Power System Engineering
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Lecture – 58
Automatic generation control (Contd.)

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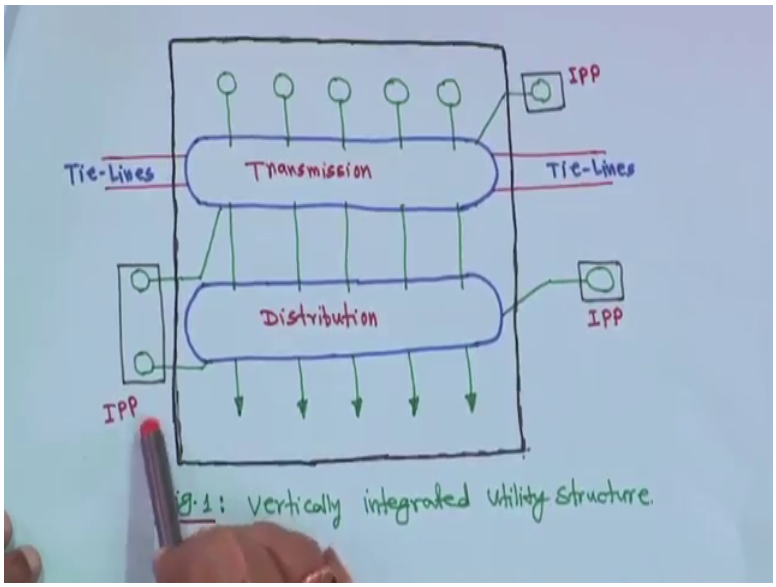

So this is actually your what you call that vertically integrated utilities, that mean you have everything together generation, transmission and distribution this was the concept and IPP is the independent power producer right.

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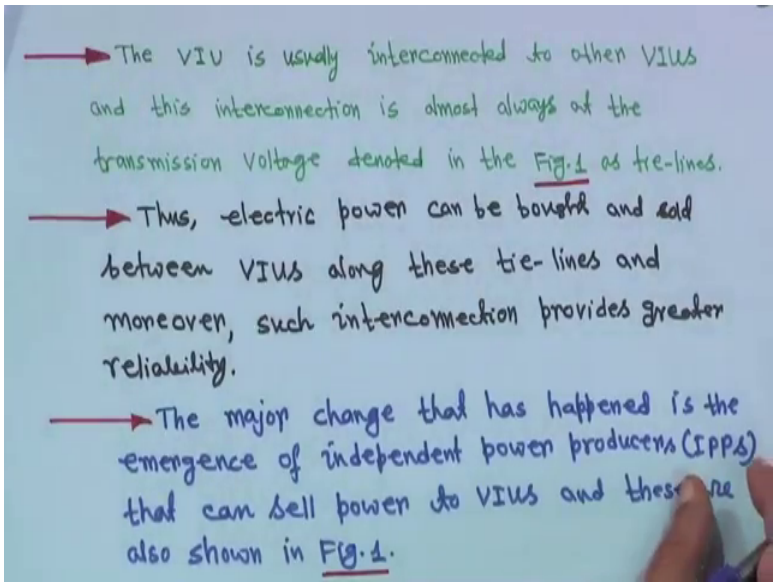

So, the vertical that is VIU, you call vertically integrated utility is usually interconnected to other vertical integrated utilities that means, tie lines are shown here both side it is shown here, I told you to two area system like that.

So, similarly it may be connected to other vertically integrated utility system, this may be connected. So, and this interconnection is almost always at the transmission voltage denoted in the figure 1. So, these are actually high voltage line right. So, it is at that transmission voltage, but not here not distribution only at the transmission right. So, thus electric power can be bought and sold between vertically integrated utilities along these tie lines and moreover such interconnection provide greater reliability right.

So, these particular power system that is connected with other tie lines also suppose other true other power system also right, through the tie lines and if other they need power, then they can borrow power or purchase power from here right, or these particular area power system can borrow power purchase power from the other connected your power system. So, right so that is why it give more flexibility and it improves the reliability also.

The major change that has happened actually is the emergence of independent power producers that can sell power to VIU s and these are also shown in figure 1, independent power producer also connected to vertically integrated utility system, they are they are private parties actually, they are also can they can also sell the power right, they are

private parties right and this one this generation transmission distribution may be it is owned by government right.

So, but mean what, but independent power producer also, now nowadays many private parties are there they are also generating power right.

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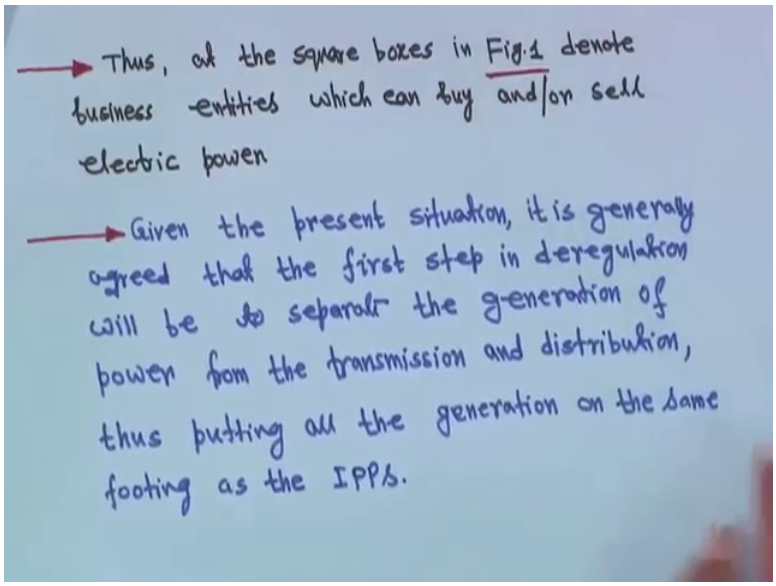

So, thus at the square boxes that mean this one this one this one at the square boxes right, in figure 1 denote business entities which can buy and or sell electric power right. So, this IPP actually that business entities, they can buy or sell power right. So, for example, if somebody has his own industries, he can have his own power plant. So, this power maybe he can use for his own industry in addition to that x is power he can sell it right.

So, given the present situation it is generally agreed that the first step in deregulation will be to separate the generation of power from the transmission and distribution; that means, separate you separate it. Thus putting all the generation on the same footing as the as the independent power producer; that means, all generation companies like independent power producer is private, this is private this generation also you put it in IPP such that it will be a separate entity, like private power producer right.

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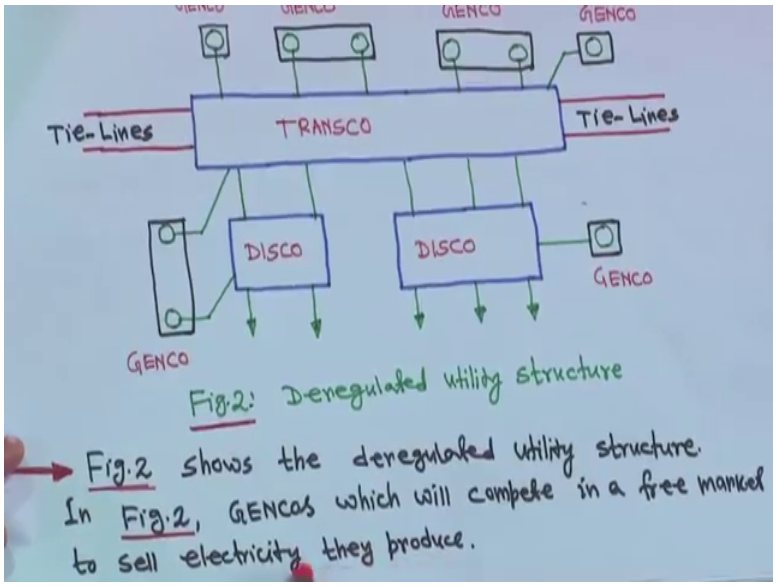

So, this is the concept. Now if we do so, if we do. So, then what we can tell this is your this is not VIU this is deregulated utility structure, in this case this generation company we will call GENCO in short we call GENCO I mean this one this one actually breaking it same thing that your concept remain same, but 3 different entities right 3 different entities. So, this is generation companies they are private, suppose if you want that I should have a power generation company, you may have power generation companies, you can sell your power through transmission line to distribution side, this is transmission company you will call TRANSCO right.

And this is distribution company in short we call DISCO right. So, GENCO TRANSCO and DISCO DISCO means distribution company in short and transmission companies connected to a tie line same is here this is transmission, it is connected to a tie line and this all generation everything has been a separate. So, GENCO suppose 1 generation company has 1 generator here a 2 generator here 2 generator here 1 generator so, on here also some GENCO is there is 1 generator may be producing power at high voltage level.

So, it connected to TRANSCO TRANSCO transmission company another GENCO it is low voltage level, suppose it is distribution companies like we in solar may be connected at a distribution side, this is also GENCO only 1 generator. So, that your distribution sides. So, these are called and there are two distribution companies.

So, this is called DISCO and this is called DISCO and here, it is showing in this diagram only one transmission companies. So, suppose that means, generation company will be somebody else right, this may be one percent this may be another percent this may be another percent. So, many generation companies transmission company may be 1 or more right, because power wheeling will take place to the transmission company and distribution companies may be many that means, this distribution company actually has to buy power from this GENCO.

But at particular time this GENCO will have bidding you have to go for bidding, this GENCO will tell that today at this at this moment right, we will cost of the power is like this. And distribution companies they have the freedom, they can buy from either of this GENCOs or from they can contact with many other GENCO, not only with one generation companies may do it many other GENCO generation companies they have the freedom to purchase power.

And this power will come to that transmission companies. So, transmission as it is transmitting power it will also charge many things right type charge, or something that generation company as well as distribution company both have to pay to the transmission company some bidding will be there, but we will not discuss about transmission companies here, right our objective will be generation companies and distribution companies and power anyway it is coming through the transmission companies right.

So, that is why that figure two shows the deregulated utility structure right in figure 2 GENCOs which will compete right in a free market to sell electricity they produce right. So, this generation company is also selling power to the distribution companies and, distribution companies also have the freedom, who will give him a cheapest power such that I can buy suppose if, you go for marketing for buying something and going to several shops. And if you see this is the cheapest one naturally you will buy that right same philosophy here, same philosophy here.

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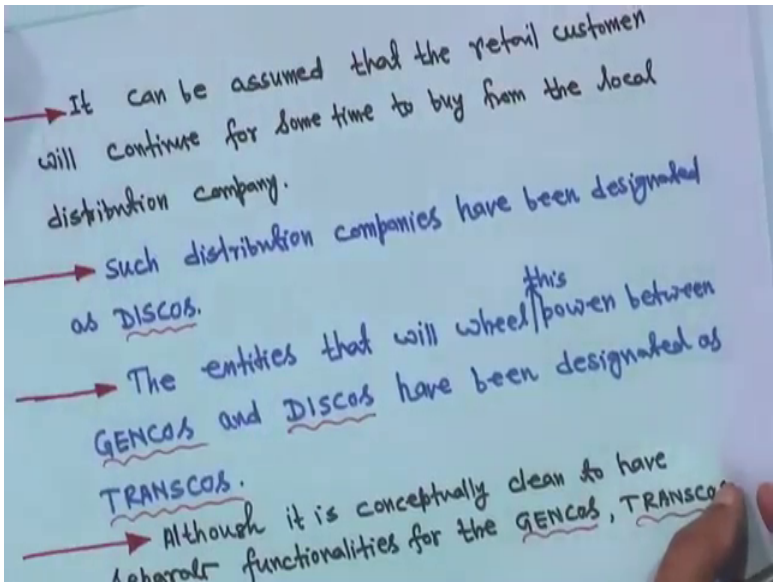

Therefore it can be assumed that the retail customers will continue for some time to buy from the local distribution companies that is there your local distribution companies right, such distribution companies have been designated as DISCOs distribution companies we call DISCOs. The entities that will wheel this power between GENCOs and DISCOs that is between GENCOs and DISCOs power has to come to transmission company right. So, that will wheel this power right, have been designated as TRANSCOs transmission companies, we call TRANSCOs several transmission companies. So, it putting TRANSCOs, GENCOs and DISCOs right.

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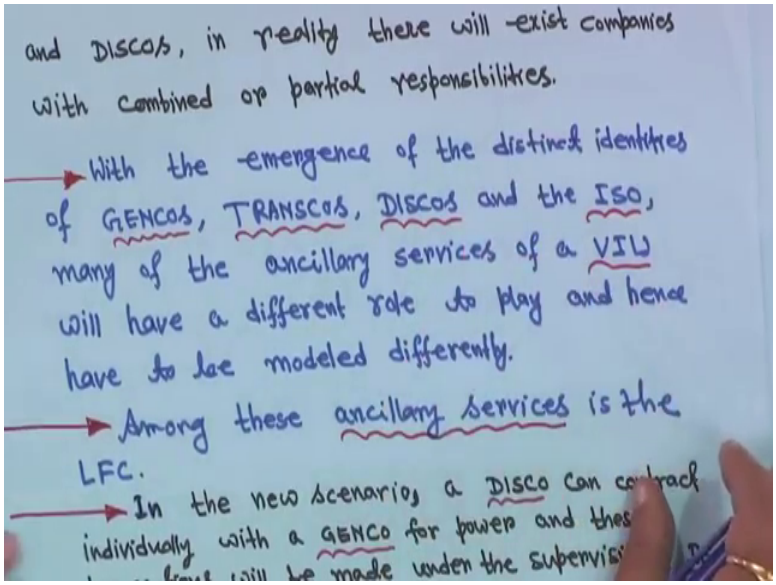

So, although it is conceptually clean to have separate functionalities of the GENCOs TRANSCOs and DISCOs right, for that what we need is in reality this will exist there will exist companies with combined, or partial responsibilities that means, you need 1 4th party that who will handle this right who will handle this. So, in that case what will happen, you need a separate entity and another office, we will call your what you call that your that is we sometimes we call ISO right. So, so in that case what will happen, I will tell you what is ISO.

Suppose generation company is giving the beat that this is the my price, distribution company is also by bidding will be there transmission company may be willing this power, for all this bidding will go to your what you call somewhere. So, sometimes ISO we call independent system operator right this ISO. So, in that in that that means, it will be a system it will be a system that where all this bidding will be given here, we call independent system operator right. So, many of the ancillary services; that means, there are many services reactive power compensation and many other thing AGC is also one of them of a vertically integrated utility will have a different role to play and, hence have to be modelled differently right.

So, among this ancillary services LFC is the one of them, right there are many ancillary services I did not list them, I thought it is irrelevant here because our objective is only this thing right. So, in that case in the new scenario a DISCO can contact individually with GENCO right, I have I have a distribution companies I can contact I can contact with GENCO that, if I get a cheapest power right for power and this transaction will be made when the under the supervision of ISO.

So, there will be a separate office, or separate entity right such that they will handle all sort of thing; that means, your under this condition things becoming actually all the power generation concept distribution concept everything remains same right transmission concept remain same, but only thing is that things becoming little bit of competitive, then it will become complicated too right.

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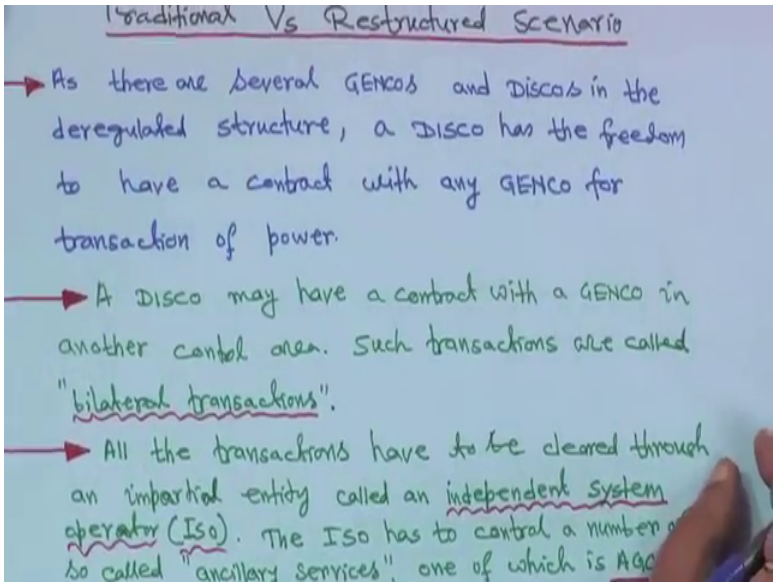

But traditional versus restructured scenario right. So, as there are several GENCOs and DISCOs in the deregulated structure, a DISCO has the freedom to have a contact with any GENCO for transaction of power, wherever I will get cheapest power, I have a distribution companies say, if I get a cheapest power, then I can find out which GENCO will sell because I will see everything in terms of money and profit right. If I say I can make more profit I am getting cheapest power. So, naturally I will I will I will your what you call go for that right.

So, a DISCO may have a contact with a GENCO in another control area also; that means, suppose if you if you take suppose you have a generation distribution companies, transmission companies and, suppose your what you call that generation company, transmission and distribution companies suppose one having in Chennai right. And another company may have in Coimbatore say right. So, distribution companies is Coimbatore need not buy need not buy power from the generation companies Coimbatore there is no need. If distribution company get is power cheaper power from Chennai say, then that that distribution company can buy power from the generation companies in Chennai right.

So, this freedom will be there this freedom will be there that is why a DISCO may have a contact with a GENCO in another control area that is a suppose it is a many areas. So, you can buy DISCO can buy power, such transactions are called bilateral transaction

naturally power your buy from other. So, it is a bilateral transaction right. So, little bit mathematics is there, I will show you very easy to understand right. All the transactions have to be cleared through an your your what you call and impartial entity called an independent system operator ISO I told you, an independent system operator right.

The ISO has to control in number of so, called ancillary services, that ISO responsibility is much more and one of which is AGC right. So, this is independent that means, it will be a separate office right that they will handle all sort of things so that means, so that means, little ideas you have that your what you call that transmission distribution and generation companies right.

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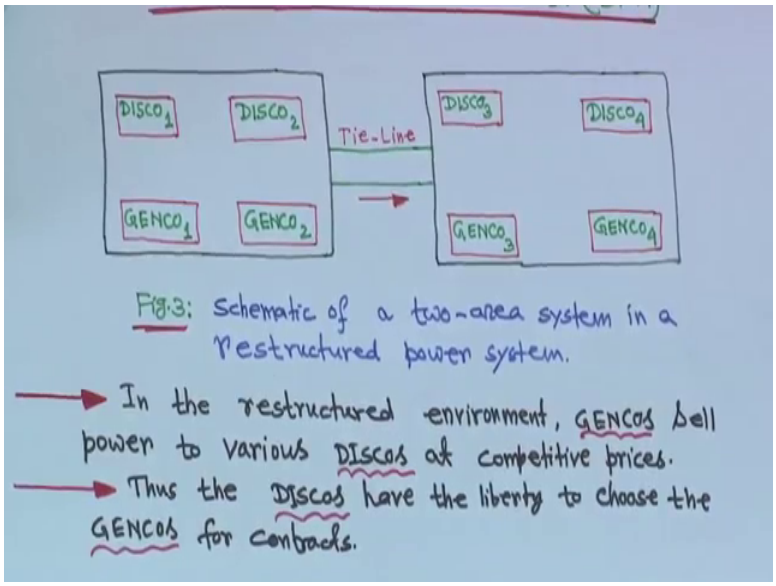

So, now if you look into that we call DISCO participation matrix in short DPM that is DISCO means distribution companies participation matrix, for your understanding we have taken a small example. Small example suppose this is area 1 and this is area 2, in area 1 2 generation companies are there it may be (Refer Time: 11:40), it does not matter distribution companies are there it may be more, right does not matter more less does not matter, but here we have taken identical number.

So, just for the purpose of you know class of exercise class of exercise. Suppose in area 1 there are 2 generation companies GENCO 1 and GENCO 2, 2 distribution companies DISCO 1 and DISCO 2 and area 2 also 2 generation companies GENCO 3 and GENCO 4 and 2 distribution companies DISCO 3 and DISCO 4 right.

So, this is schematic this is figure 3. So, schematic of a 2 area system in a restructured power system and direction of power flow, we have taken this direction it may be other direction also, but say for this direction right say it is this is connected by tie line this is the tie line. So, in the restructured environment right GENCOs sell power to the various DISCOs at competitive prices; that means, these are the distribution companies, if you get cheapest power you can buy from GENCO 1 or GENCO 2.

Similarly, these distribution companies, if it get cheapest power from area 2, then GENCO 3 and GENCO 4, there is no need that DISCO 1 and DISCO 2 distribution company 1 and distribution company 2 will buy power from GENCO 1 and GENCO 2 from shown area no there is no hard and first rule, if you get cheapest power it can contact with this GENCO 3 and GENCO 4, I told you if 1 is in Chennai another is Coimbatore right like that. So, here also here also in area 2 DISCO 3 and DISCO 4 right. Suppose if generation companies, if it buy power from GENCOs it will be GENCO 1 and GENCO 2 right instead of buying power GENCO 3 and GENCO 4, if power is not cheap.

So, so that means, that various DISCO at competitive prices thus the DISCOs have the liberty to choose the GENCOs for contract right. Another thing is that because of this contract and buying selling power, GENCOs will have lot of responsibility to supply power to the distribution companies because, they have the contract; that means, more response your GENCOs will be very much response over for generating that power such that distribution companies can your buy that power, whatever contact they have with this GENCOs right.

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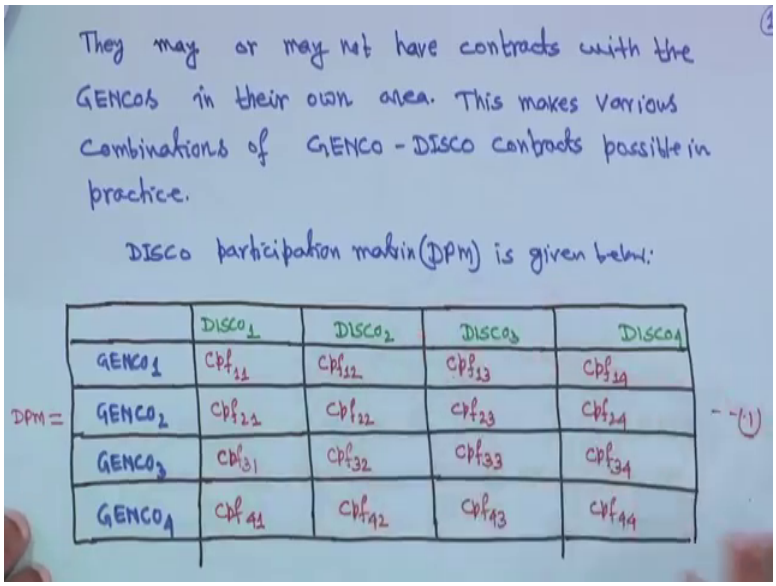

So, therefore, they may or may not have control. So, if the GENCOs in their own area I told you, this makes various combination of GENCO DISCO control possible like contract possible in practice right. So, what you do in that way we can define on matrix called DISCO participation matrix, that is DPM is given below, DISCO participation matrix just here to understand right very simple it is understand, first thing is this is nothing is here, it is blank this side is GENCOs this column.

Suppose here you have that your 4 generation companies and 4 distribution companies, we have taken that is why it matrix will be like that, but no hard and fast rule you have n number of n number of DISCOs m number of GENCOs here you have a p number DISCOs q number of GENCOs something like that it can be anything. So, you have 4 generation companies 4 distribution companies this column, we are keeping GENCO 1, GENCO 2, GENCO 3 and GENCO 4 and distribution companies DISCO 1, DISCO 2, DISCO 3 and DISCO 4 right.

Now the Cpf actually it is called contract participation factor that term Cpf, we call contract participation factor, the way we denote the matrix we putting in like matrix element Cpf 1 1, Cpf 1 2, Cpf 1 3, Cpf 1 4, Cpf 2 1, Cpf 2 2, Cpf 2 3, Cpf 2 4, Cpf 3 1, Cpf 3 2, Cpf 3 3, Cpf 3 4 and Cpf 4 1, Cpf 4 2, Cpf 4 3 Cpf 4 4 no need that is matrix will 4 into 4 it can be anything, it depends on the number of GENCOs and DISCOs in each area right.

So, these are called contract participation factor before moving that for example, suppose DISCO 1 total power demands say it needs 10 megawatt right it 10 megawatt. So, it may have contract with GENCO 1, GENCO 2, GENCO 3 and GENCO 4, it may not have contact with some GENCOs also right. Suppose if I assume DISCO 1 has contact with GENCO 1, GENCO 2 and GENCO 4 suppose it needs 10 megawatt later I will give. Suppose it total this needs 10 megawatt right.

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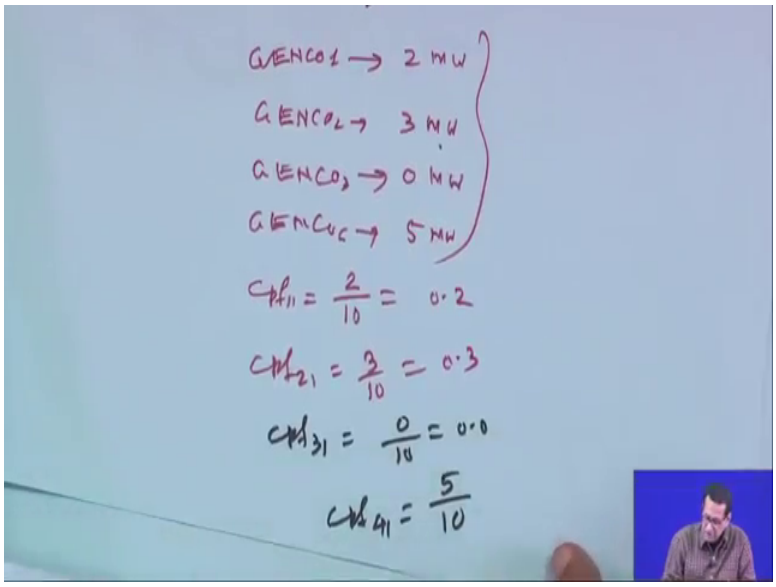

And, suppose if he takes if he takes from GENCO 1, suppose total so, DISCO 1 that is distribution company 1 is total load demand is 10 megawatt at particular hour it needs power. Suppose it has contact with GENCO 1 right GENCO 1, suppose it has contact say 2 megawatt with GENCO 1, then with GENCO 2 right suppose it has 3 megawatt right GENCO 3 it may be 0 also does not matter right it may be 0 also suppose GENCO 3 0 megawatt and GENCO 4 suppose it has 5 megawatt the total is 10 megawatt right.

Then this contact participation factor this Cpf 1 1, Cpf 2 1 because DISCO has contact with GENCO 1, GENCO 2, GENCO 3, GENCO 4 that means, your what you call that Cpf that is contract participation factor 1 I mean this one, it has contract with GENCO 1 2 megawatt that means, it will be 2 by 10 is equal to 0.2 Cpf it is always less than equal to 1, then Cpf this 2 1, because DISCO 1 has contact with GENCO 2. So, Cpf 2 1 this way you have to understand Cpf 2 1, it has 3 megawatt contact 3 megawatt. So, it will 3 by 10 that is equal to 0.3 right.

Similarly, GENCO GENCO 3 that means, Cpf 3 1 it has 0 megawatt contract; that means, Cpf 3 1 is 0 by 10 that is 0.0 right and last 1 Cpf 4 1 with GENCO 4 it has 5 megawatt contract 5 megawatt contract. So, Cpf your what you call 4 1, Cpf 4 1 will be your 5 divided by 10 because 5 megawatt, but total DISCOs is 10 megawatt load total is your what you call this 1 is 10 megawatt total is 10 megawatt so that means, it is 0.5 right that means, column wise Cpf 1 1, Cpf 2 1, Cpf 3 1, Cpf 4 1, if you add it has to be 1.

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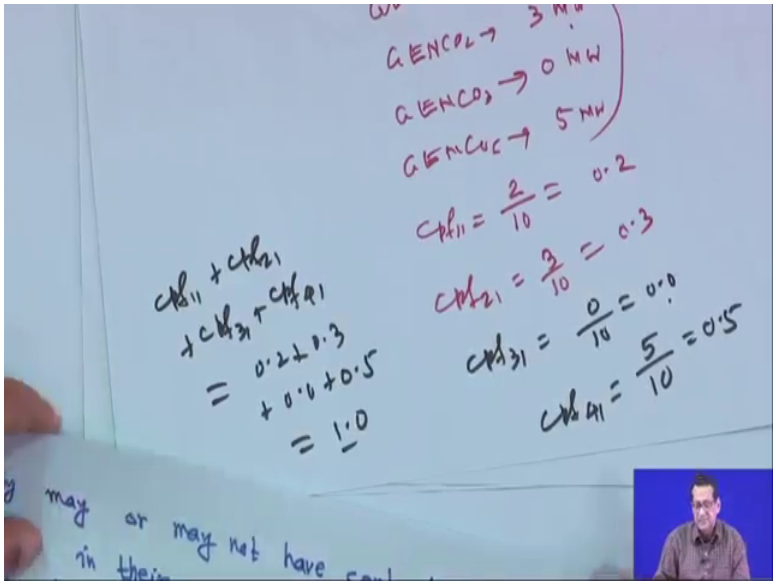

That means column wise summation that Cpf 1 1 plus Cpf 2 1 plus Cpf 3 1 plus Cpf 4 1 Cpf 1 1 is 0.2 Cpf 2 1 is 0.3 Cpf 3 1 is 0.0 and Cpf 4 1 is 5. So, total is 1.0 right.

That means this call that means, this column wise that this I just told you that column wise all the summation, here has to be 1 here also has to be 1 column wise summation here has to be 1 here has to be 1, because DISCO 2 also may have contact with this DISCO 3 also may have contract with this DISCO 4 also may have contract with this; that means, idea is that whenever this DISCO demands to a 10 megawatt, I told you suppose this DISCO demand DISCO 1 demand 10 megawatt right.

So, from GENCO 1 it has contact 1 megawatt GENCO, but it is at the same time remember at the same time may be a at the watch in front of me it is. So, in 12:40 pm so, at this moment right suppose this DISCO meet 10 megawatt, then GENCO 1 is 2 megawatt GENCO 2 meet 3 megawatt GENCO 3 it has no contract. So, 0 megawatt that

means, DISCO 1 has no contract with GENCO 3 and with GENCO 4 it is 5 megawatt. So, total is 10 so divide all this thing by 10. So, you will get the fraction and total should be column wise it should be 1 right column wise it should be 1.

So, that is why this is called actually DISCO participation matrix, this a simple thing, I think we have understood this it is a simple thing. Similarly DISCO 2 may have also some contract DISCO 3, but this column summation should be always 1 just 1 I showed you another 1 is there here right.

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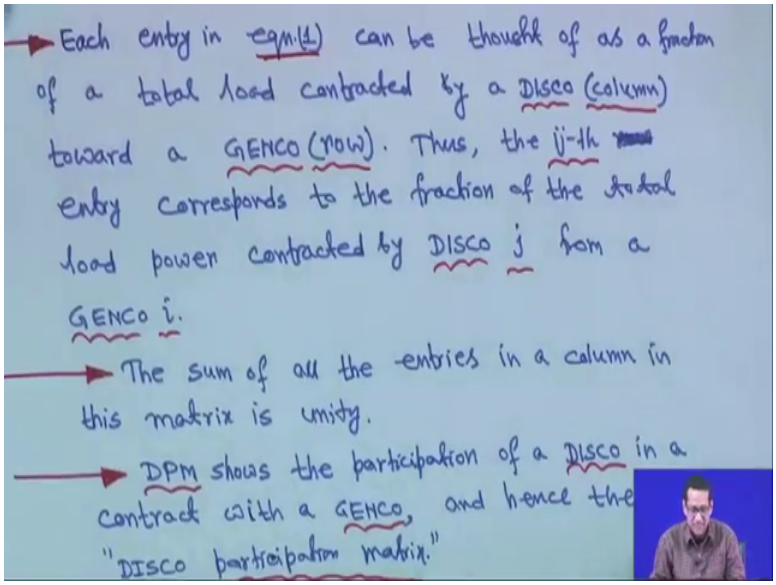

This is for your understandable understanding, right so each entry in equation now I have explained everything, now low look each entry in equation 1 can be thought of as a fraction of the total load contracted by the DISCO right, if we put that fraction means this 0.2 0.3 here it is 0 and 0.5, these are the fraction right fraction of that total demand by DISCO 1 that means, DISCO need is 24 10 megawatt this 0.2 in 10 means it is two megawatt right.

So, the entry in equation one can be thought of as a fraction of a total load contracted by DISCO that is the column 1 right, this one this one I told you column wise summation will be always unity this is the column 1 this is the column 1 right, toward GENCO right and, it is toward a GENCO it is row right this your this thing this GENCO 1 2 3 4, this row this row like this right, thus the i j-th entry correspond to the fraction of the total load power contracted by DISCO j from a GENCO i right.

So, this is we will see for the tie line power how things are like this right. So, I have a here it is written in words, but there I have explained how things are right even, if you do not read it also does not matter whatever I have explained just meaning is same here right. The sum of all the entries in the column in a matrix is unity just I told you, that column wise if you sum Cpf 1 1, Cpf 2 1, Cpf 3 1, plus Cpf 4 1, it has to be 1 right. So, that means, DISCO participation matrix the DPM shows the participation of a DISCO that is participation of distribution companies in a contract with a GENCO and, here is the DISCO hence it is called the DISCO participation matrix that is its name right.

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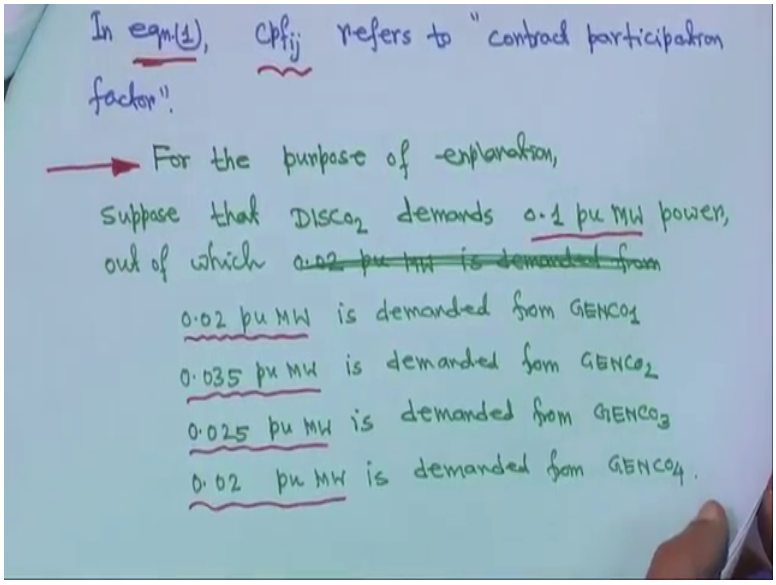

Now, in equation 1 Cpf i j refers to I told you contract participation factor here, it is mentioned the contract participation factor it is in general it is Cpf i j right. Now again for the purpose of explanation again suppose now DISCO 2 demands 0.1 per unit megawatt, I have now made it power previous 1 I showed 10 megawatt.

Now, it is a point per unit megawatt power that is DISCO 2 demands right; that means, this matrix you come here, right this matrix you come here suppose DISCO 1 I told you in real unit 10 megawatt it is showing in per unit per unit does not matter. So, DISCO 2 it suppose it has a your what you call your demands 0.1 per unit megawatt power and your 0.02 per unit megawatt demanded from GENCO 1 0 point that is DISCO 2 demand GENCO 1 that is your 0.02 per unit megawatt power. Similarly DISCO 2 from GENCO 2 actually it demands 0.035 per unit megawatt from GENCO 2 right.

Similarly, DISCO 2 demands from GENCO 3 0.025 per unit megawatt. And, similarly this DISCO 2 it demands from GENCO 4 0.02 per unit megawatt power that is the real unit this is per unit, then your Cpf 1 2 will be 0.02 by 0.1 Cpf 2 2 will be 0.35 by 0.1 Cpf your this thing 3 2 will be 0.025 by your 0.1 and Cpf 4 2 will be 0.02 by your what you call by 0.1. So, you will get the fraction of it and all summation column summation will be 1 right.

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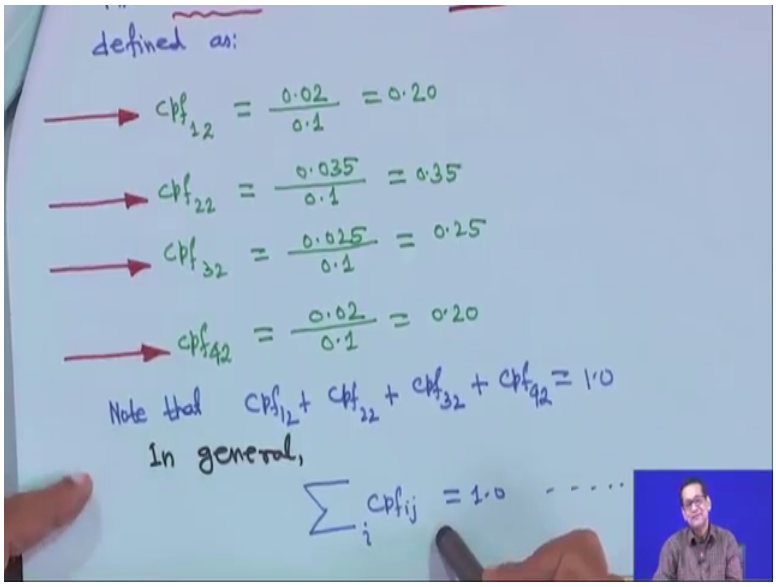

That means, your the column 2 entity your entries in equation 1 Cpf 1 2 will be 0.02 by 0.1 0.2 Cpf 2 2 will be 0.035 by 0.1 it will be 0.35 Cpf 3 2 will be 0.025 by 0.1, it will be 0.25 and Cpf 4 2 will be 0.02 by point 1, previously I took real unit and here it is per unit meaning is same meaning is same 0.2.

So, if you add all if you add all it will be 1 0.2 plus 0.35 plus 0.25 plus 0.2 it is 1. So, column column wise, it has to be your 1 column wise 1. So, in general in general sigma your your i in general for sum i Cpf i j will be 1.0 right, if j you vary 1 2, whatever in whatever your number of distribution companies at their your companies at their right. So, that is your summation should be 1, this is marked as equation 2 right.

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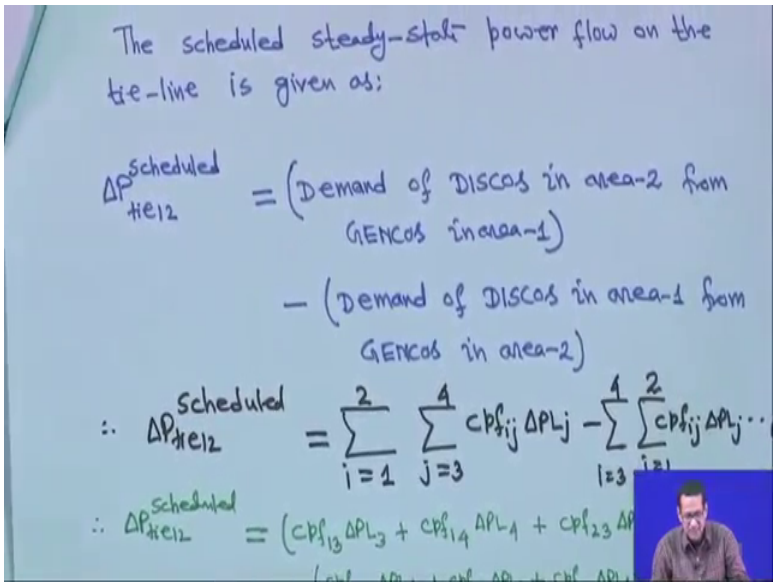

Therefore, this if you look at this diagram, this block diagram that tie line power flow, which were flowing right, this is your vertically integrated 1 and just hold down this this a j not this one not this one just hold down this one this one this one right this one. So, if you look into that then what will be the your what you call the tie line power flow how things will come. So, mathematically I will not put I will put something, but for your understanding what I will do, I will make the things much simpler right.

Now suppose we will assume the power is flowing in this direction the power is flowing in this direction right. So, if it is if it is positive this direction if it is negative 1, then it will be automatically in other direction. So, this is area 1 this is area 2 right. Now, now what is the scheduled power flowing your for from 1 to 2 right from 1 to 2. So, this is area 1 this is area 2 right.

So, if you if you have thing you can write that this is your area 1, I make it short this is area 1 and this is area 2 right and direction we have taken that will from this 1 to this 1. So, in that case what will happen that it will be that what is the flowing power flowing from you know area 1 to area 2 in this direction that means, demand of DISCOs in area 2 right from that GENCOs in area 1, because if DISCO purchase power from this GENCO 1.

So, DISCOs demand from this 1 will flow in this direction right because DISCO want is to buy power from this GENCO that means, power will be flowing in direction minus

this DISCOs, if you have a contact buying power from this. So, minus this DISCOs buying power from this one because it has to be minus because, it is basically your from 2 to 1 it is coming. So, I have to make it I have to minus it that is I have to subtract, that is why demand of DISCOs in area 2 from GENCOs in area 1 because, it is your 1 to 2 this direction you have taken power is flowing.

So, demand of DISCOs in area 2 that means, this is your area 2 from GENCO 1, then only power will flow in this direction. So, minus demand of DISCOs in area 1 from GENCOs in area 2 so, minus demand of DISCOs in area 1 from GENCOs in area 2 right. So, in that case what will happen this equation, I have written i is equal to 1 to 2 j is equal 3 to 4 Cpf i j delta PLj minus i is equal to 3 to 4 and j is equal to 1 to 2 Cpf i j delta PLj this is equation 3, this I have written for sake of mathematics, but do not better you do not do not try to because this can be made as in terms of GENCO and DISCO all this your what you call this number right general 1, i do not want to generalise 1 just see how things are look at this equation right.

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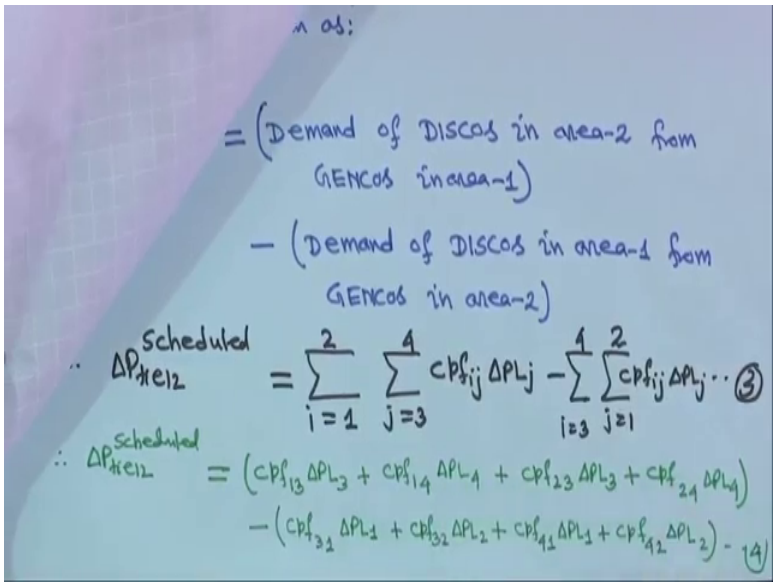

So, delta P tie 1 2 scheduled right. So, first thing is that DISCOs this thing buying power from this GENCOs. Now, if you go to the DISCO participation matrix here DISCO participation matrix here right, each DISCOs having power demand delta PL 1 this DISCO 1, DISCO 2 delta PL 2 this is delta PL 3 and this is delta PL 4 right therefore, this DISCOs DISCOs in area area your 2 right, this DISCOs in area 2 buying power from

GENCOs in area 1. So, DISCOs in area 2 is DISCO 3 and DISCO 4 and buying power from GENCO 1 and GENCO 2; that means, Cpf 1 3 Cpf 1 3 into your delta your what you call PL 3 right.

So, this is actually 1 2 scheduled see those generally that your what you call this just hold on. So, delta P tie 1 2 schedule will be Cpf 1 3 delta PL 3 plus Cpf 1 4 delta PL 4. So, this is actually your Cpf 1 3 right into your this is that your DISCO 3 may have contract with this 1 Cpf 1 3 into delta PL 3, because this is a fraction and this DISCOs demand is delta PL 3 so, but this DISCO 3 DISCO 4 buying power from GENCO 1 and GENCO 2, because it GENCO 1 and GENCO 2 is area 1 and DISCO 3, DISCO 4 is in your area 2. So, it is Cpf 1 3 into your delta P 3 PL 3 this DISCOs thing. So, Cpf 1 3 in delta PL 3 plus this DISCO 4 also area 2 so Cpf 1 4 right into delta PL 4, because Cpf 1 3, Cpf 1 4, DISCO 3, DISCO 4 has contact with GENCO in area 1 GENCO 1 in area 1 that is why it is Cpf 1 4 into delta PL 4.

Similarly, this your Cpf 2 3 sorry Cpf 2 3 DISCO 3 it has contact in area 2 GENCO that is area 1 GENCO GENCO 2. So, Cpf 2 3 into your delta PL 3 right this 1 plus Cpf 2 4 this Cpf 2 4 into delta PL 4, because delta PL 1 delta PL 2 delta PL 3 delta PL 4 it is the power demand of DISCO 1, DISCO 2, DISCO 3 and DISCO 4 right. So, here it is also Cpf 2 4 into delta PL 4. So, this part that DISCOs contact that area this thing the area 2 DISCOs whatever, they have contact with GENCOs this thing is (Refer Time: 29:08) plus parties complex.

Now minus; minus, means demand of DISCOs in area 1 from GENCOs in area 2 in area 1 DISCO 1, DISCO 2 is 3 right. So, in that case your now minus Cpf 3 1 delta PL 1 right, if you come to Cpf 3 1 this is Cpf 3 1 right DISCO 1 it demand is delta PL 1 and it is GENCO 3, GENCO 4 is in area 2. So, Cpf 3 1 into your delta PL 1, then Cpf 3 2 into your delta P, or what you call delta PL 2 so, Cpf 3 2 into delta PL 2 plus, now we will come to your what you call that DISCO 2, it is Cpf 4 1 into delta PL 1.

So, in that case it is Cpf 4 1 right into delta PL 1, then here it is Cpf 4 2 into delta PL 2, because this Cpf 4 1 DISCOs 2 has contact with GENCO 4 see DISCO 2 when Cpf 4 2 fraction of power that it has contact with GENCO 4. So, plus Cpf 4 1 delta PL 1 plus Cpf 4 2 into delta PL 2, this is equation 4 this is actually scheduled power this thing that how much actually directs power is flowing from your what you call from GENCO from area

1 to area 2 it may become negative also, it may become negative also negative means power is flowing from this to that, how much they have contact accordingly right. So, it the delta P may be positive may be negative, does not matter right it may be can negative also.

So, rather than these equation this understandable is require right, I mean I mean when we will go through this, when we will go through this then please just your what you call, just if you have any doubt you can put the question in forum further we can tell you without this thing right. So, one little small thing is there for AGC deregulation that will be taken care right. And after that little bit unit commitment will be covered, but in very brief because very difficult to solve in the classroom, but some concept will be given that what is unit commitment and how you one can proceed right so.

Thank you very much.