Water Economics and Governance
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Lecture - 03
Water Availability and Uses in India

Welcome. In the earlier lecture what we were primarily talking about was the global water distribution and uses.

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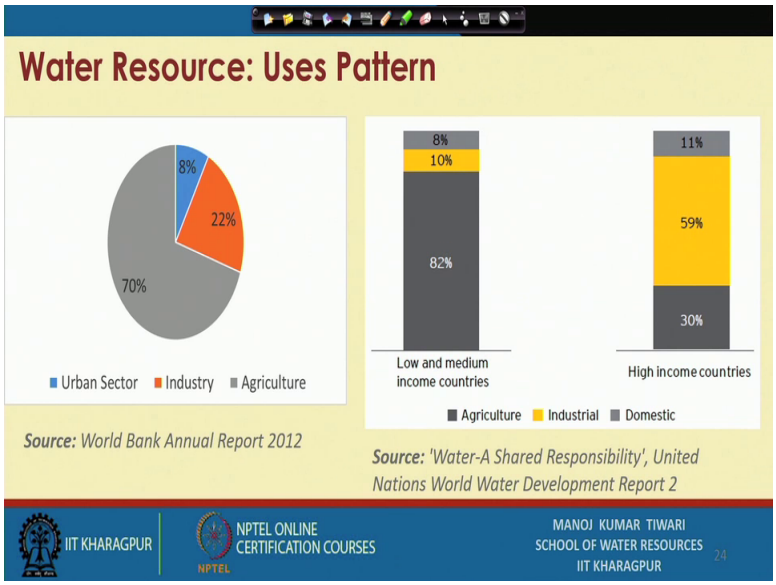

If you recall, we ended the session when we were talking about the how the water uses changes when we move from low and medium income countries to higher income countries.

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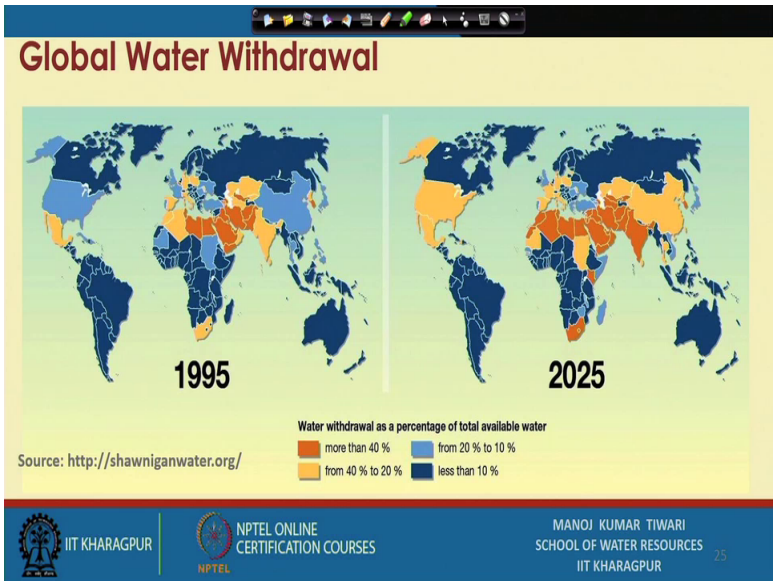

So, that way this is what we were discussing you see the global water withdrawal, again these are the estimated number available at a website. So, it suggest that the water withdrawal as a percentage of total available water, because of the higher availability of water is less than 10 percent in many of the European and this zones 20 to 10 percent rangers; whereas the area that are more critical in terms of water availability and all that.

So, if you see the estimated number for 2025 says that around annual water withdrawal or the percentage of water withdrawal totally would be more than 40 percent or in India and of the order of 20 to 40 percent in the China in this zone that you can observe over here anyway.

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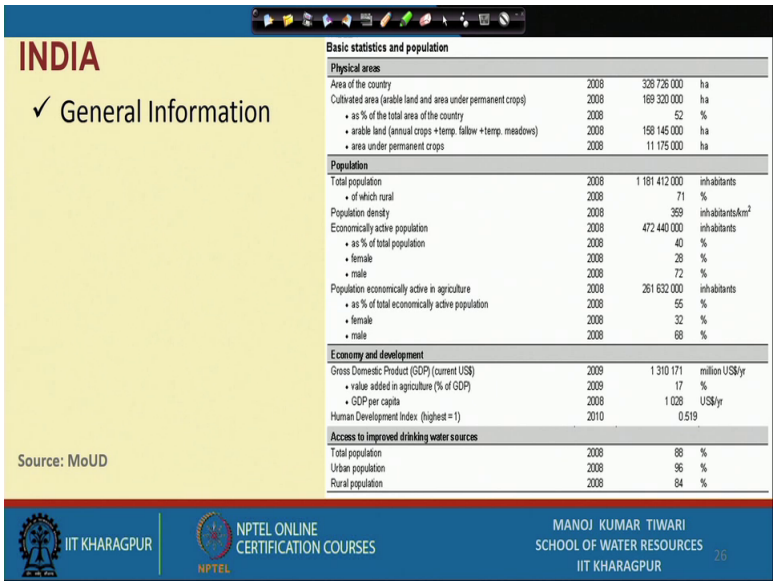

So, let us come to India how things are managed in India because as you as we you are just referring at that different countries based on their development status based on their economy, based on the available resources, the water consumption practice, water use practices are also different, water availability is of course, different.

So, the condition is not very bright for India as were apparent from the earlier or earlier discussion. So, India these are some general information as per ministry of urban development the total population in 2000 and 8. So, as per moud had improved drinking water sources around 88 percent of population has drinking water sources the 96 percent of urban and 84 percent of rural population has access to the improved drinking water sources.

However, this access to drinking water resources does not mean the household level water supply. So, when we say that access to safe drinking water source rural population has it 84 percent rural population has access to safe drinking water sources, what is primarily reflects that there are some clean water resources in the vicinity or in either in the form of groundwater or surface water in the region that can feed into the 84 percent of the population.

So, those kinds of estimates are there if you see the total population in all these numbers GDP numbers are available over here.

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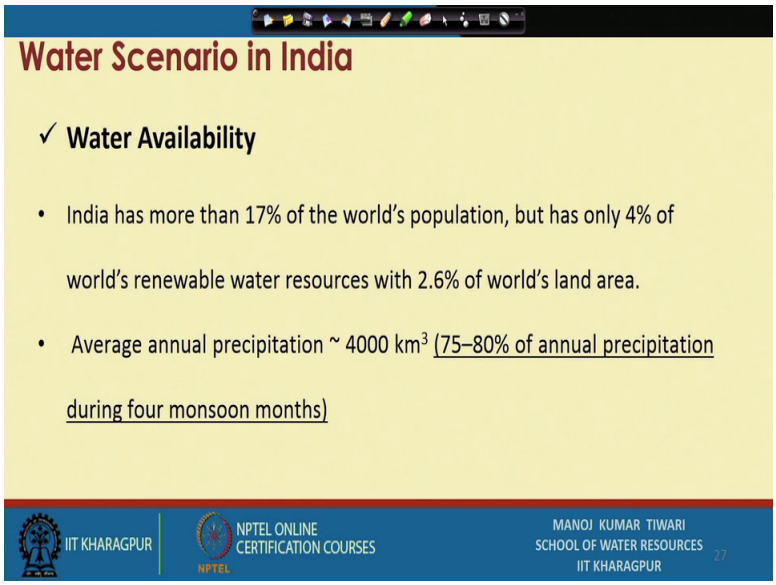

Coming to the water availability; some key points that India has more than 17 percent of world's population as of now. However, we have only 4 percent of world renewable water resources and just 2.6 percent words land area. So, you see that dealing with more around 17 percent of the total population. However, left with only 4 percent of water and even less land; the annual precipitation in the India is estimated in order of 4000 kilo meter cube of which; around 75 to 80 percent of the total precipitation of the annual precipitation comes during the our 4 monsoon months starting from June to September.

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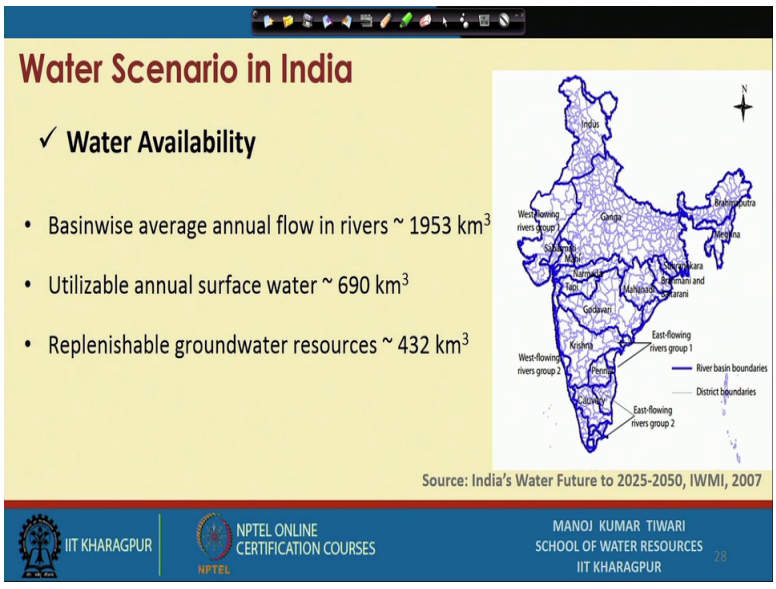

The Basinwise average annual flow in the rivers we have several river basin a major river basins major river basins various minor river basins or sub basins that way that one can see in the image here resource from India's water future IW MI report published in 2000 and 7 the ganga river basin which is the largest river basin that way and there are various the sub river basin there are different amount of water storage capacity in the different basins that we will talk about if we see the average. So, Basinwise annual average flow in the rivers in India is close to 1950 kilo meter cube, where as utilizable annual surface water is little under then 700 kilometer cube the ground water resources Replenishable groundwater resources are around 430 kilometer cube.

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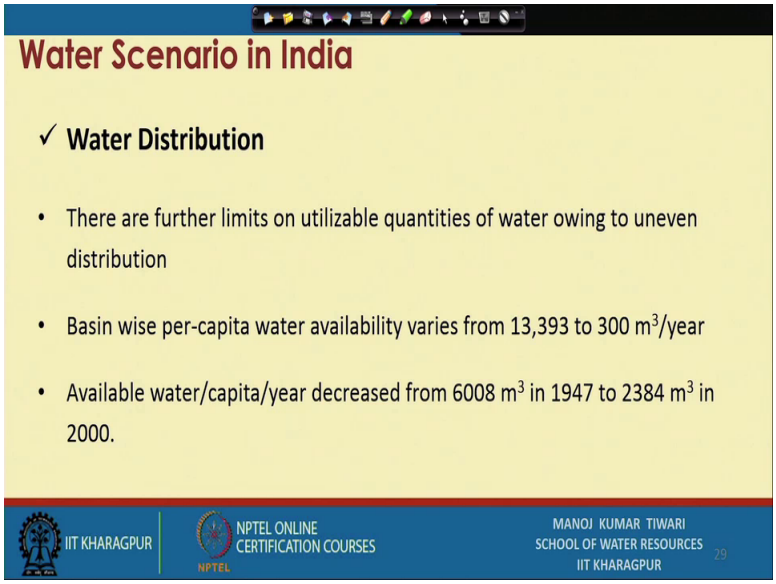

So, that sort of the total water we have into the different utilizable forms either in the surface or in the subsurface; however, there are for the limits on utilizable quantities of water owing to it is non-uniform distribution, water is not distributed again uniformly over the country as we have seen the global picture where water was not distributed uniformly across the globe. So, if we go on country scale. So, same thing we can see here that the water is not the available water is not distributed uniformly across the country. We have different states with different kind of water resources scenarios, if it is well known that the Rajasthan, Gujarat and white of Maharashtra belt is dry regions very little water availability many of the Southern States are pretty is rich in water resources.

So, that way the that non uniform distribution limits the utilizable quantities of water, we can say that total this much of water we have for a total on a countries scale let say x n number of rivers containing some substantial amount of water for users, but if those are concentrated in a particular zone in a let us 3 4 5 states. So, it is not possible for other states to draw water from these far distances or sort of the political boundaries and regional boundaries and all that makes it inappropriate or inadequate to basically a uniformly distribute the water.

So, basin wise per capita water availability in India varies from as large as round 14000 close to 14000 13,393 as the number given to around 300 meter cube per year. So, you see the degree of variation is almost to order here the there are places there are reasons there are a sub basins which has water per capita water availability has low as 300 meter cube per year while others which are having more than 13000 meter cube per year. The water availability per capita water availability has decreased on a country scale has decreased from 6000 meter cube in 1947 when we got a independence status to just a little under 24 100 cube per capita water in 2000.

So, are in a round these 53 years there has been a large reduction we got we that point of time we were 6000 meter cube per capita per year and we have we are now at around 2384 meter cube per capita per year. Now this decrease is not largely because of the decrease in the fresh water quantities available, they are still available in more or less same at least what we considered freshwater resources. There are other there are others limits and issues on to sort of what is fresh water these days, there is a lot of pollution issues coming in and the water that is in our river in our lakes all this what we call as a freshwater or usable water is not all though saline, but in terms of quality how fresh it is or how usable it is another sort of very important question in today's time.

Still, even if we consider all that as a freshwater resources still we have not like the total amount of water in these freshwater resources have not dipped that much what we have done is we have grown our self in numbers. The growth of population has been immense and that has led to the decrease in the per capita resources not only in terms of water in terms of land in terms of various food production and all that issues. So, because of the population growth because of significant population growth this per capita availability has decreased to this great extent.

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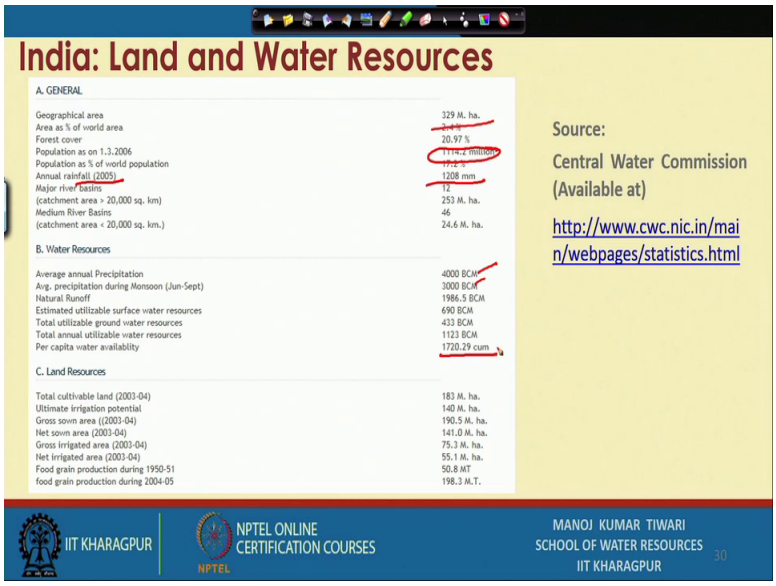

You again if you see in the numbers as per the central water commission which is available on it is website the you see that the total geographical area, we have is around 329 million hectares, which is our 2.4 percent of the world area around 21 percent we have forest cover the population world's population is around 17.2 percent if the rainfall annual rainfall is 12 which is sort of data of 2000 and 5 that you see here the 2000 data of 2000 and 5 annual rainfall is 1208 mm.

So, that is the rainfall and if you recall what you are discussing in earlier lectures that total rainfall across various continent continents continental, where of the order of 750 to 800 or something like that except southern America all other this thing has rainfall of the order of that.

So, that way the water inflow wise we are actually better than many places better than sort of most of the world that way or not most of the world, but we are doing better than the average. However, because of this huge population and less area the total water availability is not sufficient enough to feed in these many number of people and that is what is leading to decrease or to reduction in the per capita water availability annual water availability. The river basins we have a sort of 12 major river basins with the catchment area of greater than 20,000 square kilometer; where are there are 46 medium river basins with catchment area less than 20,000 square kilometer and the total sort of

area covered by this river basins. So, major river basins accounts for over 250 million hectares while the medium river basins account for a little under 25 million hectares.

Water resources data if you see. So, the members are as you can see here that the average precipitation total precipitation is 4 thousand BCM while average precipitation during monsoon is 3000 BCM. So, as around 75 percent of the precipitation of the 3000 or the 4000 comes into this monsoon period from June to September. The runoff phase of the order of 2000 BCM that ways the utilizable surface water resources 690, the total utilizable groundwater resources is 433 and per capita water availability as per central water commission this is the point that we were talking earlier that the per capita water availability is at present around 1700 meter cube. So, the CWC estimate it around 17 20 cubic meter or meter cube.

If you recall the international norms for declaring reason or a country as water stressed is less than 17 100 meter cube. So, we are right on the verge of it actually, the total water per capita water availability we have with as per our official resource which is CWC is 17 20 and as per international norms if it falls below 17, we are actually underwater stress and many many estimates. In fact, already consider India has a water stress country as you might have noticed in the earlier maps that were displayed there are similar cases and similar data onto the land resources total food grain production and all that. So, it is not that we are doing well in other term status is similar for other things as well.

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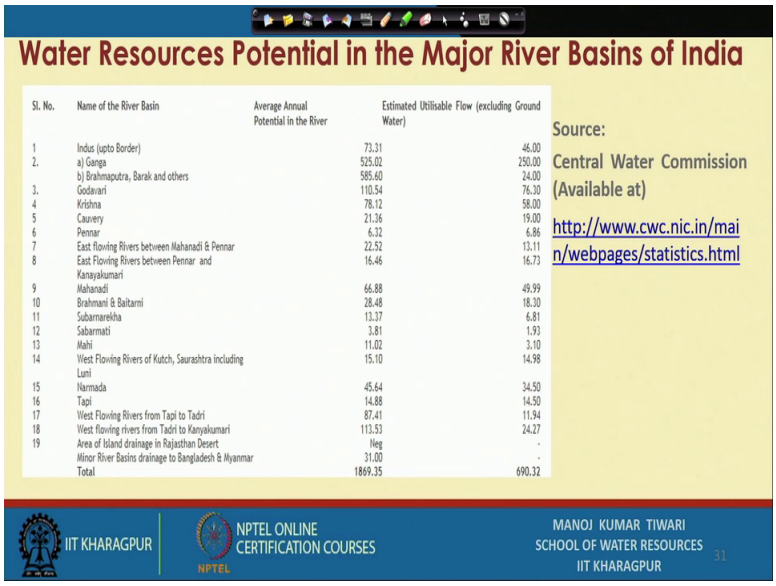

Now, the water resources potential in the river basins of India again this data is source from central water commission. So, Indus which is includes of Ganga as well as kind of Brahmaputra up to the border that way. So, Indus earlier is like the annual average annual potential in the river is 173 while Ganga Brahmaputra combinely have over thousands the average potential over thousands actually 585.6 is for Brahmaputra Barack and others while 525 is for Ganga. The estimated utilizable flow that way is a 250 it is the data similar data one can actually notice for the other rivers. So, each of them have a sort of different potential average potential in the river and the estimated floor is accordingly changes.

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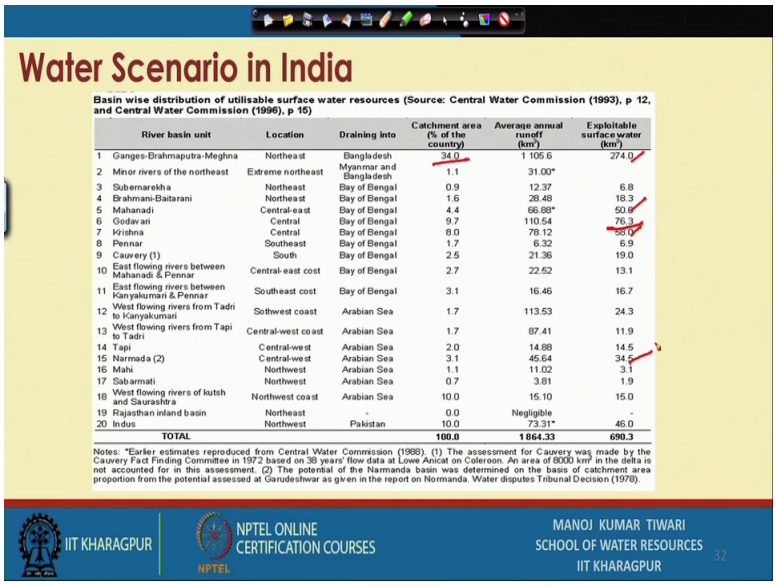

Another sort of compilation of basin wise distribution again from the Central Water Commission source they are 1993 and 1996 data. So, sea is that the ganga Brahmaputra Meghna covers around 34 percent of the total area of the country with average annual run off around 11 100 little larger than actually 11 100 kilometer cube and the exploitable surface water that is available in this basin is 274 kilometer cube, much higher as compared to any other. If you see this table over here the next higher exploiting table surface water is available in your this river basin which is Godavari.

Then there are Krishna and Mahanadi or other major basins which have significant amount of exploitable surface water or the potential wise if you see. So, the major ones are your Mahanadi of course, the Ganga, Brahmaputra are the largest one then you have Mahanadi, Godavari, Krishna is another big one and then you have this Narmada. So, Narmada is having your around 35 kilometer cube of exploitable water available. So, these are the major river basin units which serves the country.

Now the Ganga, Brahmaputra, Meghna actually caters most of the regions in the north east while your sort of Mahanadi, which is central east part Godavari and Krishna caterers the central part mostly as you can see from these numbers over here. So, this is for central part. And then of course, there are others some contribution smaller contribution from various other rivers including your Kaveri Tapi and all these.

The Narmada is the major contributor in the western part central western part. So, that is the that is the sort of status of the contribution of utilizable exploitable surface water in the various river basin you needs the groundwater scenarios if you see are the ground water scenarios are again not same everywhere.

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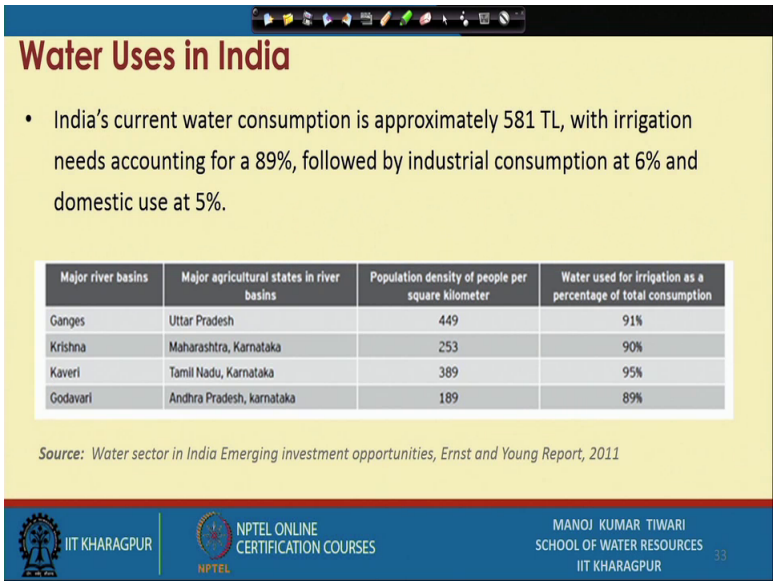

It will be sort of groundwater also varies and the depth of groundwater is varies largely in the different places in the country we will talk about that once we discuss the groundwater rather in detail. Now if you see the total water uses in the India's the India's current water consumption is approximately 581 trillion liter, whereas irrigation accounts for 89 percent, industrial consumption at 6 percent, and domestic uses at 5 percent.

So, very similar to the one that you saw earlier for the for the low and middle income countries where agricultural sector agriculture sector accounts for the most. So, in India also 89 percent contribution is 89 percent sort of water demand is from irrigation sector, not actually demand rather we should say 89 percent is used in the irrigation sector then there is a industrial consumption at 6 and domestic at 5 of the major river basin. If you see that the population density of people per square kilometer which is highest in the Uttar Pradesh is sort by the Ganga and there water used for irrigation is 91 percent. The Krishna which serves the Maharashtra and Karnataka with a population density of 253 again accounts for around 90 percent of water consumption in the irrigation sector, then Kaveri and Godavari.

Similarly they are like in the Tamil Nadu, Karnataka while Godavari in the AP with population density is wearing population densities accounts for again huge particularly Kaveri serves the 95 percent water goes for the irrigation sector, while Godavari again around 89 percent of water which serves the Andhra and Karnataka with a population density in the river basin around 189 people per square kilometer.

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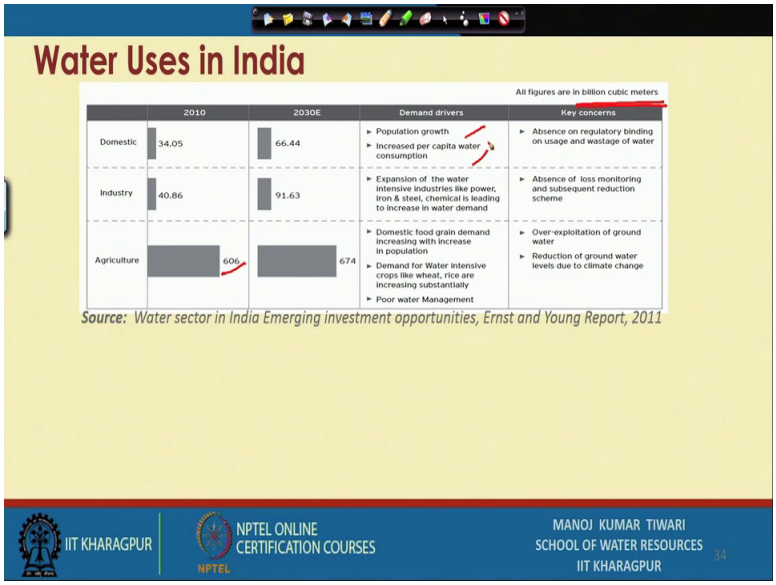

This is another the estimated use of water in the different sectors total use of water in the different sector in 2000 and 10 from a report published in 2000 10 11 by Ernst and young. So, the estimated numbers are 2000 and 10 and predicted number for 2000 13. So, the domestic consumption total all these figures are actually in a billion cubic meters. So, the domestic consumption is in 2000 and 10 was estimated to be around 34 billion cubic meter while industrial consumption around 41 billion cubic meter.

The staggering consumption was in agricultural sector accounting over little over 600 billion cubic meters, the interesting thing because India become being a growing country of course, the demand is going to increase in all the sectors and that is what has been estimated. So, estimated consumption in 20 30 is 66 billion cubic meter in domestic sector, around over 90 billion cubic meter in industrial sector and around 674 billion cubic meter in agricultural sector. Now quantitatively if you see the increase in the domestic demands or domestic consumption is almost 30 million cubic meters industrial

it is around 50 billion cubic meter and agricultural it is a little under 70 billion cubic meter.

So, still the increase in the agricultural demand is highest if you see in terms of the numbers, but interestingly if you see in terms of the percentage of the total expected increase that way. So, agricultural sector the increase of little under 70 for a consumption existing consumption if you consider 2010 as an existing consumption so for a existing consumption of 6 0 6 increase of 74 is or increase of 70 is just around 12 percent or so, but if you see the increase in the domestic consumption it is almost doubling the number. So, that way near hundred percent X increases in the domestic sector industries are more than doubled ok.

So, around 120 percent 120 to 125 that much of increase in the industrial sector and is expected, while agricultural sector the increase is very minimal that is because the India is a developing country we are going more and more towards the sort of industrialisation and infrastructure development growth the urbanization is taking place rapidly leading to the increase in the domestic demand, there is a population growth. So, if you look at the drivers for this increased the population growth and increased per capita growth are the basic demand drivers for domestic, whereas industrial extension industries like power in all sectors. In fact, and many of these are extremely water intensive industries.

So, with these industries growth we expect to increase in the industrial demand and that is what has been predicted while in the agricultural sector there is going to increase the demand of food grains. So, there will be again demand is likely to increase for water also. However, it is not going to increase that much. More over there is lot of scope of saving water in the industry by using approp by using in the agricultural sector primarily, by using the advanced irrigation technologies because very there is very poor water management reported particularly in the agricultural sector over exploitation of irrigation resources are what people of observed many times.

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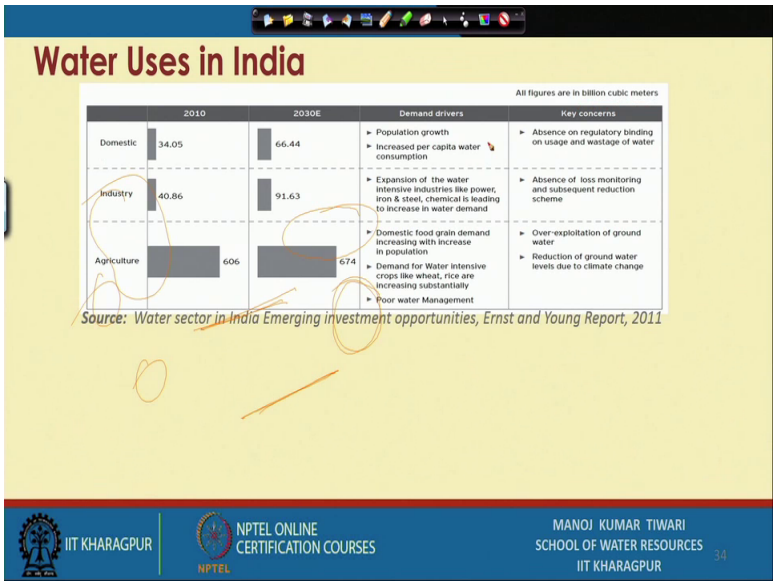

So, that is what is that is.

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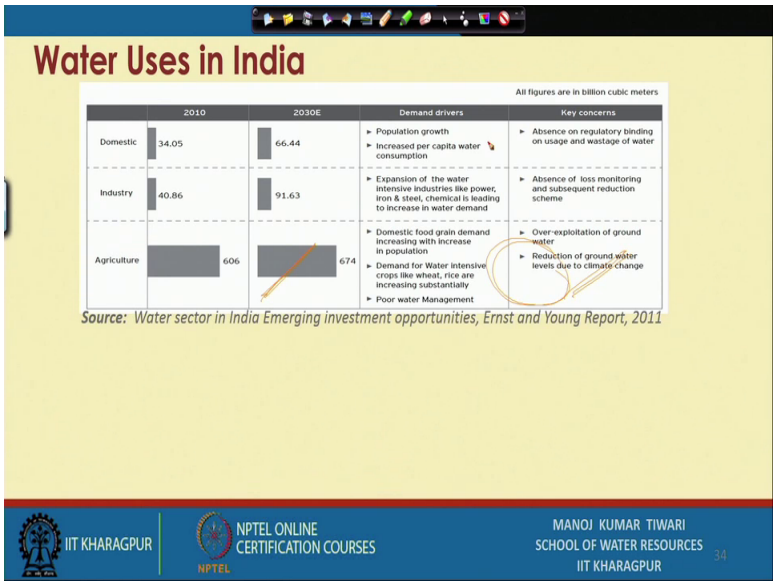

So, with this actually if you I guess we will end this lecture here. And, we will continue in the subsequent session.