Introduction to Smart Grid
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Lecture – 34
Demand Side Management in Smart Grid

Welcome you all to our NPTEL online course on Smart Grid and today we will be talking about demand side management in our Smart Grid environment. We might have seen different architecture of smart grids, development, operation, control, analysis of different smart grid mechanism; both in DC, AC as well as AC, DC platform. But once we deploy such kind of smart grid at our low voltage distribution systems; perhaps we can achieve one more main objective that the utilities looking forward to through the presence of smart grid and that is demand side management program.

Now, what is demand side management? If you see any utility across the world including India no one wish to spend or reinforced the transmission distribution corridor. And add on thermal or other source of generations until unless it is required; with time we all are excited over and over to consume more electricity for day to day life starting from air conditioner to heating arrangements and for the future electric vehicles. So, the electric demand; electricity demand has to increase over the year and I doubt even it can go as high as exponentially high and 2 to 3 fold in next 10 years time to come.

So, in this regard it is quite important for all of us along with your ambitious electricity consumption plan, we have to also optimize the national peak so that the excess reinforcement of the corridors that is transmission distribution corridors; as well as new coal plants installation can be avoided. How it is possible? The demand side management program can help you to reduce your excess peak at a given point of time so that such reinforcement of the corridors, transmission or distribution as well as new installation of the plants can be delayed for next few years; if you can adopt such demand side management program within our utility.

But execution of demand side management program is not so simple because the customers who are the real controller of the loads; may not listen to the utility in single go. Though having different price mechanism over period of day some of the customers may compromise their consumption pattern or shift their consumption pattern from time

number t 1 to t 2, but it is not necessary or guarantee that the utility will experience a peak reduction because of minor fluctuation in my load scenario.

So, to achieve it smartly because we are proposing that in next 10 years time from today most of the distribution system may look smarter through the real time adoption of AC DC smart grid or microgrid mechanism; it would be certainly possible with the presence of microgrids, we can control the load in a better way compared to a conventional utility or conventional power systems. So, today's lecture is very important because assuming that you have microgrid in place. So, we have smart grid in place at low voltage distribution systems and now how we can use those technology which is available to me to achieve the peak demand reduction of the utilities.

Now, let us understand the overview of Indian power sector be specific here.

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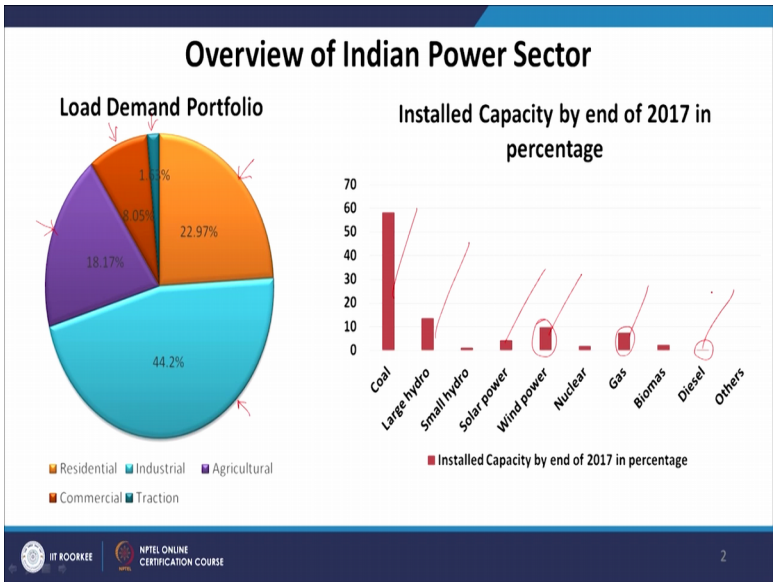

Now, if you look at the Indian contribution of load for your residential, industrial, agriculture, commercial and traction load; I think approximately 23 percent is through your residential customers and 45 percent is from industry and 18 percent from agriculture and 8 percent from commercial and close to 2 percent from traction. But this scenario not necessarily to be same across the countries because it may vary from country to country depending upon their; number of population strength, per capita consumption of electricity etcetera.

But this is true for most of the developing country in the world and where the residential part which is 23 percent now; maybe as high as 35 to 40 percent in some of the developed countries. Now looking into the generation site we can see out of 100 percent generation; I mean approximately 57 to 58 percent in India comes from coal. And we have large hydro close to 15 percent and we have major contribution approximately 10 to 12 percent from wind and 8 to 9 percent from gas and though we have a minor percentage of diesel.

Now, the question is if we keep on adding load or if our per capita consumption has to increase over next 5 to 10 years, then certainly all the generations coal and hydrogen natural so that you have to tap and wind power and then solar power gas diesel all has to go up over a period of time. And then further though generation increase will lead to reinforcement of my transmission and distribution corridors too.

So, is it not a good idea that you can delay your new installation of power plants, delay in your reinforcement of transmission distribution corridor for few years by managing the same generation to meet your increase in load for 5 to 10 percent in next few years. Means even though; if your load is increased by 5 to 10 percent let us say in 2 to 3 years from now and if you can manage with your existing generation, then that will be really wonderful. And that is only possible if the peak demand has not been allowed to increase further and how it is possible?

So, the peak need to be minimized through off peak hours through a load shifting program or maybe I mean a kind of a load shifting or maybe a could be demand response program; the customers has to act actively during off peak period if it is not a critical load for you. And if it is critical certainly you cannot do anything much about it, but if the loads are not critical then certainly we can postpone the time of operation to a off peak hours by which the peak demand of the utility can be reduced.

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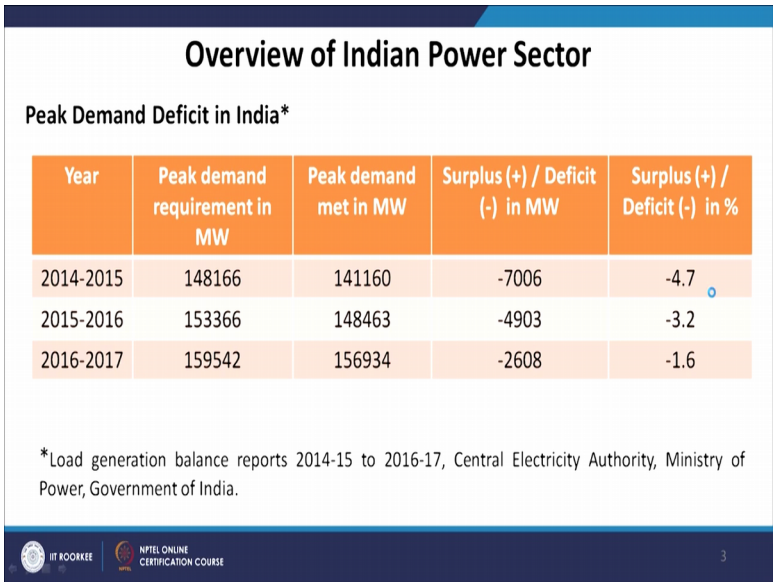

Now, moving further what is a peak demand deficit in India? I mean especially in India we all know that the generation is close to 330 gigawatt and the peak demand is approximately 160 gigawatt. And still we are not able to meet that 160 gigawatt all the time because there is a minor 1 to 2 percent peak demand deficit do experience country like hours; where most of the developing countries I am very sure maybe facing this common challenge.

But their even for the developing countries if the peak demand can be controlled then certainly they can delay the reinforcement program for next few years. So, the target for all of us to not to increase your peak demand that lead to your installation, new installations and new or transmission corridor programs can be delayed for few years; if you can restrictive your peak demand to an extent.

Now looking into last 3 years data of Indian utility we could see that the peak site was close to 5 percent in 2014-15 and 15-16 reduced to 3 percent and 16-17 it is reduced to 1.6 percent.

It is very clear signal from the government the government is very aggressive and putting new installations of generation sources so that we are able to meet the peak very closely; maybe next year the peak deficit of this country will be certainly 0, but being said that if you can accommodate few more excess load. So, even if 5 to 10 percent increase in load if you can manage without putting your generations that is there is nothing like that.

So, we all have to work hard to make sure with the existing generation can be accommodate 3 to 5 percent of increase in load to meet the ambitious plan of the consumers towards modern India, where without putting much of new generations from coal or maybe from diesel or maybe some other sources; if you can delay the reinforcement program for few years having the same generation capacity through; smart grid DSM program then it will be wonderful.

Now, what is demand side management at large? This program is not a new program; I think everyone try will their hard level best to do not allow the peak to grow much higher.

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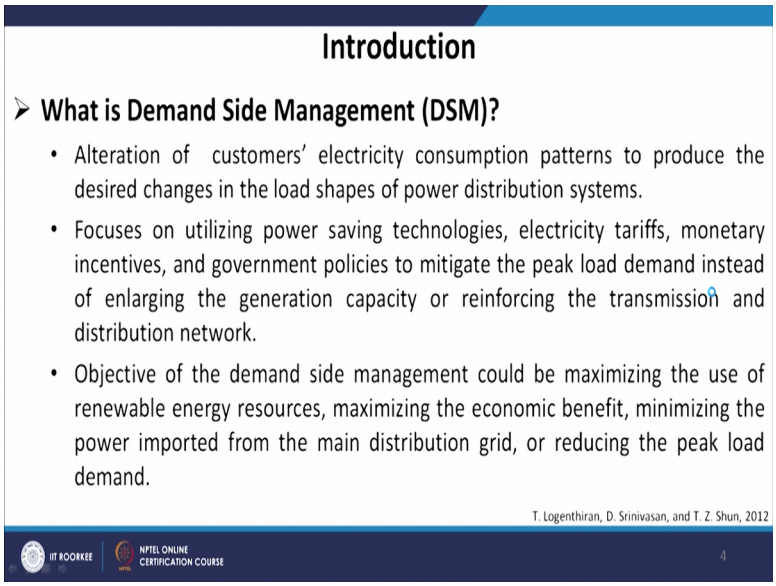

Alteration of customers electricity consumption patterns to produce the desired change in the load shapes of the power distribution system; means if you have a load characteristic if you can change the load characteristic that is DSM to me Demand Side Management. It focuses on utilizing power saving technologies, electricity tariffs, monetary incentives and government policies to mitigate the peak load demand instead of enlarging the generation capacity or reinforcing the transmission and distribution network.

Means instead of increasing your generation, increasing your reinforcement mechanism for transmission and distributionl if you can mitigate the peak load means minimize the peak instead of putting new generation to meet your new peak is demand side management was. Objective of the demand side management could be maximizing the

use of renewable energy sources, maximizing the economic benefits, minimizing the power imported from the main distribution grid or reducing the peak load demand.

Now, the main objective of demand side management is to optimally utilize the renewable energy sources present in your distribution system and also maximize your economic benefit so that the peak demand can be reduced. Now, I like to emphasize one thing here that through the smart grid programs, we can certainly control the generations as well as we can control the loads.

In my previous lecture, you might have seen out of 3 loads connected to a DC grid; I mean 2 of them are non critical and one of them are critical. So, depending upon if the load is more; if the generation is less then we do curtail some of the non critical loads from the system so that the system generation and load can be balanced or matched.

Similarly in this case if you can optimally utilize our renewable sources and avoid drawing maximum power through your distribution system; that itself is a local optimization for your smart grid. And because you are not drawing maximum power from the transmission system through the distribution system, then certainly you can reduce the peak expectations from the utility side. So, the peak demand of the utility can be reduced further if you do not draw energy from the main grid to your low voltage grid if it can be locally optimally managed.

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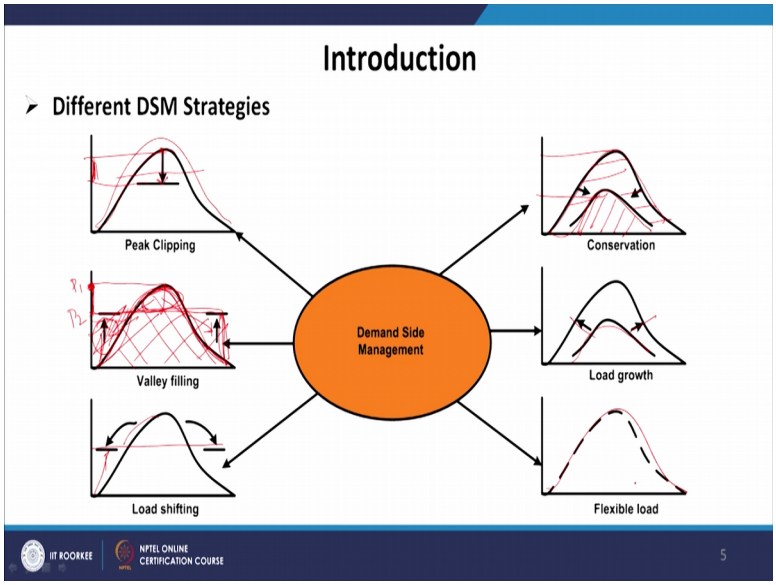

Now, if you look into the different DSM programs first of all assuming that the load characteristic will be of this nature. And as we all know the load characteristic of a particular day will experience 2 peaks; I mean ideally could be a evening hours and maybe one day peak and one evening peak. But for understanding we have considered a load characteristic which has only one peak.

And now through some mechanism if you can reduce your peak from this point to this point if the load can be minimized by this magnitude then this is known as peak clipping. Now, similarly now in case of any load characteristic now I need to have generation installed capacity to meet out this peak, but even during off peak hours, still my generation is sitting ideal because the demand is not there.

Now if you can fill this valley; if you can fill this valley means you increase your consumption during the off peak hours so that indirectly your peak energy consumption will reduce. Means if you can increase because after all the area of cross section or the energy for a given utility has to be same even though the time of operation changes. Means if the area of cross section need to be maintained balance; now I can say the area of cross section of this characteristic is same as the characteristic of my original load curve. And to do this the area under this portion now being distributed one portion to this valley and the other portion to this valley.

Now, the energy the area of cross section under this characteristic remains same as this characteristic, but the peak got reduced from P 1 to P 2. So, the difference in P 1, P 2 will help me to accommodate other customers; load customers or even though the per capita consumption of the customers increased by few percent; still I can manage with this valley filling instead of putting new install, a new generation into the system.

Now the load shifting where you can it is similar to valley filling, but instead of you increase your off peak consumption; now you reduce your peak consumption. So, if you increase your off peak consumption then it is valley filling that is being discussed here. But if you reduce your peak then it is known as load shifting either you reduced to your peak to off peak or you increase your off peak; I think the first one is valley filling and load shifting are they most both of both are almost similar pattern.

Conservation that is what is being adopted in most of the developing countries where especially farmers and the consumers are advised to use less electricity, but this is not a

time now where customers must be allowed to freely used their devices as and when they wish there should not be no restriction electricity consumption, but the peak should be protected. So, conservation mechanism says that having different LED technologies where the energy can be conserved with the same illumination and through which the characteristic; now will drop to another characteristic because the area under this characteristic is reduced compared to the previous characteristic and through which my peak can be reduced.

Now, other one is actually load growth where actually instead of conservation we can increase the load characteristic. And then we have finally, the flexible load where the load can vary in any direction. Now, the all are the part of my demand side management and we need to plant depending upon my country's population energy resources or the weather conditions we need to plan what would be the best strategy for us to achieve peak reduction through demand side management program.

Now, what is necessity to go for DSM?

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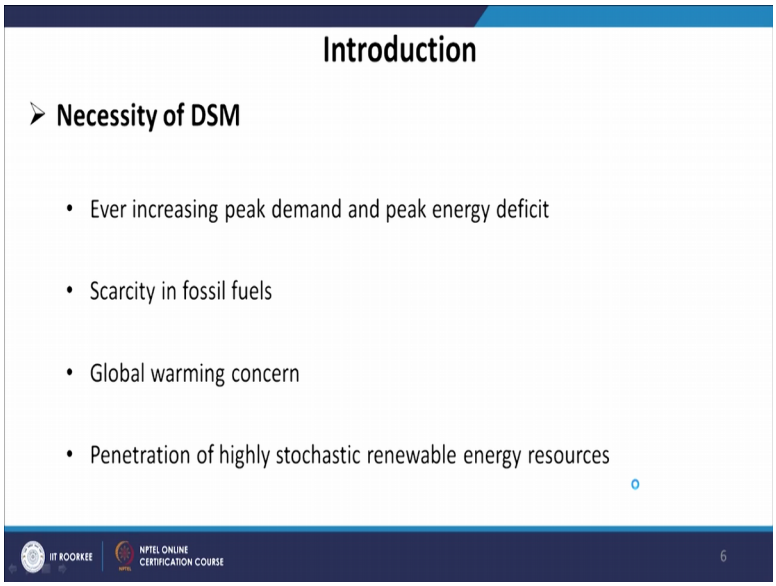

Ever increasing peak demand and peak energy deficit; very importantly the peak energy requirement of any utility has to increase; that means, because the population has to increase, the per capita consumption has to increase, the modern devices has to come in action. And most of them not necessarily consume less energy and hence the air conditioner loads, the comfort level will certainly force all the utility to expect excess

demand to appear in further future years to come. But that will lead to energy deficit if you are not well prepared to meet that load.

Scarcity in fossil fuels; now because your demand is more you have to install new power plants and if there could be fossil fuel based power plant then the fossil fuel may get over in next 50 to 100 years. Global warming the very important concern even if you have excess thermal capacity available to you, but if you generate excess energy then that will lead to global warming because of pollution and penetration of highly stochastic renewable energy sources become an issue.

Now let us try to understand first of all the energy demand of any utility has to increase, we have to respect that. And to meet that excess energy we have to put new power plants and because we do not want to pollute the earth; so, we avoid putting thermal generations in place, we perhaps move to renewable energy generations like solar and wind.

But they may not be enough to meet your peak demand and hence we are forced to put few thermal power plants along with renewable generations; to meet your future demand. Now through DSM program if you can reduce your peak then certainly you can avoid the installation of thermal generations or the global warming can be avoided.

But being said that through your renewable energy sources you can certainly add value to your energy, but not necessarily those energy we have achieved from our renewable energy sources may not necessarily guarantee the peak demand requirement of that utility. I have already informed in past that the peak energy requirement of a utility; unfortunately do not match with the peak generation of both solar and wind energy.

Means we all know the wind energy peak appears mostly in the night hours late night, late evening where the peak do not occur. Similarly during 12 to 2 pm also we do experience peak PV penetration, but we do not experience that day peak during that period. So, because of that even though we have lot of wind and renewable PV energy sources, but we cannot allow them to operate with its peak because the system cannot observe all these energy sources because the system is not experiencing peak.

So, it is important for me to store those excess energy through smart grid technology and discharge those store energy during peak hours so that my load characteristic can be made flatter by which the peak demand of a utility can be reduced.

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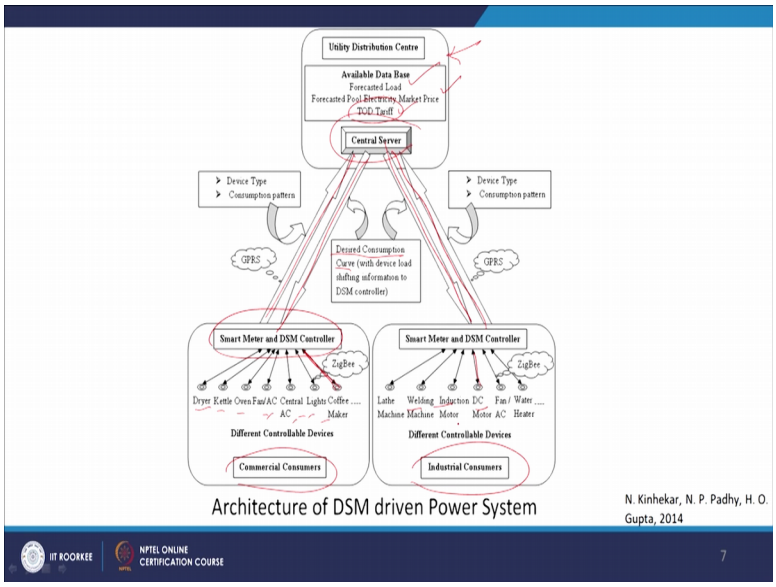

Now, if you look into architecture of demand side management program what we need to I mean understand here; let say if this is belongs to my utility or may be a distribution system utility. And assuming that the forecasted load is available to me and the electricity market price is also known to me. Because as we know each hour or half hour or maybe 15 minutes of 5 minutes time; the energy cost has to change and then once you have the market price also try to record your time of the day tariff price.

We all experience say variation in price for the load customers especially for 11 kV customers where there is a time of the day price and that price is keep on changing and not necessarily because of the peak or off peak, but it is market driven, but which is closer that if you see the peak hours, the price is certainly higher compared to the off peak hours. Now we do have a central server and my commercial customers and industrial customers; I mean assume that they do have smart meters and DSM controllers and their partially smart in nature.

So, with this source now all my devices in a commercial building starting from AC central AC lights, they do communicate with my smart meter or DSM controller through a communication Zigbee communication technology. And then those data can be

transferred to my central server through GPRS. Even for industrial customer welding machine, induction machine, DC motors all the data can be transferred to my DSM controller or smart meter through Zigbee and those data through GPRS can reach to my central server. Means at a given point of time my central server can understand what is the load pattern of my consumers especially for commercial and industrial consumer at a given time.

And now because the pricing characteristic is available to my central server ; now the central server can instruct guidelines to both commercial and industrial customers, advising the desire consumption curve how do how do they operate. So, that their electricity bill will be minimum because the TOD which is applicable to them and they can perhaps follow accordingly and load shiftings suggestions can be advisable.

Now, one step number 1 where the utility can advice both my commercial and industrial consumers that please follow this load pattern so that your electricity bill will be minimum or you can optimally utilize the time of the day tariff which is made available to you. The second step could be we can ask the commercial as well as industrial customers, the utility can ask them to identify your critical loads and non critical loads.

And those non critical loads can be turned off and on as and when required by the utility to benefit you at large. So, this is basically an agreement between the consumers and the utility. And if you agree upon that your devices can be controlled by the utility which are non critical and based on which they can optimize your operation so, that the electricity bill for you is certainly minimum and utility can experience a peak demand reduction.

So, this is a win-win arrangement that one can imagine how the demand side management program on a smart grid environment can be executed. Now moving to demand side management analysis with load shifting; there could be two different case studies.

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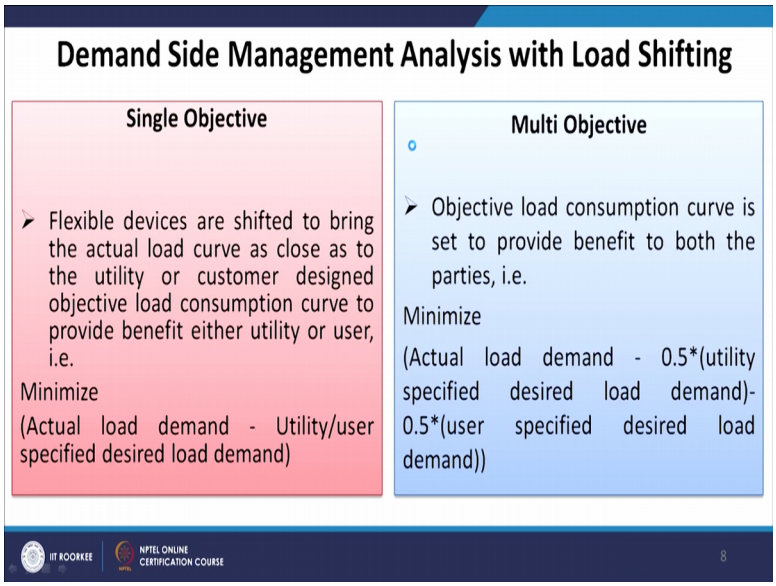

One is single objective means you always try to impose some program or some concept or some technology to your customers so, that the utility get benefited and that is a single objective optimization. You reduce your peak by you know advising your customers not to operate much during peak hours and shift their loads during off peak hours.

But the second one could be because the consumers have participated actively to achieve your goal. So, the benefit has to be shared between both utility and the consumers, otherwise consumers may not actively participate and support your program. So, that is so the second objective where we say it is multi objective; where you share the benefit both utility and consumers. Now first of all, what is that single objective? Flexible devices are shifted to bring the actual load curve as close as to the utility or customer design objective load consumption curve to provide benefit either to the utility or to the user.

Means is the current load characteristic will be of a given pattern and you have a desired load pattern and the desired load pattern may be desired by the loads or may be desired by the utility. So, if you move your original load curve to the desired load curve of the utility; so then that benefits to the utility much. If you move towards the desired load characteristics of the consumers then it benefit the consumers most. So, it is basically a single objective based either you benefit your utility or you benefit your customer. And

most of the time this programs are not necessary successful because only one side will be benefited.

So, when the customers are benefited utility be you know very positive enough to help the consumers or if it is utility benefited the customers must feel that is interest of the national benefit. Now, in the first case where we try to minimize the gap between the actual load characteristic and the desired load characteristics; if you can reduce the gap then certainly you make your load curve actually flatten.

Because in general the desired load curve is the reverse of the actual load curve; in case of multi objective the objective load consumption curve is said to provide benefit to both the parties that is utilities and customer; where what we do we like to minimize the actual load curve minus 50 percent weightage to the utility specified desired load demand and 50 percent weightage to the users specified desired load demand.

So, partially 50 percent objective will be satisfied by the utility and 50 percent goal will be satisfied by the customers. So, you try to balance between this 2 and hence the benefit can be share within these two. Now, what are the major DSM constraints?

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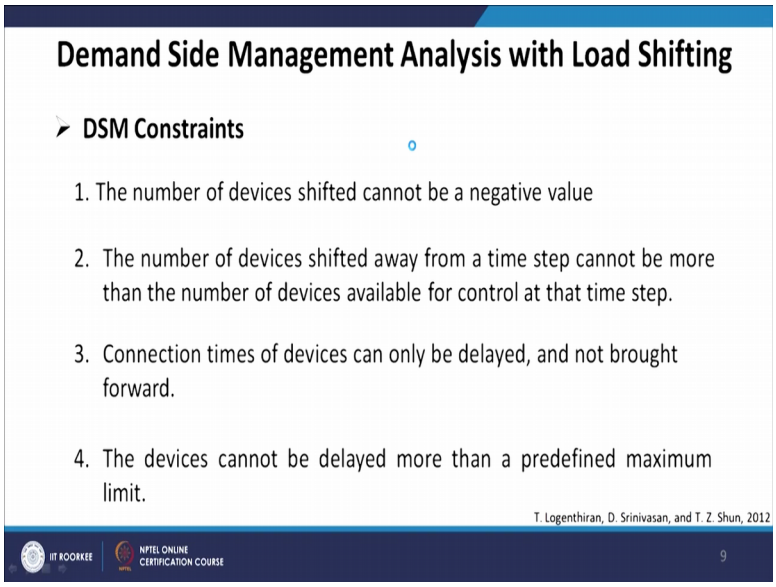

Now, the number of devices shifted cannot be a negative value for example, I cannot say I mean this a positive number always; then the number of devices shifted away from a time step cannot be more than the number of devices available for control at that same

time. Now connection time of devices can only be delayed and cannot be brought forward; means I can suggest my washing machine to operate after 2 hours, but I cannot bring back 4 hours earlier; that is not possible.

And the device cannot be delayed more than a predefined maximum limit; now I mean just if you delay the operation of a particular device it has to be in a specific the activity has to be done in a given day or 24 hours time period you cannot force your washing machine to operate tomorrow day after tomorrow; because it has to be operated within a day. But at what time that can be controlled by the DSM utility program manager. Now let us understand if the objective is set by the utility.

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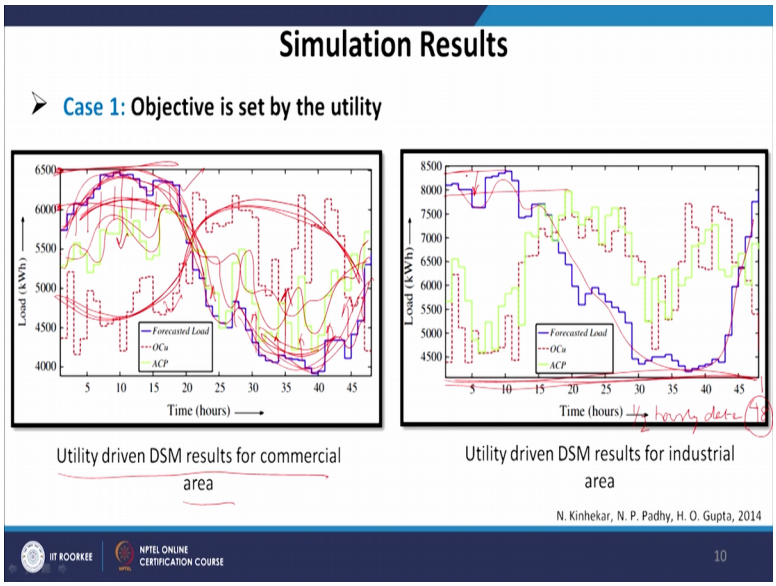

We will now consider a commercial area; utility driven DSM results for a commercial area. Now, I need your attention the blue characteristic that you see is a actual load characteristic is the actual load characteristic for the commercial customers of a particular utility. And certainly true because the energy cost and the at this peak hour will be certainly high. And the energy cost during off peak will be certainly low; now the desired load characteristic from the utility point of view, utility which the consumers must use less energy during this period and must use more energy during this period.

So, the desired characteristic could be just a approximate guess, could be an inverse though it is not exactly inverse you have to take many other constraint. But if you consider the inverse of the characteristic; the desired characteristic will be inverse means

during the peak the desire characteristic will be off peak and during off peak the desire characteristic will be peak.

But please note that by doing this is just for understanding its need not happen that the off peak become a peak hour that is not desirable, but certainly we wish that the peak our consumers must reduce their consumption pattern, off peak consumers must increase their consumption pattern that is what the main objective here. So, this load has to come down and this portion must go up.

So, if you optimize this because certainly you cannot reverse the characteristic because most of the devices cannot be shifted as you desired. So, if you run the algorithm for DSM; then you will get a new characteristic which is not necessarily the actual or desired, but it is in between these two. And why it is happening? Means most of the loads have been shifted from that hour to this hour so that; the time of operation of few devices have been shifted from this zone to this zone.

Now by doing so the load characteristic can never be straight, but one thing is very clear the peak requirement which was at let us say 6500, now can be reduced to as close as 6000. So, we can see the peak of the blue characteristic is at 6500 and the peak of the green characteristic is very close to 6000; so 500 kilowatt hour of you know is being reduced because of DSM program in place.

So, if you execute DSM program; advice your customers to move from the peak hour to off peak using your non critical loads, then certainly my peak consumption can come down to a point by which 4 to 5 percent of peak reduction is certainly possible; which is helpful for my system to delay the new installed capacity, delay in my new in reinforcement for the transmission and distribution corridors for next couple of years.

Now, if you look into the industrial customers at large; the similar arrangement has been done, but the for the industrial customer the load pattern is slightly different. And I mean you could see the x axis which is 48; this point is 48 and they are 30 minute slots because the data has been taken from a smart meter through for each and every 30 minutes data. So, we could see that 24 hours divided into 48 half; hourly these are all half hourly data.

And now here also we can say the peak which was it approximately 8400 now reduced to 8000. So, there is a small reduction in my peak due to DSM program in place even for industrial consumers.

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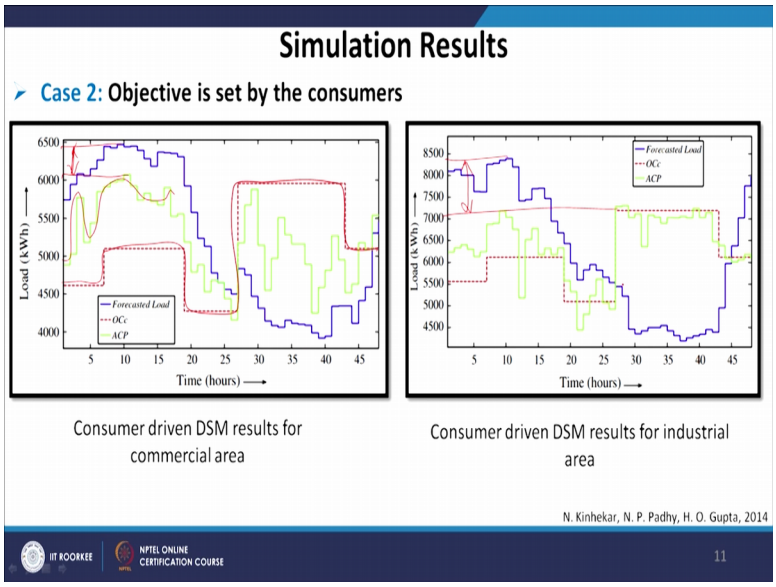

Now, instead of utility driven objective if you set for consumer driven objective in case of consumer driven; they the time the characteristic the consumer driven is not necessarily extremely variable, but it is straight forward because it is based on the tariff. And we could see that the new characteristic; the green one where the peak is now at 6100 instead of 6400. So, you could see still there is a reduction in my peak due to consumer driven DSM programming placed for commercial areas.

Now, if you move to industrial areas further we can see there is a large reduction; now it is close to 7000 instead of 8400. So, we could see there is a huge drop in my peak requirement due to DSM program for the consumer objective based we can certainly reduce the peak consumption by adopting DSM activity for my industrial customers also.

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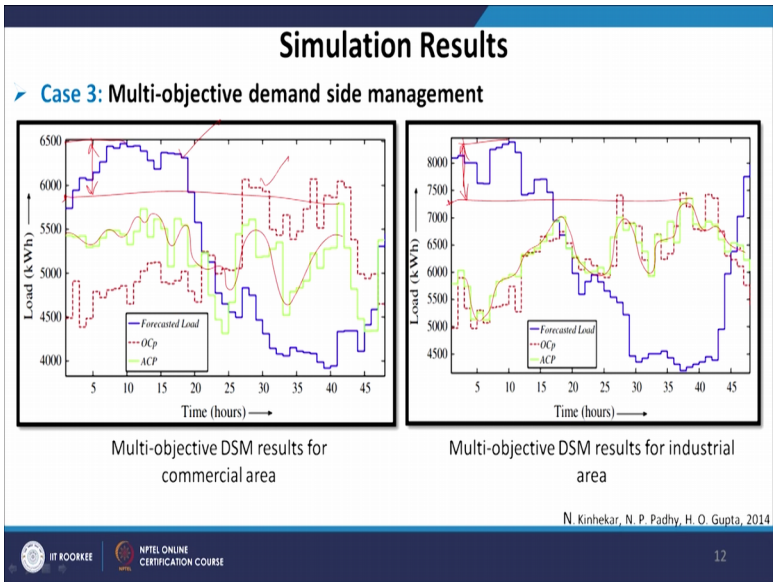

Now, if you combine both utility and customer's goal where we can see that the green characteristic which is in between the main objective; the actual load curve and the desire load curve. And here also we can see that the load the peak load comes out to be 5800 whereas, the actual was close to 6400.

In each and every case you can see there is a peak reduction because of DSM program in place. Now for industrial customers also we can see the peak has further reduced from this point to this point which is slightly the significant. Now, one interesting thing I like to explain you here; now the simulated load curve that has been obtained. And that load curve cannot be made flat that is number 1 because the devices has to keep on varying.

And you cannot force some of the device to change as per your requirement; if you would have control all the devices which is not possible otherwise mathematically the characteristic could have been flat. But in practical scenario when you fix that is few devices cannot be shifted and those who cannot be can be shifted may be shifted maximum for 4 to 6 hours.

So, putting all those constraints in your algorithm; the new characteristic, the desired characteristic that you finally, get to be executed will be in between your actual and the desired characteristic. So, the green one certainly claims that the peak requirement of a given utility for industrial and commercial customers can certainly be reduced; if the DSM program being of the algorithm being executed on a distribution system.

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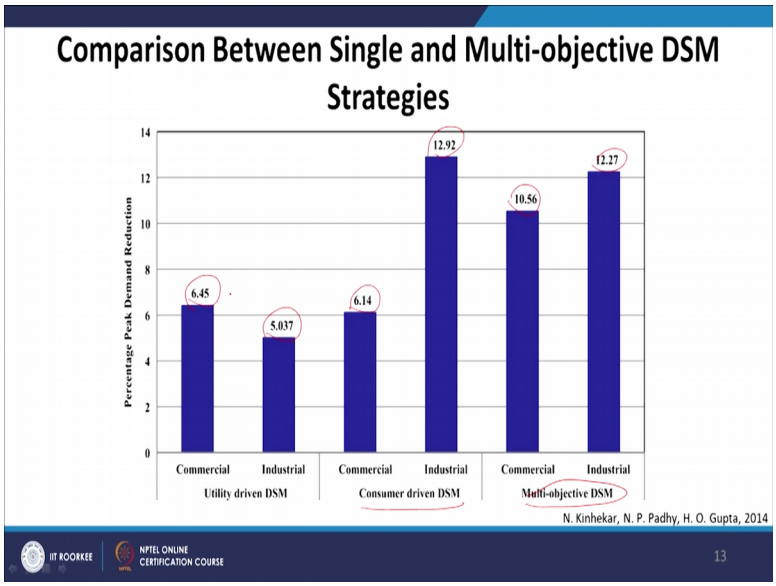

Now we can very quickly see; for the utility driven for commercial the peak reduction is close to 6 percent and it is 5 percent in case of consumer driven, it is 6 percent and 12 percent when you have a multi objective DSM; it is close to 10 percent and 12 percent.

But nevertheless in each and every case, whether it is utility driven or customer driven or it is multi objective certainly there is a benefit of peak reduction in each and every case.

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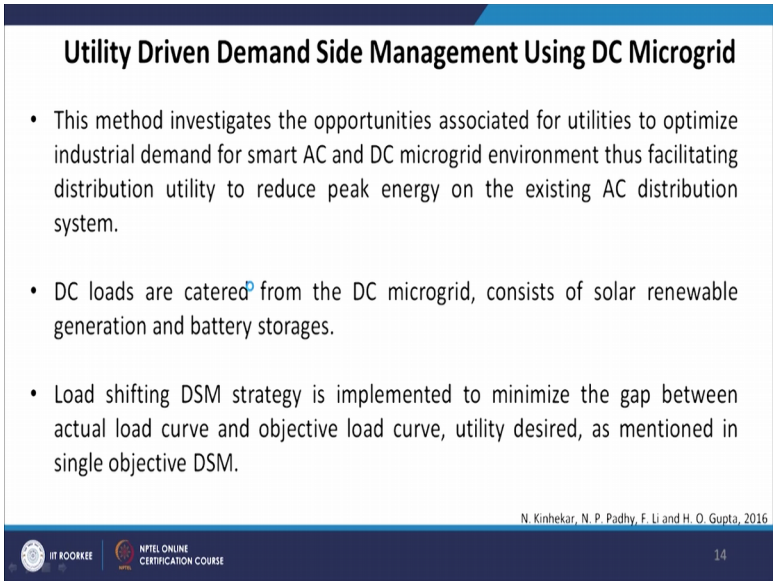

Now, let us move on to utility driven demand side management using DC microgrid; this method investigates the opportunities associated for utilities to optimize industrial

demand for smart AC and DC microgrid environment. Thus facilitating distribution utility to reduce peak energy on the existing AC distribution system; now the final claim could be that when you have a system in place. And if you have AC and DC microgrid those are active and if you can use those smart grid environment to control your loads; including load shifting then your AC distribution system can experience a peak demand reduction at its substation.

Now, DC loads are catered from the DC microgrid; consisting of solar, renewable generation and battery storage. Whereas, the load shifting DSM strategy is implemented to minimize the gap between actual load curve and objective load curve that the utility desired as mentioned in our single objective demand side management program; utility driven DSM program demand side management program using DC microgrid become an important aspect.

Because when we have smart grid in place the DSM objective can easily be achieved. Means the moment we wish to reduce your peak requirement from one level to other level; the consumers has to you know advice to vary there operational behavior from time to time and that can be automated, automatically non-critical loads can be shifted from 1 hour to other and that is possible through my smart grid.

So, let us assume that when we have AC DC smart grid in place and how the DSM program can actively be achievable.

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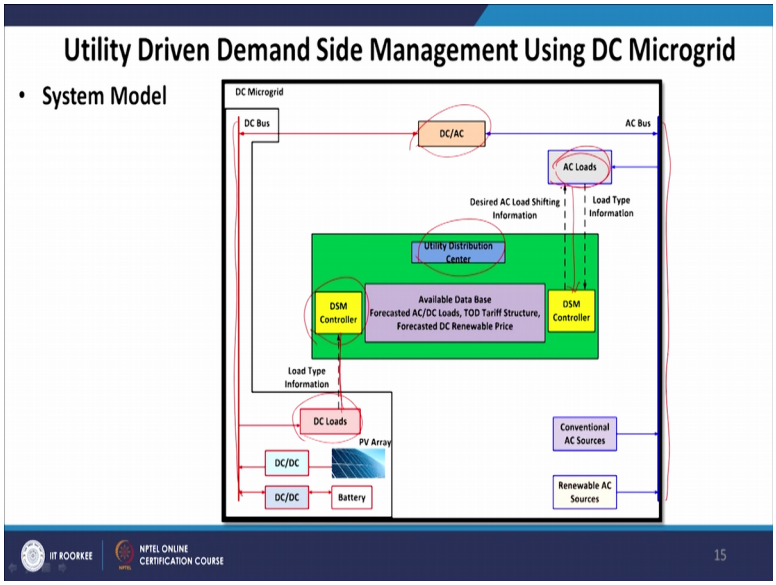

Now looking into the AC DC microgrid architecture, this is my DC bus and this is my AC bus and we do have a converter DC AC converter. Now, the DSM controller as we discussed earlier can provide the information from the DC loads. And similarly the AC loads can be connected to my DSM controller; now these 2 DSM controller will take care the behaviour of the DC loads as well as AC loads so that the utility distribution center can experience a peak demand reduction.

And the command the controller command to my devices will reach based on the market price as well as the time of the day price used as a tool to control the load shifting; so that the overall electricity bill for the consumers can be minimized and the peak requirement of the utility can also be reduced.

Very importantly the renewable energy cost also can be taken into account; if your AC DC microgrid do have excess renewable energy in place along with the storage. So, that we can optimize the energy when you sell the energy to the grid you can perhaps the microgrid can plan in such a manner, they can store their energy and give it back to the utility as an when required in a better price so that they can also be benefited.

Now if you run couple of simulation results having the opportunity of a smart grid. So, when you do DSM activity without smart grid and with smart grid; the results can be compared and we have executed a case study when the system do not have a DC smart grid in place the distribution utility execute the DSM program.

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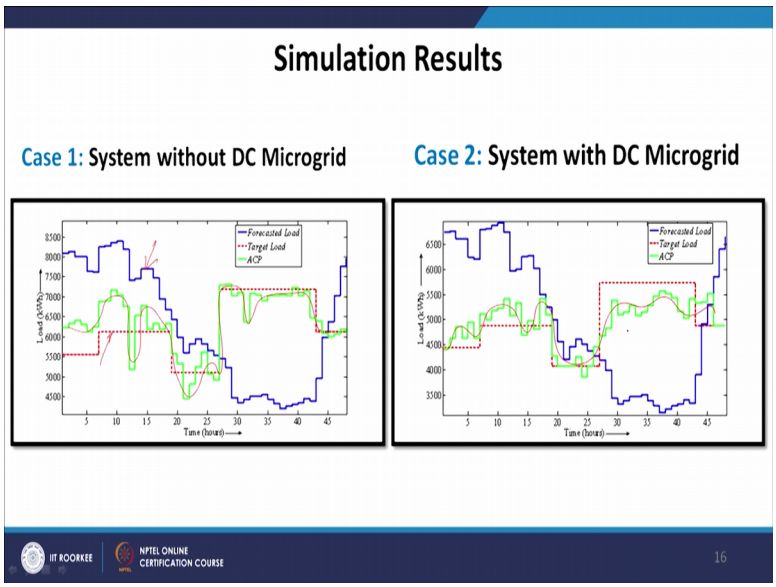

And the green colour shows the new load characteristic based on the actual and the desired one. And when you have actually DC microgrid in place; the load characteristic is slightly different and it has been claimed that the peak requirements of the utility, having a microgrid in place is better or reduced compared to a DSM activity on and utility without having a microgrid in place.

Now, similarly if you see the results it is very clearly shown.

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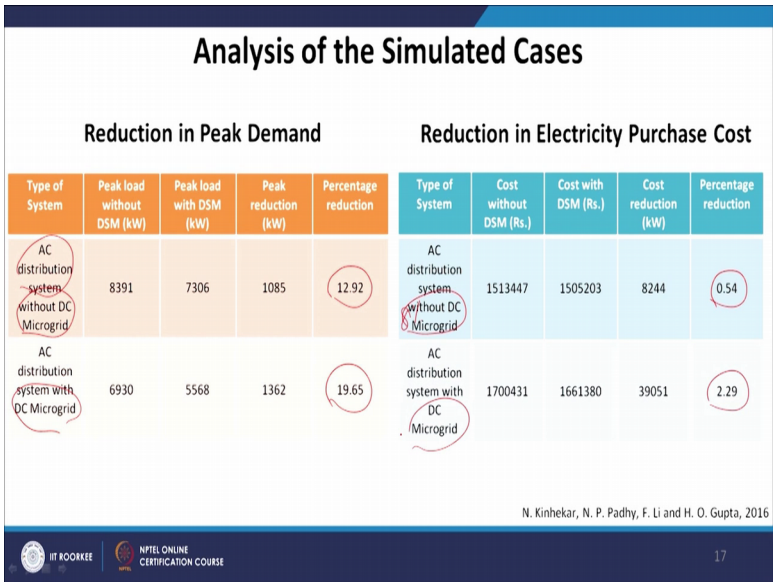

If your AC distribution system do not have a microgrid in place, then you can achieve the peak reduction maximum up to twelve percent for a specific case study. And if you have DC microgrid in place then the peak reduction could be as high as 20 percent. So, those increase in 8 percent is possible because of my smart grid in place.

So, now the conclusion is very clear that when smart grid in place certainly the DSM program can be enhanced more and the peak reduction excess peak reduction is possible because of the presence of AC DC smart grid in your distribution utility. Now, even the purchase cost the energy cost when you do not have the DC microgrid; the cost reduction for the utility, so for the consumers is going to be 0.5 percent whereas, it is 2.3 percent when you have DC microgrid in place.

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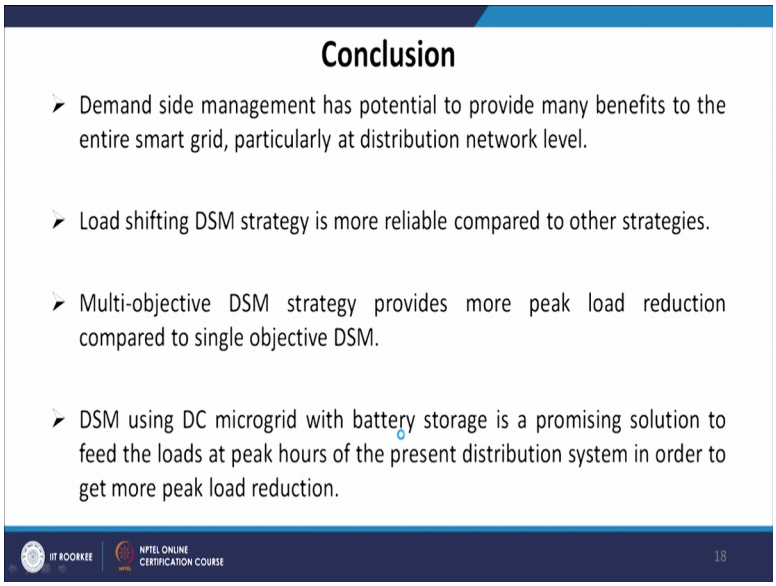

With this let us conclude demand side management has the potential to provide many benefits to the entire smart grid; particularly at distribution network level. Load shifting DSM strategy is more reliable compared to any other strategies, multi objective DSM strategy provides more peak load reduction compared to single objective DSM because both parties are getting benefited out of this activity.

DSM using DC microgrid with battery storage is a promising solution to feed the load at peak hours of the present distribution system in order to get more peak load reduction means during off peak hour, the battery can be charged and they can be discharged during peak hours; so that the energy that you take towards your consumers from the utility side will be reduced because the excess peak requirement can be met locally by the battery. So, there is a huge reduction and peak requirement and that is only possible with the presence of smart grid.

Thank you.