Water Economics and Governance
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Lecture - 36
Economics Evaluation of Water Projects

Hello everyone. This week we will be talking about the economic evaluation of projects, how the different type of water projects or how for that matter any given project is evaluated on what economic or financial basis that is what we will be discussing. We have been discussing the basic in earlier week as well, but precisely we will talk about the different evaluation methods, different methods for capital budgeting and how a project based on those principles or those concepts is either accepted or rejected. So, our this week's discussion will be primarily focused around this aspect.

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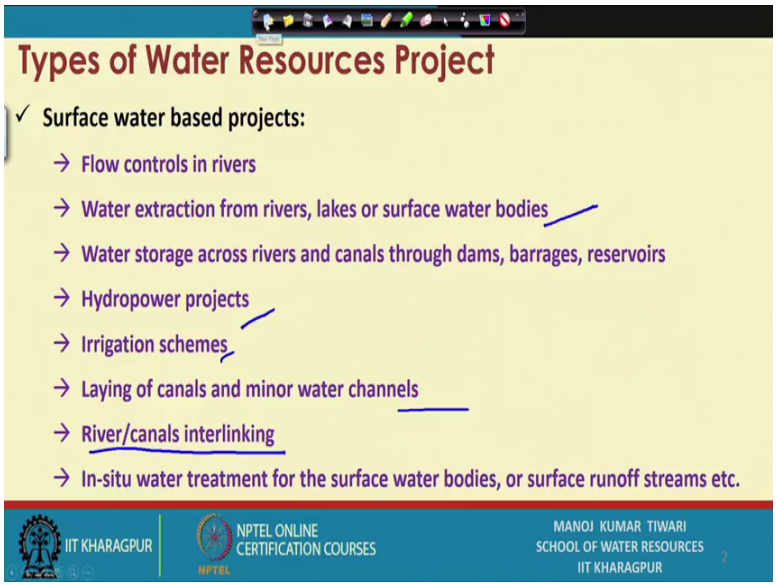

To begin with let us first see that when we say that the evaluation of water project what essentially we mean. What is a water project?

So, water project is any project or any proposal which incorporates a connection with water resources or water services. So, they can be categorized into various subsections. If we see the type of different water resources project, so there are variety of projects which are based on the surface water aspects. So, there is like you can see the list over here of course, there could be a few more inclusions into this, but this more or less compiles

major water projects onto the surface water sources like flow control in the rivers, then water extraction from the rivers lake or surface water bodies then water storage across rivers and canals through dams, barrages and reservoirs. So, what is; those sort of projects how they need to be evaluated then hydropower projects which are typically based on the surface water resources, irrigation schemes, laying of canals and major water channels, then river and canal interlinking this has been in talk around a decade back.

So, further the in situ water treatment of surface water bodies or surface runoff schemes etcetera etcetera. So, these are the primary surface water related project or major projects which can be considered at times by the government or by the agencies.

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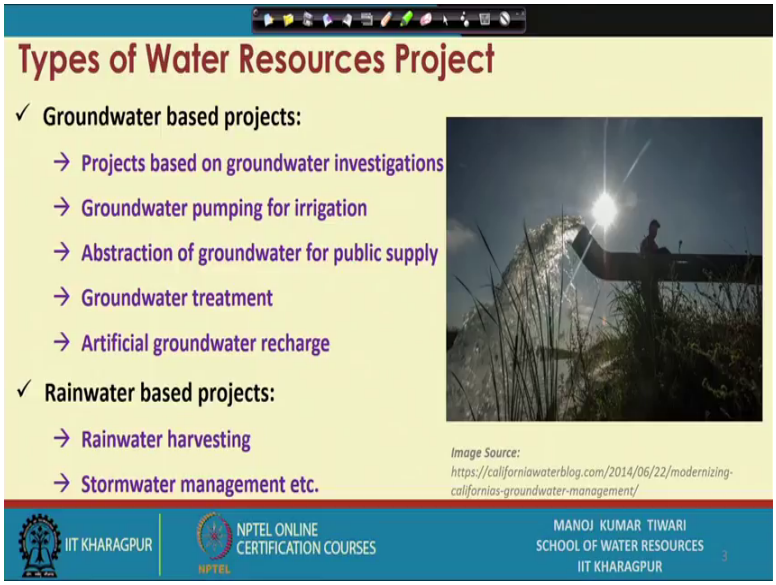

Then there are groundwater based project that includes projects based on the groundwater investigations, then groundwater pumping for irrigation, or for domestic supply abstraction of groundwater for public supplies, the groundwater treatment particularly the in situ treatment and artificial recharge, the artificial recharge of groundwater because that is also eventually affecting the groundwater. Then there are there could be rain water based projects which incorporates rainwater harvesting or storm water management in urban setups.

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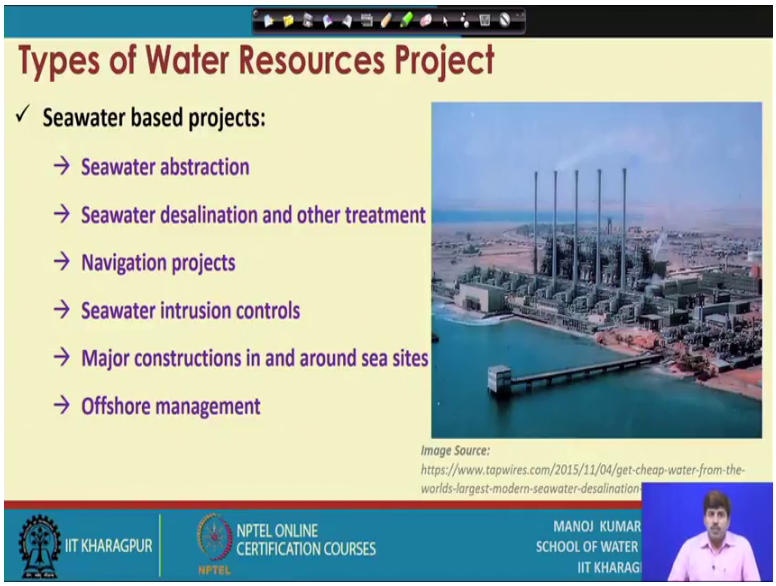

There could be sea water based projects which is the abstraction of sea water, then its desalination and other treatment given to the sea water, navigation projects in the sea, sea water intrusion control projects which is again sort of a hybrid nature project where groundwater will also be involved. Then major constructions in and around sea sides, or the offshore management related activities will broadly come under the sea water based project in terms of water resources if we talk.

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Further there are a variety of waste water based project which is you can call it wastewater or used water, water which has been used. So, there are again could be the projects for the it is treatment and discharge or it is recycling and reuse, the wetland management project the industrial effluent discharge control. So, how the industrial effluent need to be managed a project onto that then waste runoff prevention into our stream and surface water, the irrigation runoff management because irrigation runoff is also a kind of waste water which is coming out of the agricultural fields after irrigation. Sewerage collection and transport system and decentralization of sewerage management. So, these could be some of the projects dealing with wastewater services which could be of importance and at times could be given attention for funding or could be brought down for funding. So, the manager or the economist need to evaluate these projects also.

Further there could be the integrated water management projects where more than one aspects of water are combined together.

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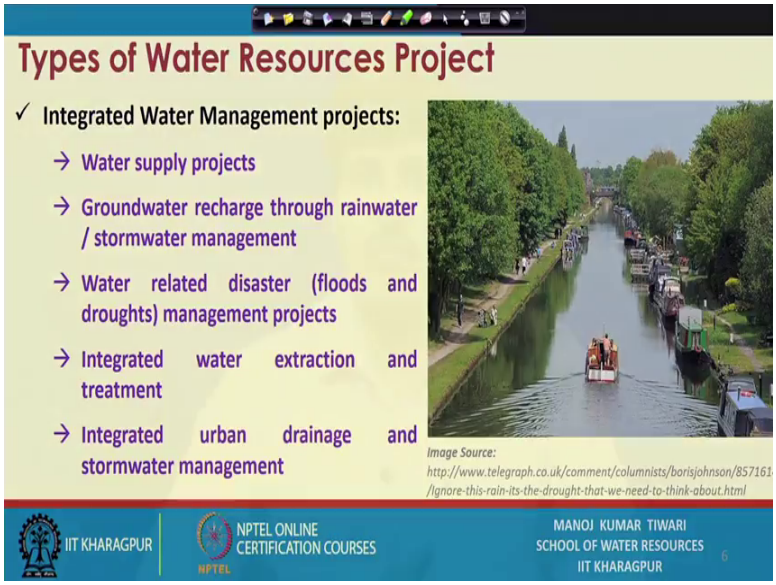

Like surface water supply projects involving your groundwater and surface water both the groundwater recharge through rain water or storm water management the water related disaster management this is again a huge area where flood control or drought mitigation or draught prevention measures are taken. So, the water related major disasters that includes flood and draught, so how to control that any project for that. The integrated water extraction and treatment systems integrated urban drainage and storm

water management system. So, this kind of system or this kind of project projects would fall into the integrated water management category.

Moreover these days because we have only are discussed that water actually flows in a cycle. So, groundwater is linked to the surface water and then eventually everything goes to sea water. So, that way if we see many projects or many new projects or concepts are being developed incorporating the idea of integrated water management. For example, you take wastewater reuse and recycling, so how the wastewater starting is being treated and then it is recycled. So, it is eventually rip reducing the demand for the fresh water. So, having impact on to there or some fresh water is being taken and blended, so how it is what ratio it is being blending. And these sort of approaches calls for integrated study of cost and impacts onto the different forms or different stages of water as well.

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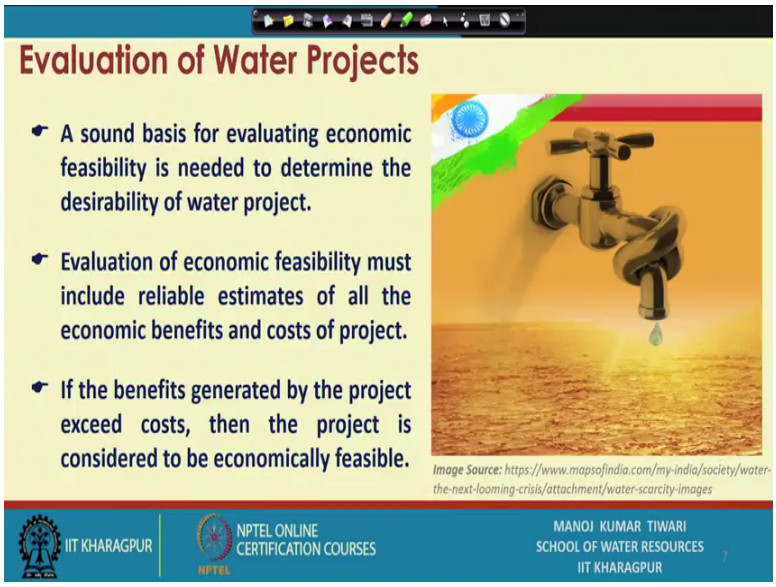

So, with these different type of water projects if we go on to the evaluation of any given project for funding purpose or for whether to go ahead with this project or not in such situation, for such purpose we need a sound basis for evaluating the economic feasibility of these projects. So, these projects would be considered economically feasible only if they achieve what is desirable from that particular project in terms of net, social benefits. The social benefits includes here everything the externalities as well as financial aspect, so evaluating the economic feasibility that includes the reliable estimate of all the economic benefits and cost of the project. If the benefit generated by the project exceeds

cost then the project is considered to be economically feasible otherwise we considered that project to be economically not feasible and such projects could be disregarded for funding.

So, the economic and financial feasibility when we use these terms many times we use it simultaneously, but these are two fundamentally different concepts. We have talked about this briefly earlier as well that the financial feasibility addresses the ability of a project to generate revenues. So, it only focuses on to the generation of revenue. So, any project which is able to generate revenue more than the investment is financially feasible. On the other hand the economic feasibility evaluates the value of project to society. So, in a larger prospective the value of project to the society and environment and it primarily answers the question if the benefits of improved water management of services which is going to come out of that project exceeds the cost of improvements.

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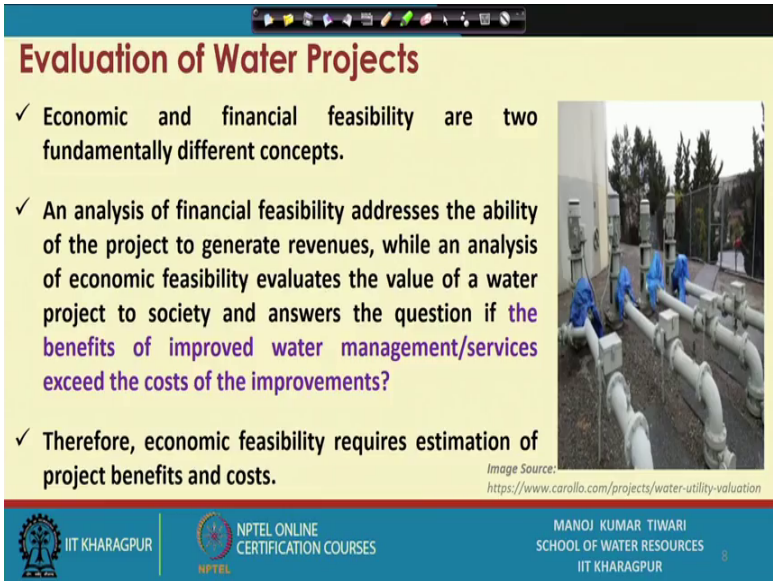

So, the difference between financial feasibility and economic feasibility is evaluation only in terms of the revenue that is related to the financial feasibility when we see that the net revenue invested or net amount invested is going to be recovered in terms of the revenue generated it is financially feasible. But a financially feasible project may not necessarily be economically feasible as well because when we talk about the economically feasible we consider a much broader prospective incorporating the overall

value to the society for that project and overall cost to the society or including environment as well.

So, externalities also come into the play for economic feasibility analysis while financial feasibility it could be ignored. However as we discussed earlier that incorporation of externalities for the purpose of economic analysis is not an easy task. So, economic feasibility requires estimation of the net project benefits which is the project benefits minus project cost in overall social and environmental terms as well. So, that includes the financials as well as social benefits and cost, and environmental benefits and cost.

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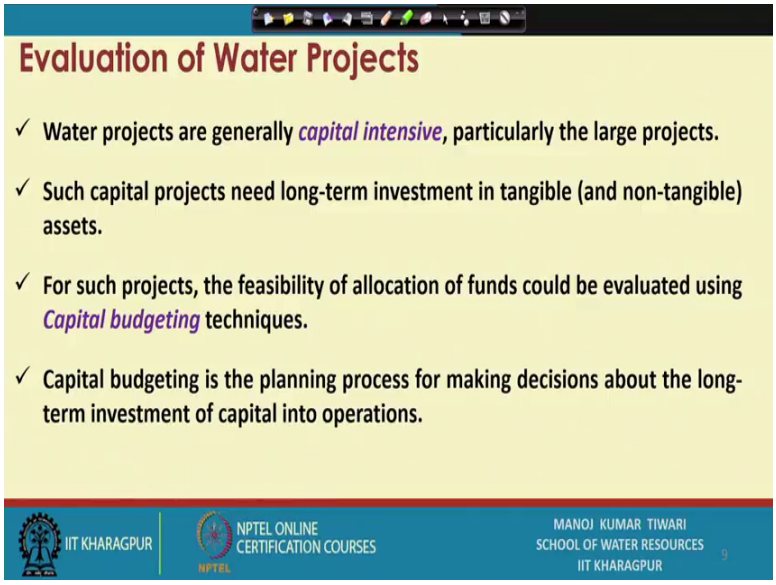

Now, generally the water projects are capital intensive, particularly the large water projects, the large nature of projects. So, for example, if one is planning to lay down a canal for irrigation. So, of course, there is going to be the huge cost implications of laying down a canal if somebody is planning to put a barrage onto a river. So, the construction of barrage is hugely capital intensive process. So, all such large projects or large water projects are very much capital intensive and such capital intensive projects need long term investment intangible assets, so how much tangible assets they are going to create. And of course, the non tangible assets and cost also need to be evaluated for the considering the larger prospective of these projects.

So, for all such projects the feasibility of allocation of funds could be evaluated using the broad capital budgeting techniques. So, the capital budgeting methods or approaches can

be used to see if it is feasible to allocate certain funds for the purpose or not. Now, we can use capital budgeting for the financial evaluation or for the economic evaluation, that depends on how much emphasis we are giving to the externalities. So, the principles are will likely to remain the same if we are including the externality social and environmental externalities we are actually evaluating project on to the economic feasibility aspect if we are excluding the externalities and just seeing the return and investment we are actually evaluating project based on the financial feasibility aspect.

So, the capital budgeting is the planning process for making decisions about long term investment of capital into operation. So, sort of the capital budgeting techniques eventually help us to take a decision in order to draw or make a decision that whether this investment of capital which I am going to make generally the long term investment of capital which one is going to make is it worth in terms of recovery net recovery or not. So, that is what is the idea of capital budgeting.

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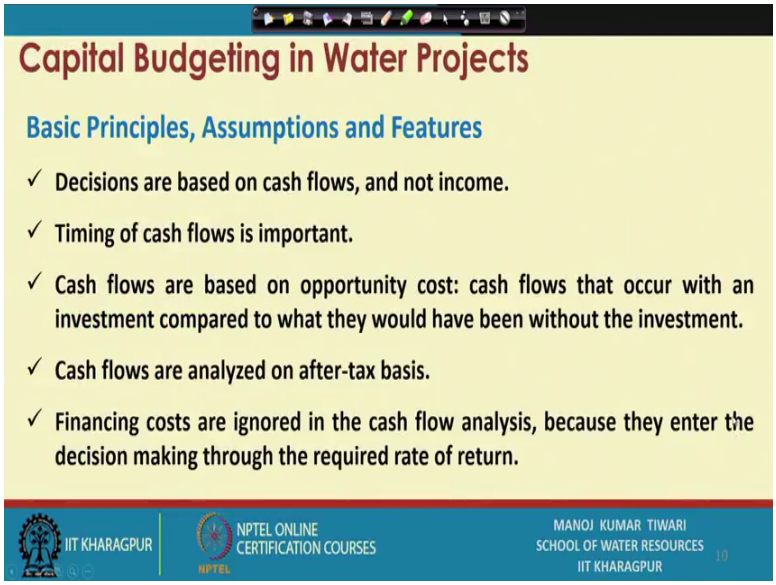

Now, the capital budgeting in water projects particularly if we see. So, there we need to understand and we need to follow certain basic principle assumptions and features of capital budgeting. The basic assumptions of capital budgeting includes that decisions are generally made based on the cash flows and not the income. So, how much cash is flowing into the system? Of course, income will be related to the cash flows. So, if this is my the cash flow into the system and this is my cash flow out of the system. So, the

difference between these is going to be sort of income at that particular given time, but it is not what it the approaches basically considers the net cash flow into the system.

The timing of cash flow is also very important. So, the time value of money is to be generally incorporated in capital budgeting although there are some old age methods which does not give importance to the time value of money, but there are modifications even in those methods to account for the time value of money by using appropriate discount rate of course, as we discussed earlier. So, the cash flows that are based on opportunity cost the cash flows that occur within investment compared to what they would have been without the investment we earlier discussed the concept of opportunity cost. So, what is going to be the next best application or next best use of the resource will give us the opportunity cost and the cash flows which are based on the opportunity cost that needs to be considered or that needs to be assumed while doing the capital budgeting.

The cash flows are generally analyzed onto the after tax basis in the advanced capital budgeting approaches of course, in the older one this is also not considered we will see when we will discuss the different methods of capital budgeting these differences will get more and more clear.

So, financing cost are generally ignored in cash flow analysis because they enter in the decision making process through the required rate of return. So, that financing cost is will be considered when we take the rate of return. So, financing cost incurred is incorporated in that particularly in the most used method the npv and irr. So, we will when, when we will discuss those methods these things will become more clear rather.

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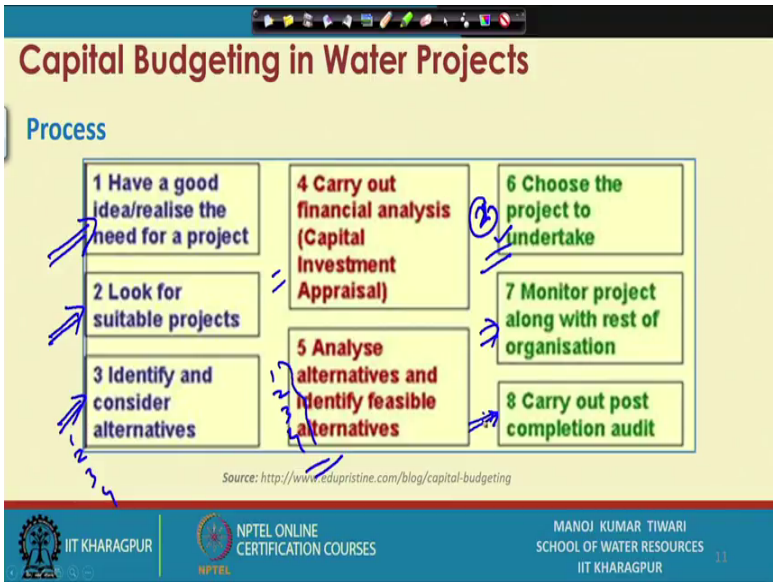

The general process for capital budgeting of water projects involves several steps. So, the first step would be to have a good idea or realize what the need of the project why we are going to think about that project, so what is the basic need of that project that needs to be understood. Then needs to be looked for suitable projects, so what could be the possible alternatives to fulfill that need or to achieve that goal needs to be analyzed and understood.

Then comes the identification and consideration of these different alternatives. So, how we can identify the different alternatives and what to consider that will be based on our further analysis which comes under the next aspect when we carry out the financial analysis? So, in this final financial analysis we see that capital investment is worth of while for this project or it is not based on the appraisal of the investment. So, how it is detected or how it is evaluated needs to be seen and then we analyze the alternatives and identify the feasible alternatives. So, when we are having multiple alternatives here let us say for example, we have 3 4 different alternatives. So, we will analyze those different alternatives over here and identify the probably most feasible alternatives.

Now, there are two different type of decision makings we will talk about that as well. So, then finally, we choose the project to be undertaken based on all these financial analysis we make a call that this particular project let us say for example, project number 2 is the one which we will be undertaking. So, that is considered and after that there is a need for

monitoring the project along with the rest of organization. So, that needs to be done and towards the last step is to carry out a post completion audit whether the intended benefits has been achieved or not and whether the cost which has been us which has been spent for the particular project is in line to the proposed values or it has exceeded and if it has exceeded what are going to be its implications.

So, the final auditing gives us the idea of the standing in terms of how nicely we have been able to achieve the targets. So, that will be coming through the final audit which is one of the one of the very important aspect. So, this is the entire process that way from very much from inception to the final audit thing; however, the financial part or the budgeting part mostly focuses on let us say point number 4 and 5 here where we conduct the financial analysis and choose the most feasible alternative based on the capital investment appraisals. Rest are the selection and initiation and objective setting process and after evaluation process is the additional steps. So, that has already occurred. So, it cannot be a part of increment cashflow of a capital budgeting analysis. For example, if you are setting up a water treatment plant near a and you are having a existing building which you want to convert it to your office or labs or for those purpose. So, that is already existing. So, that is already has occurred that will come under the sunk cost. So, when it is sunk cost it cannot be considered in an incremental cash flow because it has already occurred.

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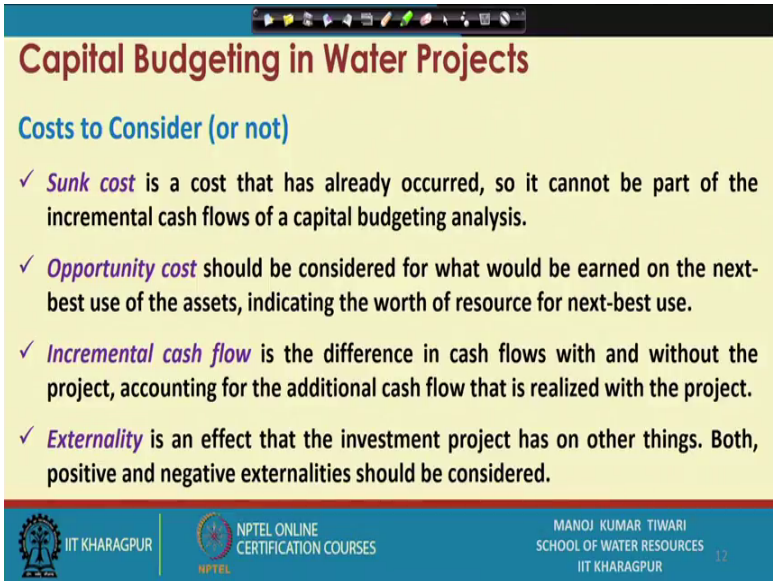

Then there is opportunity cost which should be considered for what would be earned on to the next best use of the asset, whatever is the next best use how much opportunity cost is it is leading that needs to be considered indicating the worth of resource for such next best use. Then there is an incremental cash flow which is the difference in the cash flow with and without the project, accounting for additional cash flow that is realized with the project. So, when we say that incremental clash cash flow, so how much additional cash flow is being incremented this cash flow includes both positive as well as negative. So, how much these additional cash flow is being incremented due to the project.

So, if there is no project at all how much cash flow changes are there in terms of input as well as output. So, because if there is no project we are not go there is no investment there is no operation and maintenance cost at the same time there is no benefits also. So, the benefits are also incremental the cost is also incremental when we consider from a zero state. At times if we have an existing scenario and if you want to plan some augmentation to that certain let us say capacity enhancement of a existing services or those kind of propositions if they are being proposed, so how much additional cost is needed and how much additional benefit they are going to generate needs to be considered from the existing operational cash flow, that the existing plant is able to generate. So, the difference is only incremental or the differences are to be taken over there.

Then comes the externality which is an effect that the investment project has onto the other things, so external things, that external things could be within the project area or outside the project area, but it is not generally in terms of the finance or cash finances only. So, what are the positive and negative externalities it is going to consider or it is going to impart on to the society on to the nature in general that also need to be considered for the net analysis or the for the economic feasibility particularly of the project. For financial feasibility these could be ignored, but for economic feasibility these externalities become a very important part.

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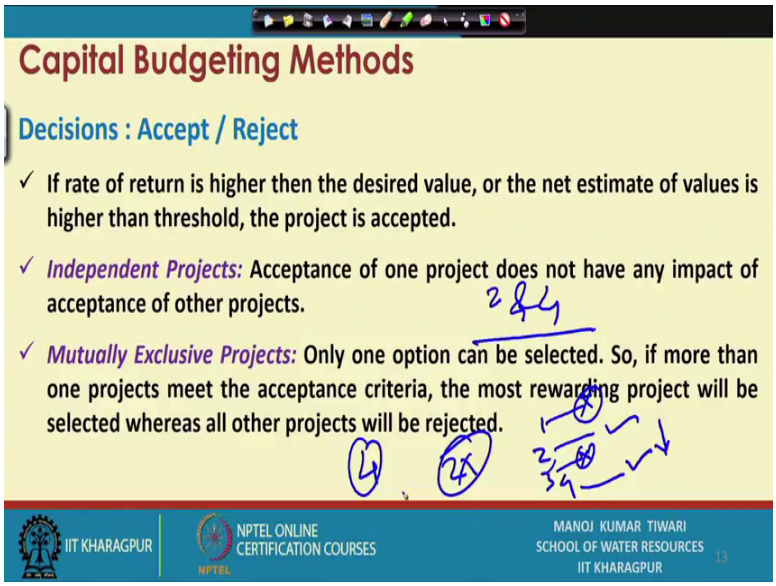

The decisions that are made through capital budgeting is generally whether to accept or reject a proposal. So, if the rate of return is higher than the desired value or the net estimate of value or net present value npv is higher than the threshold. So, we considered that project could be accepted.

Now, the project acceptance fall in two different categories of the project. The project could be mutually independent or could be mutually exclusive. So, for independent project the acceptance because each project is independent of one another project, so acceptance of one project will not have any impact on to the acceptance of other project. If I am going to accept a one project based on its the capital budgeting outcomes I can still accept the other projects if they are fulfilling my criteria; however, there could be the mutually exclusive projects where only one option can be selected only one proposal can be selected eventually.

So, if more than one projects or more than one proposals meet the acceptance criteria for us let us say we as, we were discussing let us say we have 4 different option, 1 2 3 4 and we when we analyzed we saw that this may not be the feasible, but 2 is ok, 3 may not again be feasible, but 4 is also ok. So, if they are independent project I can pass both 2 and 4, I can pass both these projects that let us go ahead with 2 as well as 4, but if these are mutually exclusive projects. So, then I may not actually pass both 2 and 4, I will have to see that both are acceptable based on my pre fixed criterias, but then because I have a

scope of just doing only one project, so the most rewarding project will be selected and all other projects will automatically be dropped. So, in that case if I see that 4 is better rewarding than 2. So, I will select 4 and 2 will be dropped.

So, that kind of analysis can also be done under mutually exclusive projects class and the outcome here would be just selection of one project. For example, let us say we have a river bank and we want to develop that river a part or area of riverbank and we see what is the advantage of making a ecological park over here or making us some other kind of recreational facility over here or developing this into a residential block. So, we have these 3 different options.

Now, from the capital budgeting sense my all 3 would be could be actually profitable project, could be making sense that I can get the desired benefit by converting it to ecological park as well I can get the net gains or if I convert it here this land into a residential block or I create a recreational facilities or those kind of stuff then also, but since the land piece is limited that becomes mutually exclusive project, I cannot sanction more than one project onto the same land. Because if it is being created in if that area is occupied for residential block how can I go for a ecological park or how can I go for us some recreational facilities. So, in such sense only one outcome which is probably going to be the most favored outcome will be selected while all others will be dropped.

The other hand if let us say I am seeing that one of, on one bank I have this land and on other bank I have two lands and I figure out that there are possibility these two, my one project is to set up a ecological park on the right bank and a residential block onto the left bank. These are two independent projects, I figured out that let us say the setting up ecological park is not financially or not ecologically feasible in economically feasible, so I will have to drop that project and I will do only residential and if I figure out that residential block is a feasible, economically feasible project, I can sanction that make a residential block onto the right bank while drop the ecological park on the left bank.

On the contrary if I find that this also is a economically feasible project I can sanction both because making amendments at one end is not going to affect on to the other end. They are not mutually exclusive, they are not in interdependent, they are independent. So, I can sanction both the projects in such cases. So, that is how the concept of capital budgeting is used in order to decision making.

Now, we will stop this session here, and in next one we are going to start discussing the methods of capital budgeting one by one.

Thank you.