Water Economics and Governance
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Lecture - 25
Pricing Water: Water Tariff Models

Hi, so in this last lecture of this week, we have been earlier talking about the different water tariff structures.

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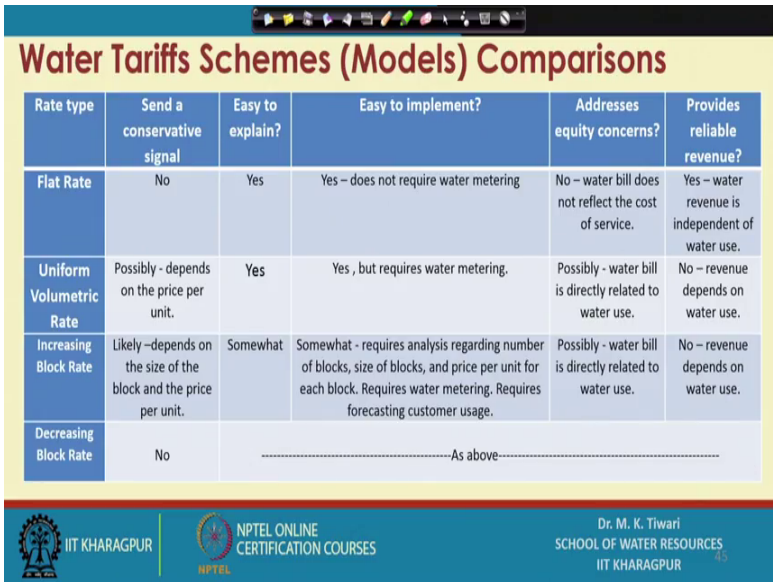

That is, this a comprehensive summary of the major ones, whereas the flat rate, uniform volumetric rate which is i bit which is uniform model and increasing block rate and decreasing block rate, which is IBT and DBT respectively. How, what are what kind of conservation signals they send whether it is easy to explain, easy to implement the address equality concerns or they provide a reliable revenues is summarized, we have already discussed this, so we will move ahead.

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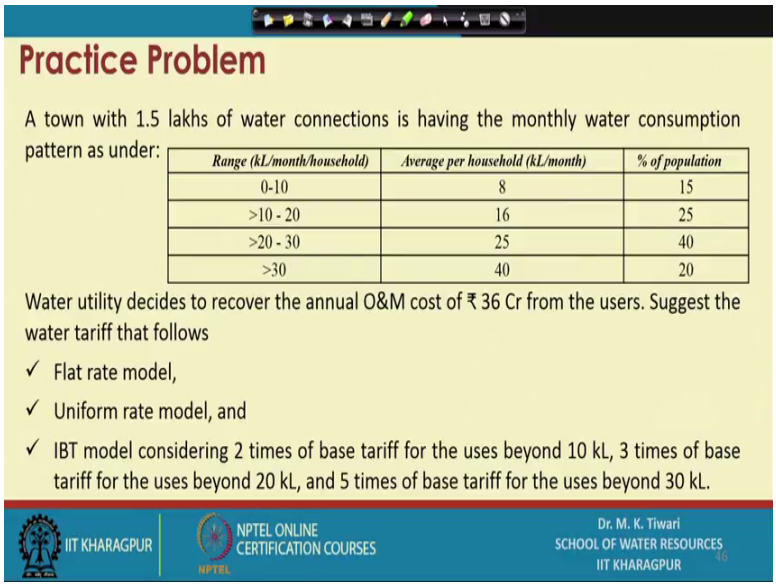

Now, you see the what this is a practice problem and example how the different water tariff structures can be designed. So, these are design problem where there is a town with a population of 1.5 lakhs and of their water consumption pattern is being given. So, the consumption pattern like there are fifteen percent of households consume between 0 to 10 with an average consumption of 8 kilo liter per month 25 percent of house household consume between 10 to 20 with an average consumption of 16 kilo liters per month.

Similarly, 40 percent of households consume around 25 kilo liters per month, while the rest 20 consumes around 40 kilo liters per month. So, the water utility decides to recover it is annual operation and maintenance cost, which is let us say coming around 36 crore from the users, tariff model is to be designed. So, how tariff model can be designed for a flat rate model, for a uniform rate model and for increasing block tariff, where 4 block tariff system is suggested that the consumption, the based tariff is made double for the consumption beyond 10 kilo liter, 3 times for the consumption beyond 20 kilo liters and 5 time for the consumptions beyond 30 kilo liter.

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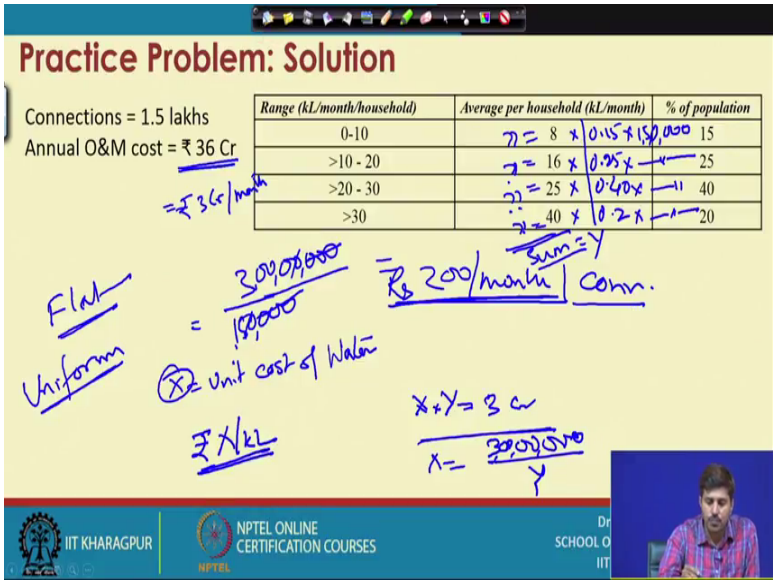

So, let us see how it can be done. The basic information, that we have at hand is the amount which needs to be recovered that is 36 crore is to be recovered in a year. So, 36 crore in a year makes of let us say rupees 3 crore per month. On an average there are total 1.5 lakhs of connections and the consumption pattern is given. So, let us start with the flat pricing system. So, for a flat price model it is fairly easy because you know that you need to recover 3 crore rupees in a month and that needs to be recovered from 1.5 lakhs customer or 1.5 lakhs customer the 3 crore rupees.

So, you make a division of this and you will get a per month price to be taken from each customer. So, if you see we can cut down the 3 0's over here 1 more goes away. So, it will boiled down to 200 rupees, rupees 200 per month per connection. So, it is fairly simple, the flat price system that how much amount is needed and how many connections are there, how many households are there because a flat price system will not consider the consumption or anything, the flat price does not by it is nature it does not consider the amount consumed by the individual customers; individual consumers.

So, for the flat pricing we do not need this table probably and what all is needed is how much amount is to be recovered and from how many number of customers it is to be recovered. So, you divide that you get a fixed price. So, each households will be sending a, will basically have to pay 200 rupees per month, that is going to be their water bill. Now, let us see the another other model which is the uniform. So, for a uniform tariff structure or uniform tariff model you will have a fixed unit cost of the water. So, let that unit cost of the water be x.

So, if x is the unit cost of water, now if x is the unit cost of water and we know that 300 crore rupees is to be collected in a month period, so that means, that the whatever is the consumption total kilo liters of consumption or total units of the conserve water which is being consumed, if we divide 300 crore with that consumption, we will get this x value, which is going to be the unit cost of water, which will eventually give us the total amount because if let us say y units of water is being consumed in a month so x into y has to be basically 3 crore.

Now, how much units are being consumed in a month that we can get from the table which is provided over here. So, 15 percent of population, so total population is 150000, so 15 percent of that population which will be of course, 0.15 times 150000 uses 8 kilo liters water in a month. So, that way you see the monthly consumption can be estimated which is going to be the 8 into 0.15 into 150000, which is the population 1.5 lakhs.

Here, it is going to be 16 the consumption is 16 into 0.25 into the population, this 25 into 0.40 because 40 percent of population using this into population and similarly 0.2 into the total population. So, when you multiply this, this is going to give you the total number of connection, there is not population in fact, because we can assume that the number of households in each person, number of households and the population is distributed in each household in a equitable manner. So, that way number of connection will translate to the percentage of population as well.

So, if you see that way, this is going to be giving us the number of connections, which is using 8 number of connection, which is using 16 number of connection, which is using 25 and number of connection, which is using 40. So, whatever is the values of these, if we sum this lets say this sum is y. So, the y is the total amount of water which is being consumed in a month by the entire town and x is the total cost of water which is, sorry not total the unit cost of water. So, x unit cost of water into the amount or the units of water consumed should give you the monthly recovery which is your target is 3 crore.

So, this way we can actually because y we will get from this table. So, this data we can utilize for getting a value of y and then x can be known as 3 crore divided by y, whatever the value of y we are getting. So, that way we will get the value of x and our uniform pricing model will say that charge each user at rupees x per kilo liter. So, like in flat pricing we get that 200 rupees per month, per customer. In the uniform price system, we

will say that charge each user at rupees x per kilo liter. So, that is how we can estimate this and this is the calculation for flat rate and uniform tariff models.

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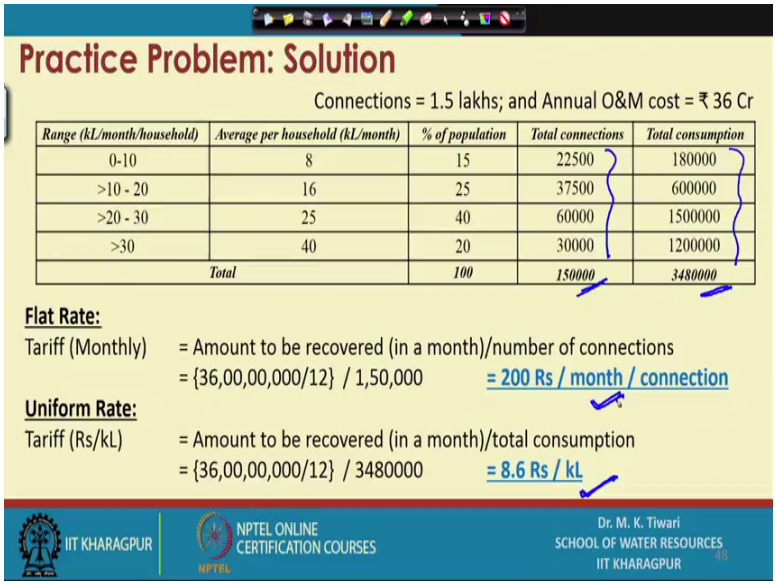

So, you see that the percentage of population, the total number of connections would be this, which again account for 150000 and the total consumption would be 3480000 kilo liters.

So, this is the total consumption, the tariff will be amount to be recovered in a month which is 36 crore divided by 12. So, eventually 3 crore, divided by the total consumptions and it is giving the 8.6 rupees per kilo liter as price, whereas earlier case the price was 200 rupees per kilo liter, so these were the simple ones. Now, what needs to be done for IBT model because increasing block tariff is relatively much more complicated or much more complex. So, that is for an IBT system, one needs to assume that different slabs with different rates.

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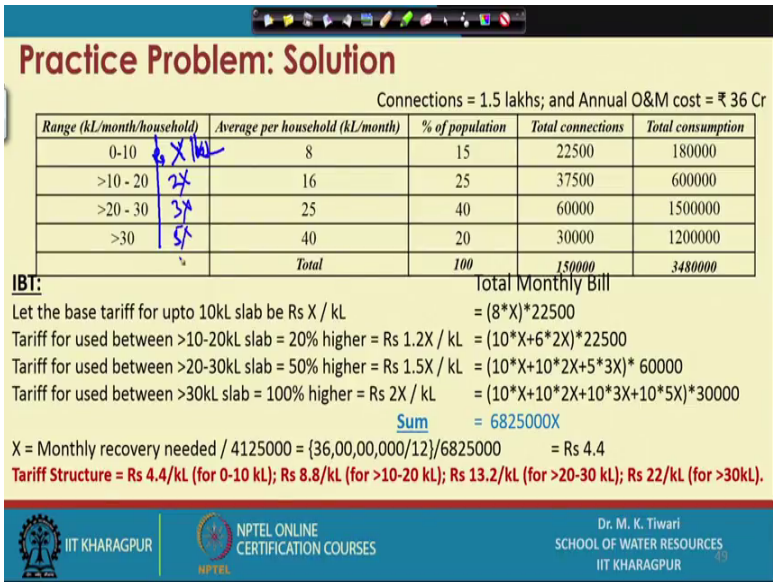

Now, the basic information is provided to us, that we have these slabs let us say this. So, these are the slabs for our IBT system. Now, if we assume that water tariff for this slab is x to 0 to 10 because that is our basic slabs. So, we can say that water tariff for this slab is x which is in fact, rupees x per kilo liter that way. So, water tariff for the next slab is given 2 times of that. So, it is going to be 2 x then for next one it is 3 times, so 3 x and the next one it is 5 times, so it is going to be 5 x.

So, for IBT system, we will have to consider that the different rates are to be put for the different slabs. So, as the problem has suggested that the rates for the basic slab is needs to be determined probably and then the tariff for the higher slabs could be 2 times, 3 times and 5 times as suggested in the problem.

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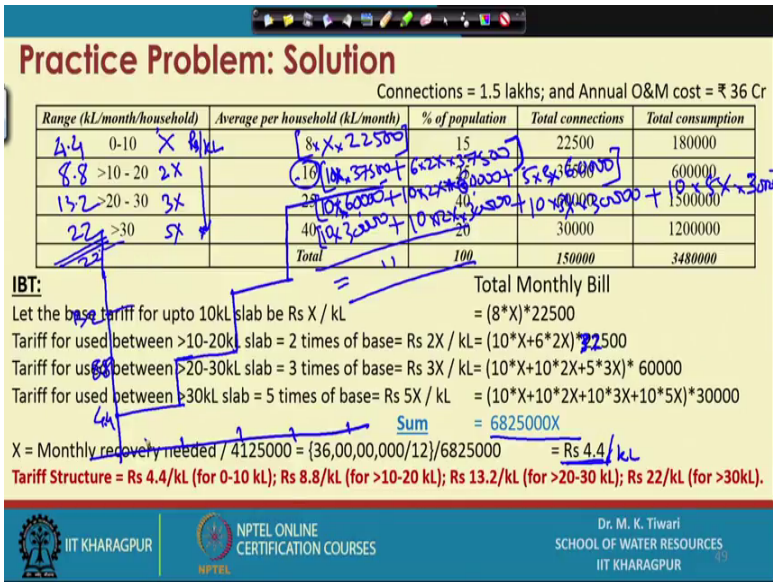

So, let us consider that rate for the basic tariff phase is x, then here obviously, rate is going to be 2 x, for this one it would be 3 x and here it is going to be a 5 x. So, all these rates are in rupees per kilo liter. So, that is the basic rate, which is to be fixed in a IBT model. Now, how do we determine x? What we know that the total recovery is to be done in a month is 3 crore rupees and the consumption data is provided to us.

Now, you see that the, if tariff for this first slab is x those households like this 22500 connections, which are having in average per household consumption as 8 and there consumption is in fact, less than 10. So, they are going to be charged only at the basic slab and charges for them is going to be 8 times x and the total amount that will be generated will be equal to if you multiplied with the number of connections which is 22500. So, 8 x plus 22500 is going to be the amount recovered from this slab, if our tariff is x.

For next slab, when our tariff is 2 x what is going to be the amount recovered from the next slab? So, amount recovered from the next slab for these 37500 connections is their uses are between 10 to 20 and their average consumption is 16. So, when the average consumption is 16 means the first 10 kilo liter of the 16 consumption. So, the first 10 of the 16, is going to be charged at the basic rate, so that means, that 10 x into this number of connections 37500 will be there plus the next 6 because the first 10 has charged at a

basic slab rate, the next 6 is going to charge at a 2 x rate. So, next is 6, 6 into 2 x into the number of household.

So, this 10 x into 37500 plus 6 into 2 x into 37500 is going to be the total amount recovered from this slab, similarly for the next one, when there it is 25 you see that the 10 x again is going to be charged for these 60000 household, is going to be charged at 10 for the first 10 liter is going to be charged at x rate, then next 10 is going to charge at 2 x. So, 10 into 2 x now, plus sorry 10 into 2 x into this 60000 number of household plus there would be another component coming for the additional 5 units, so 5 into 3 x now, because for this slab prices are the 3 x, so 3 x into number of households.

So, all this total amount will be recovery from this slab and similarly for this slab also will have 10 x into the 30000, which is the customer number plus again 10 into 2 x and into 30000 which is the customer count plus again 10 into 3 x because for this slab also 10 will be deducted. So, 10 into 3 x into 30000, which is the customer count and the additional beyond 30 their uses are 40. So, they have additional 10 which is to be paid at 5 x into number of consumers.

So, this entire total, this way is going to be coming from the forth slab people. So, the total recovery can be obtained by adding these. So, that is what is being done here. So, if it is 8, so 8 x into the number of customer, if you see number of customers for a particular slab is constant, so that can be taken out. Then you have 37500 customers in the next slab. So, their uses is going to be 10 x plus 6 into 2 x, similarly 10 x plus 10 into 2 x plus 5 into 3 x, 10 x plus 10 into 2 x plus 10 into 3 x plus 10 into 5 x with that number of customers. So, if this entire exercise is done, the total sum is coming out to is this value.

So, 6825000 x is the total revenue, that would be generated if the basics slab price is kept at x in this model. Now, we know that the total revenue generated has to be 36 crore by 12 so that means 3 crore. So, if we divide 3 crore by this number and we get the value of x as rupees 4.4, of course per kilo liter. So, this rupees 4.4 per kilo liter is going to be our basic price. So, our tariff structure would be for this it is going to be 4.4, then for this it is going to be a double of that means 8.8, then triple of that means 13.2 and then 5 terms of that means 22. So, that is going to be our IBT solution for this particular case and if

graphical tariff structure is needed, it can be designed like this that for if let us say 10, 20, 30, 40.

So, for first 10, we have 4.4, then double of this, so 8.8 here up to 20, then triple of this that is 13.2 for 30 and then beyond 30, for 40 it is going to be 22 onwards. So, this is going to be the IBT structure for the given problem and this is how we can design pricing structure for IBT system, earlier we did see the uniform system and a flat rate system, they were relatively simple, but this is how IBT system can also be design.

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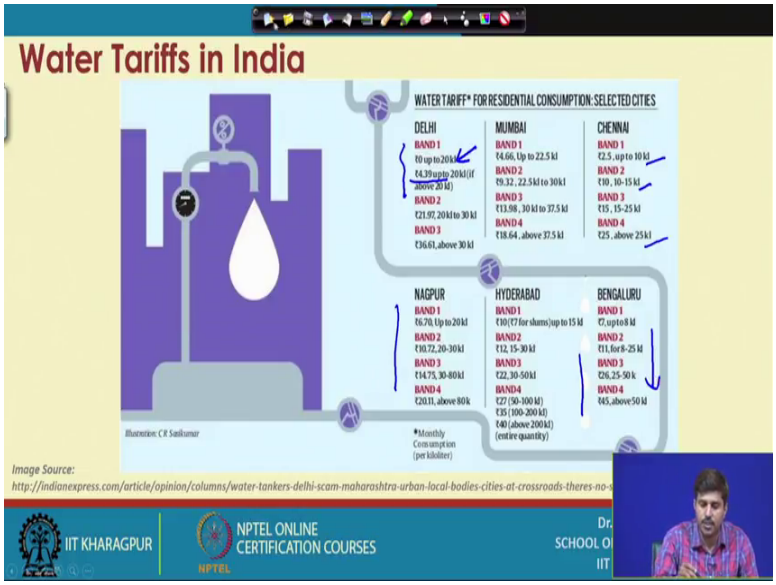

Moving ahead, so we have talked about the water tariff structures. Now in India, if we see the for section which are metered generally increasing block tariff is the model which is being followed and which makes sense also because white make sense because we are such a country that the a large chunk of the population comes from a lower income group. So, the affordability is a major criteria for water. So, for the sake of affordability we cannot keep water price is very high and that is why, if we keep the first slab or the basic minimum slab at low levels so that the we can supply water in a affordable fashion to the needy people.

So, that would serve one purpose, whereas we are on the verge of being waters scare country also, so there is water stress country. So, there is a issue related to the water conservation and if we can penalize the higher consuming units or higher consuming households with some additional charges, that will probably produce a signal to lower

them their water consumption. So, if that way water can be saved, it is further going to be the helpful for the society. So, we need affordability plus we need the water conservation or water saving philosophy which typically we can say the demand management aspect which is can be better monitored through IBT kind of system.

So, if we go on to the demand management aspect as well, we need to manage our demands judiciously at the same time we need to ensure that water is available in a affordable prices to the needy people. So, IBT would be a nice structure for Indian cities or for any cities which is having a population variation that way, where there are people who can pay higher prices. However, the major chunk of the society needs water at a lower and prices at affordable prices.

So, that is why wherever the connections are metered generally IBT is the concept which is being used, whereas for the major towns because the connections are not metered generally flat prices are being used, so as we have discussed this earlier. This is the water tariff structure for residential consumption of the selected cities. So, for example, it can be seen for Delhi, so in Delhi there is 3 band structure, whereas band 3, Delhi is a unique case because of for the political reasons it has be the first 20 kilo liter water consumption has been made free, but there is a glitch that if it will be free only if the consumption is up to 20 kilo liter.

If the consumption exceeds 20 kilo liter, the price is to be charged at the rate of 4.39 per unit, per kilo liter for the first 20 kilo liters and then there is a second band with charges around 22 rupees up to 30 kilo liter from 20 to 30 and at a rate of 36.61 rupees for the rates above for the consumptions above 30 kilo liter. Mumbai metered connections follow 4 band system, where 4.66 is the basic slab up to 22.5 kilo liter, 9.3 is the second one which goes up to 30 kilo liter and then similarly, Chennai again the prices are very low for the first 10 kilo liter 2.5 rupees, then 10 rupees per kilo liter for 10 to 15 and beyond 25 it is 25.

Nagpur water prices are also given here, Hyderabad, then Bangalore we already seen example in the last session. So, that is how the pricing system is there in some of the Indian towns, Indian major cities in fact, major cities.

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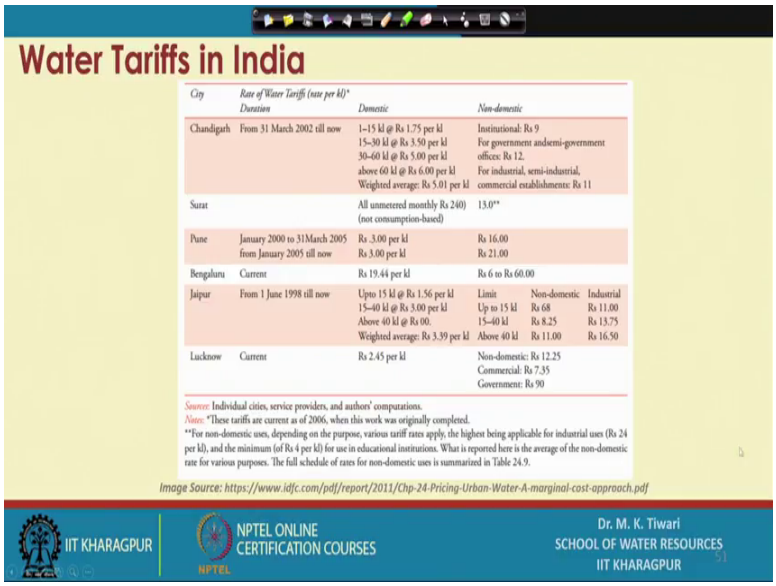

For a few small towns like Chandigarh, Surat, Pune Bangalore, Lucknow, again there is a different range and different type of classifications. Lucknow, there is uniform price for domestic customers, which is 2.45 rupees per kilo liter, in selected areas only entire of these cities are not metered in the Lucknow or Jaipur, any of these cities are not metered entirely.

So, Bangalore also some sections pay at rupees around 20 per kilo liter, again in the selected area because many places there is a IBT as we have seen earlier. Jaipur, there are water rates are given based on the consumption per kilo liter, again IBT kind of model, then Chandigarh also there is a IBT kind of models. So, this type of information is available at different sources and as we were discussing that in India at places where there is a metered connection generally consumption based tariff systems are installed, whereas for all other places either it is free or it is flat price models are being employed for the pricing water.

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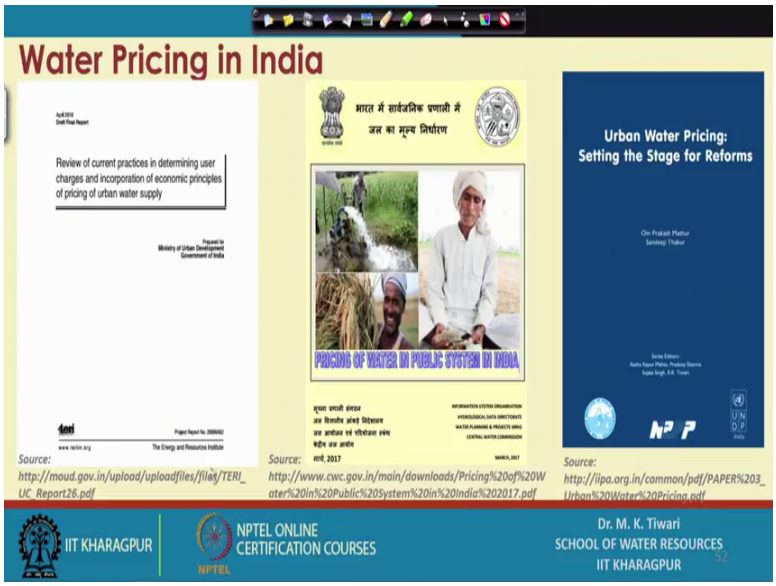

There are few documents available, which talks about the pricing in India in a comprehensive way, released from the different sources mostly the; so 1 you see that, there is a terry report which was done for the ministry of urban development, which reviews the current practices in determining user charges. This primarily considered 6, 7 cities including Bangalore, Delhi, Chennai most of the metros in fact, so their pricing is studies in here in the detail. There is another document, which is from the npfp, which talks about the again urban water pricing and the reform which was done for United Nations development program report.

There is a recent, this 2017 released report by the government central water commission, which talks about the pricing water in public systems in India and here the major focus is on to the agricultural sector. In agricultural sector, though most of the prices are taken based on the hectare of irrigation lands, so whosoever is irrigating certain amount of land using a canal system, the charges are basically collected based on that way or in for let us say government tubals and those operate on a per hour basis.

So, if you were asking a tubal to operate from this to this hour, so you will have to pay that much charges for pumping that water into your field; into your agricultural field, so those sort of price says or tariffs are followed in agricultural sector.

Over all, the concept of water pricing particularly is little complicated because it involves financial aspects, social aspects, equitable aspects and at times environmental

aspects as well and in holistic way it needs lot of understanding in order to come up with a sustainable pricing structure. So, with this, we will end this week's discussion over here.

Thank you.