Operation and Planning of Power Distribution Systems

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Lecture - 04
Load Characteristics and Load management

In my last lecture, I started discussion of a Load Characteristics and Load Management ok.

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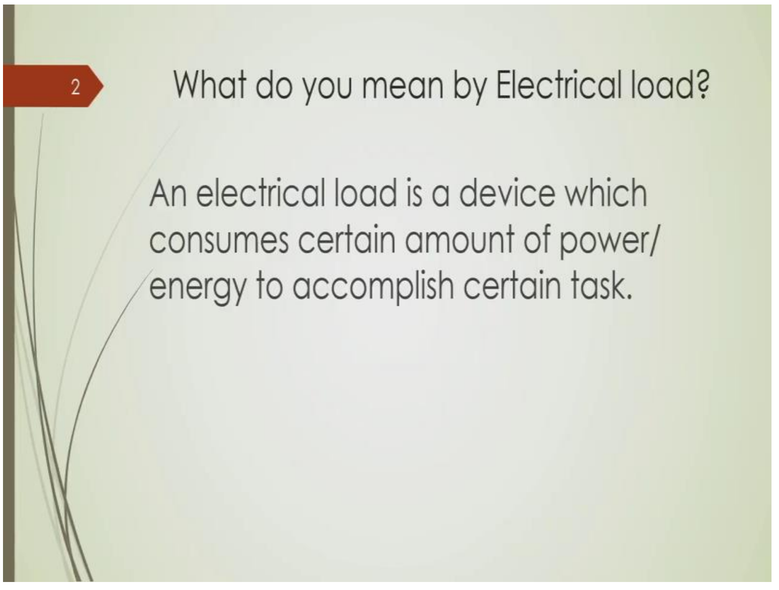

So, I discussed the electrical definition of load.

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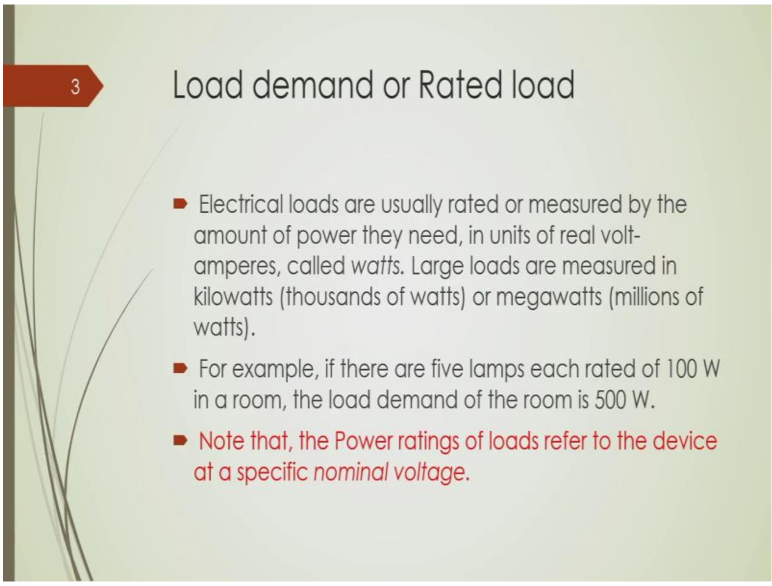

And I also discussed different types of loads.

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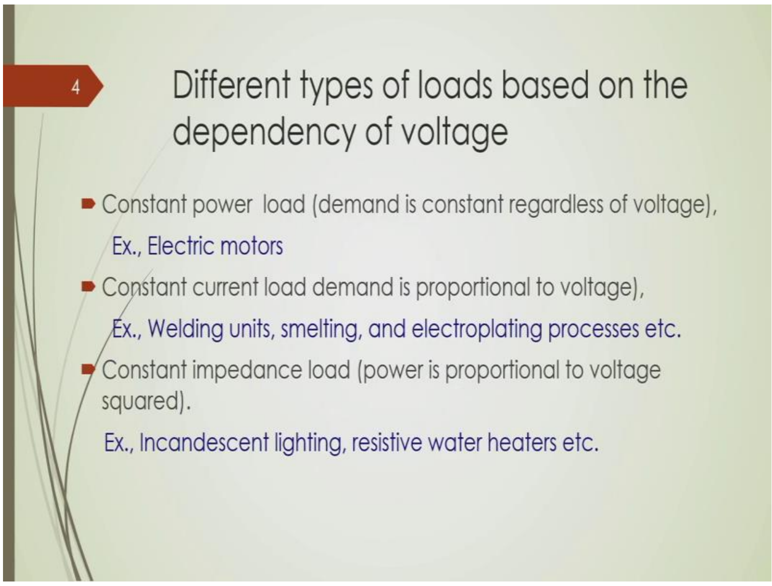

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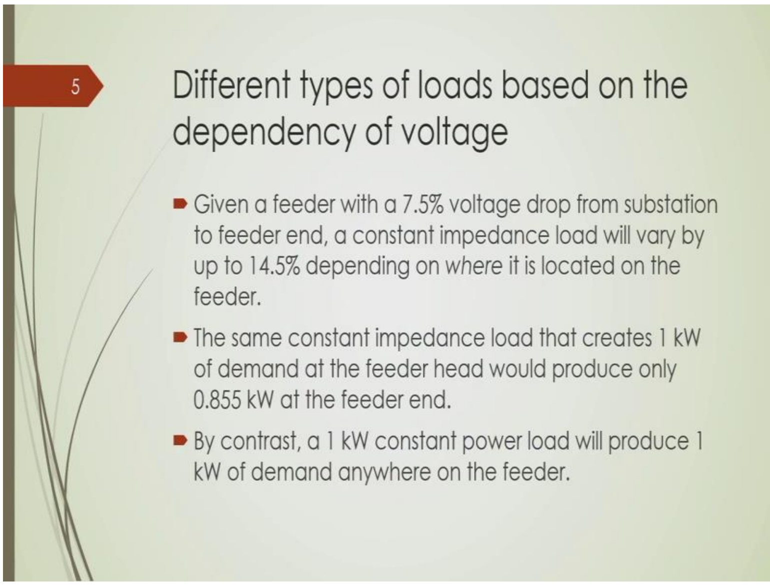

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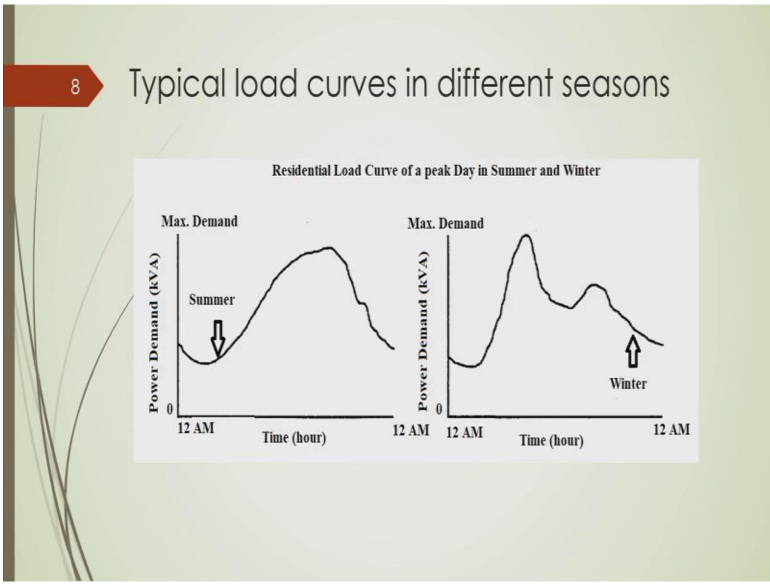

Then I also discussed this load characteristics or load curve ok.

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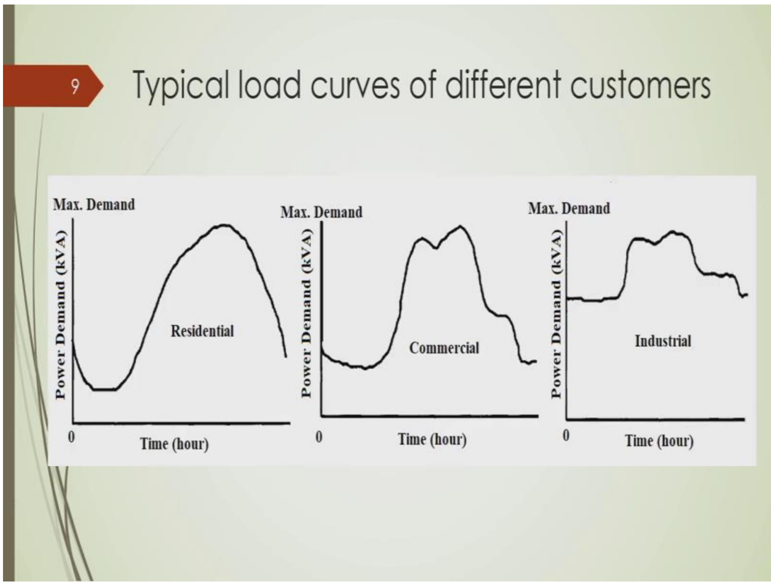

So, we have different types of load curves which include residential, commercial, industrial for residential, commercial and industrial customers.

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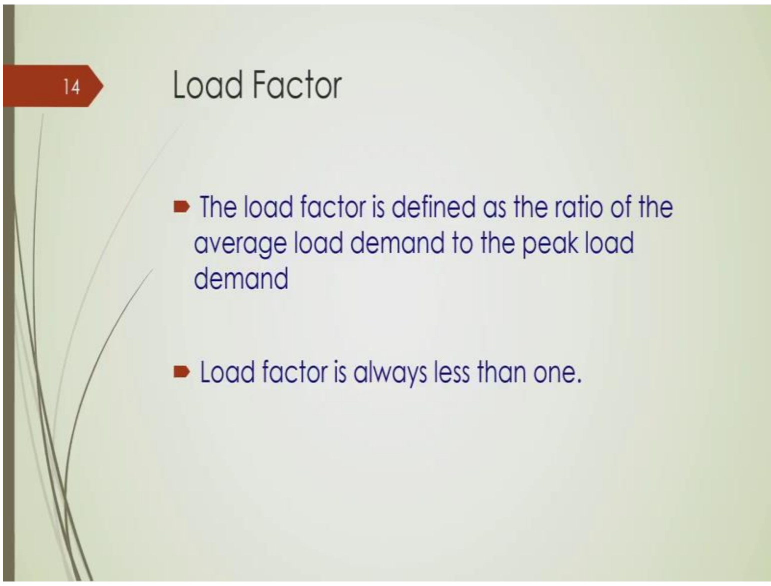

Now, I think I stopped at this point, where I discussed this load factor ok. So, load factor is one of the indices which is used for modeling electrical load ok and as I discussed in my last lecture, it is a ratio of the average load to the peak load demand or maximum load demand ok. So, load factor is always less than 1; why it is so, I discussed.

Next, I will talk about in my today's lecture is the coincidence of load ok.

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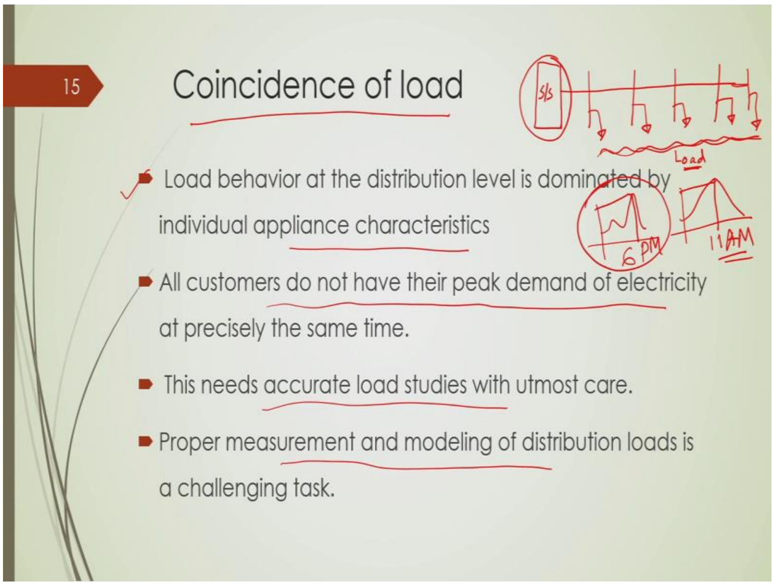

So, as you know that load whenever we are talking about is not load demand of a particular customer. So, load we are talking about is the aggregated load demand of a group of customers, of a number of customers ok. So, for example, under a distribution network, suppose this is my substation, then, we have single feeder coming out from the substation which is supplying a number of loads; a number of loads like this ok. Now, this arrow is signifying that they are connected to the load via a distribution transformer.

Now, under a distribution transformer, we have a number of loads connected; number of loads connected ok and each of the load is having their individual load curve or individual load characteristics ok. So, when we take the load curve or under this feeder, that means, this is basically the aggregated load demand of all these customers ok, whoever is connected to that particular feeder ok. And when we will talk about this aggregated load demand, there exists certain you know diversity, certain diversity or certain amount of coincidence of this load demand.

This behavior, this coincidence behavior, we will be trying to understand in this particular lecture ok. Now, as I said, load behavior at the distribution level is dominated by individual appliances characteristics ok. So, even under a particular residential customer, we have different appliances and all these appliances have their individual power characteristics ok.

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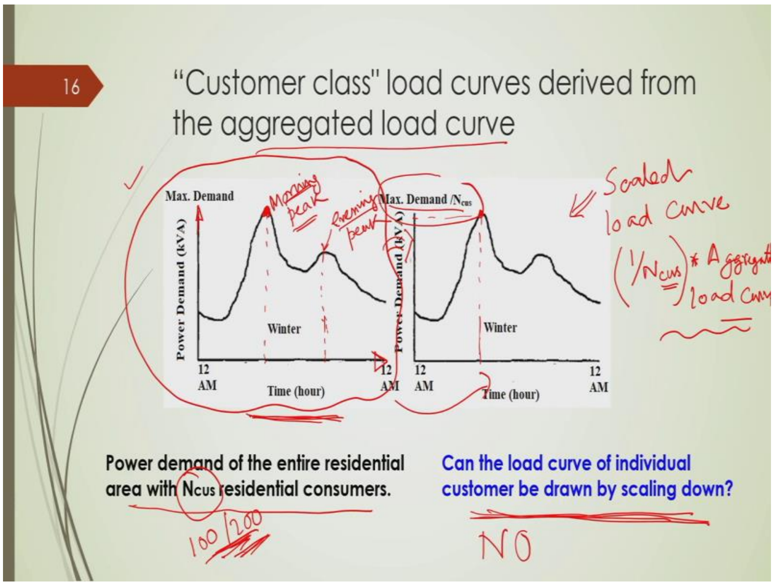

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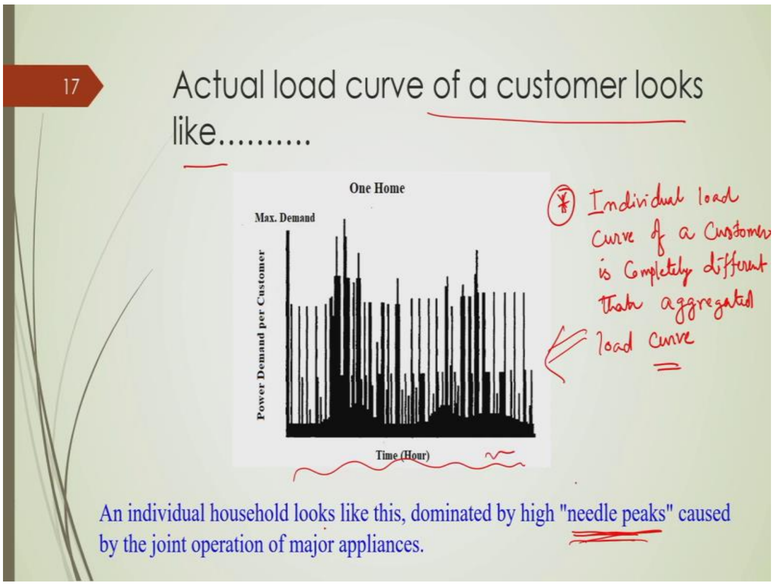

So, they have individual power characteristics ok. So, we will be trying to understand this coincidence or diversity ok. So, all customers as you know do not have their peak demand of electricity precisely at the same time. So, they do not have this peak demand at the same time. You may understand that one load characteristic is something like this; another load characteristic can be something like that.

So, this peak demand occurs at different time of the day. Suppose, this for that particular characteristic, peak demand occurs at 6 PM.; for this characteristic, peak demand can occur at 11 AM ok. So, we do not expect that all the customers will have same peak demand and they occur at the same time of a day. So, there exists certain amount of diversity ok.

So, this needs accurate load studies and also, we should have proper measurement and proper measurement infrastructure and also, for a proper modeling approach in order to understand this diversity among the different loads. Now, I have in this particular slide, I gave an example to show you how this individual load characteristic would be different than the aggregated load characteristic.

Look at this figure which is drawn in the left hand side of the slide. It is basically power demand or load curve of the entire residential area, having a number of customers; you can consider this as a 100 or 200 or whatever. So, this is the load characteristic or power demand characteristic of a residential area, where we have a number of customers connected ok. Now, this load curve is obviously the aggregated load demand, the aggregated load curve of all this 100 or 200 customers who are there in that particular area ok.

And suppose this load characteristic is something like that; this is power demand and this is the time of the consumption ok. So, this shape of this load characteristic is something like that. Here, we have one peak which occurs in the morning; here, we have another peak which occurs in the evening. So, this is morning peak; this is evening peak ok. And of course, this morning peak is the higher than this evening peak and this is the maximum demand or peak demand of that particular locality or particular residential area ok.

Now, the question is that is the aggregated load curve of this number of customers. Now, can we determine the individual customer characteristics from this aggregated demand? Or rather can we scale down this aggregated load demand characteristic and a scaled shape of this characteristic will represent this individual customer characteristic. Can we do so? So, this is the question.

That means, here in this figure in the right hand side figure whatever is drawn is basically a scaled load curve ok, which is scaled down by number of customers; which is scaled down by 1 upon N number of customers power demand. That means, this represent 1 upon N number of the overall aggregated load curve.

So, the shape of this characteristic will be same as that of this characteristic because this is nothing but a scaled characteristic of the aggregated load demand. So, that means maximum demand will be 1 upon number of customers. So, this is higher. You know maximum demand occurs and this magnitude is 1 upon this peak demand of this aggregated load characteristics.

Now, the question is do we get individual load characteristic exactly scaled version of this aggregated load demand? So, that is why I set a question here. Can the load curve of individual customer be drawn by scaling down of the aggregated load characteristics? Answer would be certainly no ok. So, it is not possible.

So, if I show you that how would be the individual load characteristic, you can understand. So, let us see that how the load curve of a customer looks like; individual customers. So, if you look at this characteristic is of different shape than the aggregated load demand of that particular area ok. So, this characteristic if you look at, it is basically like needle peaks; a number of needle peaks and it a sort of discontinuous type of load curve, sorted of discontinuous.

So, at the certain moment of time, load demand suddenly increased and it comes down almost instantaneously ok. So, this is how this individual characteristic may look like. So, individual characteristic of a customer load demand cannot be derived from this aggregated load curve just by scaling down this load characteristics. This is not possible ok.

So, if you look at this what it should look like the scale version of load curve, but this is the actual load characteristics which is completely different; not only the shape of the characteristic, but also the pattern of the consumption. So, individual load characteristic would be completely different than the aggregated load curve. This is you have to understand.

So, if I write the essence of this point that we are trying to establish here is that individual load curve of a customer is completely different than aggregated load curve. So, this one has to understand. So, although this particular customer is part of this aggregated load demand, but its individual characteristics may be completely different ok.

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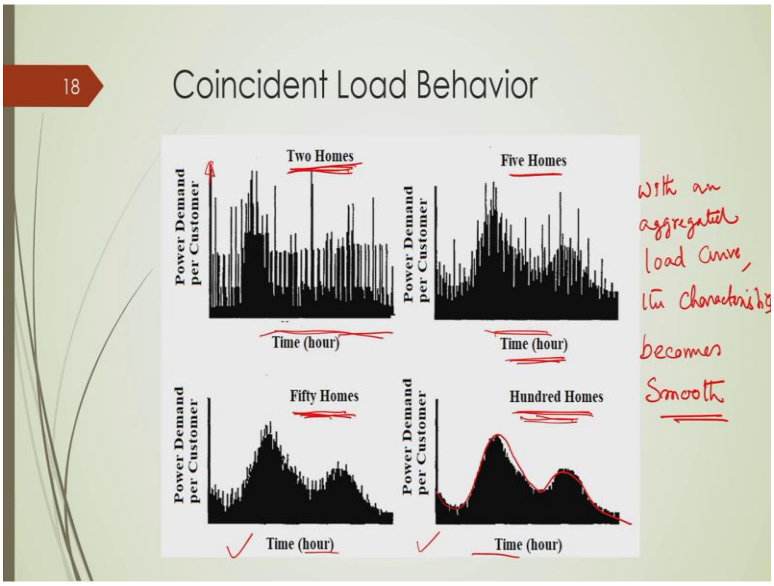

Now, here, there is an illustrative example that if we have number of customers aggregated, how this aggregated load curves will look like. So, in this figure, you can see when we have two homes; two residential homes and their load demands are aggregated; then the characteristics will be like this. Now, when we will have these five numbers of homes; each of having a residential customer and you aggregate their individual demand. So, characteristic will be like this ok. So, this is an illustrative example. It does not mean that every time, it has to be same only. But when we aggregate this load demand for fifty homes, you can see the how would be the characteristics and also, when we will aggregate this load demand of hundred residential customers, this is the aggregated load characteristic.

So, if you look at the difference of this these four characteristics, then you will understand that they are not only different in view of the shape of the characteristic, but also their consumption. You know entire this load curve gets smoothen when we will increase the number of the customers.

So, if you look at this, when we have two number of customers, when we will have this aggregated load demand characteristic almost similar to what we got in the individual load characteristic, individual customers load curve. But when we aggregate five homes and fifty homes and hundred homes, you will see this characteristic becomes more or less smooth, like this and it will get a similar kind of characteristic that we got in previous slide that is this characteristic ok.

So, the moral of the story is that with the increase number of characteristics, with the increase in number of customers, the aggregated load curve becomes a smooth characteristic; with aggregated load curve, the characteristic becomes smooth ok. So, even though in individual load characteristics are of needle shape with occurrence of this individual load demand almost instantaneous, but when we will aggregate, this characteristic will be almost smooth ok.

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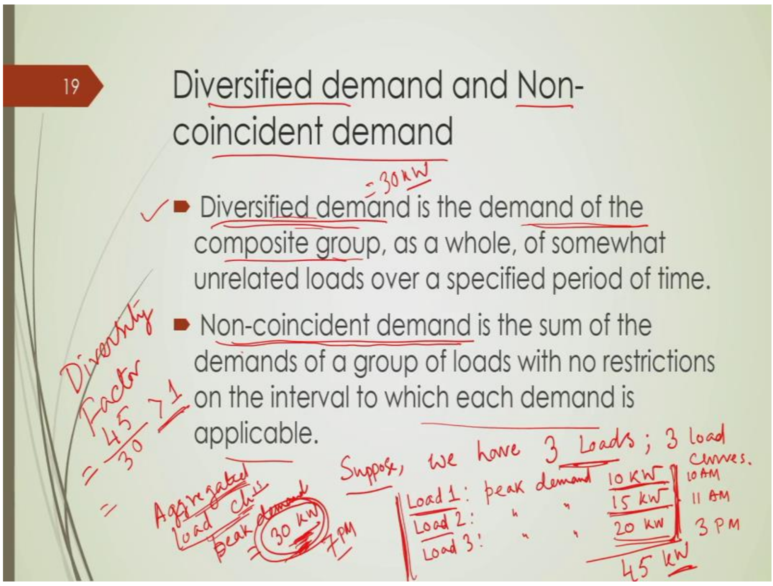

Now, why it happens; why it happens? This happens because of the diversity of the load; this happens because of the diversity of the load. Now, what do you mean by diversity? Diversity is that parameter because of which all these customers' consumption patterns are identical ok. So, there exists certain amount of diversity and there also exists certain amount of coincidence ok.

Now, we have certain indices to measure the diversity of this load demand ok. Now, before we go for these indices, we have a definition of diversified demand and non-coincident demand. Now, a diversified demand is the demand of the composite group as a whole of somewhat unrelated load over a specified period of time. What does it mean actually?

Suppose, I have a group of customers or group of loads, having hundred different types of loads and we are aggregating that ok. Now, when we will get an aggregated load curve of all these hundred customers or hundred loads; the peak value or the maximum value of that load demand would be the diversifier demand ok.

It represents the diversified demand or demand of a group; whereas, there is another definition which is non-coincident demand, which is sum of the demands of a group of individual load with no restriction that interval or to which each demand is applicable ok. If I give an example then things will be clear to you. Suppose, we have 3 loads. So, we have three load curves; that means, we have three load curves. Now, from this three load curves, let us find out the peak demand of individual load ok.

So, the peak demand of load 1, for load 1, peak demand is let us say 10 kilowatt ok. Now, for load 2, peak demand is let us say 15 kilowatt ok and for load 3, this peak demand is 20 kilowatt ok. So, these are the peak demand of individual load curves. These are the peak demands of individual load curve ok.

Now, when we aggregate all these three loads and we will get a aggregated load characteristic, ok and for this aggregated load characteristic, peak demand is let us say 30 kilowatt ok for aggregated load characteristic. What do you mean by aggregated load characteristic?

When we aggregate these three loads, you will get a composite aggregated load curve and for that aggregated load curve, the peak demand is let us say 30 kilowatt ok. Now, this 30 kilowatt is basically representing this diversified demand because it is the demand of this group or demand of this composite group ok.

So, this 30 kilowatt is the diversified demand or group demand and this non-coincidental demand is basically the sum of this individual peak demand which is equal to 5; 45 kilowatt ok. So, this 45 kilowatt is basically representing the sum of this individual peak demand; sum of this individual peak demand and most likely, they are non-coincidental. That means, they do not occur at the same time as I mentioned various types ok.

So, it may so happen that for load 1, peak demand occurs at let us say 10 AM and for this load 2, peak demand occurs let us say 11 AM whereas, for load 3, peak demands occurs let say at 3 PM. But ultimately, when will aggregate these whole characteristic, it may so happen this for aggregated load characteristic, the peak demand occurs at 7 PM ok. So, that is why we are calling this is that non-coincidental demand ok.

So, sum total of this individual peak demand which are non-coincident to each other is basically called as non-coincident demand; whereas, when we will aggregate all these individual load characteristics that peak demand of this aggregated load curve is representing that diversified demand ok.

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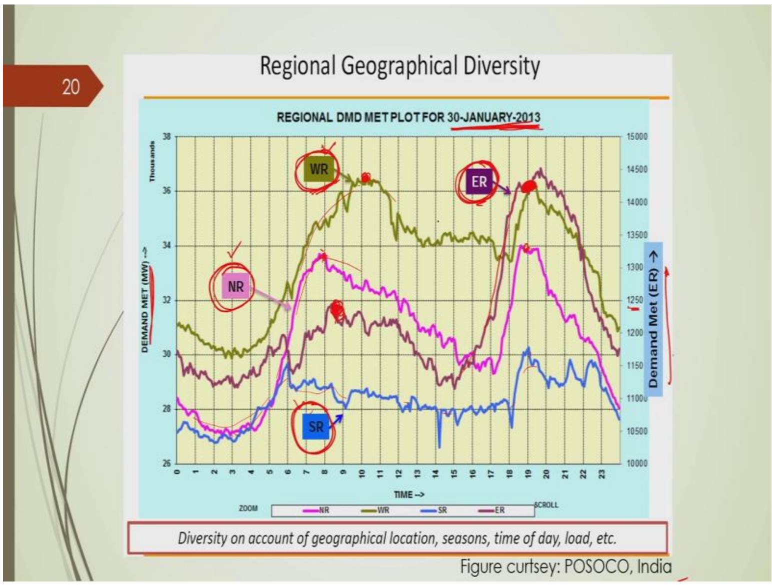

Now, look at how this regional diversity exists in Indian load characteristics ok. I again sincerely acknowledge that I took this characteristic from POSOCO, India ok. Now, if you look at these four characteristics, this WR basically representing western region load curve; western region of this country which includes the western states Gujarat, Maharashtra and those states.

NR represents the load curve of northern region. SR represents this load curve for southern region which consists of these states in the southern part of this country. And this ER is basically representing the eastern region load curve ok. Now, mostly as I have shown you this western region, northern region and southern region, their load demands are somewhat close to each other.

So, that is why for representing this load characteristics, their demand profiles are shown over in the same scale ok. So, their individual load demands are somewhat similar ok;

whereas, you know in eastern region, the load demand is almost one-third of these three regions ok and that is why for eastern regions, this scale is different and it is in right hand side of the characteristics ok.

Now, although this characteristic is of 8 years old, i.e., it was taken on 30th January 2013; but you can get an idea that how this regional diversity exists in a country ok. Now, if you look at this characteristic for western region, this is the western region characteristic. This is basically the characteristic for northern region and the bottom most one blue characteristic is basically representing southern region ok.

So, they have some individual load demand. They are basically aggregated load demand of a particular region. Now, if you compare this characteristic what things you can understand? First of all, let us see the western region. You can see there are two peaks; one is during morning peak which occurs between 10 to 11 and there is an evening peak which occurs somewhat at in between 7 O'clock to 8 O'clock. So, this is the evening peak.

And both the peaks are almost of same value ok. This is for western region and since it is in January, so evening peak or residential demand is somewhat less. In January, it is the winter season for this country and during that time, we do not have this air conditioning load ok. So, somewhat evening demand is lower and morning peak and evening peak are almost identical ok. Also, this happens because in western regions, we have many industries.

So, their morning peak is considerably high and it is almost identical to the evening peak; whereas, if you compare the load characteristic of this eastern region, this characteristic, you will see that there is a huge difference of this evening peak and this morning peak. Since morning peak somewhat occurs between 9 to 8 during that time.

And it is somewhat in a order of 1250 megawatt and this evening peak is almost double; it is almost some factors of this morning peak and there is a huge difference between this evening peak and morning peak and evening peak is much higher than this morning peak for eastern region.

Why it happens actually? This happens normally because eastern region we have less industry. So, industrial demand is not much and that is why morning peak is not much higher. So, this regional characteristic is mainly dominated by this residential area, commercial areas and that is why you know during evening, this load demand is much higher ok. Similarly, this northern region also we have industrial areas.

So, we have almost similar morning peak and evening peak and southern region also we have certain industries, also agricultural demand is there and that is why it is having almost similar characteristic as that of this other three load demand. So, the essence of the story is that we have different regions, we have different types of loads and that is why there exists diversity ok and this because of that their characteristics are of different ok.

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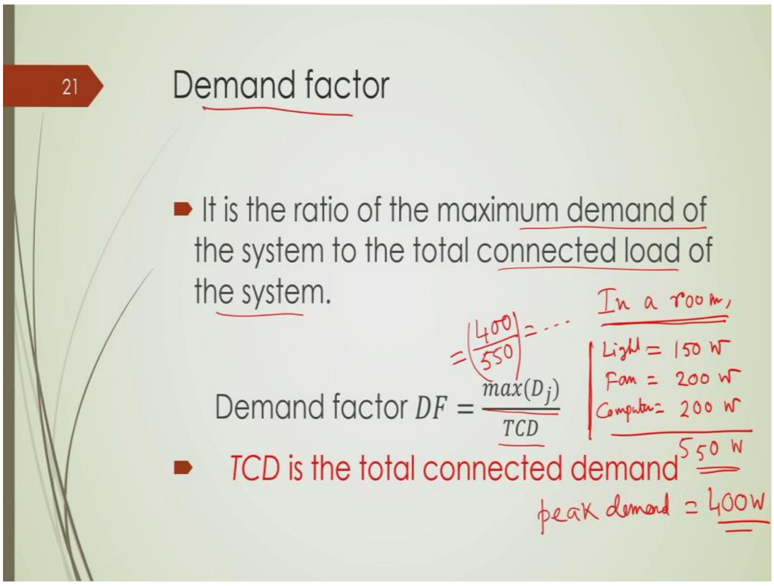

Now, we have certain indices to study; one is called demand factor. Demand factor is the ratio of maximum demand of the system to the total connected load ok. So, demand factor is the ratio of maximum demand to the total connected load. It means that if I give an example that let us say in a particular room, we have a number of appliances.

We have a number of appliances ok; we have some lighting appliances for lighting purpose or we can call them as lighting load ok. And let us say for lighting load, it has 150 watt ok; for fan let us say we have 200 watt ok; some computer, we have whose rated value of this power demand is somewhat 200 watt and so on ok.

Now, if we have these particular three types of loads in a particular room, so the total connected load demand would be equal to the sum total of individual rated capacity. So, it will be equal to 550 watt ok. But it does not mean that every time, we are using all these appliances simultaneously ok. It is very rare that we use all these appliances whichever we have in a particular room or in a particular house ok.

So, what we do? We suppose plot this load demand characteristics of this room and eventually, we get this maximum or peak demand is somewhat peak demand is somewhat 400 watt ok.

So, this demand factor will be equal to 400 divided by this total connected load that is 550, then whatever value is there ok. So, generally, this demand factor is lesser than 1, unless your peak demand coincides with your total capacity which is very rare ok. So, demand factor is calculated in that way. So, it is representing a factor or ratio of this peak demand to the total connected demand load or the sum total of the rating of all the appliances that we have ok.

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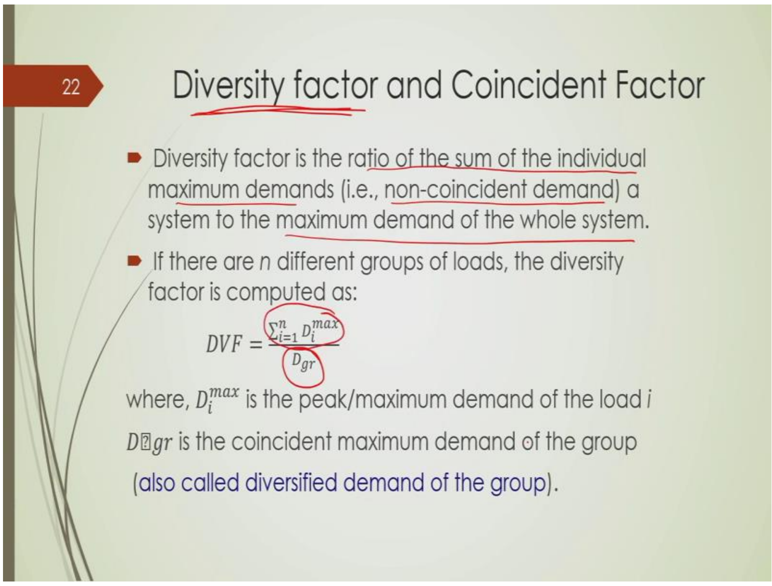

Now, there is another index which is called diversity factor, which is called diversity factor. What is this diversity factor? Diversity factor is the ratio of the sum total of the individual maximum demand, i.e., the non coincidental demand which we are talking about and it is the ratio of this non-coincident demand to the diversified demand or maximum demand of the whole system ok.

So, if I go back to this example that I said here, suppose we have this three load demands; we have three different loads and they have their individual peak values written over here 10 kilowatt, 15 kilowatt and 20 kilowatt. If you sum up, then 45 kilowatt will be equal to this non-coincidental demand or non-coincident demand and this 30 kilowatt is basically this diversified demand or the demand of this group.

Then, according to this example, the diversity factor will be equal to--- its numerator is non-coincident demand or sum total of this individual peak demand that is 45 kilowatt and its denominator is the peak demand of the group or the diversified demand which is equal to 30. So, this is 45 by 30. So, this should be greater than 1 ok.

So, diversity factor is an index which is normally greater than 1 ok. It can be equal to 1 under what condition? When your aggregated peak demand exactly equal to this you know sum total of this individual peak demand or non-coincident peak demand which is a very rare. Under that scenario only we have this diversity factor equal to 1; but other than that, diversity factor would be equal to would be greater than 1 ok.

So, it is the index whose value would be greater than 1 ok. So, it basically measures that how much diversity we have under an aggregated load ok. So, whatever I mentioned there, already I mean I have shown with example. So, diversity factor is the ratio of the sum total of individual peak demand or non-coincident demand to the diversified demand. So, denominator is the diversified demand or demand of this group and in numerator is the sum total of individual peak demand or non-coincident ok.

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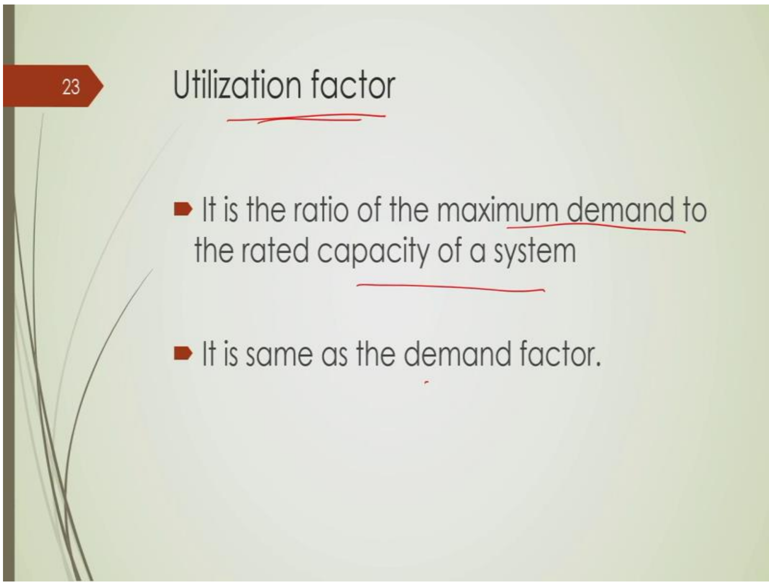

So, next index is basically the utilization factor. Next index is the utilization factor. It is the ratio of maximum demand to the rated capacity of a system. So, utilization factor is basically similar to the demand factor. It is the ratio of maximum demand to the rated capacity of the system and normally, this utilization factor is used to understand that particularly transformer is utilized; the particular transformer capacity is utilized. So, it is the ratio of peak demand or maximum demand to the rated capacity ok.

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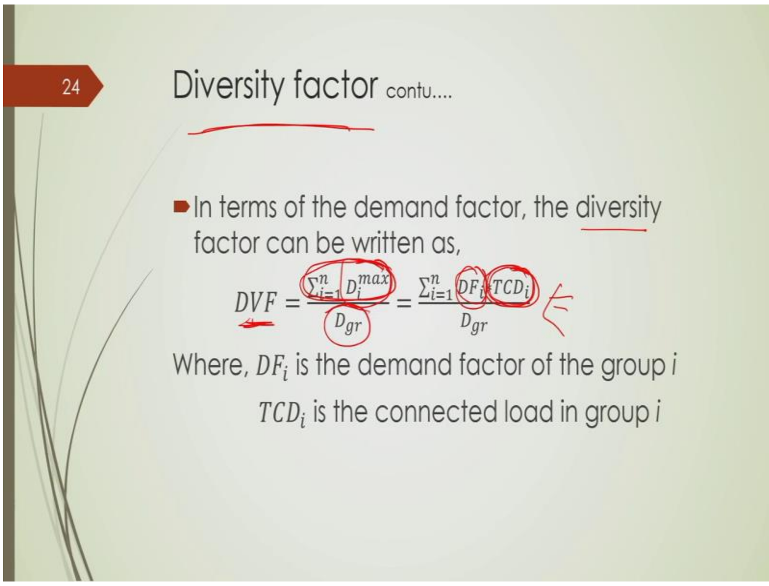

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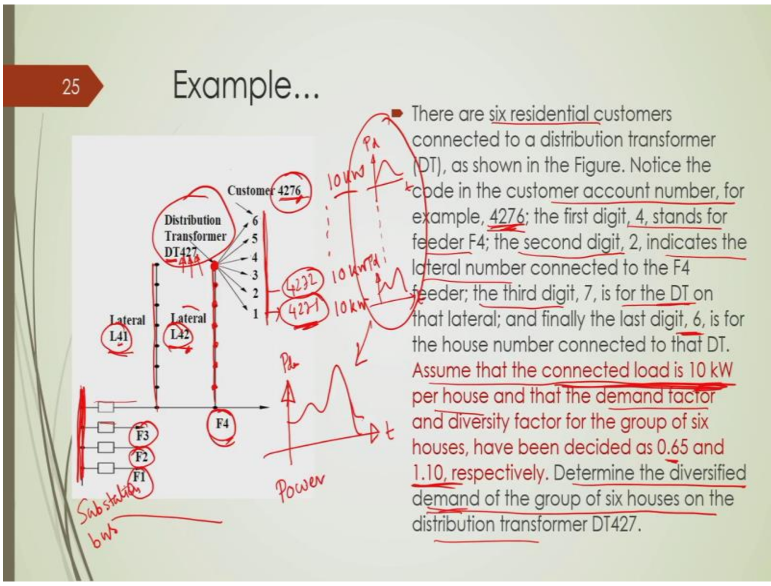

Now, we can also calculate this diversity factor in terms of this demand factor, in terms of this demand factor. So, what we can do? You can see this diversity factor is written as the sum total of individual maximum demand divided by the diversified demand or the group peak demand. Now, this individual maximum demand can be written as that individual demand factor with multiplied by total connected load.

So, this peak demand is replaced by this demand factor multiplied by total connected load because effectively this demand factor is equal to this peak demand divided by total connected load. So, peak demand is basically replaced by here; demand factor multiplied by total connected load.

So, we can find out this diversity factor in terms of this demand factor as well. If the demand factor is known to us for individual customers and if this total connected demand is known to us for an individual customer, we can calculate or compute this diversity factor from this demand factor and total connected load ok. Now, I have an example to show you a numerical example ok. So, look at this numerical example. We have a typical power distribution network ok.

So, this is the substation. This is the substation bus from which we have different number of feeders. So, this is suppose feeder 1; F1 stands for feeder 1; F2 stands for feeder 2; F3 stands for feeder 3; and F4 stands for feeder 4 ok. So, we have a four number of feeders under a substation.

This is the substation which is connected to the sub transformation line or transmission line and there is a transformer in between to step down the voltage level. Now, only this part of this feeder 4 is shown over here; only part of this feeder 4 is shown over here. This feeder 4 is having two lateral feeders, two lateral feeders; one is this lateral feeder, another is this lateral feeder ok. One is this lateral feeder and this lateral feeder. So, there is a nomenclature this L41 stands for this first lateral of this feeder 4 ok. So, L41 stands for this first lateral of this feeder 4.

Similarly, this L42 stands for the second lateral of this feeder 4. So, here four represents that this is a part of this feeder 4 and this two represents that this is lateral number 2; lateral feeder number 2 of under this particular feeder ok. Now, under this lateral 2 of this feeder 4, we have a number of distribution transformers. So, this each this black dot is representing one particular distribution transformer, one particular distribution transformer to which we have a number of loads connected, to which we have a number of loads connected.

So, here other distribution transformers are not shown over here. Here one distribution transformer is shown over here which is connected to 6 number of customers, which is connected to 6 number of customers. Again, this DT stands for distribution transformer; this 4 basically represents that it is at feeder 4; this 2 basically representing that it is part of this lateral 2 and 7 is representing that it is 7th number of node. Here, you can see 1, 2, 3, 4, 5, 6, 7; so, it is at 7th number of node ok. So, this distribution transformer is at seventh number of node ok.

Similarly, customers are also you know numbered as 4276, 4275, 4274, 4273, this one 4272 and this will be 4271 ok. This is not a very standard nomenclature; but this is one of the ways that you can represent a typical distribution network ok. So, this 4271 is basically representing one particular customer which is at feeder 4 at lateral 2, It is at seventh number of distribution transformer and it is customer ID is 1 ok. So, similarly 4276 is representing, it is at feeder 4, it is at part of this lateral 2, it is at 7th node of this particular lateral feeder and it is customer ID is 6 ok alright.

So, look at this problem then. We have six residential customers and each customer number is specified as the way I mentioned 4276 means the first digit stands for this feeder that it is a part of this feeder 4, then second digit stands for it is that at what lateral it is connected.

So, it is connected to the second lateral feeder of this feeder 4, then the third digit is representing that it is connected to the distribution number of the seventh node or it is the 7th distribution transformer to that particular lateral feeder and 6 is the customer ID ok or house number or customer ID whatever you can say ok.

Now, it is mentioned that connected load is 10 kilowatt per house ok. For each house, this connected load is same and that is for 10 kilowatt. So, this connected load is 10 kilowatt. This here also connected load is 10 kilowatt. Similarly, all this four customers' connected load is 10 kilowatt. Now, what do you mean by this connected load?

This connected load as I discussed few slides before that it is basically sum total of all this rating of the individual appliances that are there in that particular house ok. So, if we have a number of appliances in a particular house, just take a sum of their individual rating, individual voltage or power consumption rating. Then, this will represent/this summation will represent this total connected load ok.

Now, the demand factor is also given for this house, it is given as 0.65 and the diversity factor for this group of the 6 load, six customer is also given as 1.1 ok. Now, what we have to do we have to determine the diversified demand of the group of the 6 house under this transformer DT 4276. So, under this particular transformer, what would be the diversified demand? Now, what do you mean by diversified demand?

Diversified demand means suppose all these customers are having individual load characteristics. For example, this six customer, they are having some individual load curve, this is power demand, this is time; then, we also have you know different load curve for all these customers, we have power demand to the type.

Now, if you sum up, if you aggregate all these load characteristics, then you will be getting some aggregated power demand characteristic and let us say this will be something like this. This will be something like this; this your P demand and this is time. Now, when we aggregate all these characteristics, so this is the power demand or we should directly write is as a load curve, aggregated load curve.

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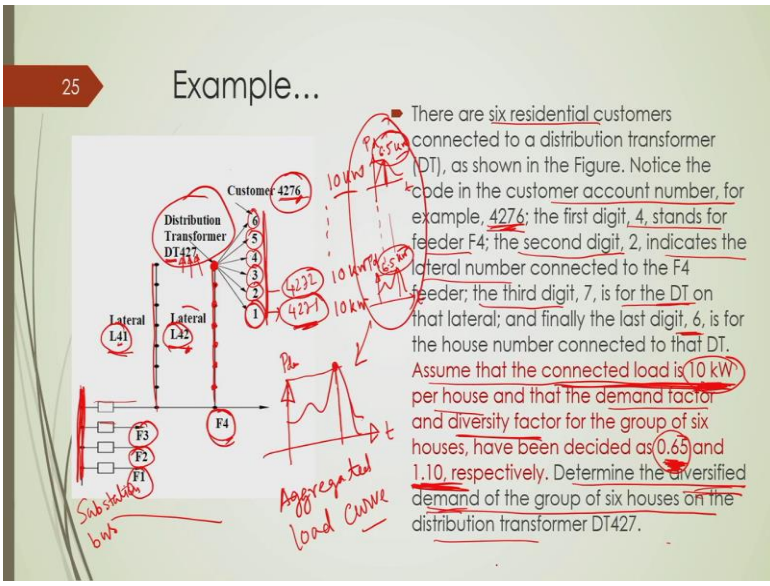

Now, this diversified demand is the peak value of this aggregated demand. This peak value of this aggregated demand is asked to find out provided that they provide you this data of total connected load, i.e., 10 kilowatt, this demand factor as 0.65 and the diversity factor 1.1 ok. So, how can we solve this? Is that difficult problem? It is not difficult problem at all ok. Because many information are given to you; first of all you know this connected load and also, you know this demand factor.

From these two, what you can determine, from the information of demand factor and the connected load, which information you can determine? Because you know that demand factor is the ratio of peak load demand, individual peak load demand and to the total connected load. So, if this demand factor is given, so if you multiply this demand factor with this total connected load, what we will get?

We will get the peak demand of all these customers and they are identical it is mentioned they are identical ok. So, peak demands of all the customers are identical; but it may not occur at the same time ok. So, what would be that peak demand? So, peak demand you can find out; simply by multiplying this you know that demand factor with this total connected load. So, which will be equal to 0.65 multiplied by 10 that is 6.5.

So, basically, the peak demand of individual customer you can find out from this demand factor and total connected load. So, it will be 6.5 kilowatt ok. Now, once you get that, then the sum total of this you know individual peak demand or non-coincident demand which is the numerator of the diversity factor can be determined ok. So, this will be equal to sum total of this all this 6.5. So, this will be nothing but 6.5 multiplied by 6.

So, once you get that this will be the numerator of the diversity factor; that will be the numerator of the diversity factor and the diversity factor is given that is 1.1. So, from that, we can determine the denominator of the diversity factor and that denominator is eventually you know that diversified demand or the demand of this group ok.

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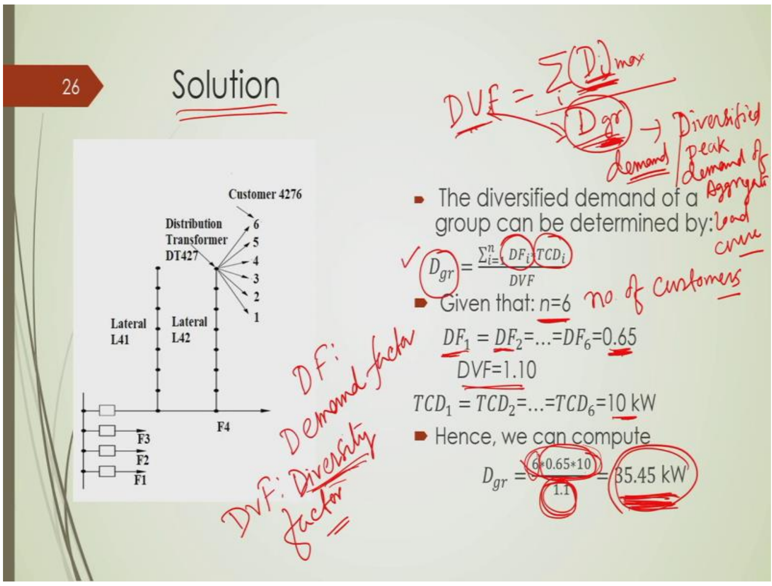

So, let us see how it is solved over here ok. So, the way I was talking about first they determine that as we know this diversity factor DVF is equal to sum total of this individual you know maximum demand with this diversified demand of the group. DGR is representing this diversified demand. So, this is representing this diversified demand which is nothing but the peak demand of the aggregated load curve.

Now, again, we know that this individual peak demand can be written as that demand factor multiplied by total connected load ok. So, it is given that n is equal to 6; n is number of customers ok and their individual demand factor DF; here DF stands for demand factor and DVF stands for diversity factor and this you have to understand ok. Now, individual demand factor is given as 0.65 and DVF that is diversity factor is given as 1.1 ok. So, from this demand factor and this total connected load, we can find out that individual peak demand which is equal to 0.65 multiplied by 10.

Now, as we know that this peak demand is same for all these six customers. So, you simply multiply with 6 in order to find out the summation of individual peak demand ok. So, the numerator will be 6 multiplied by 0.65 multiplied by 10. So, this is the numerator of this DVF and you know DVF is given as 1.1. So, like this, we can determine this diversity factor of this group which is equal to 1.1; this value divided by this diversity factor that is 1.1 which is coming out to be 35.45 kilowatt. So, this is a very simple problem given to you ok.

So, in that way, we can solve this small-small problem for this load composite load characteristics; the problem is not much difficult at all. So, here many information are given to you. Here, demand factor is given to you; total connected load is given to you, so you can find out the individual peak demand and this individual peak demand is mentioned as identical for all this six customers. So, the sum total of this individual peak demand will be total number of customers multiplied by this each of this individual peak demand which is 0.65 multiplied by 10 that is 6.5 kilowatt multiplied by 6 and this diversity factor is given as 1.1. So, you replace this denominator with this diversity factor and you can find out what is the value of this diversified demand of this group. Now, this value this 35.45 is basically representing this peak demand of this aggregated load curve of all these six customers.

So, when will individual customers occur? Peak demand is given as 6.5 each; but when you will aggregate them, this would not be exactly equal to 6 multiplied by 6.5. Because this individual peak demands do not occur at the same time ok and that is why you can see that diversified demand or the peak demand of the aggregated load is basically equal to 35.45 which is not equal to see this value that is 6 multiplied by 6.5 which is much higher than this 35.45.

And that occurs because of that the diversity of the load demand; that occurs because this individual although this loads are having some identical demand factor and connected load; but that their consumption pattern is not same. That means, at the moment of when you know customer 1 is having this peak demand, at that same moment customer two may not have this peak demand ok.

That means, all these individual customers, they have different timing for consumption of the peak demand and that is why when we will aggregate their individual peak demand, this would not be equal to this peak demand of the aggregated load curve ok. So, this is the main thing that you should understand and that aggregated load curve, we determine from this diversity factor ok.

So, with this I will stop at this point and we will continue on the next time.

Thank you.