Water Economics and Governance
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Lecture - 05
Water Use Practices and Major Challenges

Hello everyone. So, this is the last lecture for this first week throughout this week we have been primarily discussing about the different aspects of water availability and uses in Indian as well as in global prospective.

In the last lecture we did talk about the status of water availability, water with holding capacity of the rivers, in the form of surface water then, how much water is available in the different catchment areas of various major rivers, how they feed how the per capita availability is distributed in the various river basins? Then we did talk about this status of groundwater availability as well into the different states.

So, we will take forward from there in this last session of this first week which was primarily focused onto the introduction part and water availability and uses part. So, we are going to talk about what are the major critical issues and challenges in the water sector that we will of course, keep our focus mostly onto the India. So, what are the major issues and challenges onto that we are going to face and what are the basic water use practices or water issues in India.

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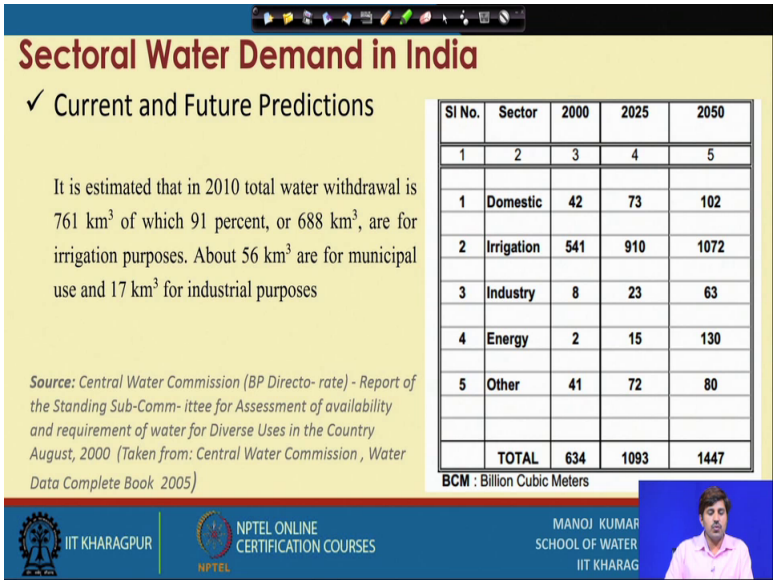

So, starting with that Sectoral Water Demand in India we have briefly touched this earlier as well. So, if you see the numbers we are going to see significant amount of increase in the sectoral water consumptions in India like for example, in domestic sector this is the estimates done by central water commission based on it is sort of subcommittee that was found for assessment of availability and requirement of water in the country.

So, it was done in 2000 and the estimated domestic use which was in 2000 billion 2000 was 42 billion cubic meters is likely to increase to 102 by 2050 which is more than double, almost 150 percent increase. In irrigation it is again going to be almost double by 2050 although the major increase if you see in irrigation is actually in this first half of that 50 years. So, from 2000 to 2050 the irrigation requirement is expected was predicted to grow enormously we have covered more than half of this phase. However, there is no real assessment up to date assessment probably available. So, if we go by this number that is what we see here and the by 2050 this is expected to increase little further to around over 1000 billion cubic meters.

Industrial growth is one of the most significant demand in terms of increase in the percentage. So, that is also expected to increase to multifold there is going to be additional requirement of water in energy sectors which earlier was largely not considered. So, with this kind of requirements it is expected that we will be sort of if you see number in 2000 total demand or total requirement, in different sectors is estimated at 634 billion cubic meter is likely to increase to close to 1100 by 2025 and around 1450 by 2050 this is the government estimates. The important point over here is that in 2010 the intermediate information that is available. So, water withdrawal total water withdrawal was 761 kil cubic kilometers of which 90 percent 91 percent was used in irrigation purpose 56 kilometer cube of water for municipal and just 17 percent for industrial purpose.

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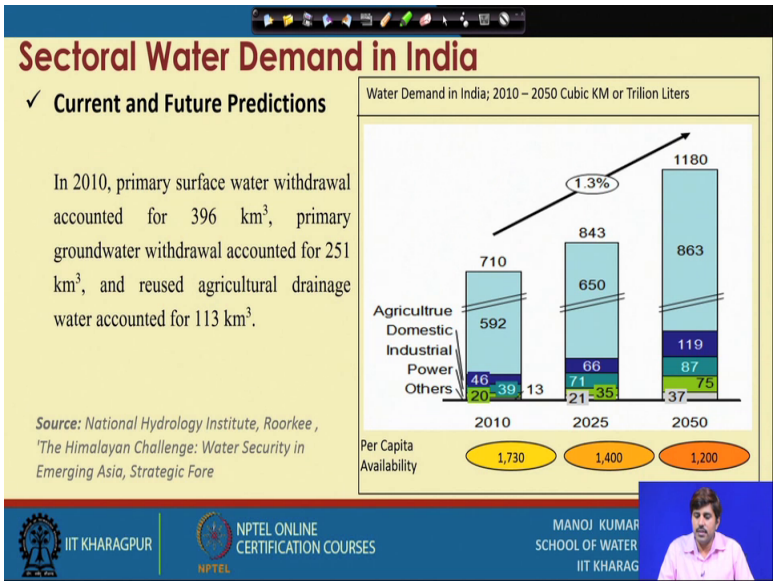

There has been similar assessment done by other agencies also the one that you are seeing is from the NHI Roorkee, which is National Hydrologic Hydrology Institute these you see here again, the growth is almost 1.3 percent in the water sector total overall growth from 2010 to 2025 to 2050 although their numbers estimated are smaller when you compared it with the other one. The interesting point here is actually the per capita availability if you look at the per capita availability. So, based on the water availability our per capita availability in 2010 is 1730 which is likely to decrease to 1400 by 2025 and 1200 by 2050.

So, by international norms we are on the verge of mean water stressed country as the 17 less than 1700 the zones with less than 1700 what cubic what elemental water availability are considered as water stressed. So, we are already on the verge of there and slowly increasing towards water scarce country on a overall basis.

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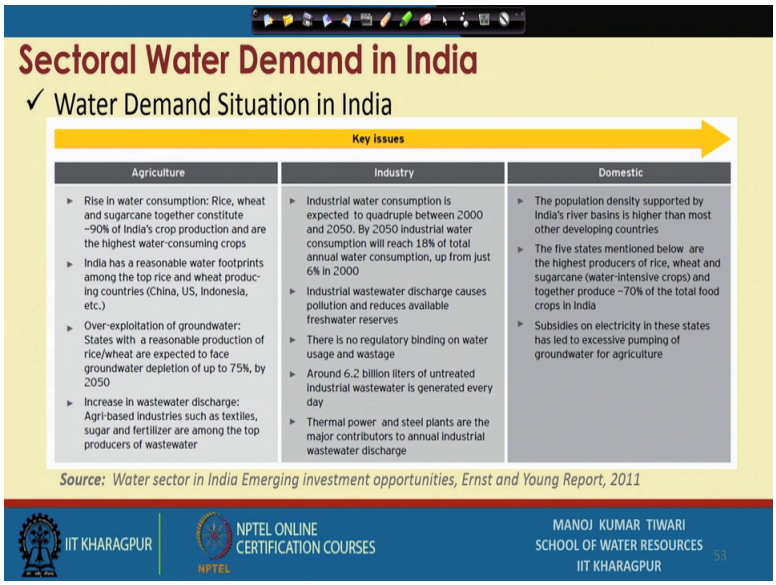

The demand situation in India is actually if you see the various important issues which are sort of controlling these demands or needs to be managed. So, in agriculture sector there is rise in water consumption, because of the various water intensive crop like rice wheat sugarcane, which sort of covers the 90 percent of India's total crop production and these are the most water intensive crops

So, we are more into the growing up of water intensive crop and that is why the agricultural water demand is so high and if we do not if we do not sort of come to proper water management techniques water management practices in agricultural sector controlling this demand is very difficult. Then there is sort of India India's footprint water footprint among the top rice and wheat producers, which is China, US, Indonesia. So, India is also up there in the list with a very high water footprints by for the production of these crops the agri based industries including fertilizer industries, pesticides, sugar and all that are also the top producer of waste water. So, when we talk about the water management in a holistic way component of waste water is should also be given due importance because that is also a form of water which needs to be managed

If it is not properly it is not about just agriculture sector that is the case with industry as well as domestic sector. So, if our waste waters are not being properly managed are not being properly controlled either discharged or utilized in some or other fashion, it becomes another problem and going by the current practices the waste water either from

industries or from the domestic sector urban sector is mostly is mostly discharged into the river body. Now it may be partially treated it may be untreated at times it is fully treated also; however, what quality is the outflow water even after the full treatment is needs to be monitored. So, with these kind of situations when we are actually releasing lot of wastewater that is going into our water bodies, when you discharge industrial effluent into the water it eventually spoils the quality of the water in the receiving body as well our major rivers has been victimized because of primarily receiving the urban municipal and industrial discharges.

So, the condition of the overall major rivers be it Ganga, Yamuna, whatever we talk about. So, all sort of if you see the Ganga it receives. So, much of industrial effluent as well as urban municipal effluent from Kanpur, Allahabad, Varanasi, Patna, so, all that it is actually the fresh water getting withdrawn from for various purpose and wastewater getting release into these bodies are making the situation even more worse. The point is that this wastewater if properly manage can actually be considered as a resource as well an alternate resource of water. Otherwise, indirectly it is a resource because it if you are discharging it into the river or nature it is somehow coming into the water cycle maybe eventually reaching you after some time, but the point is that untreated waste a little amount of untreated waste can pollute a large water body.

So, that is what is happening if we can treat that small amount of wastewater relatively small in comparison to the flow in the rivers. So, if we can treat that waste water coming from the industries or domestic sector and utilize it for some alternate water use applications. So, that way we reducing the stress onto the natural water bodies at the same time we are we are sort of not adding pollutant to them. So, that way we are protecting them qualitatively as well as quantitatively; qualitative production, because we are not adding pollute pollutant to them quantitative production because that is reducing the our dependency on those river bodies as we can use the treated water and for this agriculture for this irrigation purpose or horticultural purpose or some industrial application or non-potable application any of the non-potable applications.

So, coming back to the issues this increase so, increase in the wastewater discharge so manage of these discharge is also one of the major challenges which is there in the industrial sector as well as domestic sector apart from agriculture sector. The agriculture sector particularly it is more crucial, because the major runoff coming from the field

agricultural field is very difficult to tap they are nonpoint source pollutants, because we can easily get a municipal discharge through sewage system if it is collected treated partially treated or fully treated. So, we can manage that because it is at one specific point in we can treat that put that to reuse recycling discharge whatever.

Same with the industry the industrial outlet is fixed at a point, but agricultural runoff is not fixed at a point; agricultural runoff is generated from a huge agricultural field. So, until unless we have some natural alignment where it is collected at one single point or we engineer some approach some way to channelize that water to one particular point, which is very difficult task because we are talking about huge agricultural fields and that too in the soil. So, quite a few water gets percolated to the groundwater quite a few water through runoff actually reaches to the near water bodies at different locations at different junctions in very small quantities. So, quantity is small and spread is large. So, this kind of runoff management becomes very difficult in qualitative terms industries industrial water consumption is again expected to be around 4 times by different agencies that way. So, it is, but that is everyone acknowledges that that it is going to increase grossly.

So, there is a huge increase is expected in industrial water consumption in and the discharge of the pollutant in the industries as we were discussing earlier for the agricultural sector. Similarly the industrial discharge wastewater discharge management is another critical point. Now if you compare the waste discharge from domestic sector or agriculture sector or industrial sector generally the characteristic of the waste that is that typically comes out of an industry is much harmful or much difficult to treat when you compare it with domestic or agricultural sector. Industrial sector could have a lot of industrial pollutant emerging pollutant and all that which typically are not removed from the conventional wastewater treatment systems.

So, the management of industrial effluent or industrial wastewater discharge, which causes pollution to the freshwater reserves or freshwater bodies where it is discharged, is another very critical challenge that we are facing now. There is no regulatory binding on water uses and wastage in industries, now some formulation some rules are coming up that industries has to be 0 waste discharge kind of industries the water that they are getting has to be basically recycled water they need to put in practices in order to minimize their water consumption the water audits are being sort of enforced nowadays, but still these are under process and there is no hardcore regulatory binding onto how

much water industry is allowed to use and how much water it can actually waste or discharge this kind of stuff is actually lacking in Indian law and regulations.

There is thermal or steel kind of industries which are major contributors to the annual industrial wastewater discharge which is around 6.2 billion liters of untreated industrial wastewater that is generated every day in India. The domestic sector again the first foremost issue is the population growth because population is increasing population density is increasing and with limited amount of water availability or limited amount of water resources, the per capita availability is decreasing while with higher and higher living e standards that the way people are adopting our water demand is increasing. So, it is a 2 fold problem the population increasing, demand increasing whereas, the population increasing is leading to the leading to the loss or leading to the reduction in per capita availability; however, the demand per capita demand is increasing.

So, per capita availability is decreasing per capita demand is increasing it is very difficult scenario that we are actually facing. The several states which are actually under severe water crisis last year we have heard cases from the Maharashtra extreme sort of water scarcity scenario, Latur and all that regions water is to be transported from trains. So, Rajasthan it is usual practice many parts get dry and then there are trains and these kind of setups are made to transport water to those areas. So, we are into that scarce situation for some particular states these needs to be addressed and this one of the very critical challenges.

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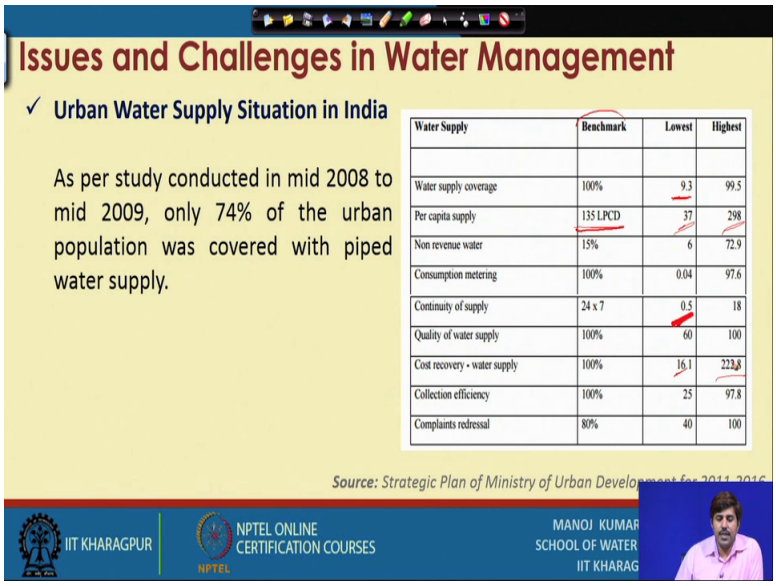

Now coming specifically onto the urban water situation in India if you see so the management of water particularly the water supply here we are talking about. So, this table that you are seeing is as per the Ministry of Urban Development under their strategic planning.

This if you see here the Benchmarks that are set and what is the lowest and highest standing under these different categories, like the our government the ministry wants 100 percent water supply coverage that is their benchmark. So, each and every citizen should be fed with water supply. However, across different cities studied under class 1, class 2 towns and all that incorporating everything. We have lowest coverage area as low as around 10 percent. Although there are almost 100 percent water coverage cities are also there where the full population full urban population is actually covered under piped water supply, but we have towns which has as low as 9.3 percent population served from the piped water supply and rest of that does not have water supply coverage.

The per capita supply the as per the cpheeo standard is one thirty 5 IPCD means 135 liters per person per day should actually be supplied. Now here also if you see the lowest supply is 37 liters per capita per day while highest is 298. Now this 298 number also is average of cities if you go deep down into the cities you will see the different sectors in a city gets different water supply. For example, in Delhi the if you see the per capita consumption for a person living in Dwarka is of the order of 400 500 liters per capita per

day while in the other sector or some slum areas of the capital you will see that per capita supply is barely 40 50 liters per capita per day.

So, on an average a city average will reduce, but the discrepancy is too high within a city also and across the city also. So, you can see the average in a city at times can fall as low as 37 per capita per day while high 3 3000 sorry 300 IPCD liters per capita per day. The non-revenue water we will talk about this in detail what exactly is non-revenue water in future classes, but just to brief that non-revenue water indicates that water at which we are not getting any bill we are not getting any tariff or we are not generating any revenue on that water. So, non-revenue water is to be reduced to 50 percent 15 percent means we want to have our 85 percent water generates some sort of revenue; however, it again varies from as low as 6 to around 73 percent.

So, 73 percent non-revenue water means that that again is a average and there is this is older data now you will see that many places. In fact, in Delhi the water has been made free for up to certain consumption. So, that is totally non-revenue water we are not generating any revenue on that. So, that will be actually even higher could be the metering, benchmark is 100 percent that all the consumers should be metered; however, the metering status is very very poor only few cities and that too in the sectors of few cities have metering for a small towns like in some places in Karnataka, Hubli, Dharwad places in Jamshedpur then we have Nagpur. And these places the consumers are metered quite a few in Delhi, but most of the city there is no metering at all. So, that is why you see that metering is almost negligible the continuity of supply or supply hours again. So, varies from 0.5 to 18 hours per day whereas, the benchmark is to 24 7 water supply means round the clock water supply 24 hours, but at places we get just half an hour supply per day on an average basis.

Quality of supply in terms of index so we want the benchmark is 100 percent quality, but it is indexed between 60 and 100 percent cost recovery is again not very attractive situation at few places. So, as low as 16 percent cost is just being recovered whereas, at other places there is a huge profit making very more than the cost recovery the collection efficiency varies from 25 to close to a 100 percent and complaint redressal again varies from 40 to 100 percent. So, the as per the study conducted in 2008 to mid-2009 only 74 percent of urban population was covered with pipe water supply in India that is what has been observed.

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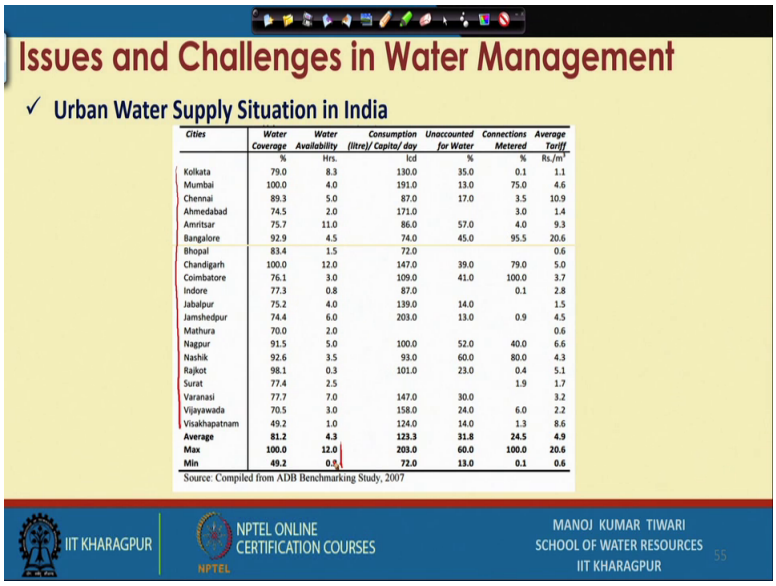

Cities	Water Coverage	Water Availability	Consumption (litre)/ Capita/ day	Unaccounted for Water	Connections Metered	Average Tariff
	%	Hrs.	lcd	%	%	Rs./m^3
Kolkata	79.0	8.3	130.0	35.0	0.1	1.1
Mumbai	100.0	4.0	191.0	13.0	75.0	4.6
Chennai	89.3	5.0	87.0	17.0	3.5	10.9
Ahmedabad	74.5	2.0	171.0		3.0	1.4
Amritsar	75.7	11.0	86.0	57.0	4.0	9.3
Bangalore	92.9	4.5	74.0	45.0	95.5	20.6
Bhopal	83.4	1.5	72.0			0.6
Chandigarh	100.0	12.0	147.0	39.0	79.0	5.0
Coimbatore	76.1	3.0	109.0	41.0	100.0	3.7
Indore	77.3	0.8	87.0		0.1	2.8
Jabalpur	75.2	4.0	139.0	14.0		1.5
Jamshedpur	74.4	6.0	203.0	13.0	0.9	4.5
Mathura	70.0	2.0				0.6
Nagpur	91.5	5.0	100.0	52.0	40.0	6.6
Nashik	92.6	3.5	93.0	60.0	80.0	4.3
Rajkot	98.1	0.3	101.0	23.0	0.4	5.1
Surat	77.4	2.5			1.9	1.7
Varanasi	77.7	7.0	147.0	30.0		3.2
Vijayawada	70.5	3.0	158.0	24.0	6.0	2.2
Visakhapatnam	49.2	1.0	124.0	14.0	1.3	8.6
Average	**81.2**	**4.3**	**123.3**	**31.8**	**24.5**	**4.9**
Max	**100.0**	**12.0**	**203.0**	**60.0**	**100.0**	**20.6**
Min	**49.2**	**0.3**	**72.0**	**13.0**	**0.1**	**0.6**

Now, if you see this is a information compiled from Asian development bank benchmarking studies. So, they took several cities the cities are listed here. So, you can see these are the cities that they considered and they evaluated based on the water coverage water availability consumption unaccounted for water, which is again the water a form of water loss then metering status and average tariff the interesting observations are if you see the variation across the cities. So, you see here that water availability in terms of hours supply of hours is from 12 hours means almost very good amount of time half a day to just 0.3 hours ok.

Similarly if you see the water tariff rupees per meter cube. So, that again varies from 20 rupees per meter cube to 0.6 rupees which is almost negligible that way. So, we have this information you can see Chandigarh is all Chandigarh and Mumbai are supposed to have the 100 percent water coverage whereas, there are places as low as 50 percent just 50 percent water coverage in vizag. So, this situation would have been improved by now because this is data from 2000 and 7 as you can see and compiled from a Asian development bank.

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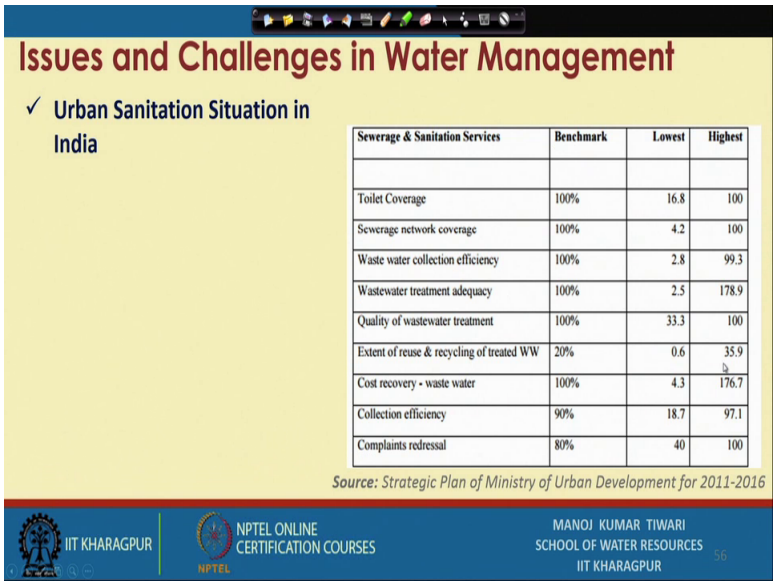

Sewerage & Sanitation Services	Benchmark	Lowest	Highest
Toilet Coverage	100%	16.8	100
Sewerage network coverage	100%	4.2	100
Waste water collection efficiency	100%	2.8	99.3
Wastewater treatment adequacy	100%	2.5	178.9
Quality of wastewater treatment	100%	33.3	100
Extent of reuse & recycling of treated WW	20%	0.6	35.9
Cost recovery - waste water	100%	4.3	176.7
Collection efficiency	90%	18.7	97.1
Complaints redressal	80%	40	100

Study the sanitation situation is even worse actually if you see. So, the sanitations a similar study by the ministry of urban development results, that the toilet coverage which is to be 100 percent is as low as 16.8 percent.

Sewage network coverage is as low as 4.2 percent wastewater collection efficiency is again as low as 2.8 percent at places the treatment adequacy is 2.5 percent as wastewater treatment adequacy as low as 2.5 percent of course, there are few cities doing fairly good. So, you will see these numbers of the order of 100 percent and that way the reuse and recycling is almost negligible at most of the places only if you places. So, highest is that you are seeing is around 35 others you see here are very low number 0.6 the cost recovery is again the cost recovery of sanitation is even worse than the water sector so 4.3 percent of the order of 4.3 percent.

The collection efficiency and complaint redressel are all the we are basically lacking in all the parameters at most places the highest number suggests that yes we are doing fairly well, but that is just cases from 1 or 2 places most places this situation is very alarming.

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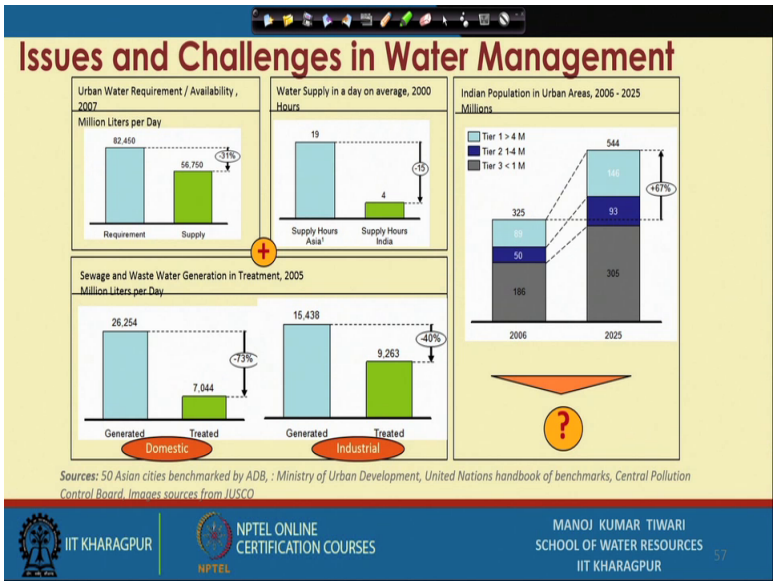

If you see the major challenges so in terms of urban water requirement this is again from 2007 data mostly compiled from the ADB study and then some data from the ministry of urban development and all that. So, if you see they require the urban water availability versus requirement. So, we are 30 percent short than the requirement in terms of supply water supply in a day. So, timely basis if you see the Asian average is 19 hours whereas, Indian average is actually 4 hour even. In fact, less than that so we are a good around 15 hour short in the sort of Asian average in terms of supply hours.

Sewage and wastewater generation and treatment if you see in the domestic sector we generate 26 million 20 over 20 6000 million liters per day whereas, we could treat only 7000 minion liters per day there is a huge 73 percent gap into the capacity of domestic sewage treatment and there is a around 40 percent gap in the capacity of industrial sewage treatment. So, these are the sort of major challenges.

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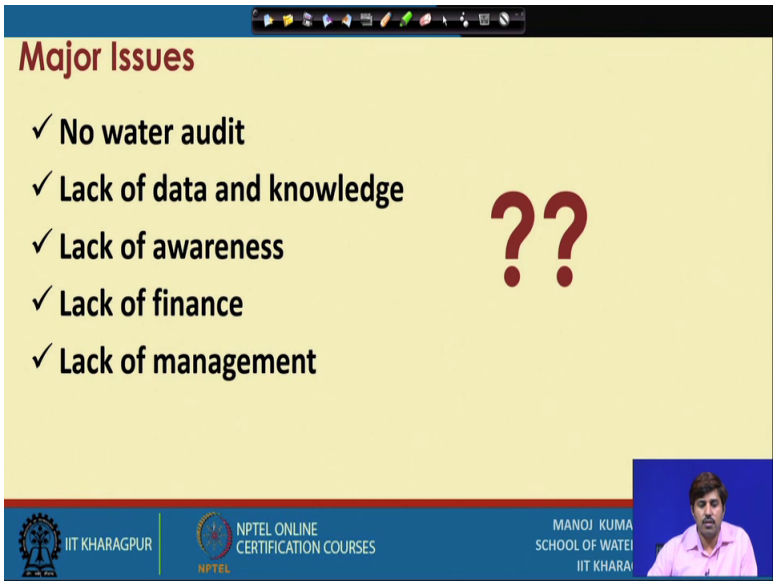

Now, if you see the major issues that we are facing if you want to address these problems, the first one is there is no proper water auditing, we do not have data the data that you are seeing of 2007 and all that is almost a decade old. So, there has to be proper auditing water auditing there has to be proper information proper data of each and every even if it is there it is not shared on public platform. So, it is very difficult to get to know the actual status actual status on that particular time or that particular year is very difficult. Because at most places there is no water auditing is done no water data is stored. And if you do not have data if there is a lack of data lack of knowledge of what actually is happening in the field one cannot make a good policies one cannot come up with a redressal plans. So, that is one place where we are largely lacking.

There is lack of awareness because we have not been so that much serious about the water management issues for so long. Now there has been agitations about the river cleaning and all that, but nobody is still not many people talk about saving water into different applications not many people talk about the water saving in agriculture, how we can develop agricultural techniques with less water requirements. There is not much talk about the improvement of industrial process and reducing of water footprints there is not much talk not much awareness about the reduction in the domestic consumption there is we do not talk about the pricing and all. So, there is a lack of finance also.

So, because the sector needs huge amount of investment and government may not be willing to invest that much. So, how to manage that finance, how to incorporate the private sector or public sector or how to ensure the financial sustainability of these processes is another major challenge, and of course there is a lack of management what so ever resources what so ever amount finance what so ever knowledge what so ever is skills we have, but still that is not also being totally managed due to the due to the improper management practices and various interventions. So, these issues needs to be addressed round and squared and we will be throughout this course we will be talking onto some of these points we will be addressing some of these points.

And with this we end up the session.

Thank you all.