MINERAL ECONOMICS AND BUSINESS

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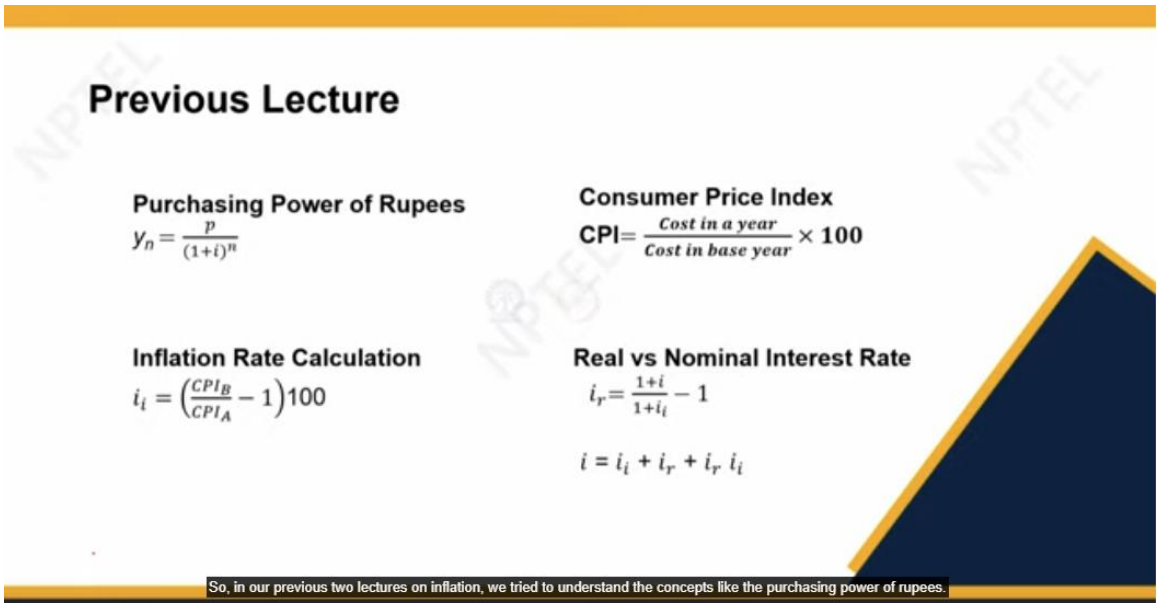
Lecture 35: Inflation - 3

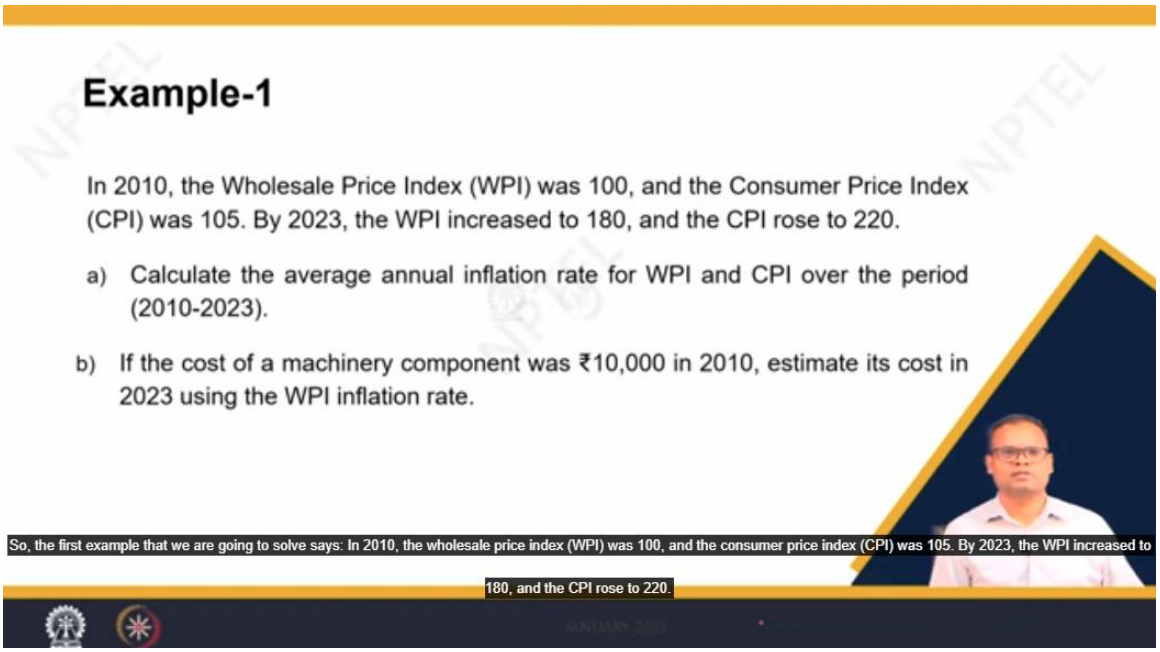


Hello everyone, and welcome again to this course on Mineral Economics and Business. This is our lecture number 35, and this is the third part of our lecture on inflation. So, in our previous two lectures on inflation, we tried to understand the concepts like the purchasing power of rupees. We learned that the purchasing power decreases with time and the inflation rate, like in this equation here: $y_n = p / (1 + i)^n$, where p is the initial amount. i is the inflation rate, and n is the number of years.

Similarly, we saw CPI, the consumer price index, which is the cost in a year divided by the cost in a base year multiplied by 100, and also we learned about WPI, which is the wholesale price index. Then we learned the inflation rate calculation, how it is done from the CPI, and we saw that the inflation rate is i = (CPI_b / CPI_a - 1) × 100, where a is the initial year and b is the final year. So, in which we are calculating the inflation. And also, the calculation for inflation using the WPI is similar to CPI. Then we learned about real

versus nominal interest rates, and we saw that the formula for the real rate is $(1 + i) / (1 + i_i) - 1$.

And the nominal rate is $i_i + i_r + i_r \times i_i$, where i_i is the inflation rate and i_r is the real rate. So, in this lecture today, we are going to solve a few problems to enhance our understanding of these concepts.



So, the first example that we are going to solve says: In 2010, the wholesale price index (WPI) was 100, and the consumer price index (CPI) was 105. By 2023, the WPI increased to 180, and the CPI rose to 220. So, it asks to calculate the average annual inflation rate for WPI and CPI over the period 2010 to 2023. And the second part asks: If the cost of a machinery component for a mine is 10,000 in 2010, estimate its cost in 2023 using the WPI inflation rate. So, to solve this example, we have a table here: In 2010, we know that the WPI is 100, and in 2023, it increased to 180.

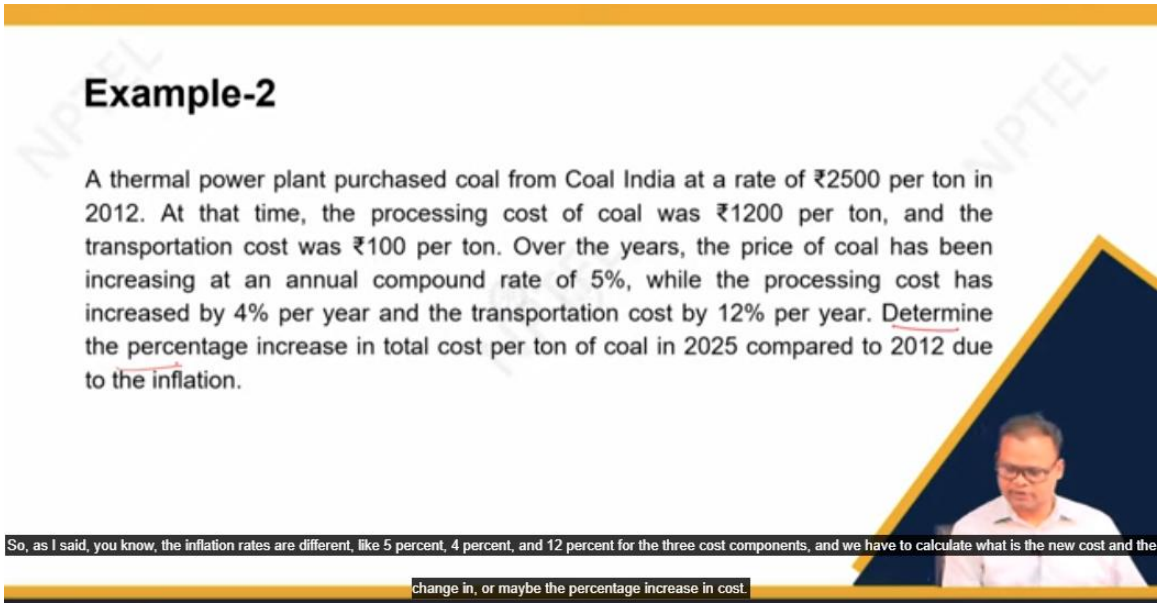
Now, ah the CPI ah increased from 105 from ah to ah to 20. So, and ah here if you see this has increased in ah 13 years. So, 2023 minus 2010 is ah 13 years here. And, here you know ah what we are we are asked to is to calculate is the annual average inflation using WPI as well as CPI. So, for this ah you know like ah we we know that ah you know this average inflation rate will be um i i equal to ah CPI

b divided by C p i a whole to the power 1 by n because we are trying to calculate per year here minus 1. So, this becomes you know into whole into we can say 100. So, this becomes 180 divided by 100 to the power 1 by 13 minus 1 whole into 100. So, this becomes our 4.63 percent.

Similarly, for CPI we can calculate the inflation rate II equal to again CPI or we can write this is WPI and this is WPI, this is CPI b divided by CPI a. minus 1 whole into to the power 1 by n minus 1 whole into you can say 100. So, this is you know this is 220 divided by 105 whole to the power again the number of years is 13. So, 1 by 13 minus 1

into 100. So, this becomes our, you know, like this value becomes 5.85 percent. So, this is the first part of the problem where we have to calculate the annual average inflation rate using WPI and CPI. So, the second part of this problem asks us to calculate the price of this equipment.

So, the initial price for the component of the equipment equals 10,000 rupees. And we know that using WPI, the inflation rate II equals 4.63 percent. So, the final price in 2023 will be, you know, the number of years will be 13 again. And we can calculate the price as F equals initial price, let us say P, into 1 plus ii to the power n. So, if you put the values, 10,000 into 1 plus ii is 0.0463, whole to the power 13 equals rupees So, this is the first question.



We will try to see another example here where it says a thermal power plant purchased coal from Coal India at a rate of 25,000 per ton in 2012. At that time, the processing cost of coal was 1,200 per ton, and the transportation cost was 100 rupees per ton. Over the years, the price of coal has increased at an annual compound rate of 5 percent, while the processing cost has increased by 4 percent per year and the transportation cost by 12 percent. So, here, you know, the inflation rates are different for different cost components, and it asks to determine the percentage of increase in total cost per ton of coal in 2025 compared to 2012 due to inflation. So, as I said, you know, the inflation rates are different, like 5 percent, 4 percent, and 12 percent for the three cost components, and we have to calculate what is the new cost and the change in, or maybe the percentage increase in cost.

So, to do this ah you know what we can do is ah we can ah make a table like here. So, this is cost of coal we can write it in ah first column, second is the processing ah cost and third thing what we have is transportation cost. So, and in 2012 this was 2500 rupees and the processing cost was 1200 rupees. and we know that for this it was 100 rupees per ton of coal to transport. And we know that this inflation rate was 5 percent, 4 percent and 12 percent.

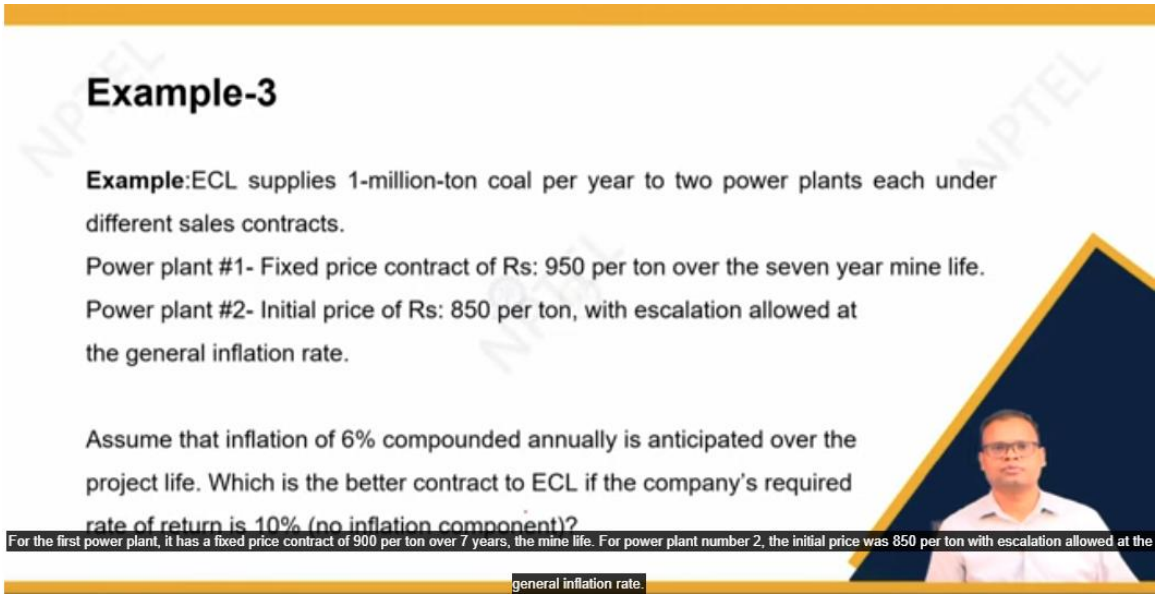
So, in this case you know we have to calculate the cost of coal with 5 percent of inflation. So, if you again subtract 2000 25 minus 2 0 1 2 is again 13 years. So, for us n equal to 13 years. So, if you see you know the cost of coal will go by you know p is the initial cost 1 plus i i to the power n again is 2500 into 1 plus II is 0.05 to the power 13 and this becomes 4714.1 rupees. Similarly, for the processing cost is the inflation is 4 percent. So, again this is P into 1 plus II to the power N where P is 1200. 1 plus i i is 4 percent. So, 0.04 whole to the power 13 equal to our 1998.1 rupees.

So, Similarly, for transportation again we can use the same formula p into 1 plus ii to the power n. So, this equal to 100 into p is 100 into 1 plus 0.12 because it is a 12 percent whole to the power 13 equal to your 436.3. So, what does mean is due to inflation the cost of coal has increased from 2500 to 4714.1 ah whereas, the processing cost has been increased from 1200 to ah 1998.1 rupees and the transportation cost has increased from ah 100 from ah 100 ah from 100 to 4000 3 ah 4 436.3 rupees. So, if you see the cost in 2012, total cost in 2012 per ton. of coal equal to ah you know this is 2500 was the cost of coal and ah 1200 was the processing plus 100 rupees was the ah the transportation charges.

So, this becomes 3800 rupees ah per ton. Similarly, for total cost in 2025 per ton. equal to 4714.1 plus 1998.1 plus 436.3 so this is the cost of coal plus the processing cost plus your

transportation cost and this is this becomes rupees 7148.2 So, you know if the initially total cost was ah 3800 per ton and ah the in 2025 it has increased to 7148.56 rupees.

So, the percentage change ah in cost is ah final cost minus initial cost divided by cost into 100. So, this becomes 7148.56 minus 3800 divided by initial cost is 3800 into 100. So, if you calculate this, this becomes 88.1 sorry 88.12 percent. So, you can see that the total cost has increased on average by 88.12 percent because of inflation.



We have another example here. So, where it says ECL supplies 1 million tons per year of coal to 2 power plants, each under different sales contracts. For the first power plant, it has a fixed price contract of 900 per ton over 7 years, the mine life. For power plant number 2, the initial price was 850 per ton with escalation allowed at the general inflation rate. Assume that inflation of 6 percent compounded annually is anticipated over the project life. Which is the better contract for ECL if the company's required return rate is 10 percent with no inflation component?

So, what it says is that ECL has made a contract with two power companies under two different contracts. Let us try to understand this. So, the first company, what they are doing is: So, this is let us say your number 1, 2, 3, 4, 5, 6, and 7. So, this is case 1. Case number 1.

So, here they are going to sell or supply this coal at a price of 950 rupees per ton. So, 1 million into 950 is they are going to get 950 million rupees. From the first year selling, it

becomes 950 for the subsequent years. 950 and 950. So, here what it says is that they want a real rate of return (IR) equal to 10 percent, and the inflation rate (I) is 6 percent.

So, this is the condition and the second case, which is Case 2. When they are supplying this coal to a second power plant. So, where we have year numbers 1, 2, 3, 4, 5, 6, and 7. So, in this case, they are going to give this coal at a price of 800 50 per ton, so 850 rupees, million rupees.

Per year. So, 850, 850, 850, 850, 850, and 850 up to the 7th year. So, in this case, what is happening for this power plant? The power plant is saying that you do not have to worry about the inflation; we are going to give this 850 rupees per ton. And we will take care of the inflation. In this case, we have to calculate the NPV from these two contracts and find out which is the better contract. So, in this case, we just have an IRR equal to 10 percent.

So, for the first case, if you see, if we make the cash flow diagram again, So, 1, 2, 3, 4, 5, 6, and 7, we are getting 950 million here. So, and in this, if we try to take the inflation compound inflation part out first, which is 0.06. So, this 950 million becomes 950 divided by 1 plus i, which is the inflation component to the power 1. This is your if you put II equal to 0.06, so 950 divided by 1 plus 0.06, so this is equal to your 890 point

So, because of the inflation ah the the the value of this 950 becomes ah 900 890.2 and on top of that we we need a real rate of return ah of ah 10 percent. So, because this the present value of this 950 ah million rupees at t equal to 0 becomes 890.2 divided by 1 plus 0.1 which is 10 percent to the power 1. So, this is your 814.2 8 rupees.

So, in this case like if you do for the second year, third year, fourth year and calculate the final ah present value of this thing at t equal to 0 ah let us say for the sixth or seventh ah 950 million here. So, because it was 6 percent of inflation this will go down to you know 950 divided by 1 plus 6 whole to the power 7. So, this is your 631.8 and further decrease due to this real rate of return I r equal to 10 percent is you know this becomes divided by 1 plus 0.1 whole to the power 7.

So, this become 324.2 rupees. So, in this case ah you know if you do and calculate ah ah reduce one because of this ah um the inflation rate and second because of this ah the required ah return the real ah return. So, the corresponding present value of these ah things can be calculated as ah this the the value shown ah here. ah Similarly, for the second case ah what we are going to do is ah you know ah in this case ah if we draw the cash flow diagram for 1, 2, 3, 4, 5, 6 and 7th year we are getting 850 ah million rupees every year.

850 all the way up to let us say seventh year 850 million rupees so in this case what again what we can do is here we the the power plant company is taking care of the inflation so we just have to get our you know ah the real rate of return which is 10 percent so we can find out you know the present value of this 850 in second year as

by 1 plus 0.1 to the power of 2. So, similarly, if you do all these values like this, it will be 850 divided by 1 plus 0.1 cubed and all the way up to 850 divided by 1 plus 0.1 to the power of 7. So, if you calculate like this, the values are given here. So, initially, for the first year, the present value of this 850 million is 772.7 million, whereas for the seventh year, the 850 million rupees that we are going to get becomes 436.2 million. So, if we do this and compare, you can see that the total present values for case 1 are given here in the blue line.

Whereas for case 2, these are in the tick mark here. So, you can calculate that for case 1, if you sum up all these present values, which are circled in red, so this becomes 3769.8 million rupees, and for case two, it is 4138.2 million rupees.

So, in this case, we can see that the present value for case 2 is more than that of case 1. So, we can say for the ECL, the second case or the second contract is a better contract. So, this ends our lecture today on inflation, and also, this is the end of my lecture for this course.