie. You may also go back and check in the previous slide that the conversion factor was given as (1.2*10^7) kilocalorie per ton. So, this gives us 12000 kilo calorie per kg. So, this is equivalent to 13.95 kiloWatt hour. Again, we are getting this value 13.95 as we divide 12000 by 860. Since the total consumption of LPG is actually 14 kg, therefore, we are multiplying 13.95 by 14 to get the total consumption of LPG, which is equivalent to 195 kiloWatt hour.

Now, you see electricity consumption was already given in terms of kiloWatt hour and now we have converted the use of petrol and LPG both in terms of kiloWatt hour. Therefore, the total energy consumption, according to the information given, of this household is 200 (this is coming from electricity)+192 (this is coming from petrol)+ 195 (this is coming from LPG)= 587 kiloWatt hour. Now, if we want to convert this 587 kiloWatt hour to kilocalorie, we simply need to multiply it by the conversion factor 860 and therefore, we get 504820 kilocalorie. So, in this example the household is actually using 587 kiloWatt hour of energy or 504820 kilocalorie of energy.

This is how you can actually combine different forms of energy measured in different units, add them up, and find out what the total energy consumption is. Now this is especially important and useful if you want to compare the energy consumption of two different individuals, or, compare the average energy consumption of two different countries and so on. Let me give you a quick exercise that you can do once we are done with the lecture and these are the interesting things, you know, that can actually encourage you to take a lot more exercises like this.

You make an exhaustive list of the different things that you do that require energy and therefore, you list down all kinds of energy that you actually need in a day or in a month. So, here as you have seen that we are talking about electricity, petrol and LPG gas, you may think of other forms of energy that you are using in your day to day life other than these three types of energy. Make a list and try to convert everything in one unit and see what is your total energy consumption per month and then you can do very interesting exercises for example, to see what proportion comes from in the form of electricity, what proportion comes in the form of LPG and so on. Once we do this let us move to the second problem.

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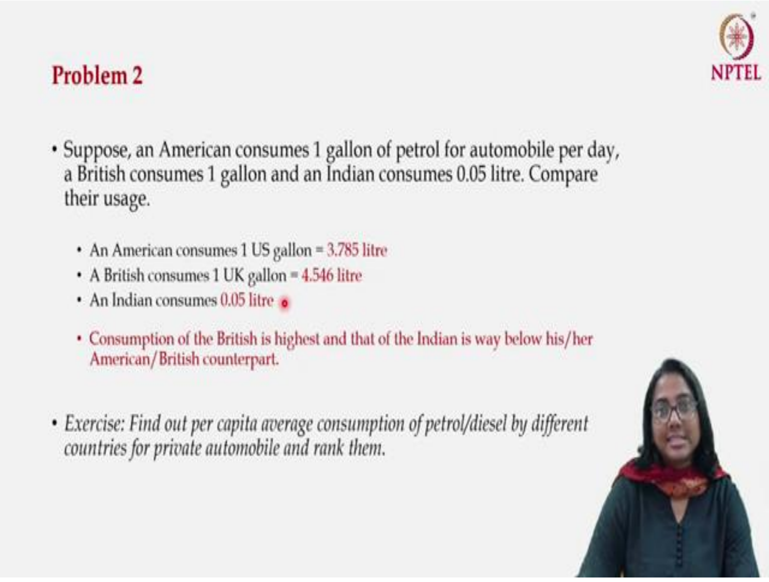

This problem is also known to you, this is something we again had discussed when we were talking about the measurement of energy but this is more specific, this is a more specific example that we are going to deal with. So, it goes like this:

Suppose an American consumes 1 gallon of petrol for automobile per day, a British also consumes 1 gallon of petrol for automobile per day whereas an Indian consumes 0.05 litre. And, the question is: can you really compare the consumption of petrol for automobiles by an American, a British and an Indian individual? So, let us try to convert everything to litre. So, we know that 1 US gallon is equal to 3.785 litre. Therefore,

An American consumes 1 US gallon = 3.785 litre
A British consumes 1 UK gallon = 4.546 litre
An Indian consumes 0.05 litre

So, we know now that an American consumes 3.785 litre of petrol per day. If we think about the British, although the information tells you that the British also consumes 1 gallon of petrol, now the UK gallon is different from the US gallon and this again we had discussed while discussing the measurement and the UK gallon is a little more than US gallon. This is equivalent to 4.546 litre. So, essentially, although both the American and the British are said to consume 1 gallon, we can assume that since they are consumed in two different countries, for the American the measurement is in terms of US gallon, whereas the measurement for the British is in terms of UK gallon.

So, the British actually consumes 4.546 litre whereas the American consumes 3.785 litre. Now you can compare these two figures with what an average Indian consumes, which is 0.05 litre and this is actually the real figure for Indian individuals. So, what you can see is that the British consumes the highest, the Indian consumes the lowest and the difference is huge between the, you know, consumption of petrol for automobiles for these different countries.

Another exercise based on this that you can carry out is that you find out the average per capita petrol consumption or diesel consumption for different countries that they are using for the private automobile. And, you try, you can try to rank them after converting everything to one unit may be in gallon or in litre or in some other unit and try to see which are the countries who are using highest or who are using you know, kind of more petrol or more diesel for private automobile and who are the countries who are using less petrol or less diesel for private automobile and then you can try to link it up with their stage of development. If you understand this one, let us move on to the third problem.

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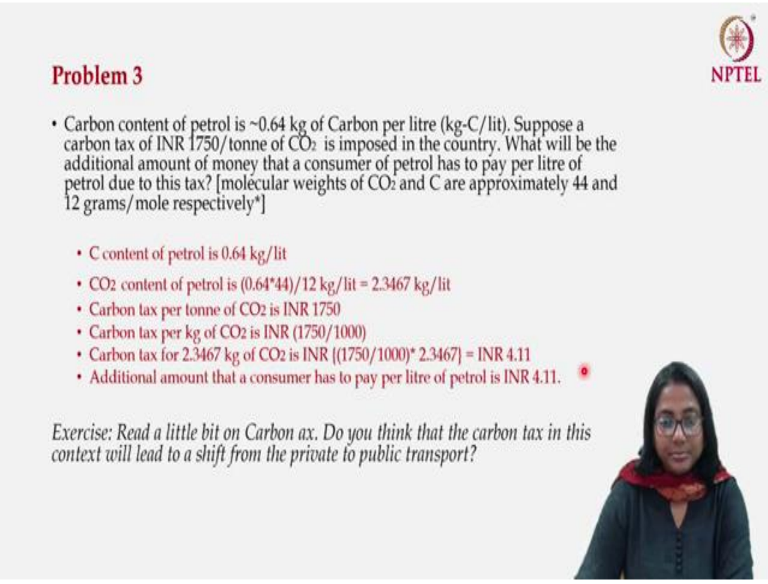

This may seem a little more complicated, but this is something which is very interesting. Let us think about this problem. So, the carbon content of petrol is approximately 0.64 kilogram of carbon per litre. Let us call this kgC that is kg carbon per litre. So, this is the amount of carbon that is there in the petrol, 1 litre of petrol. Now let us think of a policy, this is a, you can call it a climate policy or energy policy; the policy says that there will be a carbon tax imposed in the country. Now, what is a carbon tax? Carbon tax in a nutshell is a tax that you pay if your activity leads to emission of carbon dioxide. So, as you burn petrol you are producing carbon dioxide which is going to the atmosphere and for this activity what you are doing, you are paying a tax.

Now, the reason will come clear when we deal, you know, the issue with regard to energy and climate change in the later modules but for the time being let us suppose that there is a carbon tax, which is implemented in India for example, and the magnitude of the tax is 1750 that is 1750 rupees per ton of CO_2 emitted. So, notice here the carbon content is given in terms of kilogram of carbon whereas the carbon tax is mentioned in terms of rupees per ton of carbon dioxide. So, one is in terms of carbon, whereas, the other is in terms of carbon dioxide.

Now, the question is what will be the additional amount of money that a consumer of petrol has to pay per litre of petrol once this tax is imposed? Definitely this is going to increase the price of the petrol. In order to solve this problem you need one more very important piece of information, which is the molecular weights of carbon dioxide as compared to carbon. So, the molecular weights of carbon dioxide and carbon are approximately 42 and 12 grams per mole respectively and this information will, you will see how we are going to use it. So, what in a, if you don't understand the technical part of this, in the nutshell what we can say is that if, I mean in a mole, if in a mole there are 12 grams of carbon and there are 44 grams of carbon dioxide.

So, if the carbon content is 12 gram then that will lead to 44 gram emission of carbon dioxide if there is complete combustion. However, take this into consideration that the complete combustion actually doesn't take place, but this is a rough estimate that we can always use to carry out this kind of back of the envelope calculations. So, let us see what is going to be the price that the consumer has to pay if this kind of a carbon tax is imposed.

So, the carbon content of the petrol as we have said 0.64 kg of carbon per litre. This implies that the CO_2 content of petrol per litre is 0.64 multiplied by 44 divided by 12 kg which is equal to 2.3467 kg per litre. So, this information actually tells you if you use 1 litre of petrol, you are likely to emit 2.3467 kg of carbon dioxide, you are likely to emit it, you may emit a different amount depending on the type of combustion, but this is what we are assuming, approximately.

The next information that we have that the carbon tax per ton of CO_2 is rupees 1750. So, if you emit 1 ton of CO_2 then you have to pay 1750 rupees. Here you are actually emitting 2.3467 kg. So, what will be the cost that you have to pay? So, the carbon tax per kg of CO_2 will be 1750 divided by 1000 because 1 ton is equal to 1000 kg therefore, when you use 1 litre of petrol as a result you emit 2.3467 kg of carbon dioxide you have to pay 4.11 rupees. So, the price that the additional price that you have to pay because of the imposition of carbon tax for 1 litre of petrol is 4.11. So, this is the additional amount that the consumer has to pay.

To summarize,

C content of petrol is 0.64 kg/lit
CO_2 content of petrol is (0.64*44)/12 kg/lit = 2.3467 kg/lit
Carbon tax per tonne of CO_2 is INR 1750
Carbon tax per kg of CO_2 is INR (1750/1000)
Carbon tax for 2.3467 kg of CO_2 is INR {(1750/1000)* 2.3467} = INR 4.11
Additional amount that a consumer has to pay per litre of petrol is INR 4.11

Now, the carbon tax is actually a very very interesting phenomenon. One can tell you that when you are imposing a carbon tax essentially there is a burden on the consumer. So, there is a lot of debate around this issue. Now the question is why the carbon tax is implemented? The carbon tax is basically implemented because you are emitting something, you are emitting a bad commodity for which you are not making any payment.

Again, as I have said, we will discuss this in the later module, but this leads us to some very important and interesting questions that whether the carbon tax should be paid by the, you know, the user of the petrol or the person who is selling the petrol. It can also lead to a very interesting question of whether it should go to the government and what will the government do with this money.

So, it all depends, with respect it all actually depends on the policies that the government is going to adopt with regard to carbon tax. I would like you to encourage me to read a little more about carbon tax, what is carbon tax? how it is formulated and so on and then I would like you to ask another corollary question about do you think that if the carbon tax is imposed in a country on petrol will there be a shift or will there be a shift of travelers from the private transport to the public transport. Think about, think about, think about it a bit and try to come up with the answer. There is no yes or no answer to it; you can take various assumptions and formulate your scenarios.

So, these three problems they more or less actually covered the concept of measurement and conversion. The next problem that we are going to deal with is mainly related to the energy balance table that we have discussed in the previous lecture. This is the fourth problem; it has actually 7 questions and we will try to answer one, the questions one by one.

In your reading material you will find one excel file which is called energy balance India 2013-14 p which is the energy balance table for India that was published in the Energy Statistics 2015 and from there we have taken the provisional energy balance table for the year 2013 and 2014 and the questions that follow will actually based on this particular table. I will show you how it looks and how you proceed to answer these questions. So, one more who publishes these energy balance tables is basically the Ministry of Statistics and Programming Implementation of Government of India.

So, sometimes actually when you are doing empirical research with regard to energy or per say for any, in any other field; it’s very important to know what are the sources of your data, who are the ministries publishing the data, what report contains which kind of information. So, this actually eases your research a lot. So, as we know the energy balance is published by the MOSPI that is the Ministry of Statistics and Program Implementation. Let us start with the first question or maybe before we start with the first question let me take you to the energy balance table that I was talking about.

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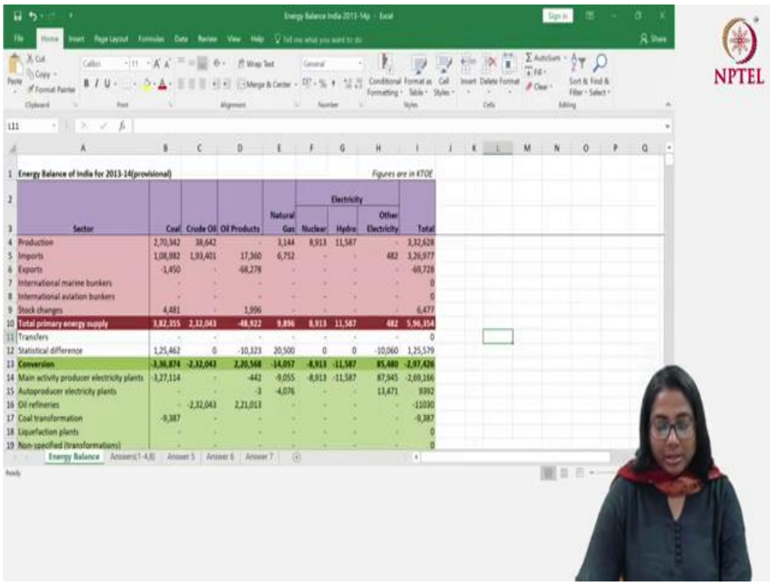

So, if you open the file called energy balance in India 2013-14 p you will find out this kind of a table. So, this is the first sheet of the excel file. This is now quite familiar to you. You will see that in the row, in the column you actually in the first column you find different sectors which consists of, you must be remembering the supply, transformation and demand of energy and different columns actually represent different forms of energy.

So, the pink part is the supply block, this brown row tells you what is the total primary energy supply then you have a transfer column you don't, but in the row of transfer there is no entry, you have some statistical difference. The green block tells you that this is the conversion where the primary energy is being converted to the secondary energy and the blue part that you see here this is basically the demand for energy. Once we have this kind of information, let me just have a look at what the questions that we have to answer.

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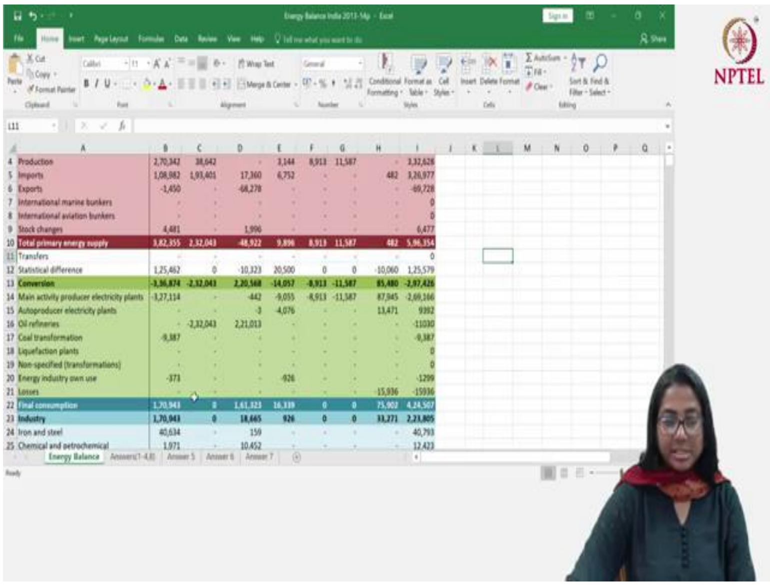

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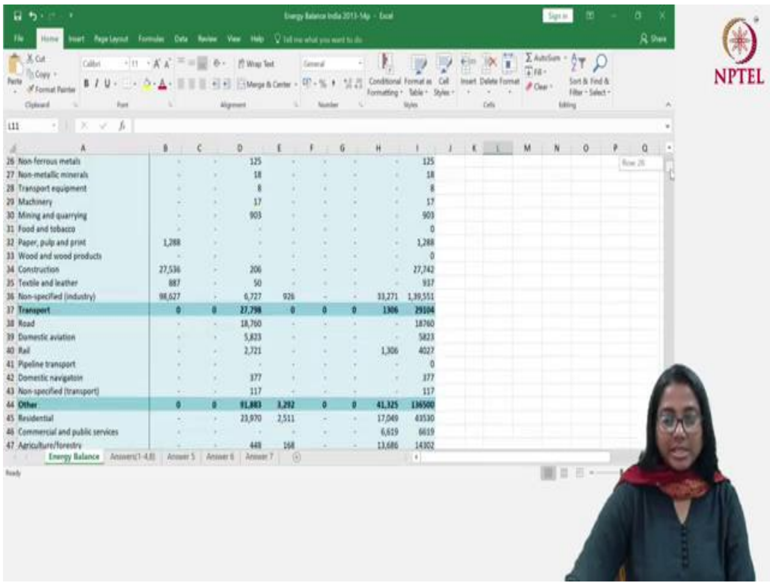

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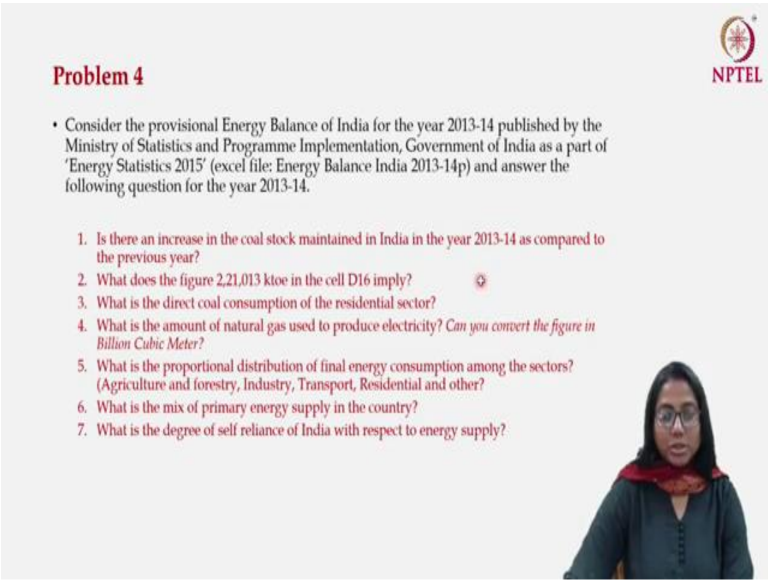

So, the first question is, is there an increase in coal stock maintained in India in the year 2013-14 as compared to the previous year? So, the question is has the coal stock gone up or gone down in the year 2013-14 as compared to the previous year. Now, we know that if we need to understand the change in the stock we have to look at this particular row under supply which says the stock change and you see the stock change entry under coal is positive; which means that due to stock change the supply of coal has gone up.

So, let me repeat due to stock change the supply of coal has gone up. It implies then the stock must have declined. So, the stock has declined and the amount of stock that has declined, has been added to supply and therefore, this has a plus sign. So, the answer to the first question is that, ‘yes’ there is a, sorry, so the answer is actually “no that there is not an increase in the stock of coal maintained rather there is a decline in the stock of coal maintained”.

Let us next go to the second question, what does the figure 221013 KTOE in the cell D16 imply? If you look at the cell D16 this is basically, this cell that, I am sorry, so yeah, so, this is basically this cell that we are talking about, this 2,21,013. So, the question is what does this figure imply? As we have discussed how you read the conversion part, you see, this is the oil product which is being produced. So, under the fuel oil product, this value is entered as a plus sign. So, this is a secondary form of energy which is being produced in the transformation conversion sector and added to the energy supply of the country.

Now, where is it being produced from? It’s of course, coming from the oil refineries. So, this is the output of the oil refinery which is the oil product. So, what is the input fuel? The input fuel if you look at this, oil refineries, what are the components that are being included, included with a minus sign? Here you can see the minus sign comes with crude oil. So, basically it says that 232043 KTOE of crude oil is being converted to 221013 KTOE of oil product in India in the year 2013-14. So, that is the implication of the entry that we have in cell D16.

Coming to the third question; what is the direct coal consumption of the residential sector? Notice we are talking about the direct coal consumption not the indirect coal consumption. So, again a quick recap, direct coal consumption means the use of coal directly not in a converted form. So, when the household is actually using the electricity then also it is probably using a part of coal, but not directly, but in an indirect form.

This coal is being converted to electricity and there then, this electricity is being used by the household. So, now, the question is what is the direct consumption of coal? So, maybe let me just see if we can fix this freeze that will be easier for us, yes, no this doesn’t quite work. So, okay, coal is actually B so remember coal is column B and let us see what is the use of coal in household?

So, in this column you will see that the residential sector, the use of coal by the residential sector is 0. So, there is basically no direct coal consumption by the residential sector. Actually not only the residential sector you see other than the industry sector there is no direct coal consumption neither in transport nor in other non in non energy sector. So, the answer to the third question is the direct coal consumption is basically equal to 0.

Coming to the fourth question; what is the amount of natural gas used to produce electricity? So, basically if you come here, let us again go to the conversion, because we are talking about electricity, production of electricity which is necessarily the conversion activity and we look at row 4. So, the question is what is the amount of natural gas that is being used to produce electricity?

So, you see, this is the total amount of electricity that is being produced 87945 kiloton of oil equivalent and these are the combination of primary energy that is being used to produce electricity and the amount of natural gas used is 9055. So, you are using 9055 kiloton of natural gas in order to produce some amount of electricity. You can also, now that you know the conversion factors and the measurements you can also actually convert this 9055 kiloton of kilo ton of natural gas to the to cubic meter of natural gas and you know, pose your answer in terms of cubic meter which is more relevant and readily understandable.

Okay, the question itself is there, can you convert the figure into a billion cubic meter? So, this is, this is actually a question you can ask. Coming to the fifth question this asks you what is the proportional distribution of final energy consumption among the different sectors? What is the proportional distribution of final energy consumptions among the sectors? Now what do we understand by 'economic sectors'? These are basically, there are, broadly there are three economic sectors, one is agriculture, the second is industry and the third is service sector.

So, in the energy balance or when you account for energy there also you will find that there are three major sectors that we are talking about: agriculture, industry and service. However, sometimes there are sub-sections or there are sub-sectors that we consider and or there are, you know, some overlap or some distinction, but here we will see that it's kind of more or less the same. Let us again have a quick look at the demand side because we are talking about the consumption.

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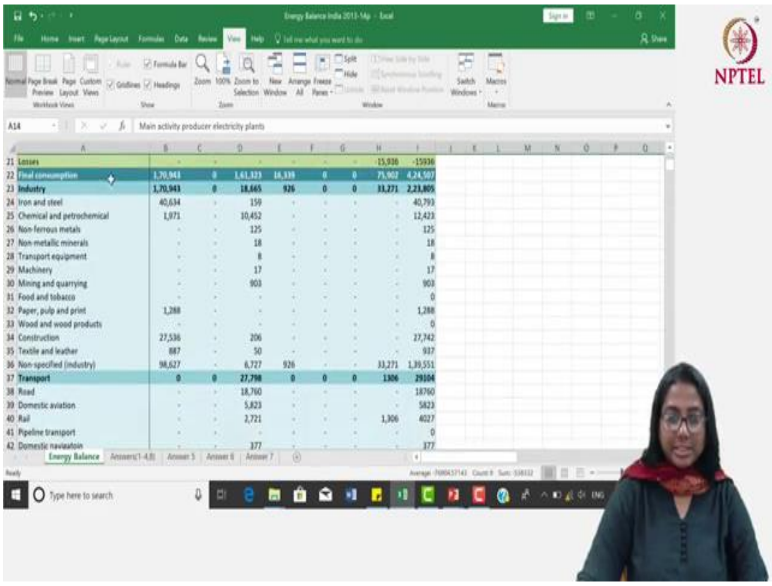

Now, if you look at the demand side, you see, this darkest blue row represents the final consumption. Below that you have industry, you have transport and you have others and then you have non-energy use. So, by now, you know the definition of all of them. So, if we are asked to tell, what is the composition of the energy demand by different sectors, you have to compare the energy demand by the industry sector, with the transport sector, with other sectors and you can also take into consideration the different sub sectors that they are talking about.

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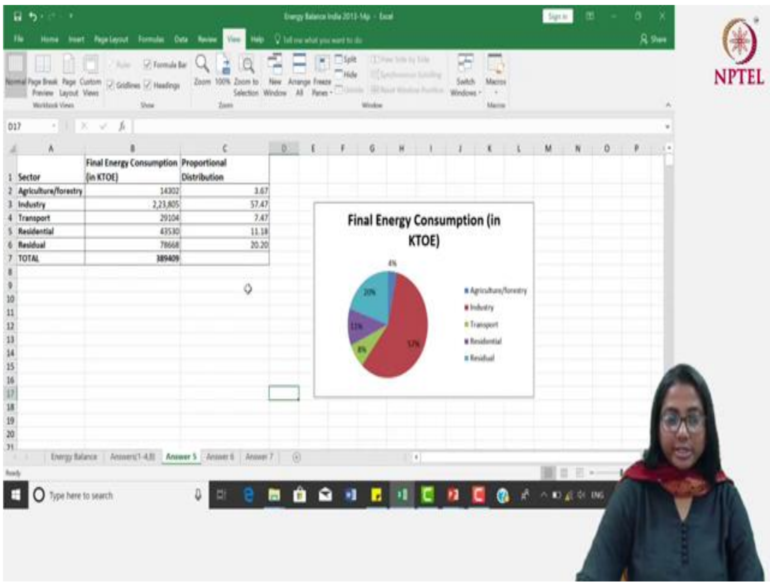

Let us see how we can answer this question. We have derived from this table a smaller table where we have taken the sectors like this agriculture, forestry, industry. So, from others we have actually taken transport, residential and residual and there is the total and we have expressed each of the sectoral consumption as the percentage. You see and this is again represented in the form of a pie chart. You see that the highest consumption of energy is by the industry sector that's the highest demand. The second highest is coming from a residual which is a composition of various things, the third highest is residential and then you have the transport sector.

Now, notice one thing that you have to notice, this is the energy consumption, this is the total energy consumption and this does not include the primary energy consumed by the electricity sector. If you separate that out, you will see that there is a very high energy consumption, primary energy consumption by the power supply sector but this is not separately accounted for year, whatever power is being produced this is again you know, kind of used by any of these sectors.

Let us move on to question number 6. So, the question 5 was with regard to the composition of demand and now we are moving on to the composition of supply and it says what is the mix of primary energy supply in the country? So, what are the different fuels that are actually forming the energy supply pool with respect to the primary energy in the country.

For that, you have to again move away from the demand part and you have to focus on the first sector that is the supply sector. So, this row, row number 10 is telling you what is your total primary energy supply and then you have to actually calculate what proportion is coming from coal, what proportion is coming from crude oil, oil product is a little tricky, because it has a minus sign and we will see how we deal with this. What proportion is coming from natural gas and what proportion is coming from electricity?

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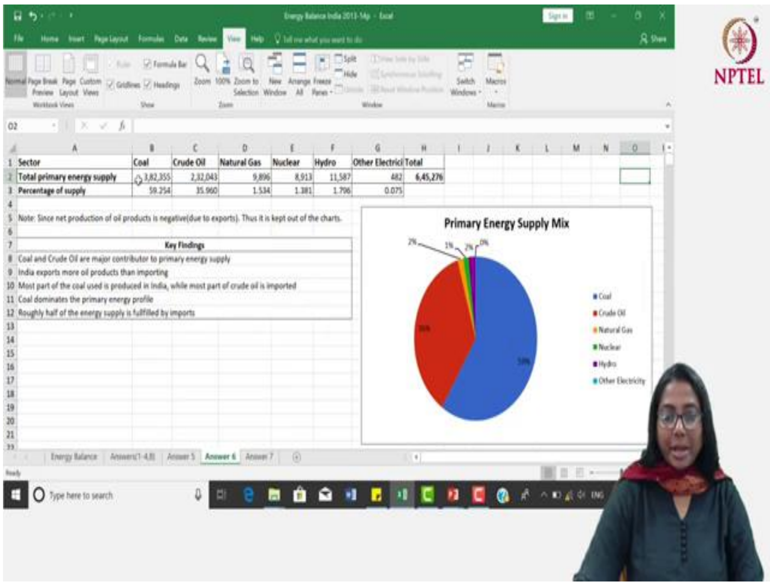

Now remember one thing, this is the mix in the primary energy supply and this electricity is essentially the primary form of electricity. We are not talking about total primary plus secondary energy supply. Then we have to do a little, we have to do some other manipulation here. So, coming here these are the figures, this is the total primary energy supply, the row that we just highlighted there and we are trying to see the percentage of supply.

So, if you click on this cell what you get, you basically get this 382355 as a percentage of 645276 which gives you approximately almost 60 percent. So, you can see in your total primary energy supply pool almost 60 percent is actually coming from the coal. 35 or almost you know, say 36 percent is coming from crude oil, 1.534 percent is coming from natural gas. Similarly, a little more than 1 percent is coming from nuclear and 1.72-1.8 percent is coming from hydro.

You can, you can actually ignore the other electricity because this figure is very small. Similar to your demand, sectoral demand, the distribution of different fuel with respect to primary energy can again be represented with the help of a pie chart. Here, there is one thing to observe, you see that this 0, this 0 is actually representing this particular other electricity which is very very small.

So, it may have some .000 something or some positive value, but not in one or two decimal places. So, what are the key things that we can observe when we plot this composition of primary energy supply in India in the year 2013-14? You can clearly see that in the primary energy sources, there is a huge dominance of coal and this is one of the criticism that India often faces that it’s highly coal dependent and coal causes a lot of emission in carbon dioxide.

However, from the part of India the argument goes like this because we have indigenous coal that kind of enhances our energy security. Energy security is again another topic that we will be discussing in some future module. So, this is one of the areas of debate, should we use coal which is domestically available or should we shift to some other less emitting fuel which may not be domestically available or what kind of emphasis should be there on renewable.

So, these are the current, sort of discourse that we are facing at this point. After coal you see the next reliance is basically on crude oil. So, 36 almost 36 percent is being, of the primary energy supply this is coming from crude oil and rest of them are quite small in figure, but crude oil, you will see in probably as we talk about the next question, the source of crude oil is actually not domestic. A lot of it is actually imported from other countries.

So, this is how the energy mix looks like.

Let us next move on to the last question which asks you what is the degree of self-reliance of India with respect to energy supply? Now the moment we start talking about self-reliance it basically depends on what is your total consumption or what is your total supply of energy, how much you are producing yourself and how much is coming from outside.

So, higher the dependence on import, lower will be your self-reliance and this actually comes very nicely out of this energy balance table. If you again look at the supply sector, you will see production, this is domestic production, then you have export and import and then you have total primary energy supply. If you actually calculate what is the percentage of domestic production to your total primary energy supply that figure is indicating what is the, what is the self-reliance that you have.

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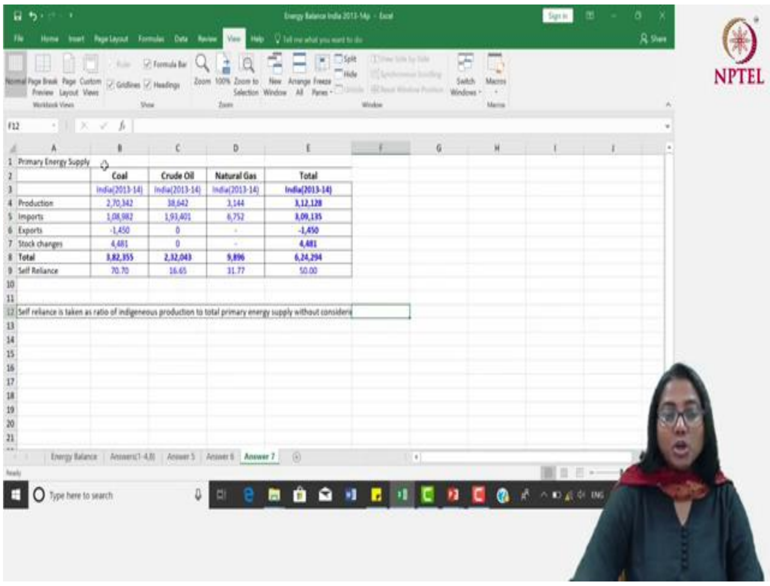

So, if you look at this figure, you will see, if you calculate the self-reliance for each individual fuel you see that the production of coal in India in the year 2013-14 was 2703342 kiloton of oil equivalent whereas the total energy supply, primary energy supply was 3382355 kiloton of oil equivalent. So, 70 percent, more than 70 percent of coal that India is actually, that is there, in the primary energy supply of India, more than 70 percent comes, more than 70 percent is actually domestically produced. It is only approximately 30 percent that India imports, but this 30 percent is again to say it’s not a very, you know, low proportion to import because India has a lot of coal but the quality of coal is such that often India has to import.

If you look at the figure for crude oil that’s actually very very different, the scenario is very different from what you see for coal. So, in the case of coal you saw that only 30 percent is being imported. Here you see more than twenty more than 80 percent is being imported by India. So, only a little above 16 percent or you can say only 17 percent of crude oil in the primary energy supply is actually domestically produced in India and the rest of it is actually import, imported. So, you see that the self-reliance with respect to crude oil is very very low with respect to India.

Third, if you look at natural gas, in natural gas also the self-reliance is only little over 31 percent and rest of it India has to import. So, India started emphasizing on natural gas but the domestic supply has become really limited because of lack of discovery and lack of extractions.

So, you can see that other than coal, for crude oil and natural gas the self-reliance in India is very-very low. So, for these fuels India really needs to rely on other countries. If you take all these three fuels, coal, crude oil and natural gas together, you will see that the self reliance is 50 percent. So, out of the total primary energy supply, 50 percent of the energy is actually domestically produced by India whereas the rest of the 50 percent is imported.

But one line of caution when you are talking about this self-reliance we are essentially not talking about the export or import explicitly. So, one idea could be you can modify these numbers by taking into consideration the export and import, because it might also be the case that you are producing a lot, you are importing less, you are importing a lot but at the same time you are exporting a lot. So, although you rely on other countries to import certain kind of fuel, you also supply a lot of fuel in the global market. So, that kind of balances the situation.

So, one point of caution is that when you are actually analyzing these numbers, it is good to come up with some qualitative analysis of the geopolitics especially when you are talking about energy security and self-reliance. So, we will go back to the previous question because one point that we left there we said that, we will discuss why oil products were not included in the previous analysis and here also you see, when we are talking about the primary energy supply, we are not talking about oil products. Although, if you look at the energy balance table you see that there is some import and some export of oil products in India and there is some entry here.

So, this is basically an entry with negatives which means India exports more oil products as compared to what India imports. But this oil product is not included here because it comes with a negative sign which makes the whole thing cumbersome. If you come to question number 6, here also you see we have included crude oil, but we have not included oil products in the primary energy supply because it was coming with the negative sign which may create confusion. The other thing is that this, see although this is being included in the primary energy supply, this is basically coming through export and import. So, this is not coming through domestic production.

So, you only get the figures for import and export, but you don’t get any figure for domestic production, any figure for domestic production for oil products will actually go to the conversion sector. So, in a way this is easier and this is logical if you drop the oil product when you are talking about the mix of primary energy supply. This is where we actually stop and this is the end of the first week. I hope you enjoyed the first week and I will, I look forward to seeing you with some new topics in the next week.

Thank you.