MINERAL ECONOMICS AND BUSINESS

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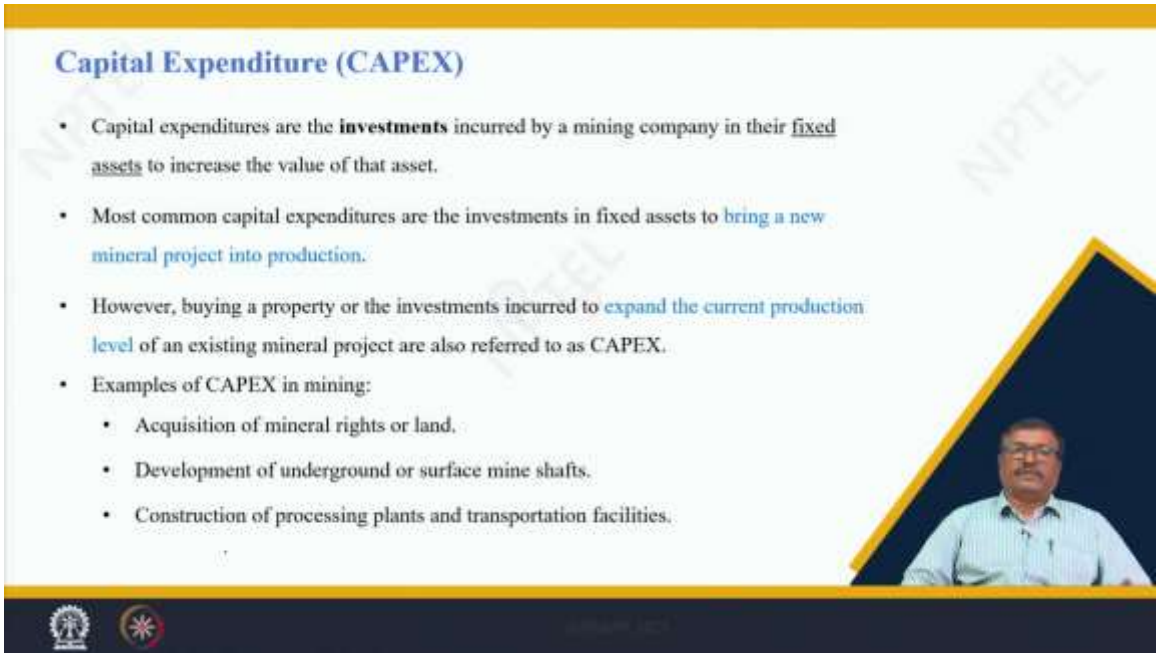
Week 4

Lecture 17 : Capital Expenditure and Operating Expenditure

Welcome everybody. Today we will be discussing capital expenditure and operating expenditure. In my previous lecture, I have extensively dealt with feasibility studies, pre-feasibility, and scoping studies also. Everywhere, you might have noticed that I have used CAPEX and OPEX as important parameters for calculating the cost and, therefore, their implications on project viability.

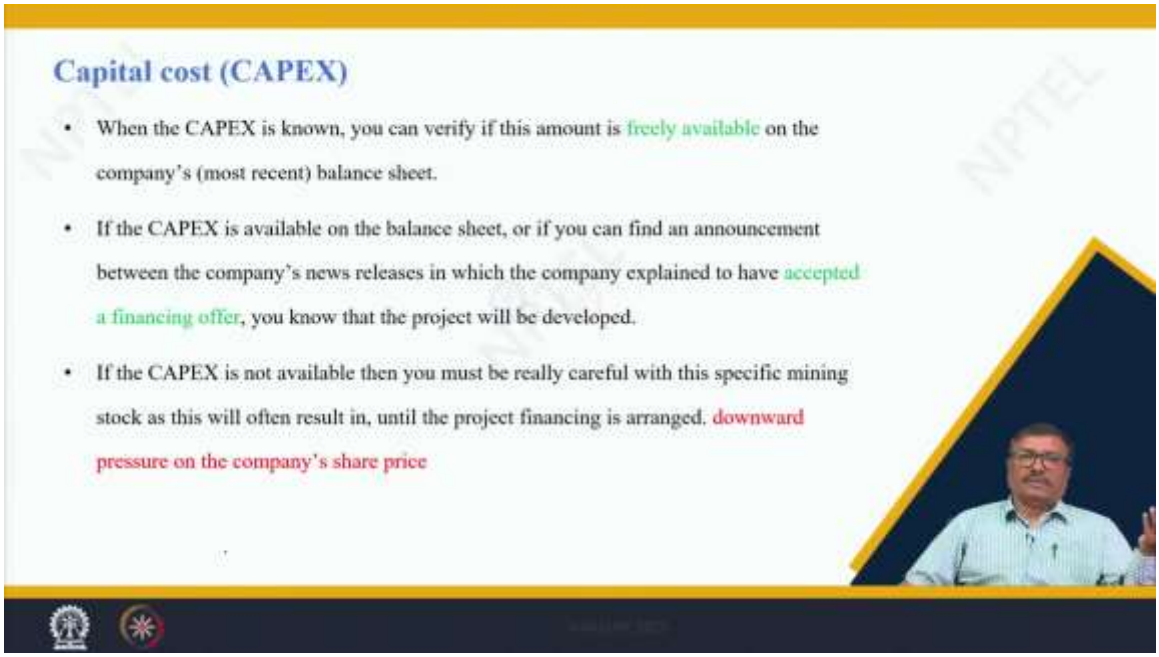
Here, we will be concentrating on capital expenditure and operating expenditure in detail with some examples. Basic definitions will be covered: what are the different types of capital expenditures involved, what are the factors that influence capital expenditure, CAPEX in financial statements—where do they appear, sources of CAPEX funding, introduction to operating cost or OPEX (operating expenditure). Components of this OPEX, which are the factors that influence OPEX, what are the key OPEX metrics, and

the trends in OPEX management. So, that will be discussed today, and these concepts will be covered in this particular lecture.

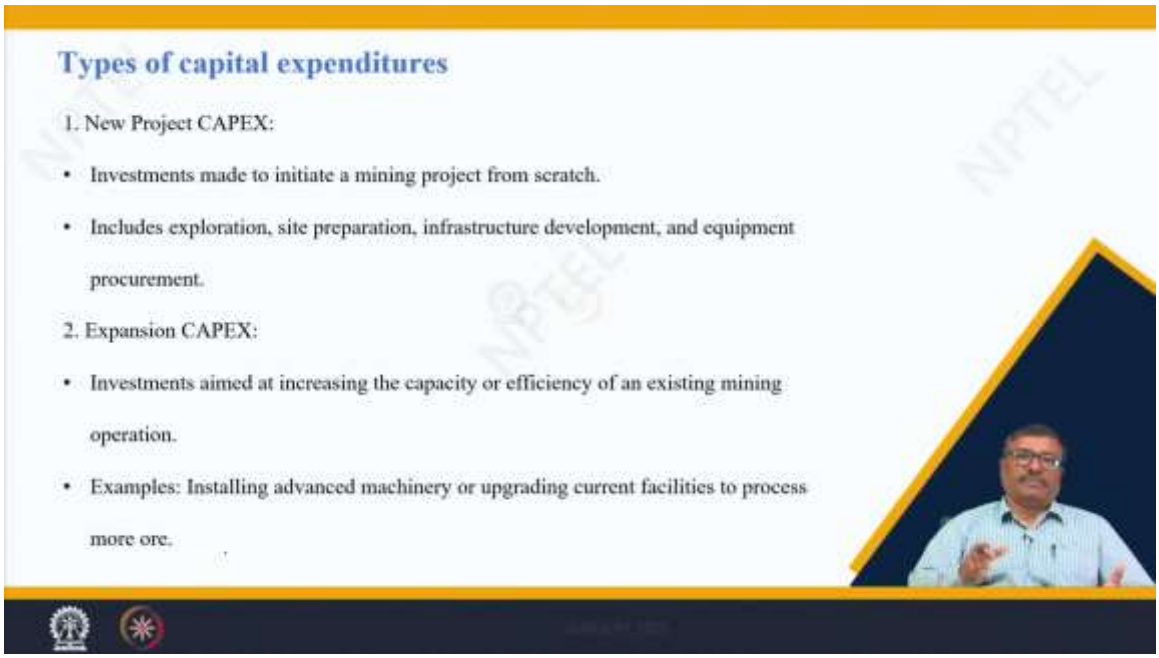


I start with the definitions of capital expenditure, popularly known and abbreviated as CAPEX. Capital expenditures are the investments incurred by a mining company in their fixed assets to increase the value of those assets. So, basically, the expenditure incurred by a mining company in their fixed assets. The most common capital expenditures are the investments in fixed assets to bring a new mineral project into production. So, in the beginning, we require this capital expenditure to bring the project into the production phase.

But buying property or the investment incurred to expand the current production level is also referred to as CAPEX. This is something I will talk about later. So, what are the examples of CAPEX in mining? Acquisition of mineral rights or land, development of underground or surface mine shafts, construction of processing plants, and providing transportation facilities. Now, when the CAPEX is known, you can verify if this amount is freely available on the company's balance sheet or not. For a running company, that is where you can get the money for reinvestment as capital expenditure.

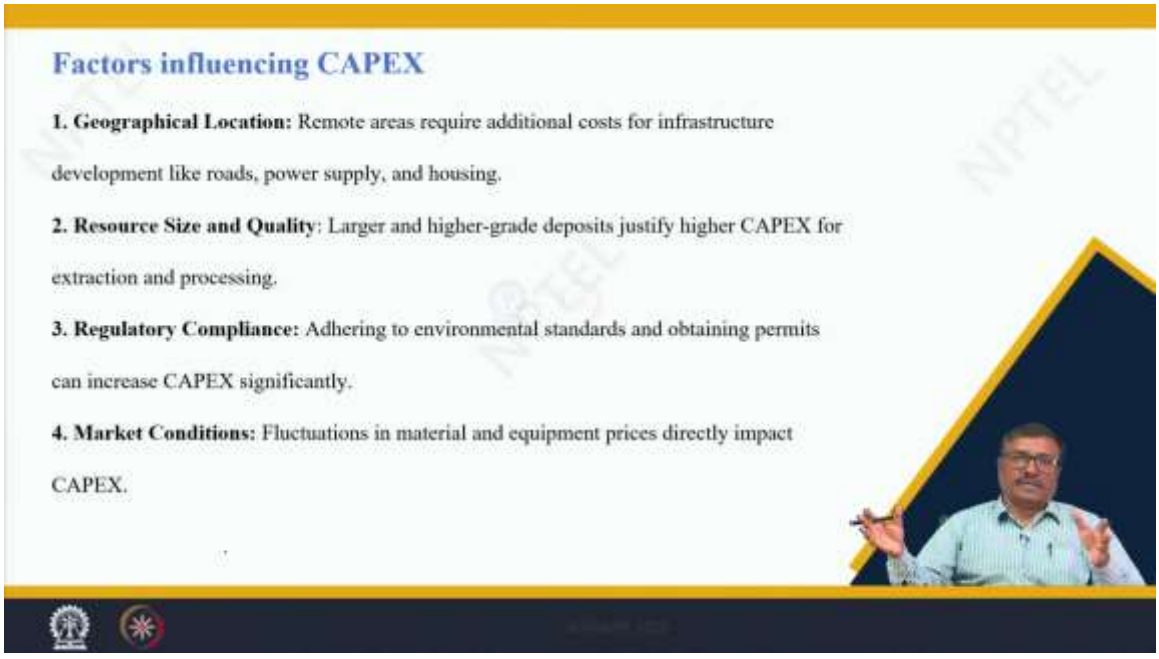


But if the CAPEX is available on the balance sheet or if you can find an announcement in the company's news release where the company explains having accepted a financial or financing offer, then the project will be developed. But if the CAPEX is not available, then you must be very careful with this specific mining stock, as this will often result in downward pressure on the company's share price until the project finance is arranged. Because, say, if the company is trying to expand its business and trying to get capital infusion not only for expansion but maybe also for new technology or new machines. In that case, the balance sheet must show that the capital expenditure funds are available. So, from there, it can be taken, and the company can proceed with the expansion projects.



But if it is not, in that case, it has to find some kind of sources, and unless the company gets an opportunity to secure new capital infusion, there will be pressure on the stock. Now, the types of capital expenditure, for example, what are the different types? There is new project CAPEX, where investments are made to initiate a mining project from scratch. There was no project, and then we infuse capital for equipment, site preparation, infrastructure development, and equipment procurement, which are expensive. And then we can transform this greenfield into a brownfield project and operate it where the mining operation can start. The second type, as I mentioned just now, is the expansion CAPEX.

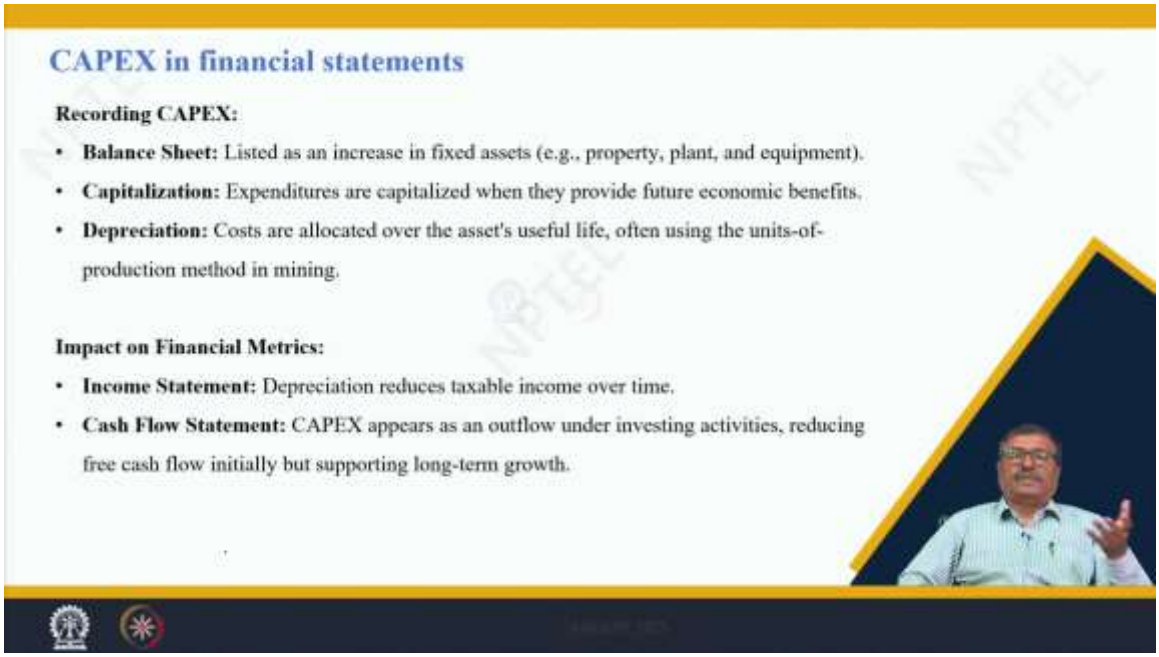
These investments are aimed at increasing the capacity or efficiency of an existing mining operation, either by adding new fleets or expanding mining operations to increase capacity. At the same time, maybe you are switching over to new technologies, much better technologies. Efficient technologies will increase efficiency, but in the beginning, you will require capital infusion. In the long run, you will benefit by increasing efficiency and decreasing operating expenditure, resulting in overall benefits. For example, installing advanced machinery, as I said, or upgrading current facilities to process more ore will require additional capital to be infused.



What are the factors that influence CAPEX, like where you are located? Remote areas will require additional costs for infrastructure, access roads, power supply, new housing,

and you cannot rent anything. So, you have to build new housing complexes to accommodate your labor, officers, or supervisors. Now, the resource size and quality. Larger and higher-grade deposits will justify higher CAPEX because, without proper large-size equipment, the production rate will be low.

So, it justifies more capital investment for extraction as well as processing of the mineral. Regulatory compliance also requires capital expenditure, like adhering to environmental standards. Obtaining permits can significantly increase CAPEX in the beginning, as can market conditions. Fluctuations in material and equipment prices directly impact CAPEX because the equipment, plants, or other facilities you purchase and install are bought directly from the market. So, that will considerably affect the total CAPEX if there is a positive fluctuation in the market.



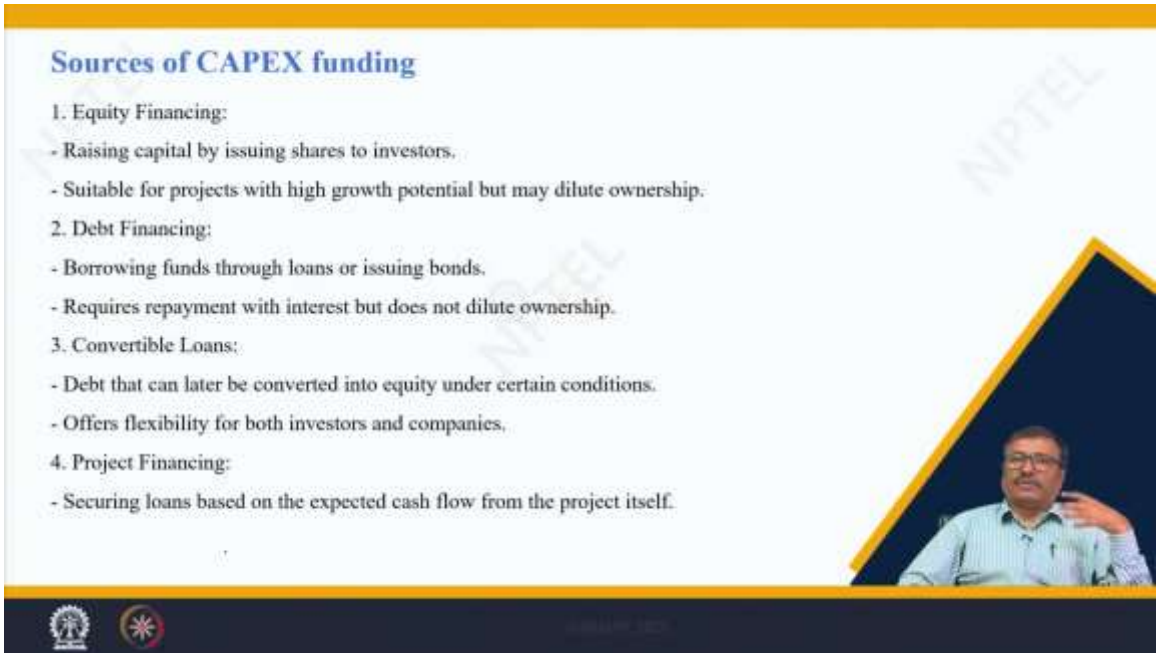
Now, the ah in the financial statements why do you record it? In the balance sheet listed as an increase in fixed assets because you are ah you are transforming this the the capital expenditure in terms of asset like you have now property, you have plant, you have more ah equipment. So, you are transforming them into asset. So, in the balance sheet that capital expenditure CAPEX will now appear as fixed asset increase in the fixed asset. you are capitalizing also expenditures are capitalized when they provide future economic benefits then you can capitalize it.

So, that means, show in the capital expenditure and the depreciation is also ah a part of this ah how to how to show that in your balance sheet. This will have a separate class ah on the on the depreciation itself. The cost will be allocated for the time being let me say this that the cost will be allocated over the assets useful life. As you go on producing

Then, what you do a part of the expenditure will be assetized, it will be shown as a ah as a depreciation. A simple example is units of production method of depreciation as applied in mining. This I will I will separately ah take a class on ah on this depreciation itself. And what is its impact on the financial matrix? Then in the income statement, the depreciation will reduce the taxable income over time.

We have a tax benefit there, and in the cash flow statement, CAPEX appears as an outflow because we are investing under investing activities, reducing the free cash flow initially. But in the long term, you will see that production is increasing as we expand to get a return sooner. Now, what are the challenges in getting this CAPEX? Funding constraints are there; mining projects require significant upfront investment. So, you may not get that amount immediately unless you can convince the funding agencies. There could be project delays due to regulatory approvals.

For example, you may decide to expand a certain activity where substantial capital expenditure is required, but there could be delays in regulatory approvals before you can use that capital expenditure to expand the business and increase production. The volatility of commodity prices, changes in market demand, or pricing affect the justification. You justify your capital expenditure based on the assumption that certain prices will stay the same or increase. So, your return on investment will increase, but if there is a negative trend in market prices, then your justifications may not hold longer. So, we need to be careful about the risks involved in this kind of capital investment. So, what are the solutions we can provide?

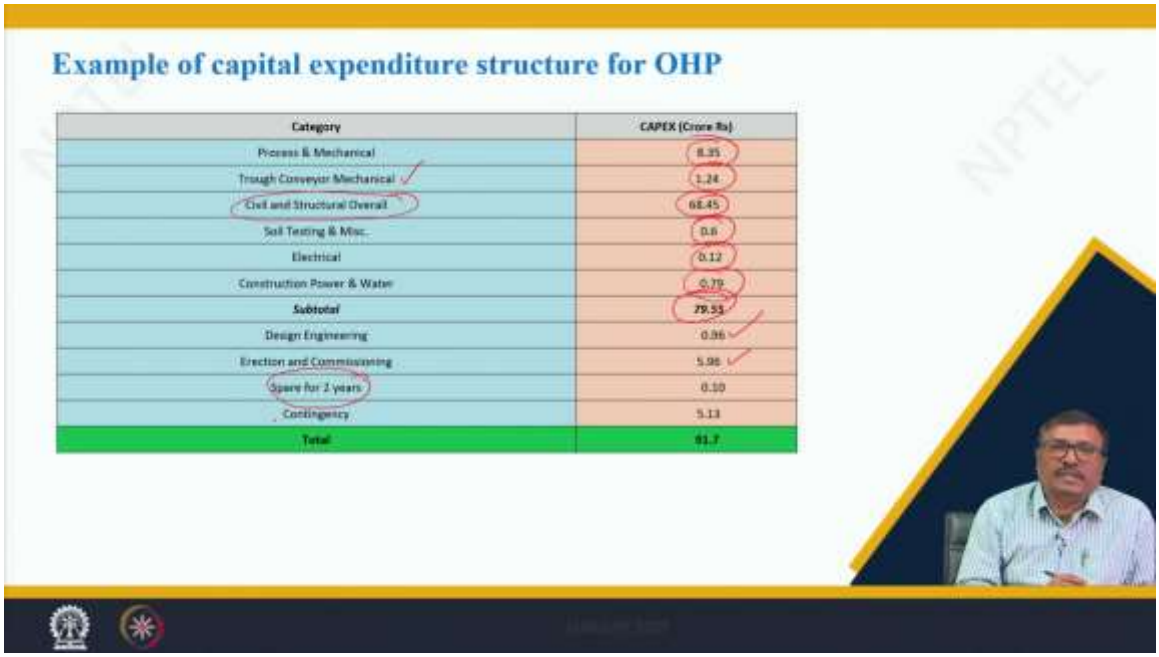


We can conduct a thorough feasibility study. If I am infusing new capital, what are the risks involved? What exactly are we going to do here? What are the expenditures involved, and how can we reduce them without affecting our expectations? From the feasibility study, we can also try to understand what the return on investment will be. And then, a cost-benefit study can be done. We can also explore diversified financing options, partnerships, and joint ventures.

So, that the stakeholders are more they can give you better advice as to how to do it. It can be through equity financing new. We can raise capital by issuing shares to investors.

So, from the market itself you can get that money. And this is suitable for projects with high growth potential, but may dilute ownership.

What happens the when you increase the ah the shareholders then the your ownership will definitely dilute because the ah shareholders number of shareholders will be increasing here, but when there is a high growth proven high growth for any company, then the investors will be easily attracted and you can raise the capital within no time. Or you can go for debt financing, you can borrow funds through loan or issuing bonds and ah it requires repayment with interest, but does not dilute ownership because you are taking a loan and we will also discuss the also discuss the ah the stock ah the shares and the debts in detail later. But here this is another option other than equity we have debt also. We have convertible loans, debt that can be later converted into stocks and this offers flexibility for both investors and the company.



The project financing and you can secure loans based on the expected cash flow from the project itself that is also and then you can take temporary from there and then you produce, you make profit and you can replenish the loan and so that know it is managed from the project itself. Say for an ore handling plant, this is not a typical mine, a part of the unit, a part of the mine that we have shown here. So, what are the capital expenditures involved? How they are structured?

Rather what is the expenditure structure for ore handling plant here? This is for iron ore mine. You can see that the process and mechanical part we need for example, 8.35 here. Then the conveyor belt trough that will be required. So, we have an allocation for this.

Then we have civil and overall civil structures all the structure huge structures are required for the constructing building the ore handling plant. So, we have kept 68 crore for the capital expenditure for civil and overall structures. There are soil testing and other things for the purpose of installation. So, we have kept the provision for that. This is also a part of the kept collection details.

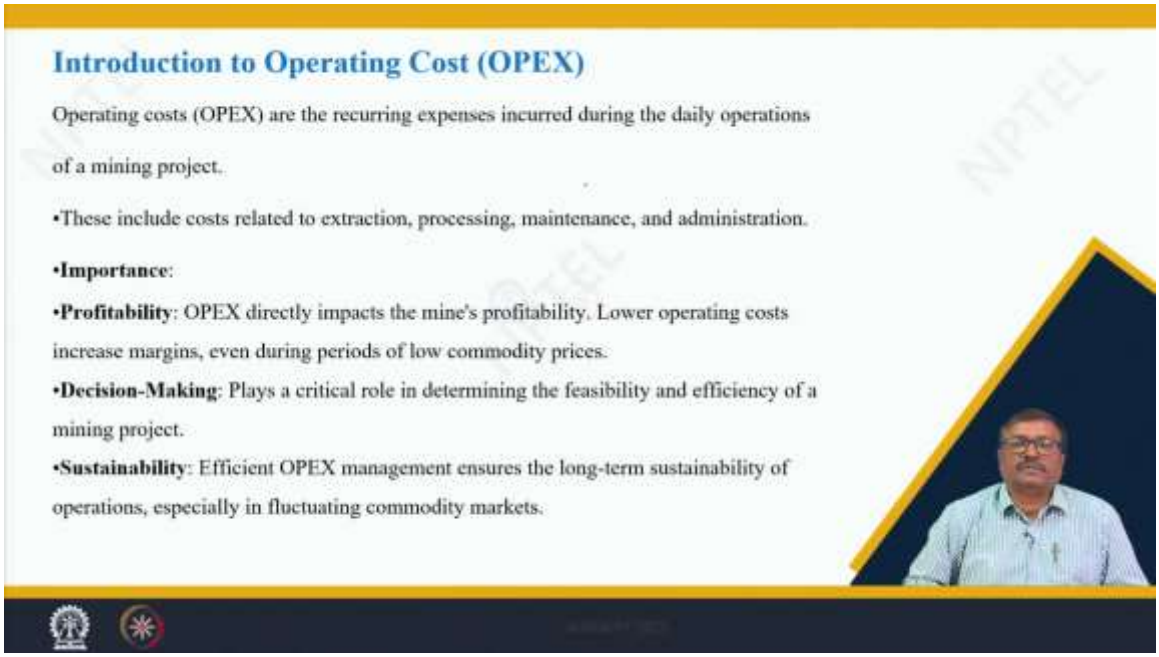
And there are electricals and construction power and water we have kept a provision during the construction itself it will be required. So, subtotal for example, is about 80 crores here. Now there are expenses for design engineering, erection in commissioning you have to pay for the for the people the contractors who will build the entire thing and commission and then hand over to you. And of course, for a hassle free operation we kept for example, spares for 2 years. right in the beginning.

It does not I mean mean that that it has to be for 2 years it depends on you. If you have good money you take keep it for 2 years or 3 years. So, what happens that immediately if there is any breakdown or some maintenance issue comes, then you can use this space from there or there are consumables. which may be required every 6 months or every year. So, the spares can be kept and that can be used so that the operation is smoothly run.

we have contingency expenses another 5 crore. So, total here you see the 91.7 of the 92 crore this is how the the whole thing is ah say divided this is the structure. So, you see that the civil and and the structural since this is the ore handling plant. So, the main expenditure is here main expenditure is here in the civil structure and the structure overall structure this is the maximum. Also we have the different process and mechanical items that will be will be requiring another 8 crores or so.

This is just an example that how we prepare the expenditure capital expenditure estimate for a particular unit. Now, for the other units like the office buildings or the township we also can develop similar capital expenditure schedule where things should be broken down into smaller And, there you allot the figures which are realistic and you get this from the from different sources in the market. Now, in the operating cost part which we know also ah now we will talk about the operating expenditure which is also popularly

known as OPEX. In the operating cost, we have the recurring expenses that is this is not one time or a major capital in the infusion.



If you are running the process or the mine, then for daily operations will be requiring ah this recurring expenses. So, this will this includes the cost related to extraction that means, drilling blasting ah loading all those things processing of this ah the mineral that is produced if it requires processing. then maintenance of the equipment, machinery and administration part also. And what is the importance? The profitability is one factor where the OPEX directly actually impacts the miners profitability.

if the operating cost is low then since you have the you have certain things fixed cost then if you you can reduce the operating cost then overall cost will be reducing and your profit margin will definitely increase definitely increase. The decision making, this plays a critical role in determining the feasibility and efficiency of a mining project because the OPECs significantly contribute to the overall cost. So, if the operating cost or operating expenditure is very high, then you need to be cautious whether we should go ahead with the project or not or we should think about alternative methods or machines or process where we can reduce the overall cost. and thereby reduce the, thereby increase the profit margin because overall cost will be reduced. So, you can expect more profit margin from there.

About the sustainability part ah it automatically is understood that efficient OPEX management operating expenditure management will ensure the long term sustainability of the operations because it becomes cost effective specially when it is a fluctuating commodity market. If the if the market is fluctuating and if your margin is high then you can accommodate fluctuations here. if the profit margin is low because of the high operating expenditure, then any fluctuation in the market will seriously affect the profitability of the mining project. What are the different components in mining cost? The cost of drilling is operating expenditure, blasting,

Hauling means the transportation of material. This also includes the salaries of mine workers and equipment operators. Now, in processing cost, this is associated with the crushing, grinding, or processing of ore to extract minerals in the beneficiation process. Maintenance cost includes repairs and maintenance of machinery, equipment, or any facility. There are office expenses, management salaries, and compliance with different regulations, for which you need people in the administration.

These will come under the subhead administrative cost under operating expenditure. Then comes the power and fuel expenses, which are often a significant portion in mining operations. So, this energy cost is part of the operating expenditure. So, whenever you are operating machines and running the plants, you will have to pay the power bill and

account for fuel consumption. So, all these things are quite significant and are likely to influence the operating expenditure.

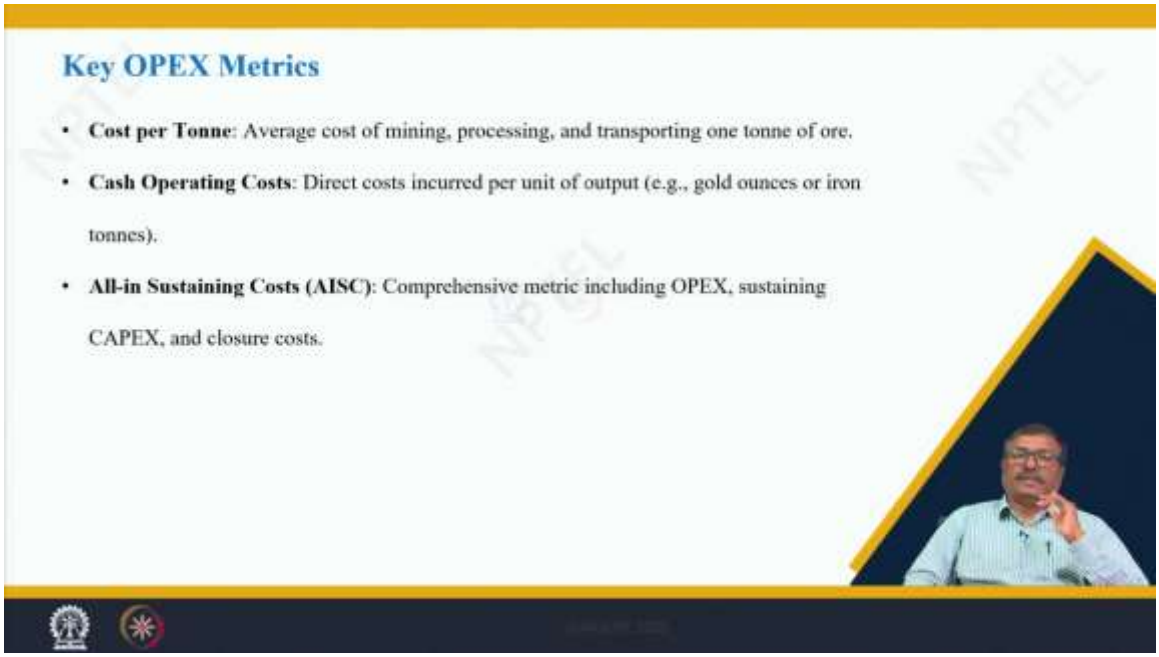
Now, what are the factors that may affect the operating expenditure, as we studied in the case of capital expenditure? What is the type of mining method that you have adopted—open pit mining or underground mining? In underground mining, there will be higher operating expenditure due to its complexity. Ore grade and deposit size. Lower-grade ores will require more processing, increasing costs.

If you have high-grade ores, then it will require less processing. It depends on what we are talking about. It is not so simplistic, but more about the processing involved for the purpose of any beneficiation or improvement in the grade. In that case, the cost will be higher. And if you are located in remote locations, there will be higher logistics costs, meaning transportation, manpower, and infrastructure maintenance.

So, for these things, the geographical location will also contribute to higher operating expenditure. What are the regulatory requirements? Costs associated with environmental compliance and safety standards. There is also a part that can be attributed to the operating expenditure. And then, the market conditions—fluctuations in fuel prices, as fuel expenditure comes under operating expenditure.

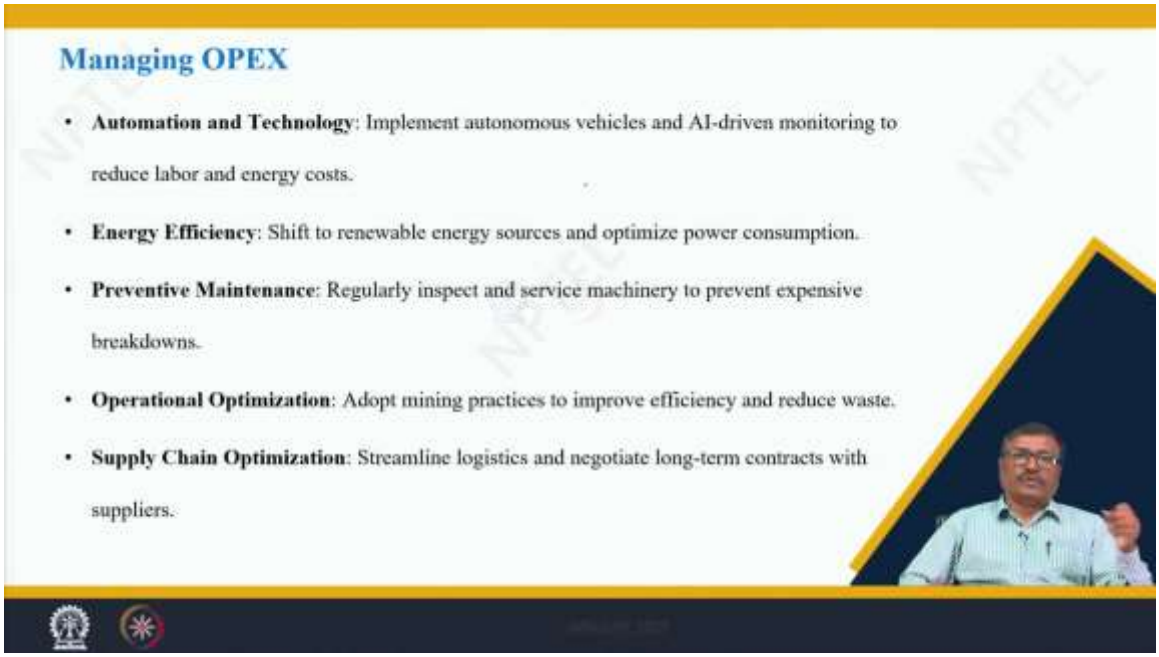
So, fluctuations in labor costs—if you have contractual labor where wages may vary—will definitely affect the overall OPEX, as well as the raw materials required for production. Now, how do you show or indicate the OPEX? What are the indicators? How do you show it in the management information system? Number one, it can be expressed as cost per ton—say, rupees per ton—average cost of mining, processing, and transporting one ton of ore.

So, people may like to know how much we spend in the mining, drilling, and blasting total, or even we can break down the entire thing into much smaller items. We may ask you the question: what is the drilling cost per ton? How much explosive cost are you incurring for 1 ton of ore? Or what is the cost of processing 1 ton of ore? Or what is the cost of transporting 1 ton of ore from the mine to the place where you are delivering, to the port or going to the railway. Now, or you can say cash operating cost, the direct cost incurred per unit output. For example, gold ounce or iron tons, that is the whole thing as a direct cost per unit of output, per ton, per ounce of gold, like that. But also, we can have



And all-in sustaining cost, like a comprehensive metric including OPEX, sustaining CAPEX, and closure cost. All these things can also be encapsulated in one AISC, that is all-in sustaining cost. But, most commonly, I am telling you, cost per ton is the most common unit that we use in management in the processing system. And if we add everything, then we can say the operating cost is this much per ton. If you want to know

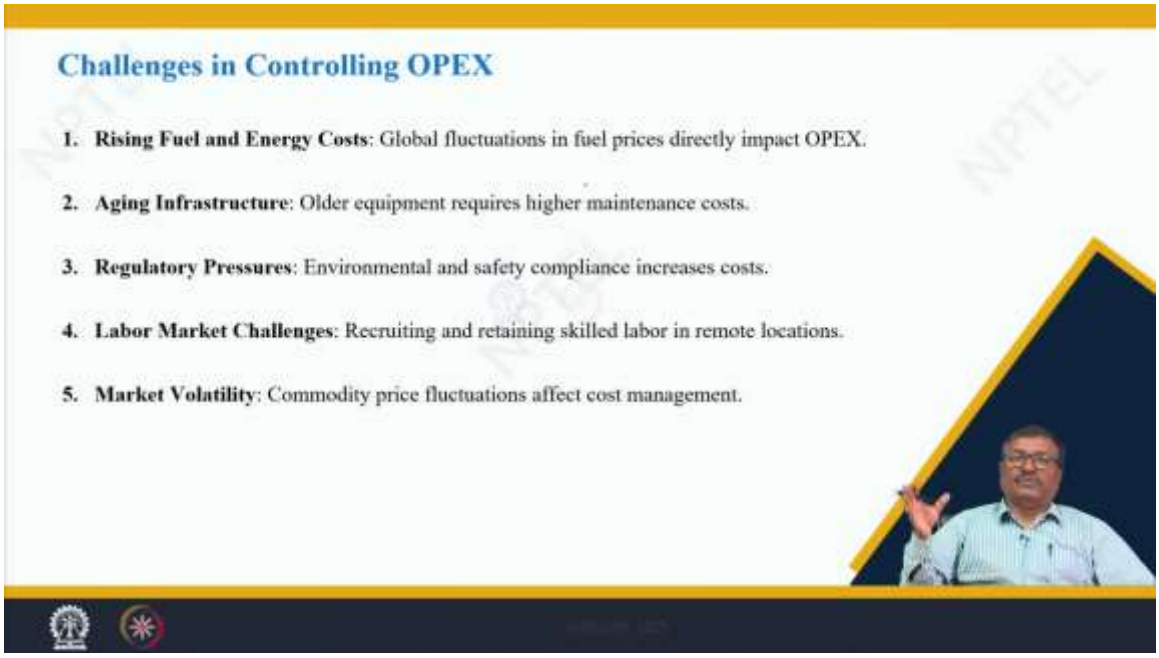
the details, you can go for the drilling, blasting, transporting, all these things. The first two are most common and very popular in the costing.



Now, how to manage this OPEX if it is going high or low. So, I mean, how to make it predictable. Or manageable rather, in the beginning, let us manage it. So, we can implement autonomous vehicles or AI-driven, artificial intelligence-driven monitoring. Nowadays, we are trying to do it in many mining companies. I have seen in China also, a lot of these AI-driven machines are running to reduce the labor and energy cost.

So, our in India also we are trying to implement the different autonomous vehicles or rather very much monitored movement and which can increase the efficiency of the transportation also And you must have heard about the TDS and where you can see everything and control everything and the machine also gives you a guidance as to how to reduce idle time and maximize the utilization of the vehicle thereby reducing the operating expenditures. You can shift to renewable energy sources so that you pay less. There are mining companies which are installing huge solar power panels solar panels from there they can reduce because they will feeding the grid and they get the benefit of reducing their power bills. Then is very important point preventive maintenance, how to reduce this maintenance cost.

So, if you can regularly inspect and service the machinery, so that you do not have to face an unwanted sudden breakdown which is expensive, it may damage huge parts and so the you have to replace those parts ah then in that case there will be lot of expenditure. If the regular inspection and the predictive maintenance is done, then you can avoid this kind of unnecessary expenditure or huge expenditures. It is called preventive maintenance which is also a part of this is basically based on the predictive things that this can happen this can happen. So, there are many IoT enabled process also where you can understand that this is going to happen. Or at a regular interval you go on inspecting whether it is a breakdown maintenance or not, you just regularly go on inspecting and go on checking.



So, that the maintenance cost goes down by implementing predictive and preventive maintenance both. The operational optimization you have to adopt the mining practices in such a way that you can improve efficiency. Inefficient method is not good for the ah ah for the expenditure management. So, you have to design the ah stoves or design the working place in such a way that you can reduce the ah ah the expenditure because you can improve efficiency and you can also reduce the waste generation waste generation also unnecessary wastage will not be there. So, you can optimize the operation.

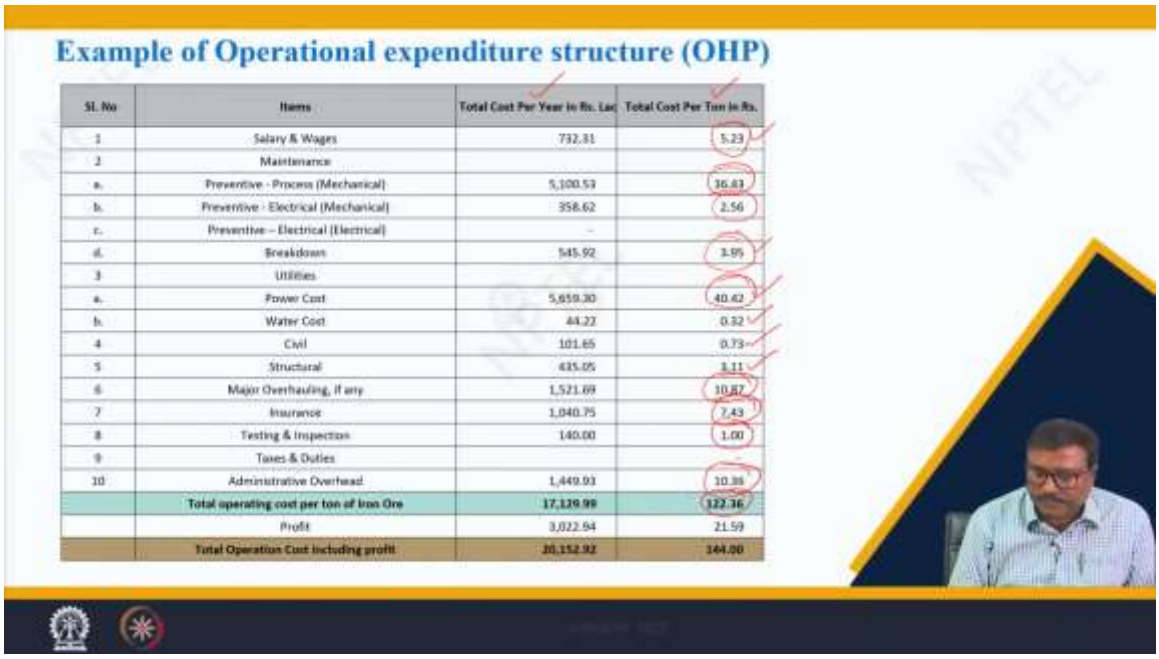
Supply chain optimization means that you are selling the output ore or coal. So, you must streamline the logistics in such a way using your managerial capabilities and links, and you should negotiate for long-term contracts. So, that your supply chain optimization is done and it is a sustainable business. Now, in controlling OPEX, the rising fuel and energy costs are definitely a matter. So, if it is increasing, then it will heavily affect your operating expenditures.

The infrastructure that we installed in the beginning will get old and will require higher maintenance costs unavoidably, but you need to maintain them regularly. So, that it does not wear out and unnecessary capital infusion is not required again. The regulatory pressures also require environmental and safety compliance; you have to do it—it's compulsory. So, you need to do it judiciously and with proper planning, as these are the things that we must do regularly. So, it will increase costs definitely, but it is compulsory. You need to understand the inability of these things and plan accordingly, and the expenditure can be planned in such a way that there would be no unnecessary pressure.

There will be regulations on this—without environmental and safety compliance, you cannot run any mining business. And the labor market challenge: recruitment and retaining skilled labor in remote locations is tough, and for that, you may require training facilities and proper recruitment strategies to retain experienced people; otherwise, you

will have unskilled labor even if you pay more. So, these are challenges that we need to be aware of. As I said earlier, the market volatility will cause prices to fluctuate, and that will affect our cost management. We need to have a business with a better, higher profit margin so that the price fluctuations can be managed temporarily.

In the current trend in OPEX management, we have digital transformation and digital mining, which we are discussing as more efficient. So, the operating expenditure is supposed to come down. As I said, you can switch over to renewable energy integration—solar, wind, hybrid power systems—that will cut the cost. We must have sustainable mining practices, which, in other words, means waste reduction, water recycling, and reduced emissions. This will give you sustainability in the mining process and collaborative workforce models—flexible, technology-enabled workforce for better cost efficiency.

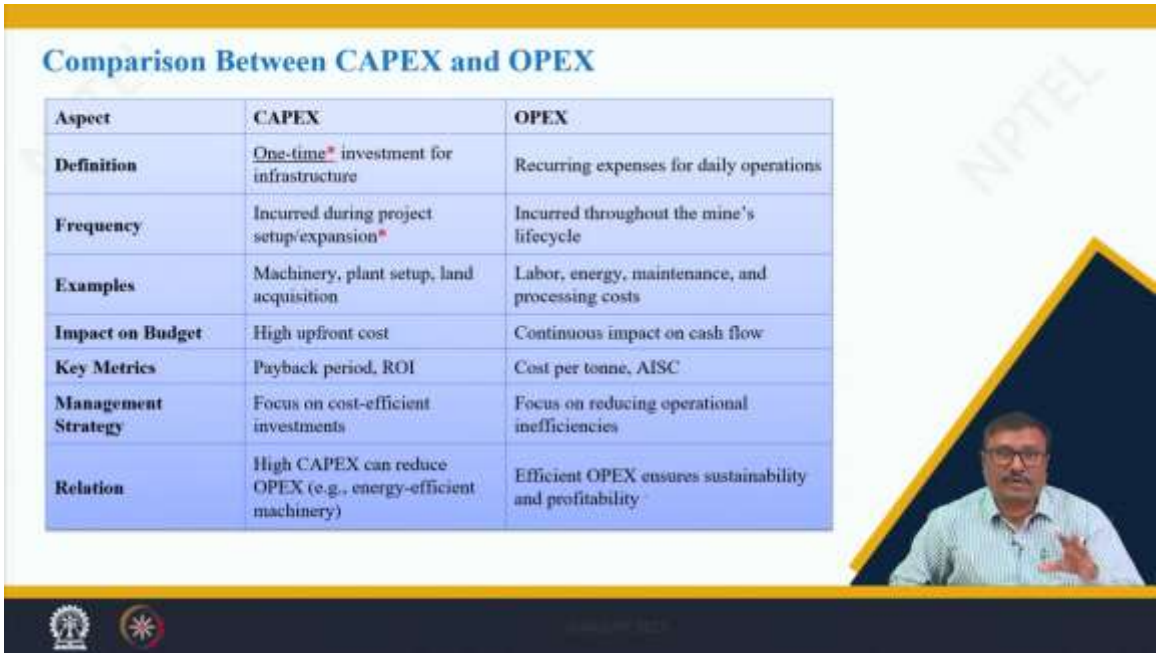


This will give us more managerial capability in cost-cutting. For example, we have another schedule for the same ore-handling plant, where we have kept provisions for salary and wages at 732 per year. So, we have expressed it in per year and per ton here. So, this is 5 rupees—say, 5 to 6 rupees per ton here. This is the manpower that we have calculated, and the salaries and wages that we pay, which we have divided to get this figure.

So, under the head maintenance, we have preventive maintenance at 36.43 per ton—you see, electrical is 2.56. Now, breakdown maintenance also affects the cost. So, that comes to around another 4. So, it is predicted that this will be there. So, for breakdown maintenance, we have to keep a provision of, say, 4 rupees per ton.

Power cost, see how how much power is power intensive the whole handling plant is power intensive, all machines are using motors and all these things. So, the ah the the power cost is heavy 40 rupees per ton here. Water cost, then civil structures the structural part major over handling if required we have kept a provision for that. Testing and inspection we have kept a small provision for this. Administrative overhead is again 10 rupees per ton here.

So, overall say total operating cost per ton of iron ore in this over your ore handling plant is 122 for the processing part only. So, you can add the mining cost, operating cost, operating cost for the ore handling, operating cost for the logistics, the transportation. Then if you add up the whole thing, then you can find out the total of X per ton of ore per unit of production you may say. So, from this chart what we can understand is that the operational expenditure has to be broken down logically rationally. So, that the major heads are covered nothing is left out.



So, this is only an example how we make we prepare the schedule of the OPEX for example, for an over handling plant here. So, what are the comparison basic comparison

between the CAPEX and OPEX? Definition we say one time it is not one time, but for the timing you take it. In the beginning we have one type investment for the infrastructures for the purpose of which is called the capital expenditure. The frequency incurred during the project setup or expansion I have said it earlier.

For OPEX it is recurring expenses for daily operations and it is incurred throughout the mines life cycle. This is not intermittent that during setup or during expansion. It is incurred throughout the mines life cycle. Examples here we have machinery, plant setup, land acquisition for the capital expenditure and here in labour, energy, maintenance and processing cost. We are now summarizing things.

So, this these are the differences between this capital expenditure and the operating expenditures. Impact on budget high upfront cost because you will be requiring use cost in the beginning. So, suddenly it will increase, but operating expenditure will give you a continuous impact as long as you are operating the mine because the operating the mine means that will be incurring operating expenditure will be there. So, key matrix how to measure it the payback period after how many years you are getting the capital investment back the capital expenditure back or return on investment. Whereas, I have said that cost per ton is a good indicator for the operating expenditure and all inclusive also it is an indicator, but I would rather prefer the cost per ton is is one of the best rather the best to understand the operating expenditure and the fluctuations in that can be easily understood in terms of per unit operating expenditures.

The focus on cost efficient investment is there because it is cost intensive, lot of money is involved in the capital expenditure. So, we try to have a cost efficient in the system, where you purchase or install those machines and those facilities will give you more return. But, here the operational inefficiency is in the focus. You have to make the operation efficient, operation should be efficient. So, that your operating expenditure per ton will be reducing.

With the same expenditure the output will be more. That is why the focus is on the reducing of the operational inefficiency. You have to find out where which part of the operation is inefficient. So, there you have to take control and take the corrective measure. So, that the inefficiencies goes down and your output goes high.

So, the relation is the high CAPEX can reduce OPEX energy efficient machinery which are also having low operating expenditure. Efficient OPEX ensures sustainability and profitability of the mine. Sometimes as I said that it is not one time for the for the

CAPEX, it is during the expansion a good example is also when you are switching over from opencast to underground. So, when a mining company is switching over from the opencast to underground, you have to infuse capital at a stage in such a way that when the opencast mining is over, then you can switch over to the underground smoothly without a break. Otherwise, there will be a break in production and company will be simply sitting idle without any return on investment.

So, there will be a lot of investment required when you are switching over from the open cash to the underground and you need to infuse that capital in time in proper time so that when the opencast is over it is a smooth transition from the opencast to the underground. This is an example when where the CAPEX is ah ah very very important at what point CAPEX is to be in fuel and in at at and then how much is ah ah required. So, all those detail feasibility study has to be done and the right capital and the detail feasibility study of the expansion program has to be made. With this we come to the end of the discussion on the capital expenditure and the operational expenditure.

Things can be studied from the mining capital methods, from where a large amount of material has been. taken. Hope you have understood the basics of capital expenditure and operating expenditures, and what is the importance of these two in the overall management of the mining business. Thank you very much. I hope you enjoyed the class.

Thank you once again.