Introduction to Environmental Economics
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Lecture - 55
Environmental Regulations and Basic Regulatory Instruments-Market Based Instruments/Approches-I

Hello, everyone we are discussing the Basic Regulatory Instruments and in the last class we talked about a special case of regulatory instruments that is; the Pigovian fee. So, today we will be giving a broad outline of what is the basic regulatory instrument so, far the environmental regulation is concerned. And, then we will be talking about the market based instruments only.

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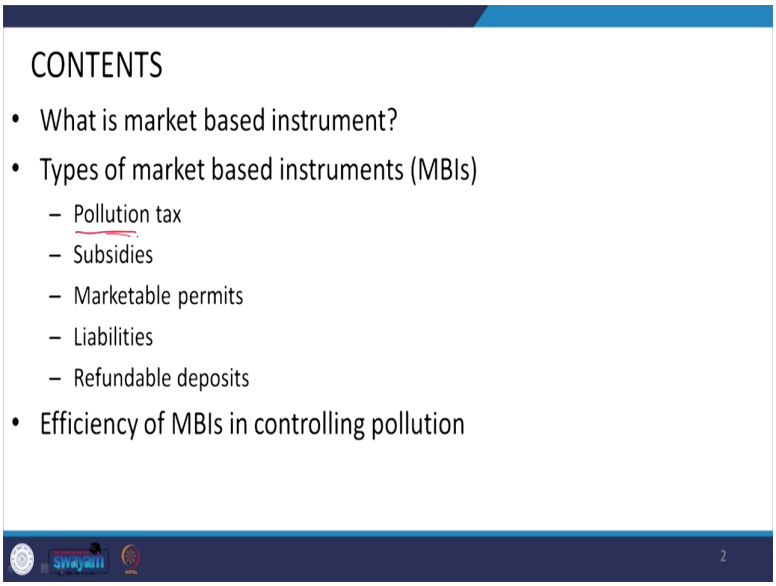

So, the broad contents of this basic regulatory instruments here we will be discussing; what is the market based instruments then we will be talking about what are the different forms of market based instruments. So, over all in under this regulatory instruments we will be talking about different mechanisms like; your poly syntax then we will be talking about the subsidies, marketable permits, liabilities and refundable deposits.

And, then you will be judging that; what is this the efficiency of this market based instruments in controlling the pollution itself. So, this is the broad outline that will be trying to cover under this market based instruments. Today we will be talking about the case of this pollution tax.

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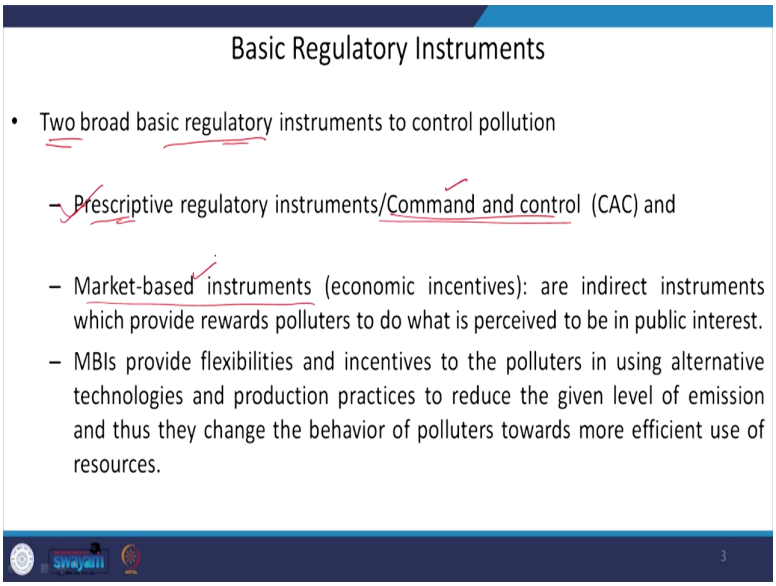

So, first of all we will understand and the basic regulatory instruments so, as you understand that we are having the two broad categories of regulatory instruments in order to control the pollutions. And, these two forms are the prescriptive regulations which is also known as the

command and control regulation method or a command and control approach. And, the second one is the market based instruments.

So, in the first one this is the prescriptive regulations or which is also known as the command and control approach; it has already been taught by a professor S P Singh. So, this part is over. So, today we will be focusing on the market based instruments and we will be talking about a special case the one of the instruments that is the pollution tax.

So, let us understand what is the market based instruments? Because, in the command and control approach; this is a as a regulatory instrument, what the government or regulatory body is doing? It is prescribing some standards setting some standards so, that the polluted they will be avoiding by those standards and in that way, this is a kind of direct mechanisms to control the pollution.

But in case of market based instrument this approach is not followed. Here the regulator is giving adducting some kind of indirect instruments, right. So, that this instruments will be providing the polluter a kind of incentive and to control the pollution itself. And so, if you compare these two mechanisms; one is your command and control method and second one is the market based instrument.

Then we will be finding that; in case of command and control you do not have any flexibility or the polluter they will not have any incentive that they do not have any flexibility to change the these pollution levels. They need to abate by what is prescribed or what is commanded by the regulator itself.

But, in case of market based instruments this is giving a opportunities or economic incentives to change to for the polluter to change the pollution itself. So, now, the thing is that we need to understand; how this market based instruments are providing flexibility and incentives to the polluting firms to change and the mode of productions and the level of pollutions.

So, these when we are talking about market based instruments, they are providing the alternative technologies or the production practices, right. So, the polluting agencies they can

actually explore about the alternative states of technologies or production practices or management practices so, that they can reduce the level of this emission or the pollution. And, thereby they can change the behaviour of the polluters toward adapting more efficient use of resources.

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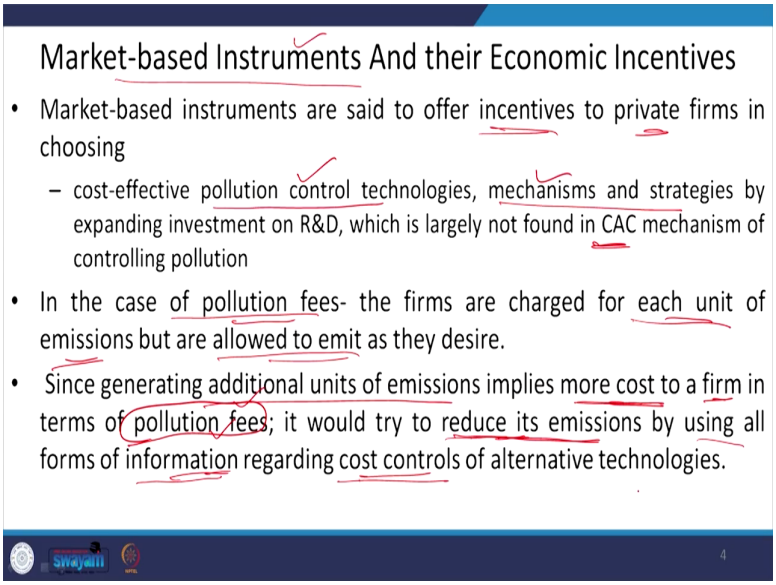

So, now, we will be talking that; this we are continuing with this market based instruments and now, we will be finding what are the economic incentives? So, as you understand that the market based instruments they are offering some kind of incentives to the polluting agencies are firms in choosing the case of the cost effective pollution control technologies.

So, they are free to choose that which technologies; pollution control technologies most cost effective so, that they can control the pollutions. They are also free to choose the mechanisms and strategies and they are also free to choose and invest in the right kind of technologies on R

and D and so, that the pollution can be controlled. But these flexibilities are not found in case of command and control mechanisms of controlling the pollution itself. In this market based instruments now, we will be taking a case the first instrument that is the pollution fees or which is known as the pollution tax.

So, in pollution fees and pollution tax; here the polluting agency is a firm they are charged per unit of pollutions. So, they are tax for each unit of pollution they are producing and ah; obviously, they are allowed to pollute. So, the for the first hand in the in one hand they are allowed to emit and pollute and in the second hand the firms they are charged for each unit of pollutions they are producing.

And, moreover here when we are talking about this generating additional level of pollution it will be implying that more pollution means; more cost to a firm, right. So, more cost to a firm how? Because, when the polluter is polluting more the; obviously, the polluter needs to pay in more in terms of the pollution fee. So, because the polluter now, is to pay the pollution fee more that is why it is an indirect incentive that the polluter would be will be trying to reduce the emission fee in order to avoid the or in order to lessen the pollution tax.

And that is why, in order to do this exercise in order to reduce this pollution, the polluter we will be now exploring different kind of informations and processes how to control the cost by using and exploring different alternative technologies?

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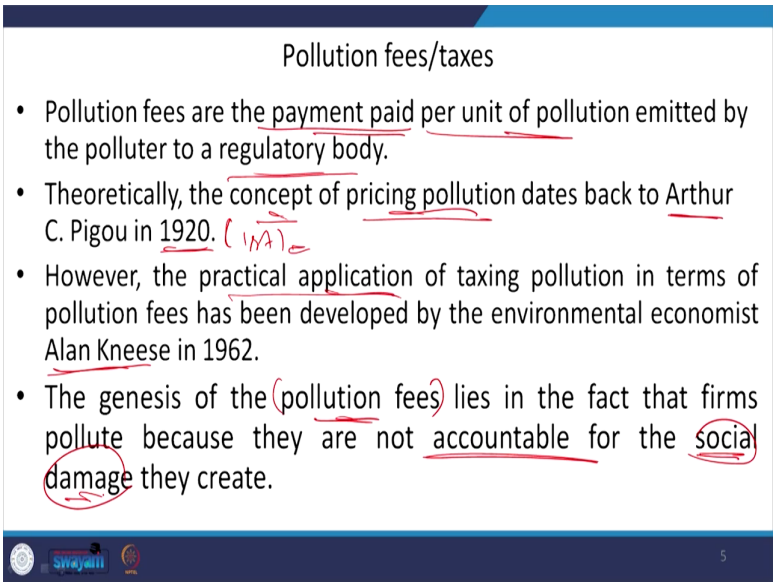

So, now let us have a look on the pollution fees or taxes, right. So, we started with the Pigovian fees and as you understand; this Pigovian fee is a kind of pollution fees we will be discussing how the Pigovian fee or Pigovian tax is a special kind of pollution tax. So, now let us talk about the pollution tax or pollution fee is itself. So, what is pollution fee or pollution tax? Pollution fees are the payment; that are paid by the polluting agencies for per unit of pollution they are emitting, right. And, they are paying this tax amount to a regulatory body or the government or regulatory agencies.

And, if you are saying we trying to find the theoretical underpinnings of this pollution fees, that when a polluter is polluting he has to pay the tax for pollution so, the theoretically this concept of pricing the pollution it was by the author Arthur C Pigou. So, he developed this idea in 1920 itself.

So, this is the first edition first edition where he talked about the pollution fee can be imposed to the polluting agencies. And, later on we had different versions and editions of this idea. However, if we are talking about the practical application or implementation of this pollution fees, it was developed by these author Alan Kneese in 1962, he is an environmental economist and he talked about that we can apply this pollution fees concept in order to reduce the pollution itself.

And, the very genesis of this concept pollution fee is that; the first they do not then take into account this pollution, because they do not account do not take into account this social cost or social damage they are creating along with their own productions. So, because they are not taking into account this social costs or social damage in their production profit function, then this is a problem.

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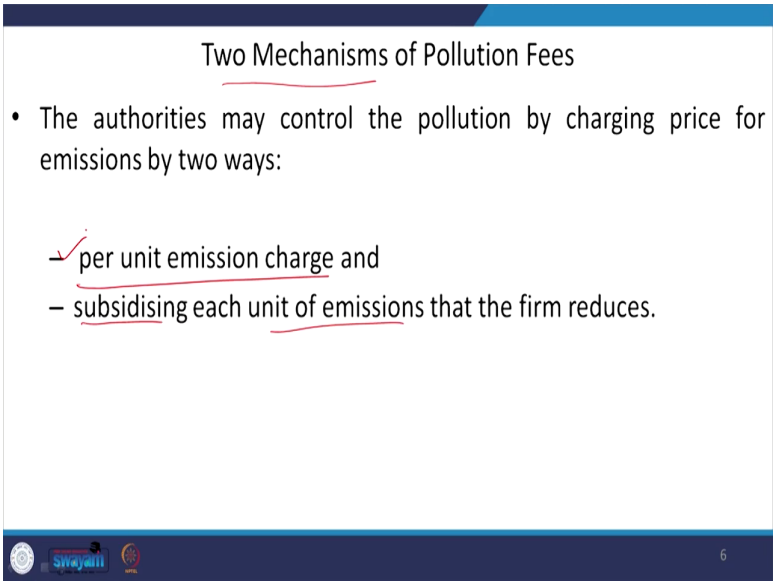

So, in this context of pollution fees we are will be discussing two mechanisms of pollution fees and here the regulator can exercise, the or implement this pollution fees by two ways; the first one is per unit emission charge or per unit pollution generated. Per this and that must be charged that must be taxed.

And, the second one is subsidising each unit of emissions that the firm is reducing. So, this is the first one that we need to charge imposed per unit emission tax and the second one is we need to subsidize each unit of emissions that the firm is cutting back.

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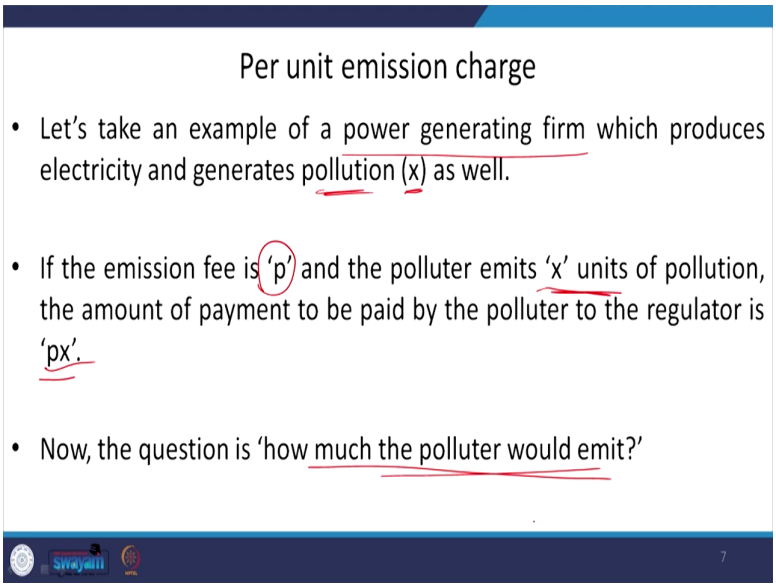

So, now let us discuss the first major that is per unit emission charge. So, we can take an example. So, let us suppose; we are taking the case of power generating firm, right. So, power

generating firm, but the output of the power generating firm is electricity. And along with the electricity production it will be generating the pollution itself, right.

So, now let us take this pollution level generated to be x. So, if the pollution fee or emission fee is charged and per unit charge is p rupees, right. So, and the pollution the firm is generating pollution amount x; x unit of pollution. So, the tax bill that is to be paid by this power generating firm to the regulator is the px, price multiplied by quantity this is the simple one.

But, now the question is; how much the polluter would emit? Although we have some idea from the Pigovian tax, but we will explore by explaining the concepts of marginal saving and marginal cost concepts.

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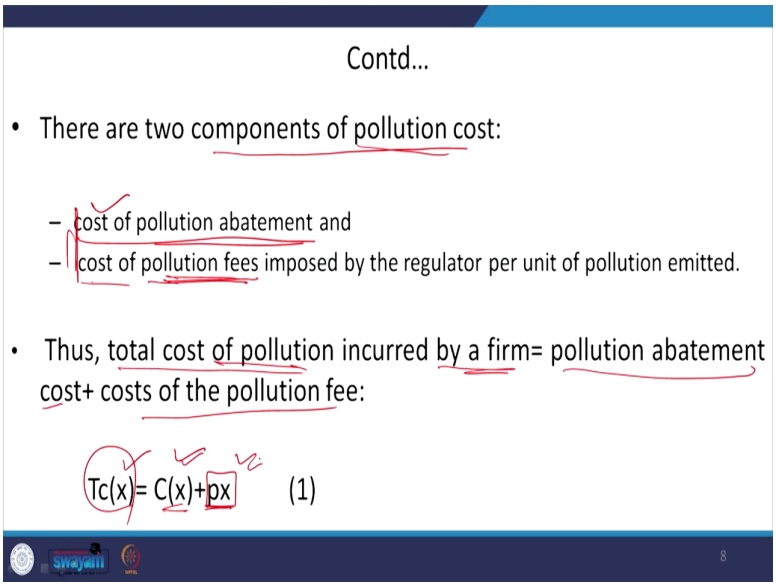

So, here for explaining this question, now we will be talking about the components of pollution costs. So, what are the components of the pollution costs? So, the first component of pollution costs is that; the firm who is polluting or generating pollution should be it will be spending money or spending expenditure in order to took your back the pollution. So, that means; it is a kind of treatment.

So, that one is known as the cost of pollution abatement. How to treat the pollution or how to cut back the pollution level? So, that this is known as the pollution abatement costs. And the second one is that, if the firm is not spending anything in order to reduce the pollution level then; obviously, the firm is going to pay or the taxes imposed for each level of pollution produced. So, that costs is known as the pollution fees or pollution fees cost.

So, which is imposed by the regulator itself or per unit of pollution that are emitted by the firm itself. So, now we can find out these are the two components and now we can find out what is the total cost of pollution? So, the total cost of the pollution that is by a firm is pollution abatement cost, this is a first component and the second one is the cost of pollution fee, right.

So, now we can symbolically say; that this total cost of pollution which is represented by the Tc x is the first component that is the pollution abatement cost plus pollution tax bill or pollution fee. That is p into x.

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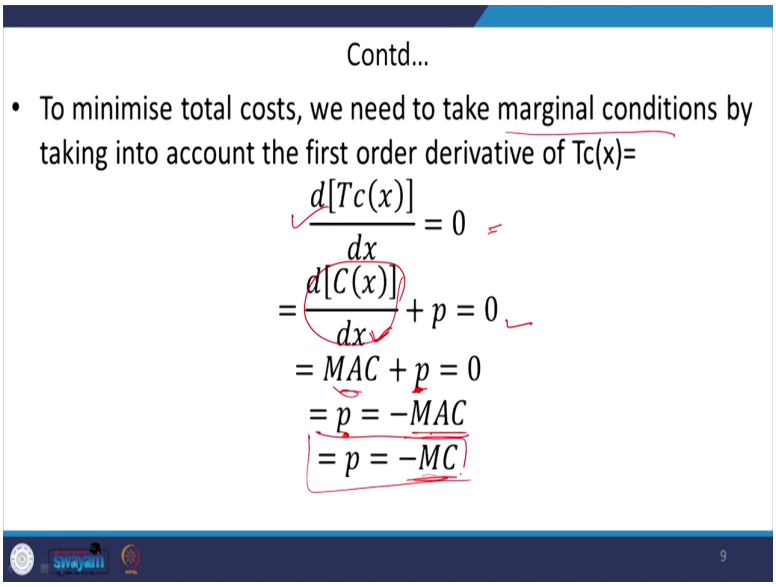

So, what do you need to do that, if this is the total costs then; obviously, total costs is to be minimized, right. So, in order to minimize the total costs what we need to do? We need to take into account the marginal conditions, right. So, what is the marginal conditions? That first order derivative of the total cost function must be equivalent to 0.

So, we are taken into account this first order derivative of this total costs and we are we getting to 0 then we are finding that, these are the two components C x plus p into x. So, we are finding this is the; this is the result. So here derivation of the total costs is with respect to your treatment of the pollution or the with respect to pollution itself, is known as the marginal abatement cost or marginal cost that is incurred by the firm itself and this is p, right.

So, by solving it you can find this; p is the minus of marginal abatement cost or this marginal abatement cost is also taken as the marginal costs. So, we are finding this p is a minus marginal cost or minus of negative of marginal abatement cost, right.

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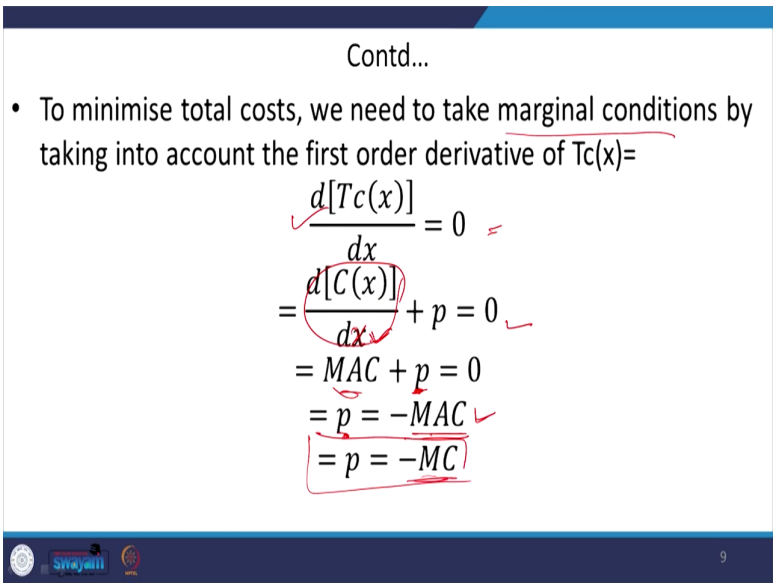

So, now we will be finding that; some other concept that and they are necessary in order to understand the concept of pollution fee. So, first thing that we need to taken we take into account is the marginal abatement cost. So, what is a marginal abatement cost? So, although we talked about here, how to find out this marginal abatement cost that is; the total cost here that we are take into account with respect to the for one unit of pollution we are take into account.

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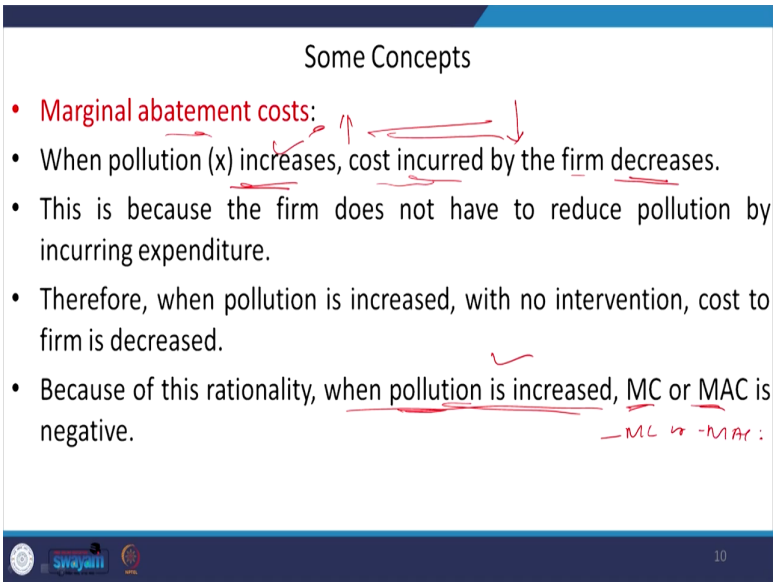

So, here we are defining this that it can be understood when pollution is increasing, right. So, that means; the cost spent by the firm is decreasing then only pollution can increasing, right. So, when pollution increases; obviously, we need to see that the firm is not spending enough for treating the pollution. So, the cost of cost incurred by the firm in treating the pollution is decreasing. So, that is how we are saying the pollution is increasing.

So, therefore, we can say that when pollution is increased and if there is no intervention from the regulatory authority so, cost of the firm will be decreasing. So, because of this logic we are saying; when the pollution is increased, right. The marginal cost or marginal abatement cost is negative, ok.

Because, the see the when pollution is increasing the cost incurred by the firm for treating this pollution is decreasing. So, there exists a negative relationship. So, that is why you are saying

when pollution is increasing the marginal cost the marginal abatement cost it must be negative. So, that is why we are saying that minus of marginal cost or minus of marginal abatement costs.

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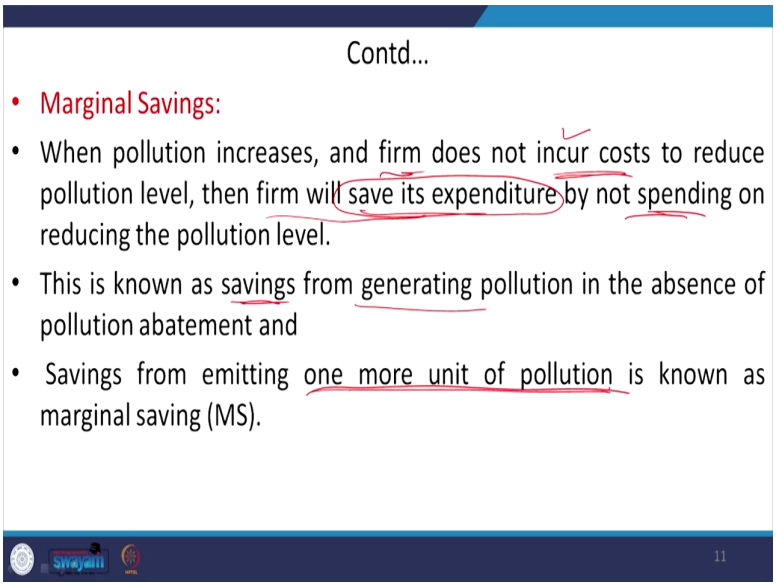

The second concept is; the marginal savings. What is marginal savings? Now, we can take this when again from the same example we are saying when pollution is increasing and so; that means, the firm is not incurring enough expenditure in order to reduce the pollution level, right. When the when the expenditure is not met or expenditure is not made then; obviously, the firm will be saving this expenditure, right.

Because there is no regulatory mechanisms so, pollution will be increasing; so, when pollution is increasing the firm is not incurring expenditure, in order to reduce the firm. So, that means; this level of expenditure is saved, right or which are not spend for reducing the pollution level.

So, this saving from because you are continuing to generate the pollutions and you are not doing any kind of expenditure for treating so, this saving from generating the pollutions in the absence of any pollution abatement, right. It is known as the marginal savings right. So, marginal savings can be defined as savings from emitting one more unit of pollutions, right.

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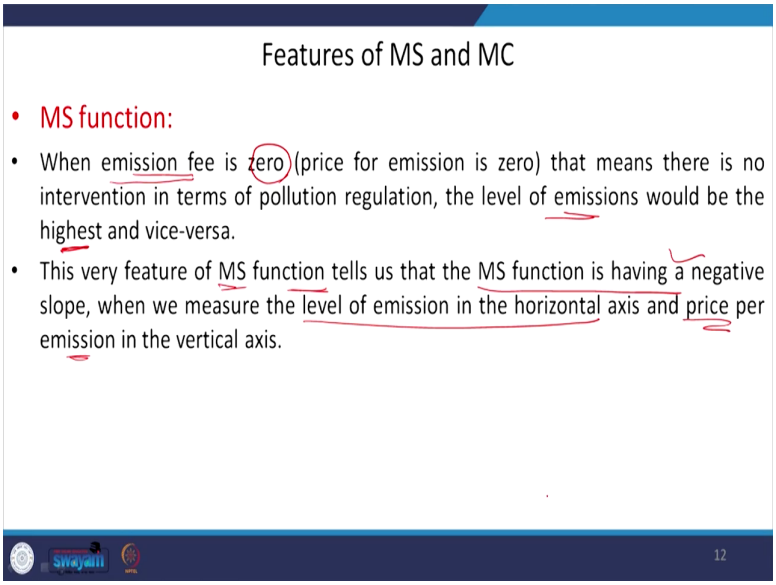

So, now after understanding this marginal saving functions and marginal abatement cost or marginal cost function; now, we can find out some of the features of marginal saving functions and marginal cost function. So, what are the features very basic features of these marginal saving functions? So, we can say that; when this pollution fee or pollution tax is 0; that means, price for the pollution is 0, right. So, it means; the government is or the regulatory authority is not intervening, right.

So, so as a result when pollution fee is 0 the government or the regulating authority is not intervening to control the pollution as a result; the pollution level would be the highest one, right. And, because of these this is reflected in the marginal saving function. So, the very feature of this marginal saving functions it teaches us that this marginal saving function is having a negative slope, right.

So, we can say we measure this when you are measuring this level of emissions in the horizontal axis x axis and the price per the level of emissions in the vertical axis, right. Then we are having this negative relationship; will be explaining that what will be the shape and slope of this functions.

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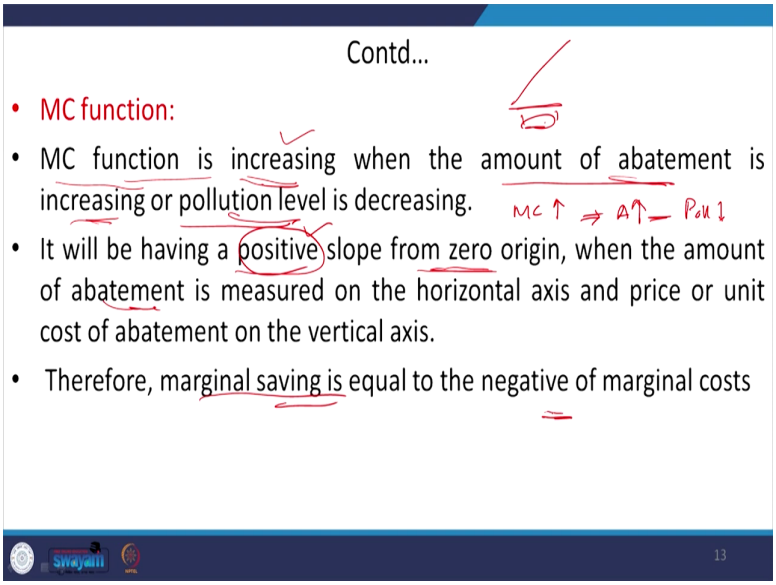

So, now let us talk about the marginal the features of the marginal cost functions. So, as you understand that this marginal saving sorry, marginal cost function when it is increasing, right.

When the abatement cost, right is increasing. So, what is the marginal cost function? So, marginal cost function means; when the firm is spending expenditures for controlling one more unit of pollution, right.

So, when this marginal cost function is increasing; that means, the firm is trying to abate more and that is why, it is spending more on controlling or abating the pollution itself. So, as a result; what will happen? The pollution level will be decreasing. So, we are saying the marginal cost function is increasing, because the abatement expenditure it is increasing.

So, it means the; obviously, the pollution level will be decreasing right. So, that is why, this marginal cost function is going to have a positive flow; if you are taking into account this marginal cost function from the zero origin, right. So, and when the when this abatement amount is measured on the horizontal axis and similarly, the price or the unit cost of abatement is measured in the vertical axis then the marginal cost function will be have a having a positive slope from the zero origin. So, what you can say that; this marginal saving is equal to the negative of marginal cost functions.

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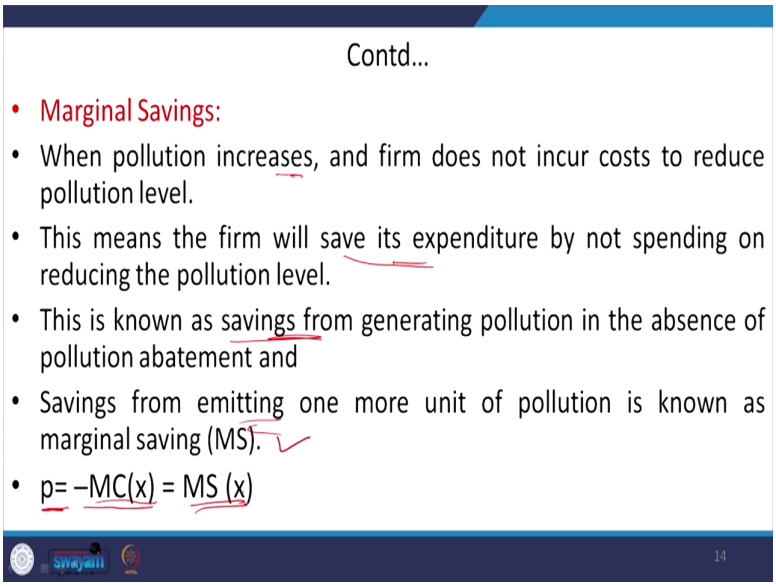

Now, we can graphically display this figure. So, what we are talking is; when the pollution is increasing firm does not incur the costs to control the pollution level. And this means; is that the firm will be saving its expenditure by not spending for reducing the pollution level and this is known as the savings from generating the pollutions in the absence of the pollution abatement. And, this savings from emitting one more unit of pollution is known as the marginal saving functions, that this is we you have discussed right.

So, what we are saying is that; this price is the negative of marginal cost that is the marginal saving function with respect to the pollution itself.

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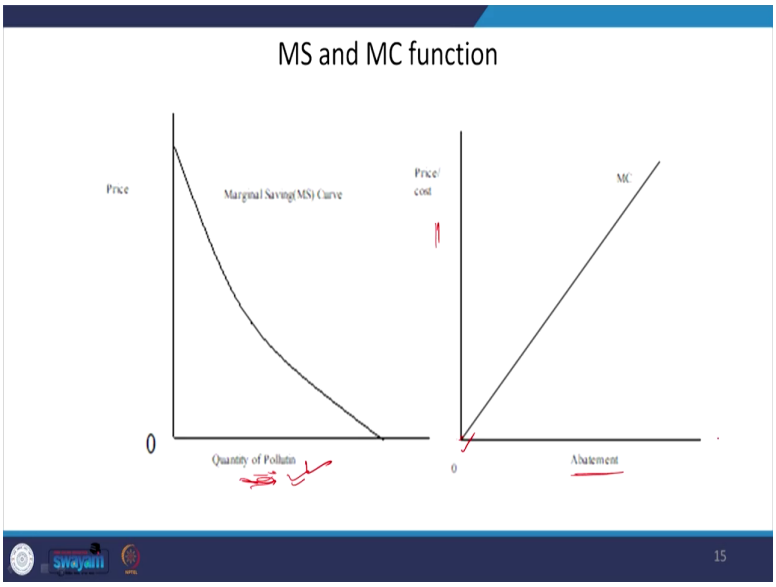

So, based on this understanding and rationality of marginal costs and marginal and marginal saving functions and their very features; we can say that is the marginal saving function will be having a negative slope and the marginal cost or marginal abatement cost functions will be having a positive slope, when it will be starting from the zero origin, right.

So, here we are measuring the abatement costs in the horizontal axis and the price in the vertical axis. So, likewise for the marginal saving function it is having a negative slope, when measuring the quantity of pollutions see; the unit of measurement is here different here we are measuring the quantity of pollution whereas, here we are measuring the abatement, right. The how we are abating the or reducing the pollution itself.

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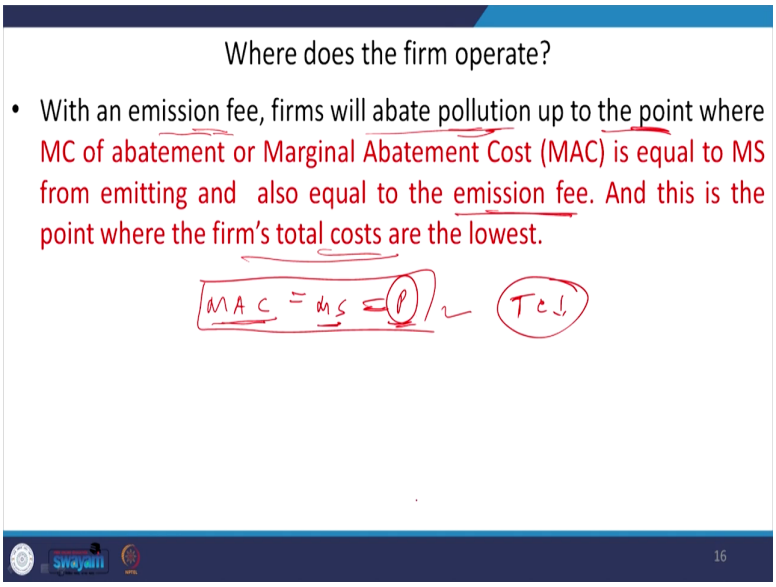

So, now after understanding this concept now, the next question that we need to see or ask is; where does this firm operate, at what point the firm will be operating? So, now we are saying that; when the emission fee or pollution fees their firm will be trying to abate the pollution. To what extend it will be trying to reduce or abate the pollution? So, it can continue to abate the pollution to the point where marginal cost of abatement, right. It is equal to the marginal saving from emitting one more unit of pollution and this must be equal to the pollution fee or emission fee.

When this condition is satisfied marginal abatement cost is equal to the marginal saving cost, saving function costs and which is equivalent to your emission fee. So, when this condition is satisfied we can say the firm can continue to abate till this point and at this point the firms total cost are the lowest one. So, the total cost of the firm will be the lowest.

So, in our derivation what we have discussed is; we showed the components if you can remember, we showed the components of the total cost function this is this portion. We showed the components of total cost functions right. So, this is the cost of the abatement and this is the pollution and tax will right we try to minimize the costs.

So, there we are finding this is the price is equal to minus of marginal cost. And, here after doing so, we just proved that; the polluting firm it can continue to reduce pollution or abate pollution till the point marginal abate abatement cost is equivalent to the marginal cost is equivalent to the price itself.

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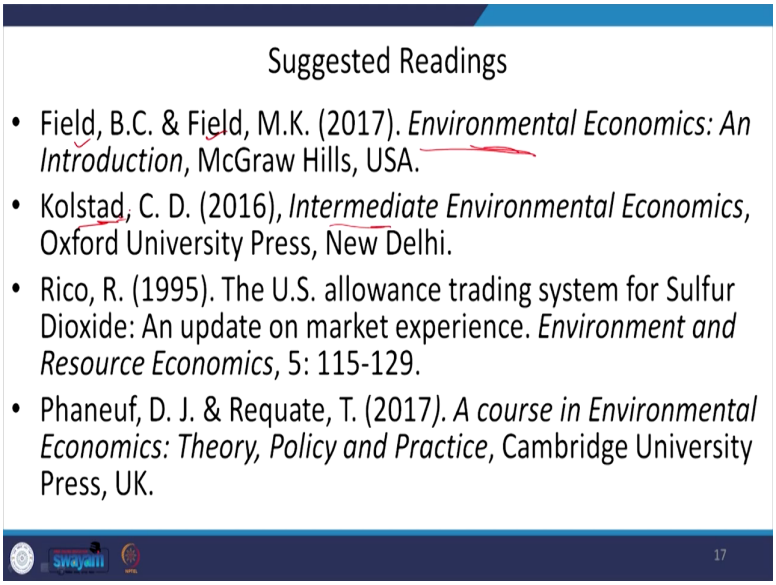

So, for this portion you can refer to this book. Environmental Economics by Field and Field, you can also refer to the this portion Environmental Economics by this is the basic reading, this is by Kolstad itself. So, in the next lecture we will be continuing from here there we will

be talking about the how this Pigovian fee or Pigovian tax is a special case of the pollution tax? It is not a pollution tax it is a special case of pollution tax.

And secondly, we will be discussing the second portion second mechanisms that is in terms of subsidies. Subsidies as the pollution may pollution fee.

Thank you very much.