**Infrastructure Finance**

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**Lecture - 13**
**Analysis of Project Viability Capital Budgeting Guidelines**

Welcome back to this course on Infrastructure Finance. This is lecture 13 on basically what we have been doing is the previous lectures is what we are going to continue this lecture as well. Essentially what we are trying to do is, we are trying to look at how do you analyze the project viability.

And we looked at various aspects, when we started discussing project viability. and we looked at calculating the time value of money, we looked out the discount rate. And previous lecture, we talked about how do you identify the different cash flows, which we will use to determine the project viability. Now, you should be wondering, why we are talking, so much about project viability and before we even start implementing the project, what is the reason that we have to talk really so much about project viability.

So, the reason that we are spending lot of time about project viability is essentially, because of the reason that infrastructure project are fairly long term projects. And the assets that we actually use, in infrastructure project are fairly specific, in the sense that they have very little alternative uses. And therefore, it is very important for us to actually realize that, before we actually make the actual investment we have to be very sure about the projects profitability, that is whether the investment is going to actually give some return to the investors.

Because, once we actually make the investment, it is going to be very difficult for us to recover the investment, because of the fact that, this investments have fairly long life and because of the fact that, they actually have very, very little alternative uses. So, that is the reason, why we actually spend lot of time to analyze the project viability, even before a investment actually happens.

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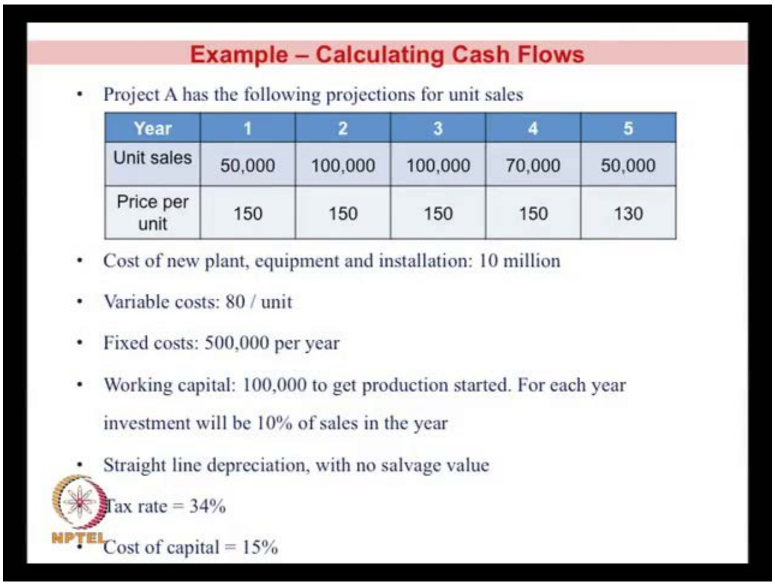


So, we will continue where we left in the previous lecture, we were looking at an example of a project and we have identified the various cash flows. To kind of summarize, what we have been looking at is we have been looking at a project, which actually has a duration of 5 year life. And then for the age of the 5 year, it actually sales a different units and the price per unit, for which it is able to sell the products is also given for each of the years.

So, if you actually notice, this is a project that is not anything specific to infrastructure, but we are looking at a fairly simple capital budgeting project, that is probably seen in many industrial situations. So, if you actually look at it, you actually for finding scenario in terms of unit sales, where it starts at the level of 50000 and then, it increases to 100000 and then in year 4 and 5, it gradually reduces.

In fact this is a trend that, you will normally see in any estimations, any financial planning of project and so on. So, the reason is when you actually begin production, you might not be able to produce to the fullest extent right from your 1, because of various reasons. See for the example, the product is very new then, the acceptance of the product in the marketplace is going to sometime. So, you start at a production level, which is a not at the maximum, but it gradually builds up over a period of time.

So, in this case, we actually have unit sales at 50000 and it actually increases to 100000 and then, goes on to actually become 50000 in year 5. Now, why is a reduction towards at the end of the project life, the reduction towards the end of the project life is essentially, because of the fact that, the product, if it is actually becoming little bit older. The demand in the market can actually tapers down, and when the demand tapers down obviously the sales also will reduce.

So, essentially if the product matures, and there is a possibility that, the demand might actually come down and therefore, we will actually have a lower sales. In terms of the price per unit, what you actually see is we are seeing price per unit 150 for the first 4 years and then, the price per unit reduces in the 5th year, why is the reduction in the price per unit in the 5th year. The reduction is because it is possible that the demand for the product has come down and therefore, to incentivize customers to buy the product, we actually will have to sell it at a lower price.

So, that is the reason, why you normally find the price per unit also reducing towards the end of the project line, so these are some very common trends, that you will actually see in any financial planning or any financial investment particularly in capital budgeting. And this is something that, you will have to whenever you are looking at making a financial projections, you will have the kind of remember, this basic rules. In the sense at right from your 1 or right from the year, first year of operation, we cannot expect to achieve the maximum production.

And the price per unit is generally expected to show a decreasing trend with time, so we may not be able to see, we may not be able to sell, the product at the same price that, what we have been selling right from year 1. And we also discussed the fact that, the cost of a new plant was 10 million and then, now the cost can be divided into two categories, there is a variable cost and there is a fixed cost. The fixed cost does not change irrespective of level the of production.

So, we assumed it for the sake of simplicity to be constant at a 500000 per year, so the fixed cost irrespective of whether, we sell 100000 or whether we sell 50000, it is going to remain the same. So, that is why it is called as a fixed cost and then, the second category of the cost is called as a variable cost, in a variable cost the total variable cost will change, in terms of the amount of units that is actually produced.

So, if you actually produce more number of units, then the total variable cost is going to increase, if we actually going to produce a lower number of units, then the total variable cost will be lower. So, variable cost are essentially, it could be in terms of the raw material needed to produce the product, the labor that is needed to produce the product and so on.

And it is directly correlated to the amount of output that we produce, and we also discuss the fact that this project needs investment in working capital; and initially to start up the project that is needed for the 100000 in terms of working capital. And for every subsequent year the working capital investments, that is needed would be 10 percent of the sales of the particular year. So, we also have to account for the working capital requirements.

And the assets are going be depreciated on a straight-line basis, a straight-line basis indicates at the depreciation will be uniformed, throughout the entire project life. And we might also remember the fact that we discussed, there are different types of depreciation, there is something called as written down value and then, there is something called as the straight lines; these are the two most common forms of depreciation that is used.

In a straight-line depreciation the contemn of depreciation is uniformed throughout, the project life and in this case given the fact that, there is no salvage value, the market value of the fixed assets is 0. So, the entire amount is depreciated during the project life, so the entire 10 million is depreciated over the 5 year period and therefore, the depreciation each year is going to be 2 million.

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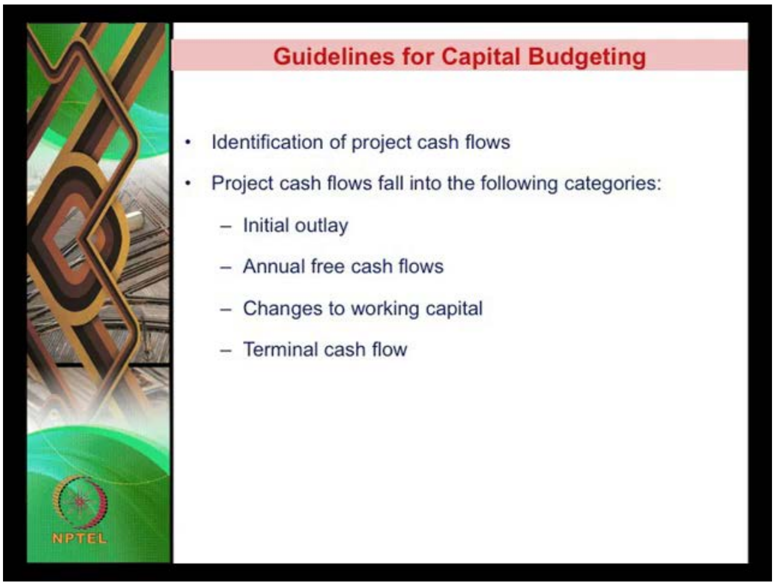

And a tax rate that we will assumed for our calculation is 34 percent and then the cost of the capital is 50 percent. So, we also discussed fact that, we have to identify the four types of project cash flows, we have to identify the initial outlay, we have to identify the annual free cash flows that come from operation. And then, we will have to consider the changes to the working capital and then finally, we will have to find out the terminal cash flow. And we actually in the previous lecture determined each of the cash flows, to kind of summarize, let us go back to what, we discussed in the previous class.

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The initial outlay was initial equipment cost, which is about minus 10000 K and then the operating cash flows, which will be actually coming from the profit and loss of statement for the each of the year, we have estimated for the 5 years, this is what I have put here. And then, we have the changes in net working capital, so the changes in networking capital is basically the investment needed for working capital in the initial years. And then, the later part of the years, we actually have reduction in working capital, so therefore, it is treated as cash inflow.

And then finally, the terminal value the terminal value for this project is 0, because we assumed that, than as a 0 salvage value, so we have identified separately the cash flow associated with the four different types. Now, we will have to find out the free cash flow from, the project is nothing but some of the cash flows or some of the all the four individual cash flows, so this is your total free cash flows from the project. Now let us calculate the total free cash flows from the project, for each of the years. So, simply we have to sum them up to get the total free cash flows.

So, for year 0, it will be 10100 K and for year 1, it will be 2010 K and for year 2, it will be 4220, for year 3, it will be 4970 then, year 4 will be 4034 and year 5 will be 3050. So, now, we have the free cash flows project, for each of the years and we then use this free cash flows and use a suitable capital budgeting technique that we have discussed earlier to find out, whether the project is viable or not.

So, if recollect, we looked at a different types of capital budgeting techniques, such as playback periods, we talked about the net present value, we talked about the profitability index, we talked about the internal data fitter. So, we can actually use any of this capital budgeting techniques, to determined whether the project is viable or not, now let us start with our net present value. For determining the net present value, we need two things, we need the free cash flows, which we have got with us now and second we need the discount rate, at which we are going to discount the cash flow.

And let us assume discount rate of 15 percent, if we assume a discount rate of 15 percent and we use that, discount rate to find out, the net present value from this free cash flows, now the net present value works out to be 1933. In fact, I have omitted the 1000's all the values are in 1000's, if you recollect, because the project is actually, the project figures are in millions and we have not captured in millions, you all captured in 1000's net present value of 1000s is 1933000, so it is about 1.9 million.

So, you may actually then find out the net present value is positive, so therefore, the project is viable, so the decision on this could be go a ahead and implement the project. Now, we can also identify the project viability using IRR, now let us look at calculating IRR in a simple excel spreadsheet.

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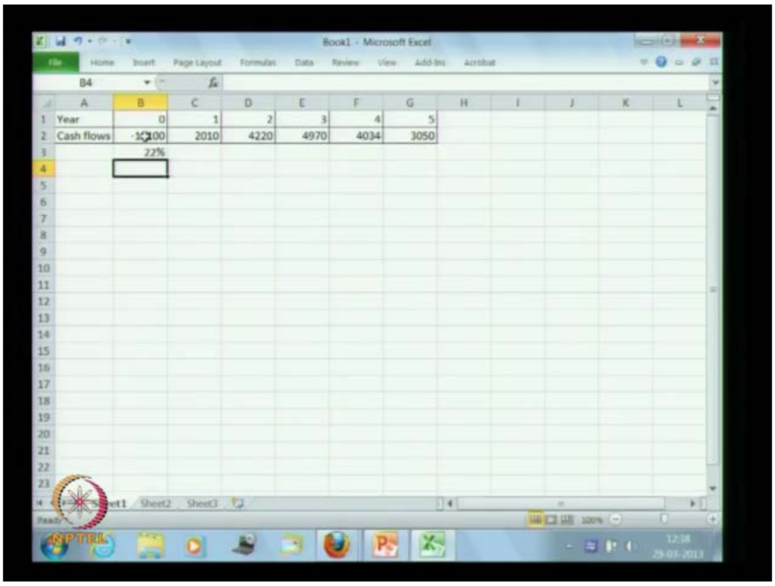


So, now what we have done is I actually have the project cash flows, listed for the 5 different years, so I have calculated the summation of all the cash flows. So, the cash flows that, you see in the spreadsheet here is nothing but the cash flows from each of the from four different steams and then summed up. And we have the cash flows for each of the 5 years, now we can use the cash flow to calculate the internal rate of returns.

And internal rate of returns, if we have to do manually, for 5 years it actually becomes a polynomial of the 5th degree, it is going to be very difficult to calculate. But, we have several functions in the software applications such as excel, which helps us to calculate the IRR very easily. So, I am going to now calculate the IRR, for this cash flow steam, I am going to use the IRR function that, exist in the excel spreadsheet. So, I use the IRR function and then, I actually use the cash flow values for the 6 year, that is from the year 0 to 5.

And if I use this 6 years values and then, if I go and press enter, I actually get and IRR value of 22 percent, so IRR is greater than the discount rate that we have used of 15 percent. If you assume that 15 percent is the cost of capital or the required rate of return, IRR is greater than cost of capital are required rate of return, so therefore the decision should be to go ahead and accept the project. So, this is a simple capital budgeting example that we did, where we actually used a project forecast and then, evaluated the viability of the project, using the capital budgeting technique.

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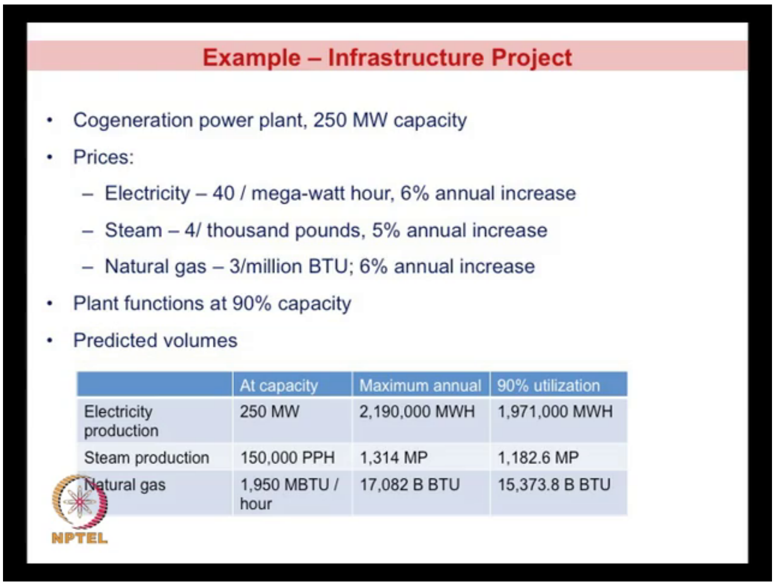


Now, this is a course on infrastructure finance and therefore, what we will do is, we will take up another example, this time we will actually take up an example of infrastructure project. And then see, how do we actually use, how do we actually, I do a capital budgeting decision in that case, so the example that, I am going to discuss with you is the example of a cogeneration power plant and the power plant as a capacity of 250 Megawatts.

So, in fact, if some of you are not familiar, what is this cogeneration power plant, let us take a couple of minutes to discuss a cogeneration power plant is remember, you talking about power plant. A power plant generates a power using fuel and this power is actually sold to a different consumers, and the project gets revenues from this sale of power. And the power could generated from the power plant can be sold to the industries, or it can be sold to various distribution agencies, which then distributes this power to several other smaller consumers.

So, for example, today the many of the power generators, they sell the power that, they generate to what is called as your state electricity boards or various state governments owned, power distribution companies. And this distribution companies in turn sell the power to various residential and individual customers; so individual customers do not directly purchase the power, from the power generators, they actually purchase the power from the distribution agencies.

So, the cogeneration power plants, so before we actually talk about the cogeneration power plant, we should also understand the fact that, there are various ways, in which we can generate power, broadly we can classify the technology power into four categories. The first is your idle power, where we actually use energy from water source to generate power; and then, second is your thermal power, in which we actually use a fuel to generate steam and then, the energy of the steam is used to drive the turbines to generate power.

And then your third category is your nuclear power plants, in which the energy from nuclear fission is actually used to generate steam and then and this steam is again used to generate power. So, if you really look at, it in some sense both the thermal power plant and the nuclear power plant more or less each actually use energy to generate steam, which in turn used to generate power. And then, the fourth is actually called as your renewable energy sources or non conventional energy sources and you have several ways, in which you can produce power from non conventional energy sources.

It could be like wind energy, we actually use energy from wind, to kind of a you know generate a power from a wind turbine and then, increasingly these days, you actually generating power from photo word excel, so that is a solar energy. So, there are a different ways, in which you can generate power, but this example that, we are talking about is an example of generating power from a cogeneration power plant.

So, what is this cogeneration power plant, so cogeneration power plants falls, in which of those 4 categories that, we talked about, cogeneration power plant is actually a thermal power plant. But, this is this is a plant that actually generates both steam and electricity, so that is why, it is called as cogeneration, it generate both steam and electricity and the output from such a power plant are to it basically steam as well as electricity. Now, we have the following, the estimations for the prices, at which they will be able to sell electricity and steam.

See normally in a infrastructure project particularly in a power sector, we actually have a power purchase agreement and power purchase agreement determines, at what price the power generator is going to be purchased by the consumer, or the distribution company and so on and so forth. So, in this case given the fact, that is cogeneration power plant, there are 2 different outputs, both are steam and electricity and it is assumed that, there is a steam purchase agreement and a power purchase agreement and the rates that are indicated in the power purchase agreement is as follows.

The rates for electricity is a 40 from megawatt hour and power purchase agreement provides for a 6 percent and while escalation in a electricity prices. And that means, in year 0, the price of the power in going to be 40 Megawatt per hour keep on it is not in the year 0. In the first year, it is going to be 40 Megawatt per hour and then, for every subsequent year, there will be an annual increase of 6 percent.

Similarly the price of a steam as specified in the steam purchase agreement is 4 per 1000 pounds and it specifies for 5 percent annual increase. So, remember when you actually sign an agreement, for purchasing electricity or steam, it actually gives a lot of a credibility and comfort. In terms of revenues, a power purchase agreement clearly specifies the price, at which the power or steam is going to be purchased and therefore, it gives a lot of certainty for the revenue for the project.

So, if there is no power purchase agreement, then there are lots of uncertainty, in terms of revenues whether the project will be able to find a buyer and even though, there is a buyer and at what price the buyer will be able to purchase the power that is being generated. And for a power plant is also important, that we have assured supply of fuel, because understand till the fuel is available it is not going to be possible to generate power.

And like a power purchase agreement in many causes power plant actually have a fuel supply agreement, a fuel supply agreement is an agreement with a fuel supplier, which ensures an interrupted supply of fuel, for the functioning of the power plant. So, in this case, there are fuel for the power plant is natural gas, so remember thermal plants can actually generate powers from a variety of sources, it could actually be from coal, it can actually be from oil, it can actually be from a natural gas and so on.

So, the example that, we are talking about is a natural gas power plant and the cost of the fuel of a natural gas as specified in the fuel supply agreement is 3 per million British thermal unit. So, this is the metric that is actually used, to a to price fuel and in terms of British thermal unit and again in a fuel supply agreement, it provides for an annual escalations of 6 percent on the fuel price.

Now, we should actually be aware that, in many cases given the fact that, this project are actually going to have a very long economic life, power plant can actually have a life of a 20 years, 25 year, 30 years and so on. So, therefore, it is standard practice, to assume a constant a annual increase, in reality and the constant annual increase, you know might not be constant, but actually can vary you know at the margins, when we are actually making financial estimate is usual practice to assume constant increase in prices or cost.

And it is also specified that a the plan functions that, ninety percent capacity, now a plan as a capacity of 250 Megawatts, but very rarely we would actually have a situation, where the plan functions at 100 percent capacity. In fact, a most of the plans will actually function, only at about 80 to 90 percent capacity, because of the fact that the plant might need to shut down for maintenance the plant might actually, have any emergency, in which the capacity, at which the function will have be pull down so on and so forth.

And so you are really looking that, functioning 90 percent capacity then, what is a kind of maximum electricity production and the steam production, that can actually be made and into the production, what is a kind of natural gas requirement, what is a kind of fuel requirement that, we actually need. So, the table actually gives the electricity production, steam production and the natural gas values for the each of the years, so let us see, how this numbers are calculated.

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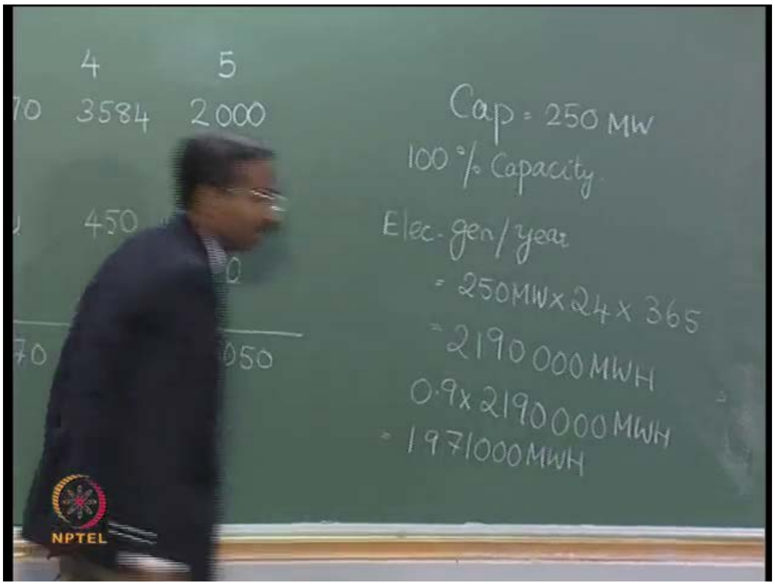

So, the capacity of the plant is 250 megawatt, now if you are talking about a plant generating at 100 percent capacity, so you remember electricity generation is always a electricity is always measured, in terms of Megawatt hours. So, at 100 percent capacity electricity generated per year, would be 2050 megawatt, there are 24 hours in a day and then, there are 300 and 65 days in a year. And if we actually calculated, this will give you 2190000 Megawatts.

So, if the plant functions at 100 percent capacity than, the amount of electricity that will be generated, in 1 year will be 2190000 Megawatts hour, but we are assuming that the plant will function only at about ninety percent capacity. So, at 90 percent capacity, it is going to be 0.9 multiplied by 2190000 Megawatts and this is nothing but 1971000 Megawatts, so this is the electricity production that the plant will produce every year. So similarly, we actually do the same calculation for the steam production, steam production had capacity at 100 percent capacity is 150000 pounds per hour, PPH is pounds per hour and if it actually functions at 100 percent capacity, than the total quantity of steam.

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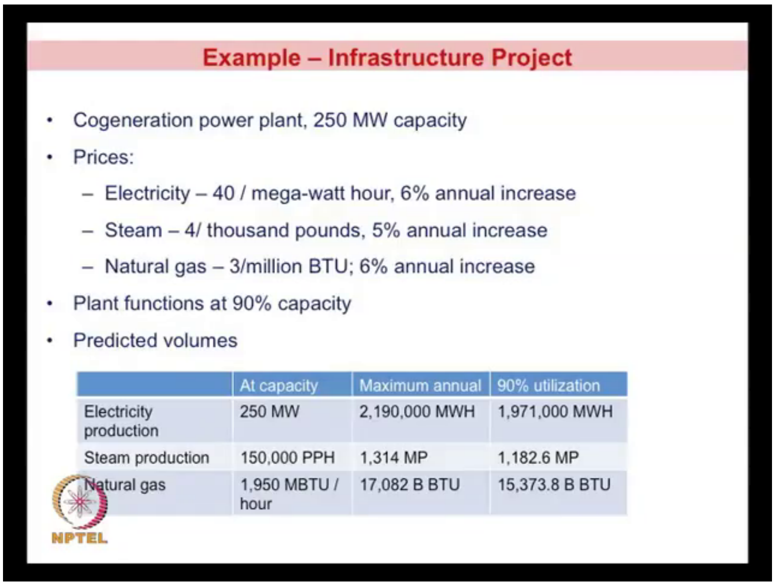


That get produced in a year is 1.314 million pounds, but we are not functioning at 100 percent, we are functioning at only ninety percent, so therefore, steam production in a year is going to be 1182 point 6 million pounds. Now, we actually need to find out the electricity production and the in the steam productions, because this is important for us to actually generate to find out to estimate the revenues that are going to be generated, for each and every year.

A revenue is nothing but the quantity of electricity that is generated multiplied by the price of electricity plus the amount of steam that is produced multiplied by the price of steam. So, we will have to first determine, the steam production and the electricity production multiplied by the prizes to get the revenues, so that is the reason, why we are actually going through this calculations. And then we also have the fuel, and the cost of the fuel is determined by the amount of fuel that is needed multiplied by the price of fuel, so in this case natural gas requirement is 1.9190 million British thermal units per hour.

So, that is the fuel, that is needed if the plant is going to functioning at 100 percent capacity and the total fuel requirement, per year is going to be 17082 million British thermal units. Again we are not looking at 100 percent capacity, we are going to function only at 90 percent, so therefore, at 90 percent replication, the natural gas requirement is going to be 15373.8 British thermal unit. So, this actually gives you a broad metric, in terms of how much of electricity is going to be produced and how much of steam is going to be produced and how much of natural gas is needed for providing that electricity and steam.

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Next we go and look at some other parameter related to a project, we also have to account for, the operating and other cash expenses, earlier we talked about natural gas is just a fuel expense. But, in addition to that there might be several other expenses for example, salaries have to be paid, there would be expenses related to administration, there could be expenses related to office and so on.

So, there are several other expenses and we assume that in the first year, this expenses are amount to about 8 million per year and we also estimate that, this expenses will increase, 5 percent on a yearly basis. Now, this is this is again estimated, see for example, we know the actual increase may be more than 5 percent, are less than 5 percent. But, at the time, we are actually making the projection determine the viability, we will have to choose some level of annual estimations.

So, we will have to choose something, that is reasonable and the most common metric, that is actually used to determine the annual increases is the average inflation levels. So, if the average inflation has been about 5 percent in the last couple of years, people use that as a way to estimate the future escalations. The tax rate is assumed to be 40 percent on the project and let us assume for a sake of simplicity, working capital investments needed are negligible.

So, in the previous project, we assume that, there are working capital investments that are needed and it has to be faceted in. and in fact, working capital requirements are commonly needed for almost all the projects. But, for this project for the sake of simplicity, we will assume that, there are negligible investment, that are needed for the working capital requirement and the total investment that is needed.

So, this is important to the total outlay investments, that is needed in is 13508 million 113.508 million and then, we are actually getting initial capital from 2 sources 25 percent of it from equity and remaining 75 percent by the way of debt. This is very common feature that, you will actually find in infrastructure project were a large port of the large part of the project cost actually, met by way of debt. And to a certain extent this also benefits a project, because than having a substantial amount of debt reduces the project cost. So, in this case, we assume that the entire project is founded with about, 25 percent of equity.

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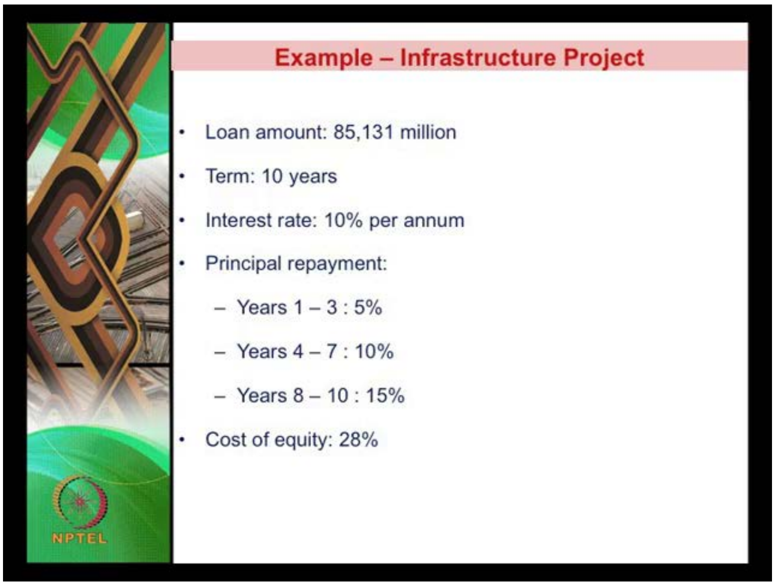


And 75 percent debt, so when we assume a 75 percent debt that, loan amount will work out to 85000 and a 85.131 million, this is the total amount that is needed. And there are some conditionality features of the loan, the loan as the term of 10 years and then, the interest rate is a 10 percent per annum. And then, the principal repayment varies with the project life in years 1 2 3, the principal repayment is a 5 percent in years 4 to 7, the principal repayment is 10 percent.

So, what we mean is 10 percent on of the total loan is paid in a year 456 and 7 and years 123 5 percent of loan amount is paid in each year, 1, 2 and 3, in years 8, 9 and 10, we pay 15 percent on of the principal of the 15 percent of total principal is paid in a year 8 15 percent, in year 9 and 15 percent in year 10. So, if you look at it the entire principal, the 100 percent of loan is repaid by the end of the 10th year, but the repayment is not equal the repayment changes every year.

So, this is again a very common a way of structuring a repayment in many infrastructure projects, the initially years project might not have adequate cash flows. So, therefore, the payment is structured, in such a way that, the repayment increases with time and the later part of the years, the repayment is higher rate, as compared to the initial years. So, sometime this is also referred to as the balloon repayment, so like the balloon, which actually kind of a increases with actually keep, when you actually blow, a more air as time progresses, the repayment also increases.

So, we have actually now all the essential elements that, we need to find out, the cash flows and determined the project viability, the one missing information is your cost of equity, the cost of equity, we assume to be 28 percent. Let us say, we have looked, we have discuss the ways, in which, we determine cost of equity, if we use a C A P A model, we use the risk free rate of return, we use the beta and then, the market premium determine the cost of equity.

But, for this project, let us assume that, we have used values for risk free rate of returns better the market premium and using this values, we have determined the cost of equity to be 28 percent. So, with this values, we are now in the position to determine, what is the cash flow for this particular project and thereby, also determined the project viability. So, what I will do is, I will live it to you to use the discussion that, we had in the previous class, to determine the various project cash flows and also determined the project viability, we will actually continue discussion from here, in the next lecture

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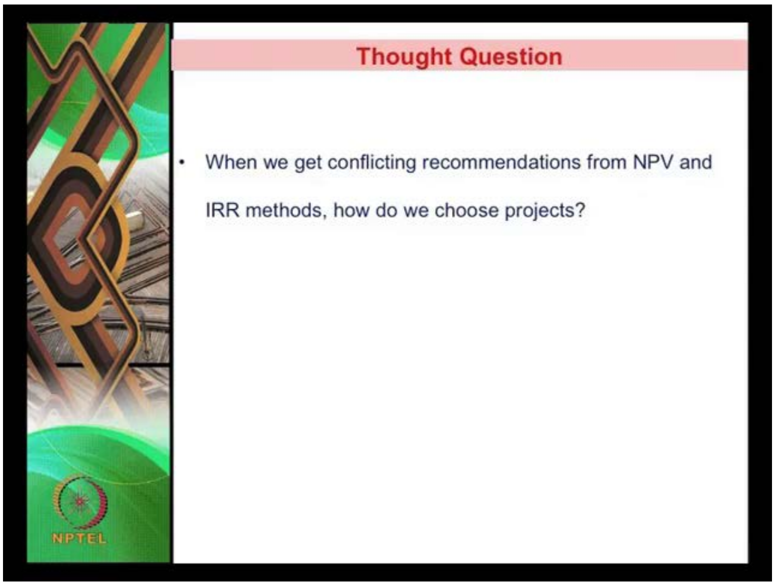


This is, so far, we are been really looking at different ways of evaluating capital budgeting project and then, we talked about, NPV method and then, we talked about and IRR method and so on. So, the question for you is when we have actually have conflicting recommendations, from the NPV and the IRR method, how do we actually choose a projects.

So, for example, if the NPV, if the NPV is negative, but IRR is positive or if the IRR is actually higher for a project a as compared to project b, but it is actually a reverse as far as NPV is concerned, NPV of project a is higher and instead of project b. So, if you really have this kind of conflicting recommendation between NPV and IRR methods, which of these methods have to be actually choose. So, think about this question and we will also discuss, it in the next lecture.