Process Design Decisions and Project Economics
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Module - 8
Chemical Project Economics
Lecture - 39
Project Cost Estimation (Part I)

Welcome, in the previous lectures we saw the aspects related to the selection of technology, selection of project site, and some other aspects that are related to project implementation. Today we shall address the issue of Project Cost Estimation.

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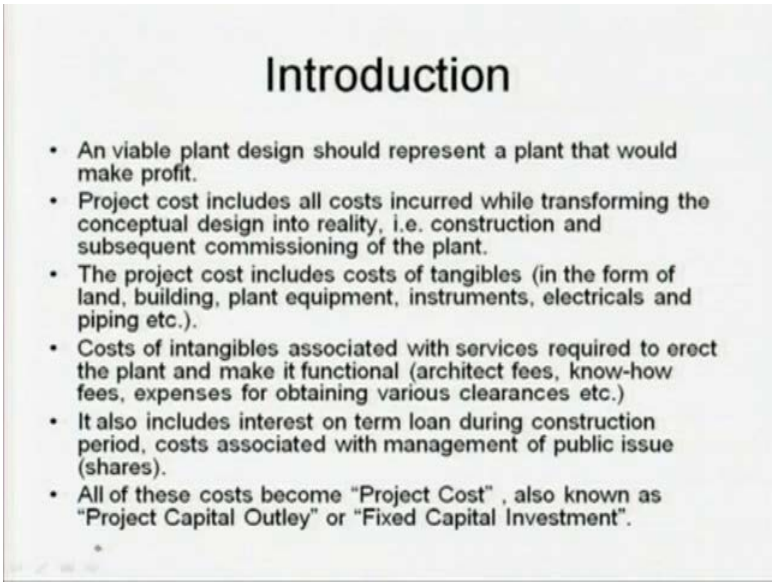

An expectable plan design must be a plant that can produce product that should sell and make a profit for the owner of the plant. The owner initially has to have sufficient capital for the construction of all aspects of the plant, the project cost includes the cost incurred while transforming the conceptual design into reality, the construction is subsequent commissioning of the plant. The project cost includes the cost of tangibles in the form of land, building, plant equipment, instruments, electricals, piping, etcetera. Then it also includes the cost of intangibles associated with services required to erect the plant and make it functional, such as architect fees, know-how fees, expenses for obtaining various clearances and then other various types of costs that are associated with each step.

There after comes the cost of production the net profit, that plant generate is equal to the total income minus all expenses. Therefore, we also need to have detailed idea of the manufacturing cost and then we need to have funds available for direct plant expenses such as those for raw material, labor, utilities and indirect expenses. Such as administrative salaries product sells and distribution cost, that is what is known as the working capital. In addition we also have to consider the interest of the term loan during construction period, if the capital is borrowed from bank then cost associated with management of public issue if the money is borrowed in the form of shares. So, all of these cost become the project cost also known as the project capital outlay or capital investment in short.

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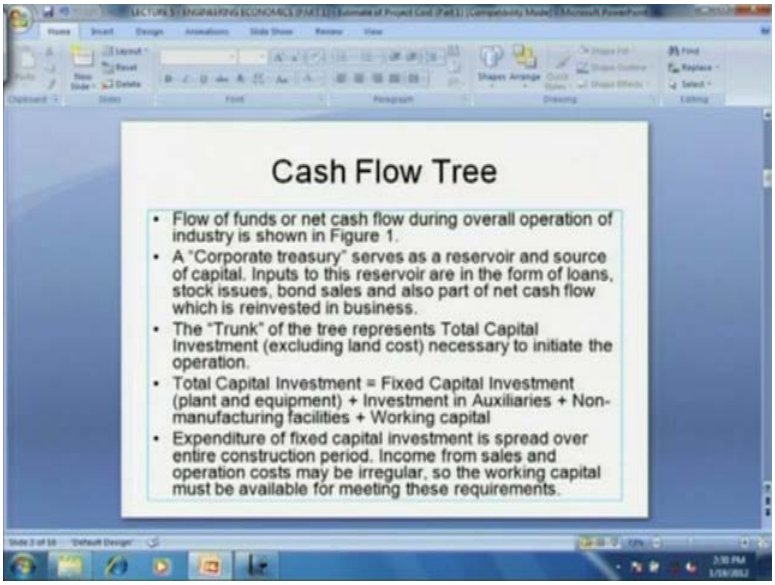

Now, let us try to consider construct a sort of a cash tree for the industrial operation or the diagram showing the cash flow from where the money comes and where the money goes and how does the entire industry function. We shall consider a corporate treasury as a reservoir and source of capital, the input to such reservoir are in the form of loans, stock issues bond sales and also part of net cash flow, which is reinvested in business.

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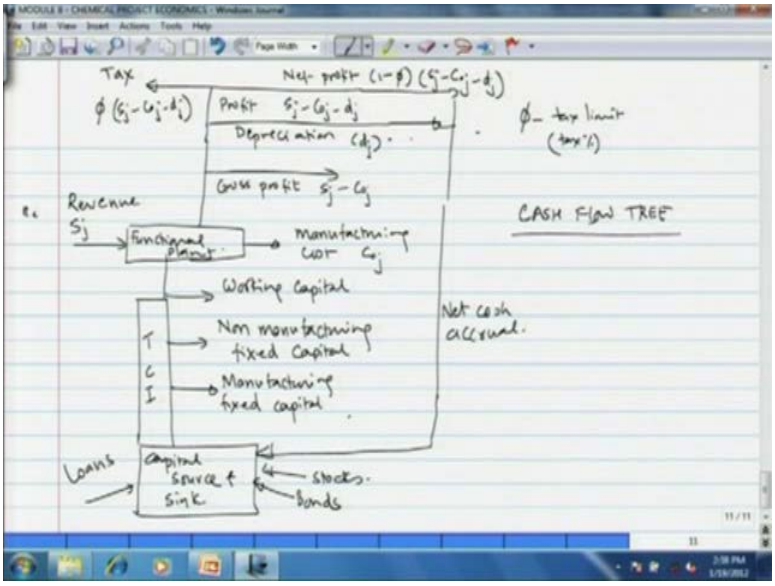

So, let us try to simultaneously draw this tree, so we have a capital source and also sink then the trunk of the trees represents the total capital investment for the business. Now, let us not include the land cost at this moment, so as to have simplicity then total capital investment has three components, first the fixed capital investment, the plant and equipment, then investment in auxiliaries, then non manufacturing facilities and working capital.

So, let us draw the trunk, the root, the corporate reservoir, inputs to this or in the form of loan, bonds, prefer stocks, so on, so forth. Then the steam of the tree has three steams, first steam that is the manufacturing fixed capital, we where the three components of total capital investment that I have denoted with acronym T C I. Then second steam is of non manufacturing fixed capital and the third steam is that of working capital. Now, this is required till the plant becomes functional, so let us draw a box hear that indicates the functional plant, functional plant produces revenue from sales that we denoted by letter S j.

And then it incurs the cost of manufacturing or production cost that we denote by C naught j. Now, the manufacturing cost also includes the item the of depreciation for the sub component of depreciation that we are going to deal in greater detail later in this module. But let us say that manufacture cost C naught j is not including the depreciation,

then part of the funds that are obtained, part of the revenue is written for as depreciation fund.

So, the gross profit the next steam of the tree is this revenue minus the operating cost or the manufacturing cost and then part of this gross profit is written as depreciation that depreciation denote by letter d j. So, d j is the depreciation charge and then out of the net profit part goes as in the form of income tax, the net profit is S j minus C naught j minus d j. Let us say fees is the percentage of or tax limit or tax percentage, so out of this profit, the tax goes as fee into s j minus c not j minus d j and the net profit that is written by the company is 1 minus fee into S j minus C naught j minus d j.

Now, this net profit together with the depreciation fund returns back to the capital source. Now, this much is the net cash accrual of the company, the company may consider investigate in further in the business. So, this is essentially the cash flow tree that we have, which indicates the source and sink of the money for operation of any typical industrial plant.

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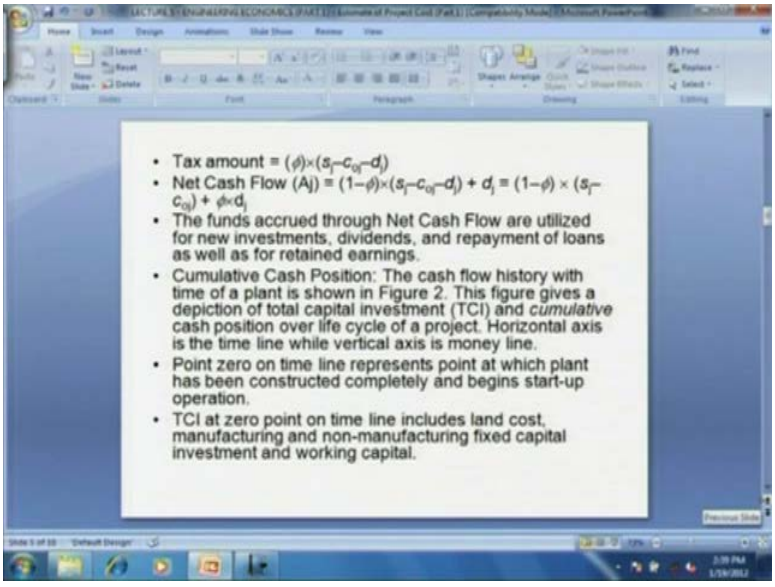

Let us see another similar diagram that is the cumulative cash position the cash flow history with time of a plant is what is known as the cumulative cash position. Now, we shall draw another diagram in which money and time will be the two axis and then we shall see how the does the funds vary over time and magnitude.

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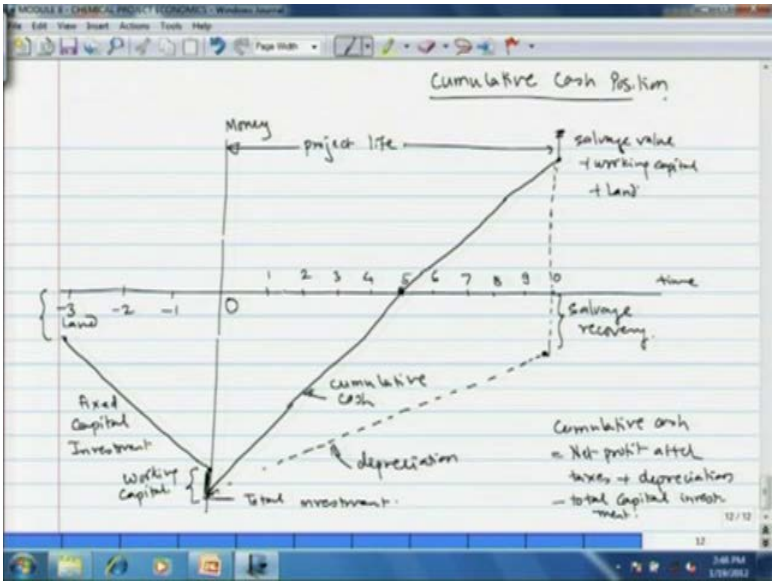

Cumulative cash position diagram for a company, here we have two axis, first axis the y axis is that of money and x axis is that of time. As soon as the we decide to erect a plant we have to the first activity would be to select a project site and there after start building the plant, if the land is not own by company, we have to first buy the land. So, time 0 is let us say is the time when operation is complete or the plant operation starts. So, negative of x axis that is time axis would indicate the construction of plant, let us say it takes 3 years to construct the plant.

So, at the time minus 3, we have to buy the land now this is money, so this much cost is that of the land cost and at time minus 3 years we buy the land and then as construction starts we have to invest the fixed capital. So, that goes on till, let us say this point last six months and then this is the fixed capital investment. There after we have to have working capital to buy the raw material and start the functioning of the plant. So, let us say we invest the working capital right at time 0, so that mix it is here.

So, here the fixed capital investments then this is the working capital at time, so this is the total investment at time, at time 0, the plant functioning starts and plant starts making money. Now, at in the initial period not all of the plant capacity would be utilized, but let us make an assumption that the full plant capacity is utilized right form time 0 and we consider let us say 10 years of operation. Now, thus as you have seen in the previous

cash flow tree there are two types of cash accruals first is the gross profit and second is the depreciation.

Let us assume that the depreciation is uniform in time, so we get a straight line till time 10 years that is depreciation and then there is an uneven profit. And the total cash let us say starts at time 0 and then increases with time this is a cumulative cash, cumulative cash includes the net profit after taxes plus depreciation and then minus total capital investment, because we want to recover the invested money. So, the cumulative cash position grows and then acts certain time that cumulative cash becomes equal to the 0, which means the entire money has been recovered.

And then comes the further profit that is up to year 10 and then at 10 years let us say we sale of plant equipment and try to the get the salvage value for the equipment. Then working capital is already recovered plus, let us say we also sell the land, so this is the project life ten years and finally we are left with this much money. So, if the amount of money that we are left with that at the end of 10 years is higher than that is invested at time 0 that could be sort of a major profitability of the business.

Of course, cumulative cash I have shown in linear form it cannot be linear, because as soon as you make a profit let us say you deposit to bank, then at each year the interest accumulates and the cumulative cash grows non-linearly it grows more or less in the form of exponential. Therefore, that but that aspect we are not taking in to consideration at the moment, because we are seen simpler model for project economics or profitability like this is this much is the that salvage recovery deprecation; that means, you sale of the equipment at year 10 and the total cost of equipment at this point is this much. So, this much we add here at the top and that is it.

So, this is the typical cumulative cash flow diagram, now how do you relate relative profitability of the process the earlier this crosses this line cumulative cash line crosses y equal to 0 line. Then this for example, if you have a process which is like this, then it is more profitable than this the other initial process, more profitable, because here the cash accruals are high; therefore, the money grows very rapidly in time.

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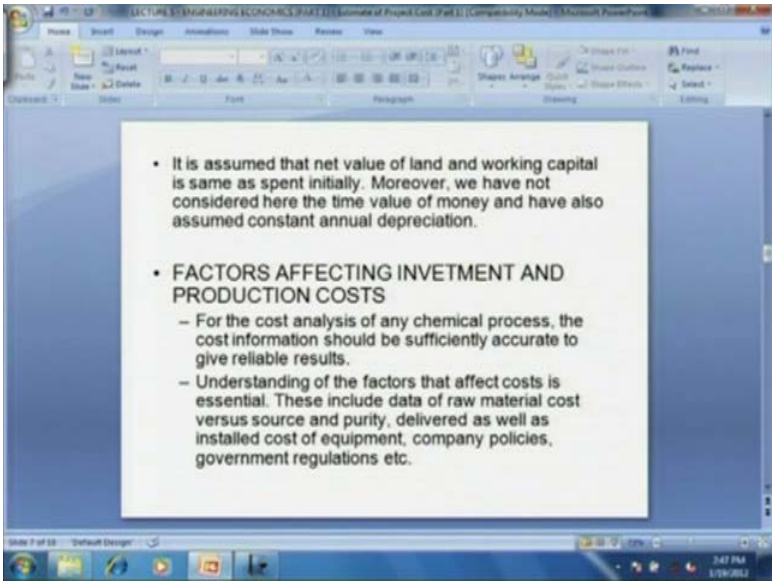

Let us see some factors that affect the investment and the production cost, when a chemical engineer determines the cost for any type of industry process this cost should be of sufficient accuracy to provide reasonable decision or reliable decision. To accomplish this the engineer must have a complete understanding of many factors that affect the cost. Like for example, in some companies have reciprocal arrangement with other companies, where by certain raw materials or type of equipment may be purchased at prices, lower than the prevailing market prices. Therefore, the if chemical engineer basis the economic analysis of the plant on the basis of raw materials in open market is like to get a wrong estimate of profitability. So, such things we need to account for, now what I have done here is that, I have listed some major factors that affect the investment and production cost.

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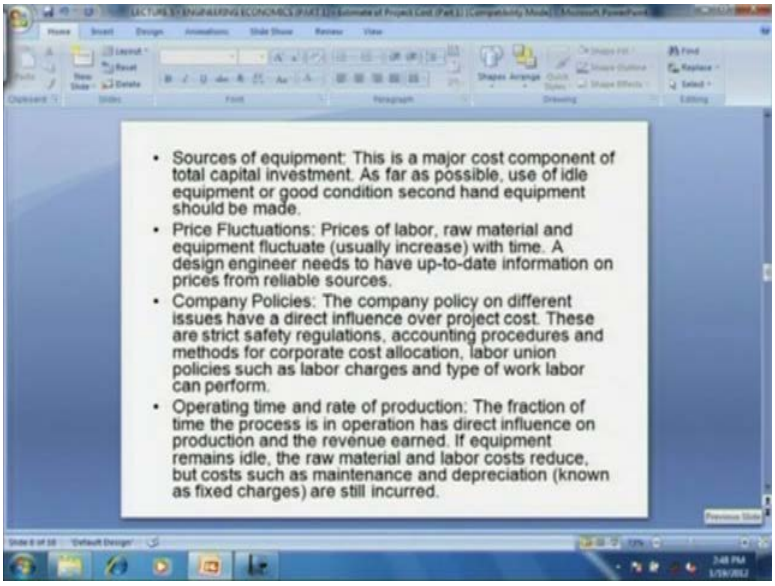

The first is the source of equipment as I just said, one major cost is that of the cost component of that source of equipment. As far as possible use the ideal equipment or the equipment in good condition second hand like bought from other companies for your plant that will reduce the fixed capital investment of your company and will increase the profitability.

Then second thing is the price fluctuation, one needs to have a reasonable prediction of price fluctuation or may reasonable idea of price fluctuation, the price of labor raw material and equipment fluctuates in time usually it increases, but sometimes it may go down also. A design engineer needs to needs to have an up to date information on prices of the equipment and all the aspect like raw material equipment and labor and in this case the purity of raw material also comes into picture, the purer raw material is expensive, but it reduces the cost of pre treatment.

Therefore, one has to have reasonable idea of the price fluctuation, then next is the polices of company, company may have different policy like I just said that company may have agreement with some other company to get equipment or raw material at reduce price. Another policy are the strict safety regulation accounting procedure and methods for cooperate cost allocation labor union policies as such as labor charges and type of work labor that can perform.

So, these polices have a direct influence over the project cost, then next is the operating time of the project and rate of production the fraction of the time the process is in operation has a direct influence on production and the revenue that is generated, if the equipment remains idle the raw material labor cost reduce. However, the fixed cost such as the cost of maintenance, the depreciation they are still incurred these are known as fixed charges they are still incurred.

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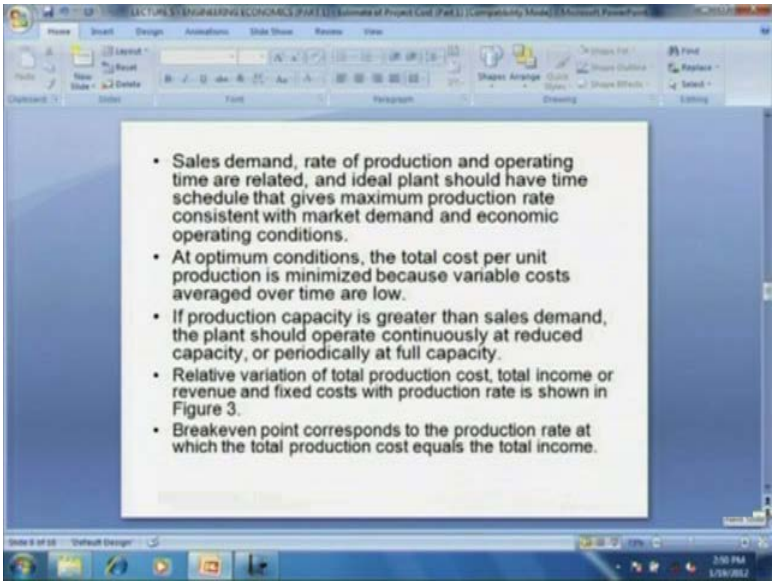

And therefore, one has to have as much utilization of or optimum utilization of the equipment as possible. Then the sales demand, the rate of production and operating time are related, ideal plant should have time schedule that gives maximum production in the rate consistent to market demand and economic operating condition. At optimum condition the total cost per unit production is minimized, because of variable cost averaged over time or low.

Now, sales demand rate of production and operating time are very closely interrelated, the ideal plant should operate under time schedule that gives maximum production rate, consistent in market demand safety maintainability, economic operating condition. Let us see in the form of a diagram the affect of cost and profit based on the rate of production and the exact variation of the varies cost.

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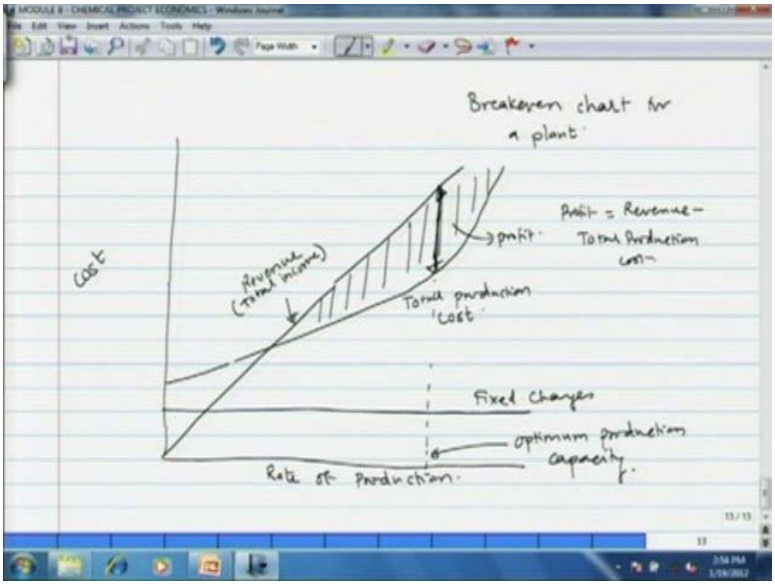

Like we shall see another diagram what is known as the Breakeven chart for a plant, what should be the operating capacity here the y axis I am plotting the revenue or let us say just the cost not revenue cost whether either rupees or dollars; and on the x axis the rate of production. Now, I just said cost such as maintenance depreciation they are these are independent of the rate of production. Therefore, these are fixed charges, so these remain constant irrespective of whether the equipment is functioning or not, the total production cost increases as the rate of production increases.

However it is not linear the total production cost may go up exponentially after certain time and then is the total income. Now, let us number the line horizontal line is fixed charges, the curve line is total production cost and again the inclined straight line is the revenue or total income total income of company after all products will being sold. Now, obviously the profit is equal to the revenue minus the total production cost therefore, the region between the production curve and the revenue line the one which I am hatching now is the profit region.

And you can see that at a particular production rate the profit is maximum, so this is the optimum production capacity at which the gross profit is at it is maximum. And then the Breakeven point this point is Breakeven point, here the revenue just balances the total product cost and this region is that of loss. The region between or the region below the

fixed charges here the net revenue is negative and that is loss, so this is the Breakeven chart for the possessive plant.

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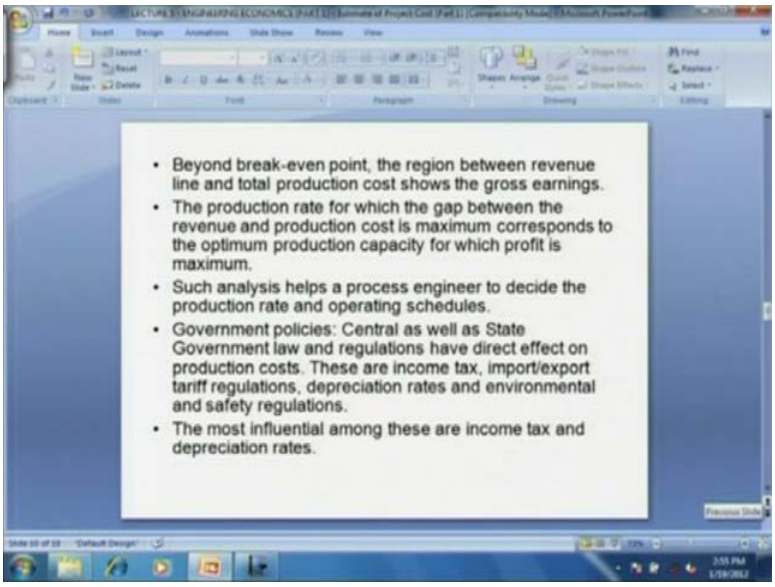

Beyond Breakeven point the region between revenue and total production cost shows gross earning as I just said. Now, there are certain government polices central as well as state government, law and regulations have a direct affect on production cost these are income taxes import and export, tariff regulation, depreciation in the rate and environmental and safety regulation. One needs to have a very thorough and careful understanding of all the government polices was to estimate the profit at a maximum profit obtainable at and at a particular point, the most influential is the income tax and depreciation rate.

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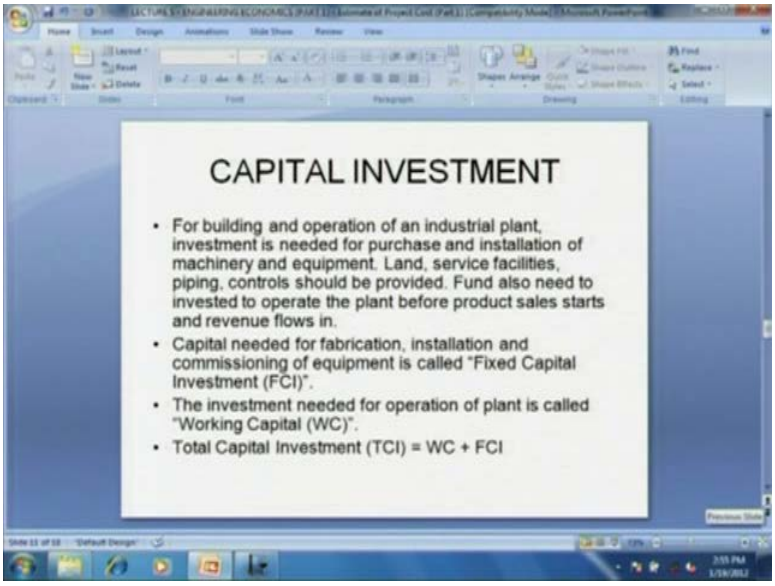

Now, let us see the as the issue of fixed capital investment, for building an operation of an industrial plant, investment is needed for purchase and installation of machinery and equipment. The traditional economic definition of capital is stock of accumulated wealth in an applied sense the capital is having that may be used as the owner decides. One use of the saving with the investment that is to use the saving to promote production of other goods instead of being available.

So, only for purposes of immediate enjoyment or with view of obtaining further income or profit. The capital needed to supply the required manufacturing and plant facilities is called as fixed capital investment, while the capital that is required for the operation of the plant is the working capital. Some of these two things the some of the fixed capital investment and working capital is the total capital investment.

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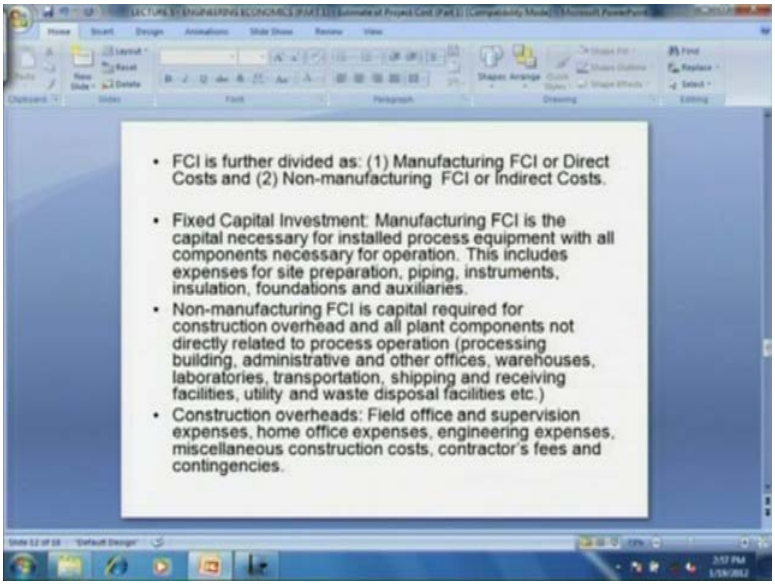

There are sub categories of fixed capital investment it could be divided as the manufacturing fixed capital investment also known as the direct cost or non manufacturing fixed capital investment known as indirect. Now, let us see what in detail what we mean by fixed capital investment or what are the components of it, manufacturing fixed capital investment is the capital necessary for installed process equipment with all components that have necessary for operation.

This includes expenses for site preparation piping, instruments, insulation, foundation, auxiliaries that is fixed capital investment. Now, non manufacturing FCI fixed capital investment is the capital required for construction of construction over heads and all other plant components that have not directly related to process operation like processing building or administrative and other offices, warehouses, laboratories, transportation, shipping and receiving facilities, utilities and waste disposal facilities, so on, so forth. The construction over heads are the field and office supervision expenses, the home office expenses, engineering expenses, miscellaneous, construction cost, contractor fees and contingency.

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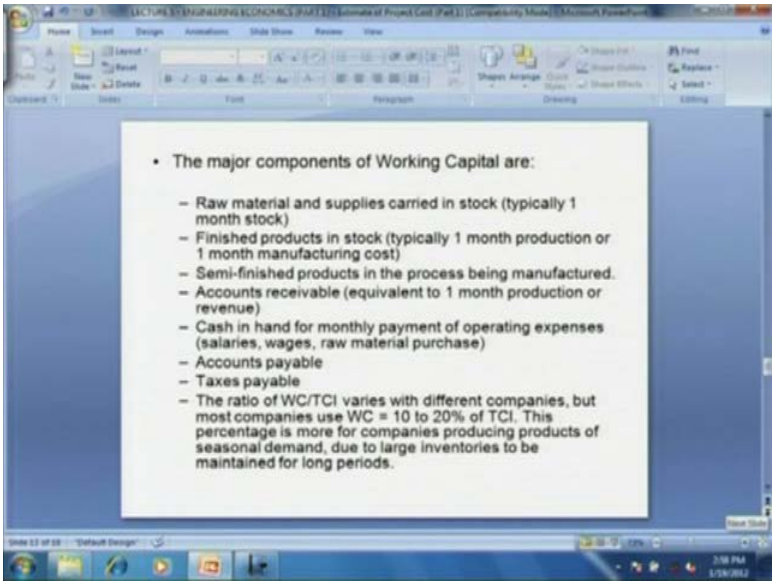

The major components of working capital are first of all the raw material and supplies carried in stock typically one month stock, but if the plant is located far away from the main city or the main source of raw material. Then you have to go for even additional stocks like three months or sometimes even six months of stock, in case you are not assured of regular supply unlimited supply of the raw material. Then the finish production stock what you produce may not sell immediately therefore, you have to keep the products in stock typically this is for more important for products with seasonal demand.

Like for example, fertilizer urea may be produced all over year, but it sales only during the crop seasons seasons, therefore after manufacturing you have to store the finished product for a considerable period. Typically one month of production or one month of manufacturing cost is taken as the finish production stock that is the thumb rule, then say my finish products in process being manufactured, then accounts receivable the people who buy your product may not be able to pay the money immediately.

So, you have to keep the accounts open for them like you have to keep some margin for this receivable accounts then cash in hand for monthly payment of operating expenses. Such as salaries and wages of your personal or raw material purchase then accounts that are payable, then taxes they are payable the ratio of working capital to total capital investment varies with different components. So, typically it is most of the companies

use working capital equal to 10 to 20 percent of total capital investment. This percentage should be more for companies producing products of seasonal demand as I just said due to large inventories that we need to maintain for longer period.

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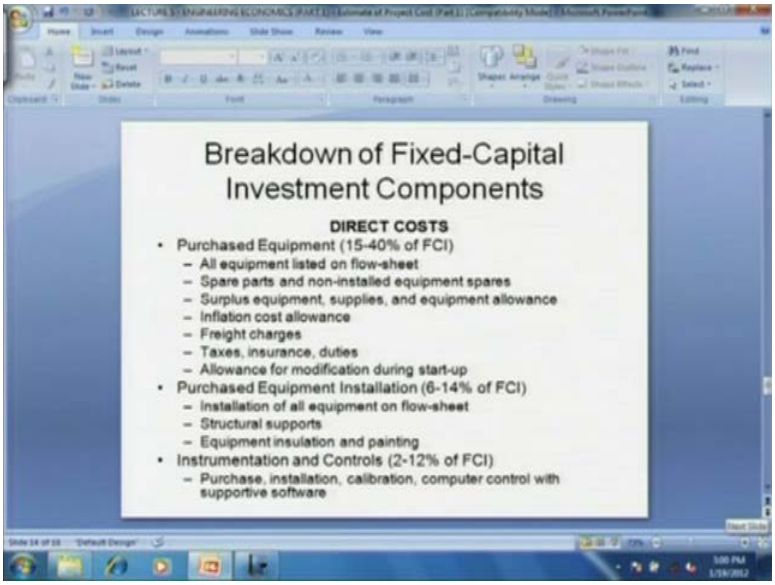

Then let us see what are the components of fixed capital investment, fixed capital investment has two components direct cost and indirect cost. The major subcomponents of indirect cost are purchase equipment this amounts to typically 15 to 40 percent of fixed capital investment. The items that come under purchase equipment is all equipment that are listed on the flow sheet, we have already seen how to break a flow sheet we have to go for economic analysis in steps, we cannot go for the entire economic analysis at the at the initial stage.

So, we have to design the flow sheet and then go for simultaneous economic analysis. So, initially you written only the major equipment on the flow sheet and then find out the total cost of equipment then add further details, if the economic potential is sufficiently promising. So, all equipment listed on the flow sheet then spare parts and non installed equipments spares, surplus equipment supplies, equipment allowances, then inflation cost allowances freight charges, taxes, insurance and duties, allowance for modification during startup these are all the let us say sub components of the purchase equipment component.

Then purchase equipment installation this is typically 6 to 14 percent of fixed capital investment, this includes insulation of all equipment on the flow sheet, then structural support, then equipment, insulation and painting. Then the third is instrumentation and control, this is typically 2 to 12 percent of fixed capital investment this includes purchase installation, calibration and computer control with supportive software.

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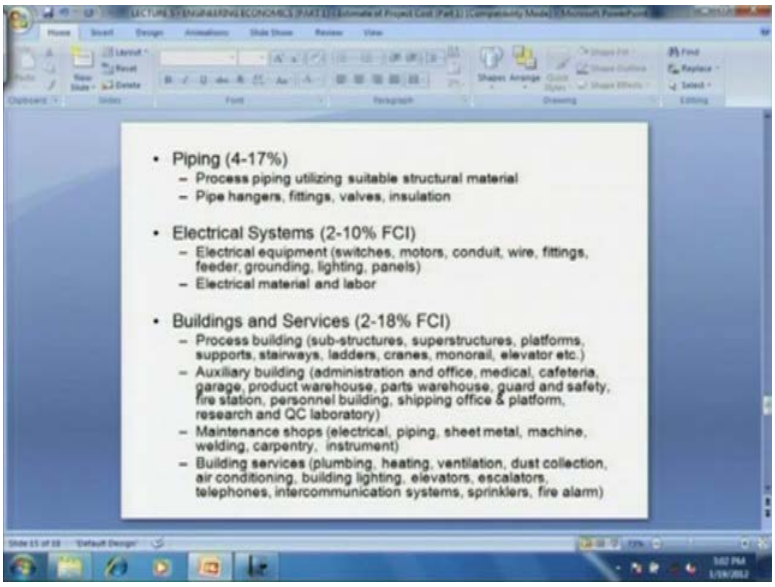

Then comes the cost of piping this is typically 4 to 17 percent of fixed capital investment piping includes all the process piping utilizing suitable structural material, then pipe hangers or fittings or valves or insulation like the accessories for pipe those are all included under category of piping. Then the electrical systems these are 2 to 10 percent of fixed capital investment they include electrical equipment, switches, motors, conduit wire, fitting, feeder, grounding, lighting and panels.

Then electrical material and labor, then the next component is that of building and services this is typically 2 to 18 percent of fixed capital investment this includes process building, the sub-structures, superstructures, platform, supports, stairways, ladders, cranes, monorail elevator. Then the auxiliary building, it should have an administrative office, then medical facilities, cafeteria, garage. Then product ware house, parts ware, house guard and safety fire station, personal building, shipping, office and platform, then the research and quality control laboratory.

Then you also need to have maintenance shops the electrical maintenance, piping or plumbing, the sheet metal, machining, welding, carpentry instrumentation, maintenance shops for all of these things. Then the building services, plumbing, heating, ventilation, dust collection, air conditioning, building, lighting, elevators, escalators, telephones, intercommunication system, sprinkler and fire alarm.

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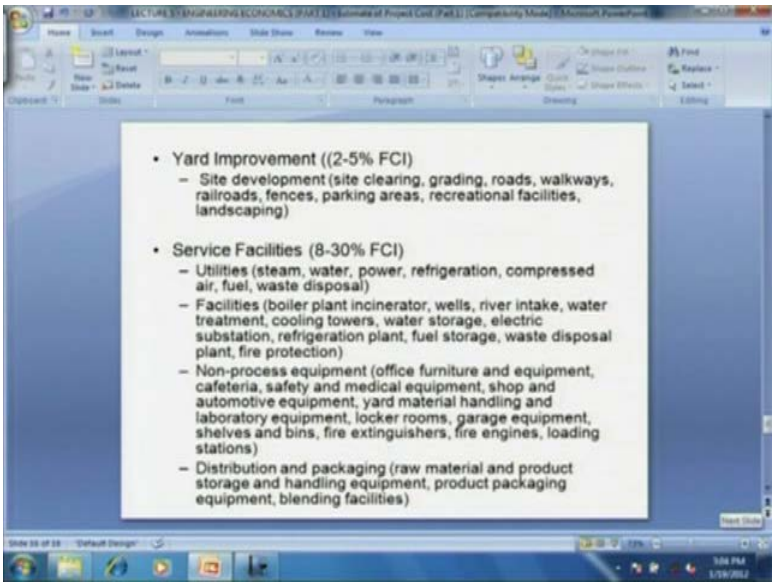

Then the cost of yard improvement, the land that you get for plant may not be a completely flat land, it may it can have certain small hills or small culvert or some lake kind of things, so you have to make them even by making proper demolishing or filling of land. So, site development is an important issue, site clearing, grading, building of roads, walkways, railroad, fences, parking areas, recreational facilities, quarters for your personal then landscaping, the making beautification.

Then comes the service facilities, this count to about 8 to 30 percent of fixed capital investment, the utility such as steam, power, refrigeration, compressed air, fuel, waste disposal so on and so forth. Then facilities additional facilities such as boiler plant incinerator, wells, river intake, water treatment, cooling waters, water storage, electric substation, refrigeration plant, fuel storage tanks, then waste disposal plant and then fire protection equipment.

Then non process equipment such as office, furniture and equipment, cafeteria, safety and medical equipment, shop and automotive equipment, yard material handling and

laboratory equipment, locker rooms, garage equipment, shelves and bins, then fire extinguishers, fire engines, loading and unloading stations. Then comes the cost of distribution and packaging, basically raw material and product storage handling equipment, then product packaging equipment and then blending facilities, if the products are in liquid form.

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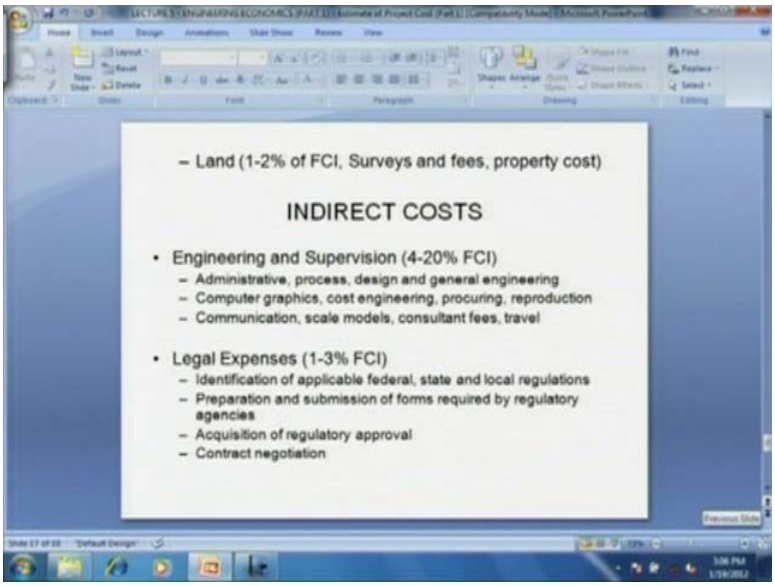

And then finally, the land we have taken as 1 to 2 percent of fixed capital investment, but with the rising cost of land and several issues, political issues, associated with it. The cost of land could be even higher than this it could be 10 percent or even 20 percent of fixed capital investment. Then you have to conduct survey in the land to assess the natural reservoirs like whether it has sufficient water, whether it is connected to highway, whether it is connected to a railway station or it is near a port so on and so forth; then the cost of properties.

Then let us see what are the indirect cost, these what we say where the direct cost of the fixed capital investment, let us see now the indirect cost, indirect cost includes the cost of engineering and supervision that is administrative process, design and general engineering, computer graphics, cost engineering, procuring, reproduction communication, scale models, consultant fees and travel; these together amount to about 4 to 20 percent of fixed capital investment.

Then the legal expenses identification of applicable federal state and local regulation, then preparation and submission of forms required by regulatory agencies, then acquisition of regulatory acquisition of regulatory approval, then contract negotiation. So, you have to higher an legal consultant or may be a legal personal, an advocate for your company, who will handle all these issues.

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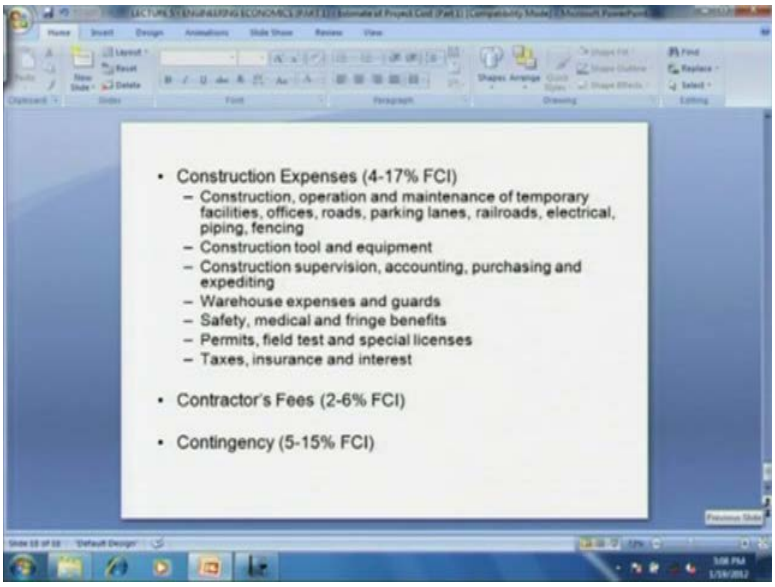

Then the construction expenses these are typically 4 to 17 percent of fixed capital investment, this includes construction, operation, maintenance and temporary facilities, offices and roads, parking lanes, railroads, electrical piping, fencing. Then construction of tools and equipment and construction, supervision accounting, purchasing and expediting, ware house expenses and guards, safety medical and fringe benefits, permits field test and special licenses, taxes and insurances and interest. Then finally, are the two components the contractors fees, that is typically 2 to 6 percent of fixed capital investment and then contingency, which 5 to 15 percent of fixed capital investment.

Contingency grant is unforeseen expenses such as suddenly prices raise or if there is any flood or any natural calamity, then the funds required for the damage cost or compensate for the prices, price, sometimes let us say roads get blocked due to rain, then the cost of additional transportation facilities so on and so forth. So, contingency is the funds required for unforeseen expenses, let us say some suddenly some equipment breaks down and the cost of repair is significantly high, then it is paid through contingency

grant. So, that was the typical structure of the fixed capital investment and working capital, let us see the typical cost estimates metal cost estimates.

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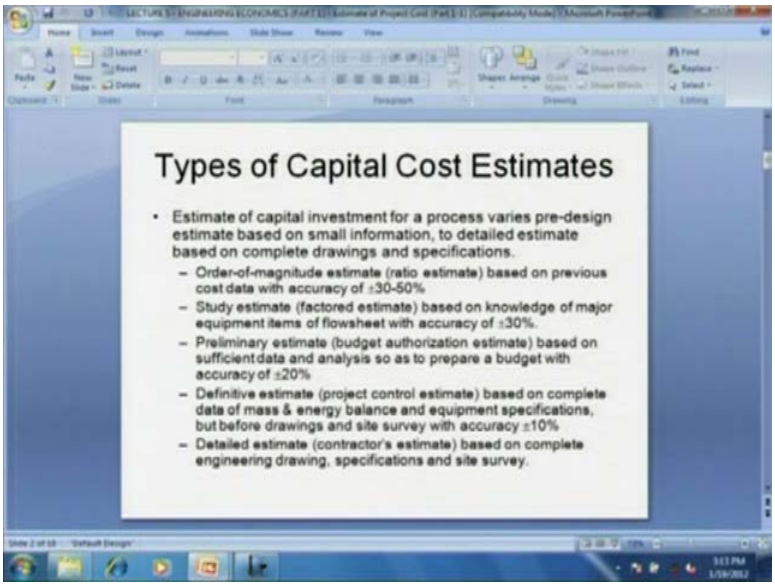

The estimate for capital investment for a process may vary from a pre-decision estimate based on little information except the magnitude of the proposed project to a detailed estimate prepared from complete drawing and specification. Between these two extremes extreme of the total economic analysis, we have to develop the capital investment estimate through various steps and there could be numerous other estimates that vary in accuracy depending upon the stage of development of the project.

These estimates are called by a variety of names, but we have categorized these basically estimates in the five categories, that represent accuracy range and designations, normally used for the design purposes. First estimate is the order of magnitude estimate or what is known as ratio estimate, this is based on previous cost data and the accuracy of such estimate is typically 30 to 50 percent. Then there is steady estimate or what is known as factored estimate based on knowledge of major equipment items of the flow sheet, this is with accuracy plus minus 30 percent.

Then the preliminary estimate or what is also known as budget authorization estimate this is based on sufficient data and analysis. So, as to prepare a budget with accuracy of plus minus 20 percent, then the definitive estimate or what is also known as project control estimate, this is based on complete data of mass and energy balance and

equipment specification. But, before the actual drawings and site survey is done this is with accuracy of plus minus 10 percent. Then the detailed estimate or what is also known as contractor estimate based on the complete engineering diagram specification and the site survey, what are known as the cost indexes.

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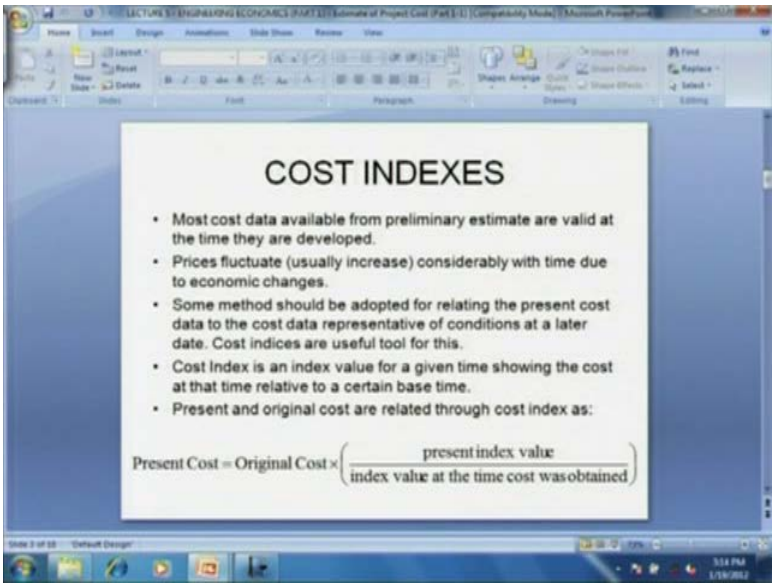

Before we go that let us see why we have to see all these estimates. In the first place we have to pay significant amount of money or fees to the consultant to get these estimates. So, before we go for a detailed estimate, we have to make sure whether the project is sufficiently profitable or sufficiently promising for investing that much of money, to just to get a total project estimate. Pre design cost estimate defined what we also define as order of magnitude estimates or preliminary estimates require much less detail than the firm estimate such as definitive or detailed estimate.

However, pre design estimates are extremely important for determining whether a proposed project such be given further consideration or comparing the process alternatives or process alternate designs. And therefore, for this reason much of the information presented is what we shall see now that is what we shall see in this course or in this module is for the pre design estimate.

Although we need to understand that the distinction between pre design and for an estimate gradually disappears as more and more details are included. Pre design estimate can be may be used to provide basis for requesting and obtaining capital appropriation

from company management, that is sometimes called as budget authorizing estimate. So, you put before the management of your company, the entire project proposal with the pre design estimate, that will help the management determine the worthiness of your project, whether it is worth investing money.

Now, let us see how we can get these estimates one important method is that of cost index, most of the cost data that are available for making pre preliminary pre design estimate are only valid at the time when they were developed. Let us say in module 3 when we try to estimate the reactor design I had given you a home work of updating the cost. The cost correlations that we used were developed in 2002, we are now in 2012, so you have to update the cost and that can be using cost index, the prices fluctuate, they usually increase considerably with time due to economic changes.

And we have to adopt some method for relating the present cost to the cost data in future or cost data representative of conditions at a later date, cost indexes are useful tool. Cost index is an index value for a given time showing the cost at that time relative to a certain base time, the present and original cost are then related to through the index as present cost is equal to original cost into present index value divided by the index value at time when cost was obtained. So, this is the basically a relation of obtaining the present cost from the previous cost.

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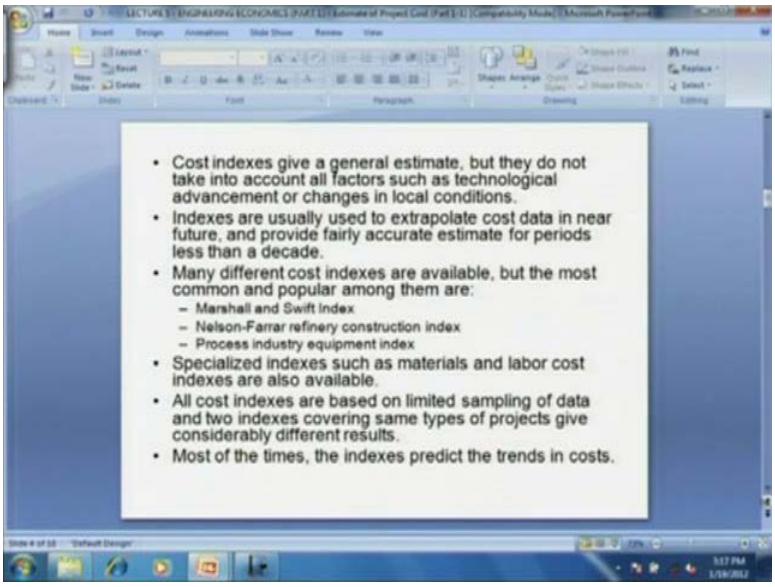

Cost indexes give a general estimate, but they do not take into account all factors such as technological advancement or changes in local conditions indices are usually used for extrapolating cost data in near future. Let us say over a period of 4 to 5 years and provide fairly accurate estimate for periods less than a decade. Many different cost indices are available in the literature, the most common and popular index indices are Marshall and swift index, Nelson-Farrar refinery construction index and then process industry equipment index.

Specialized indexes are available such as material and labor cost index, all cost indexes are based on limited sampling of data and two indexes covering same type of project that give different completely considerable different results, this we should keep in mind that the indices are based on very limited data. So, the cost that we obtained through Marshall and swift index could be significantly different than the Nelson-Farrar index, most of the times indexes only predict a trend in the cost rather than actual quantification.

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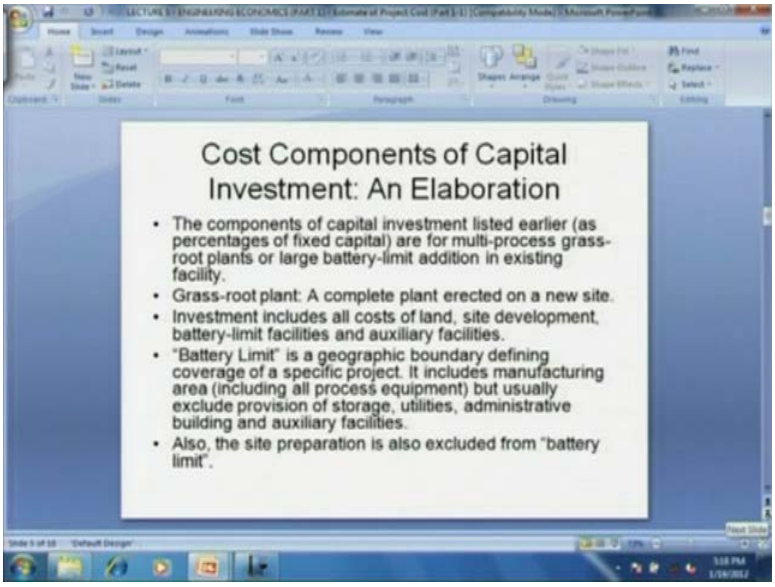

Then let us see how we determine the cost of purchased equipment, the total cost of purchased equipment forms basis for estimation of total capital investment in most of the pre design methods. The plant equipment is usually categorized as processing equipment, then raw material handling and storage equipment, finish products handling and storage equipment, then the cost of equipment basically depends on it is size.

So, sizes and specifications of equipment are needed for a chemical process and these are determined from the equipment characteristic parameters fixed or calculated with material energy balance calculation. For example, if you consider a distillation column the engineer must specify the number of equilibrium stages or plates the reflex ratio the total and partial condensation of over head streams and operating pressure, so as to determine a typical cost.

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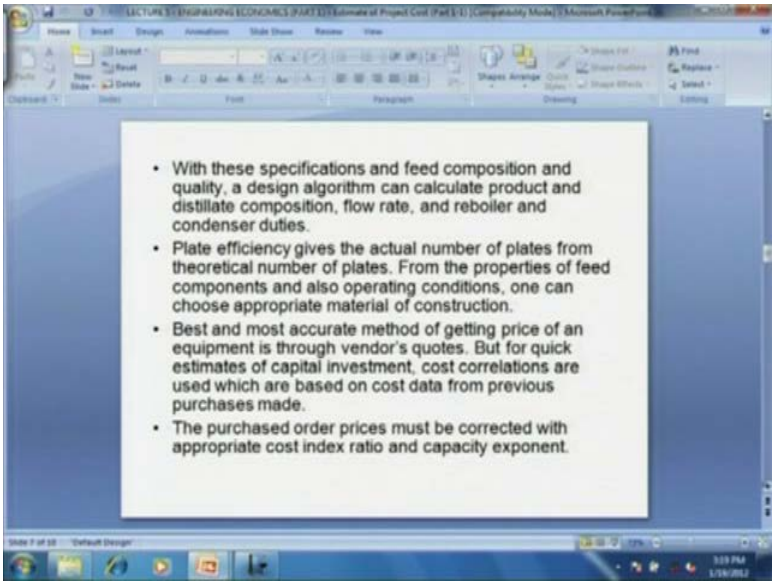

When these specification and feed composition and quality taken into consideration, we can design an algorithm that can calculate the product and distillate composition, the flow rates, the re-boiler and condenser duties. The plate efficiency gives the number of actual plates from theoretical number of plates, which we can determine through F U G method as we are going to see later on in this module or the module of the shortcut design methods.

And from the property of feed component and also operating condition one can choose the appropriate material of construction, this is applicable for all equipment that we have to see the properties of the fluid or material that equipment is handling before choosing a material of construction and the best and most accurate method of getting price of an equipment quickly is through vendor's quotes.

But, getting vendor quote is not a easy task like to even prepare quote vendor has to spend sufficient time. So, unless and until he gets a firm order, he may not be able to

give a quotation, but for feed estimate of capital investment, we can use cost correlations which are used based on the cost data from various previous purchase purchased order prices must be corrected with appropriate cost index ratio and a capacity exponent. If we are trying to get cost of a higher capacity equipment from a low capacity equipment, we have to use a capacity exponent to extrapolate the cost.

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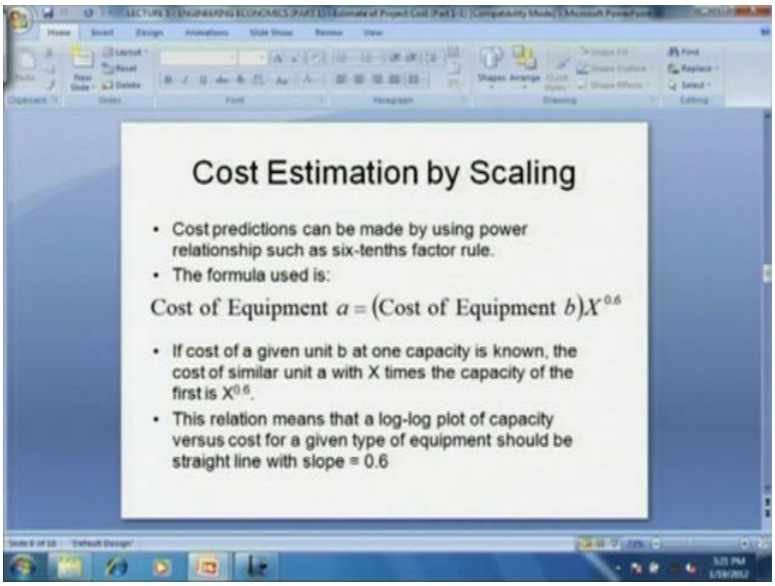

So, this is cost estimation by scaling cost predictions can be made by using power relation as the six ten's factor rule cost of equipment a is equal to cost of equipment b with a higher capacitor load cost of equipment b into X raise to 0.6. The cost of a given unit b of one capacity is known the cost of similar unit with X times the capacity X could be less than or greater than 1 is x raise to 0.6. This means that on a log lag plot the capacity versus cost relation should be a straight line with slope equal to 0.6.

These are some of the basic issues we shall see a more detailed algorithm for estimation of project cost with this thing in the with all these information and data in the subsequent lecture.