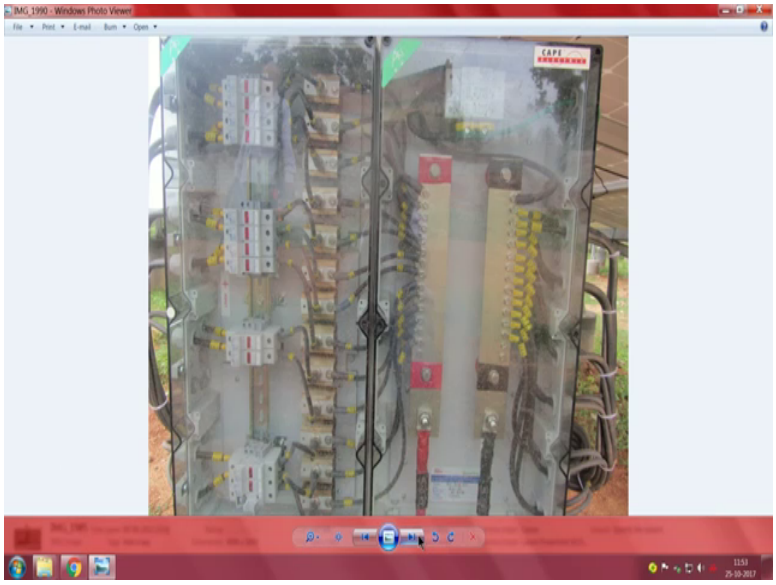
Electronics Enclosures Thermal Issues
Prof. N. V. Chalapathi Rao
Department of Electronic Systems Engineering
Indian Institute of Science, Bangalore

Lecture – 23
Real packages

(Refer Slide Time: 00:33)

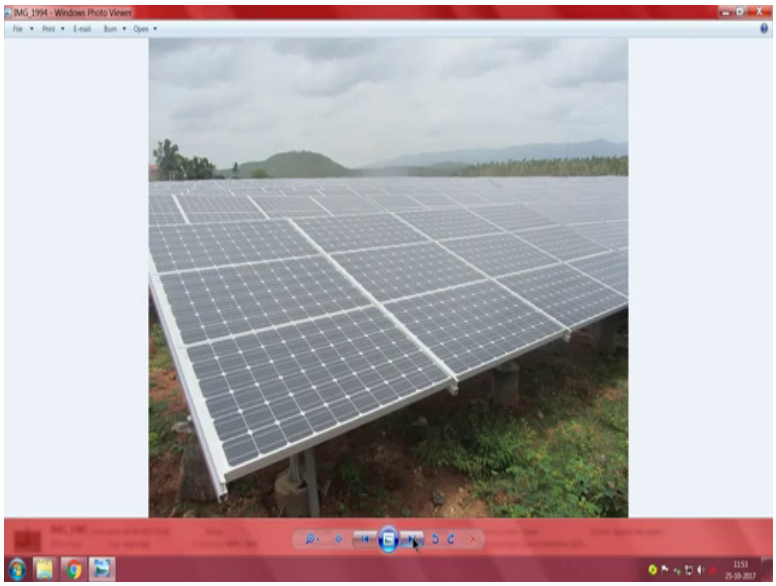
Let me continue with where I had left of earlier. And then also go back to place where I mean you can have if you can look at the monitor, you will notice here that this is an outdoor installation where the solar panels have been placed here. At least in the common understanding we expect that there is a huge amount of energies sunshine, which is available is that some way of harnessing it. So, typically one of the easiest ways is to have a simple standalone device that is you have a solar what you call arrays solar panels. And then you connect it directly to a load and then in case you want to have storage, you can have the storage in the form of a battery in the local place.

(Refer Slide Time: 01:28)



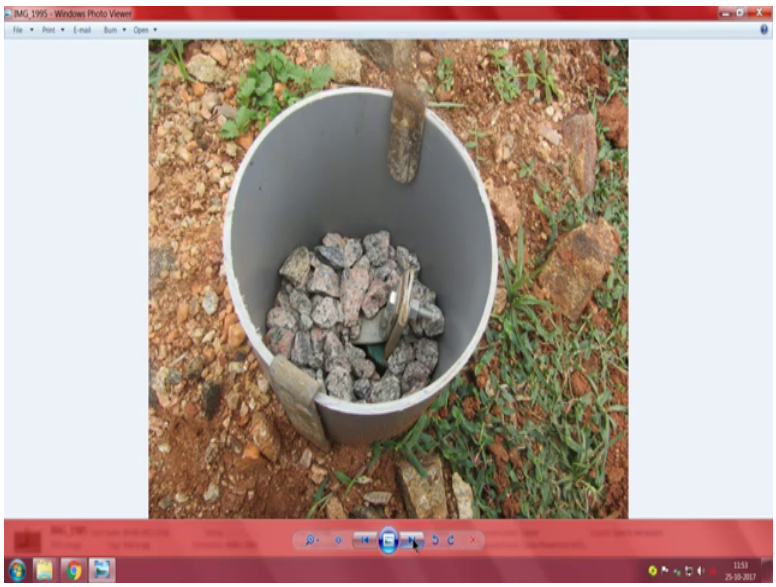
(Refer Slide Time: 01:30)

(Refer Slide Time: 01:32)



But what you perhaps never (Refer Time: 01:32) is first of all where do you store the energy and then what do you with the energy and then how do you integrated well with existing infrastructures. So, this one is from the Karnataka Government. I would like to thank my colleagues which I mean you can see the picture later on.

(Refer Slide Time: 01:59)



(Refer Slide Time: 01:59)

Out some compulsion, you will notice that it make sense if you put it far away.

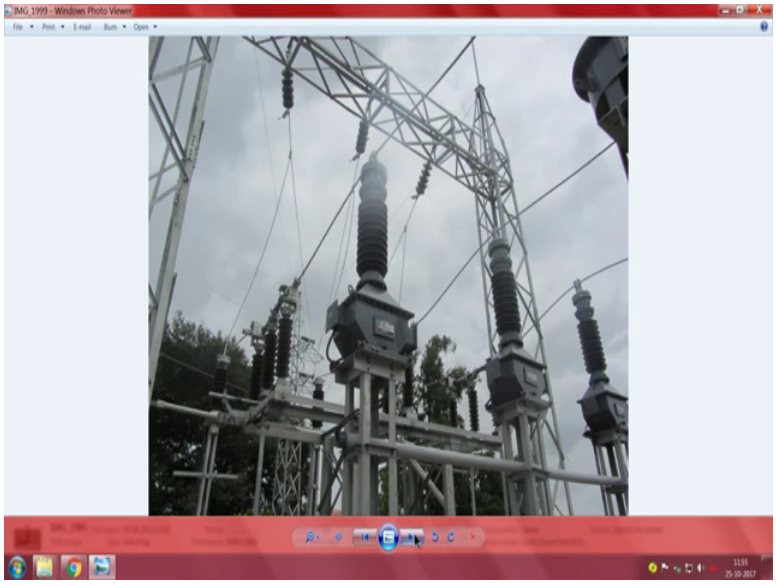
(Refer Slide Time: 02:07)

(Refer Slide Time: 02:14)

And why I will get back to it in a little course. You see this comes from a place called Shivanasamudram also call the BLUFF falls. So, the it is a small thing 5 mega watt solar power project. I will call it a more like a pilot project. The idea is here is we already have what you call water fall are based hydroelectric power project there. It is logical to have this huge panels outside very near that place because when sunshine is available, and hence the solar power is available, it is easy to fit it to the grid. And during the day time it directly fits the grid. 5 mega watt is a very small thing probably you know may be typically if you take 5 kilo watt per household peak.

So, a 1000 what you call households can be run on this which is of course, I come in, you just ignore it that the minute I will come back to that.

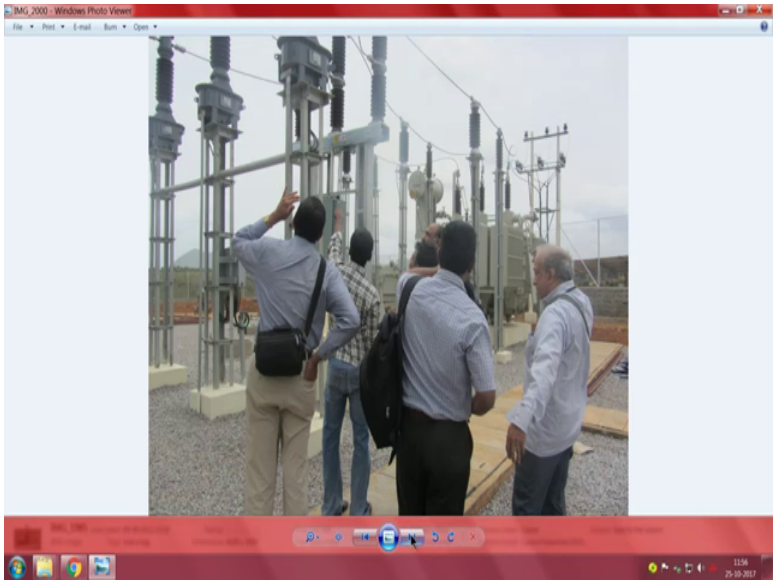
(Refer Slide Time: 03:27)



The thing being we have already a huge feeder network everywhere ok. We have a grid network power is directly effect to the grid and as long as power is available from any source conventional, non-conventional. In non-conventional, we have wind and typically solar; in the conventional, we have hydroelectric and gas or other what you call non-renewable type of sources. The issue being it is not as a if load is completely unpredictable may be the clouds is see there know they are not very predictable, but however, load is unpredictable we know very well in the evening, there is a peeking of load.

Since, we leaving the tropics we have no issue about heating, but elsewhere also the same thing can be done and it is probably heating is taken in some other level.

(Refer Slide Time: 04:30)



So, if you go here you see here it directly feeds to the grid and storage is the water that is already stored. So, during the evenings when you need power, but solar is not available, but a little bit of wind can be there, hydroelectric as well as the nonrenewable or fossil fuel based things can work, handling these things here.

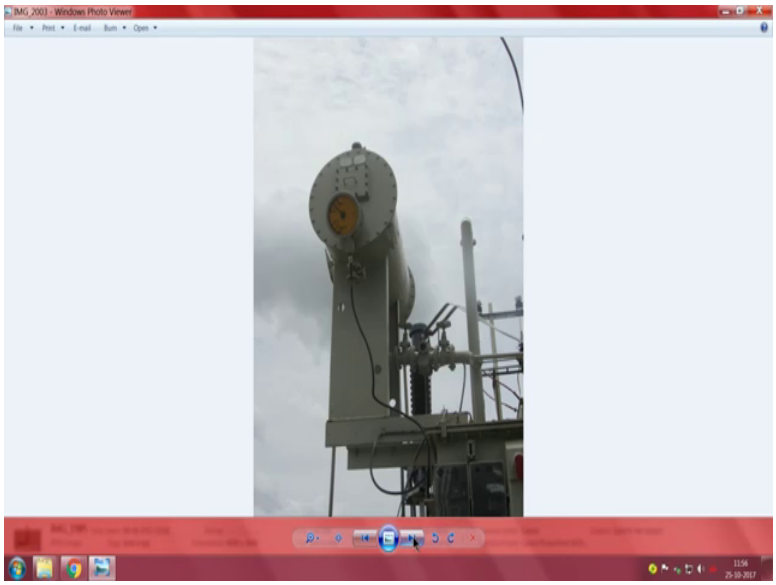
(Refer Slide Time: 05:02)

So, an early with here this is something probably it something it with ethylic edge system.

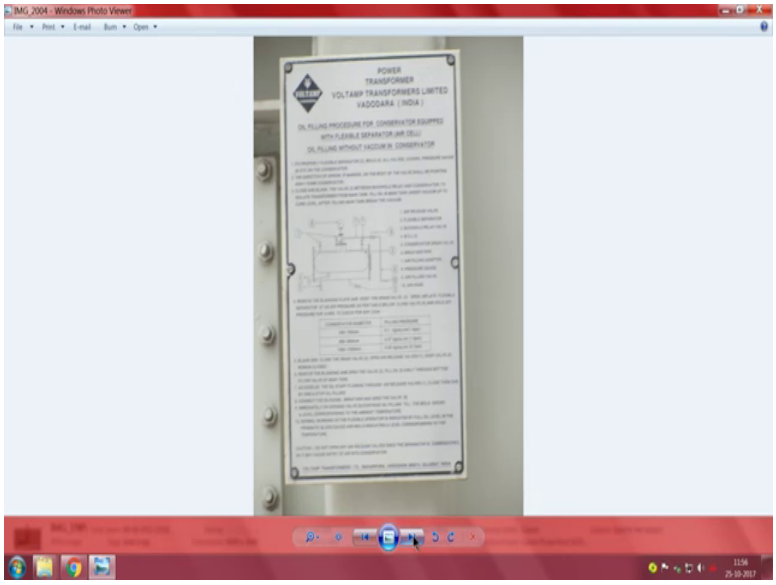
(Refer Slide Time: 05:09)

These are all the usual transformers.

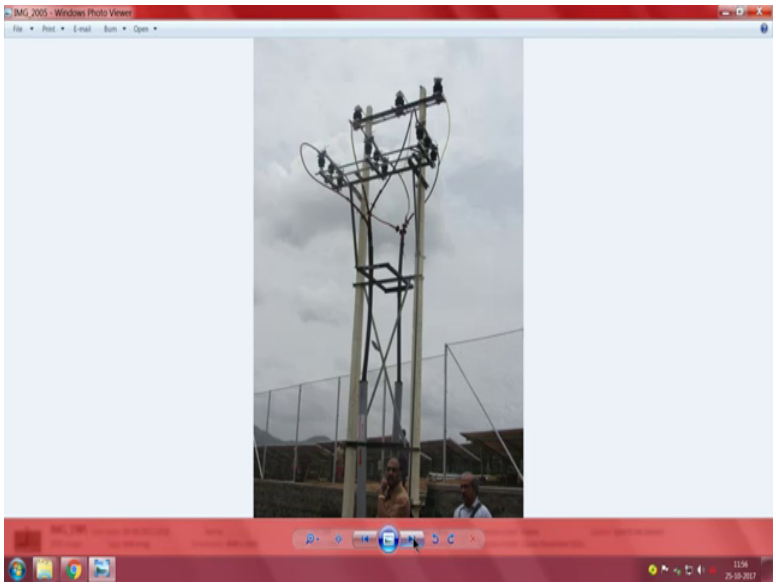
(Refer Slide Time: 05:10)



(Refer Slide Time: 05:12)

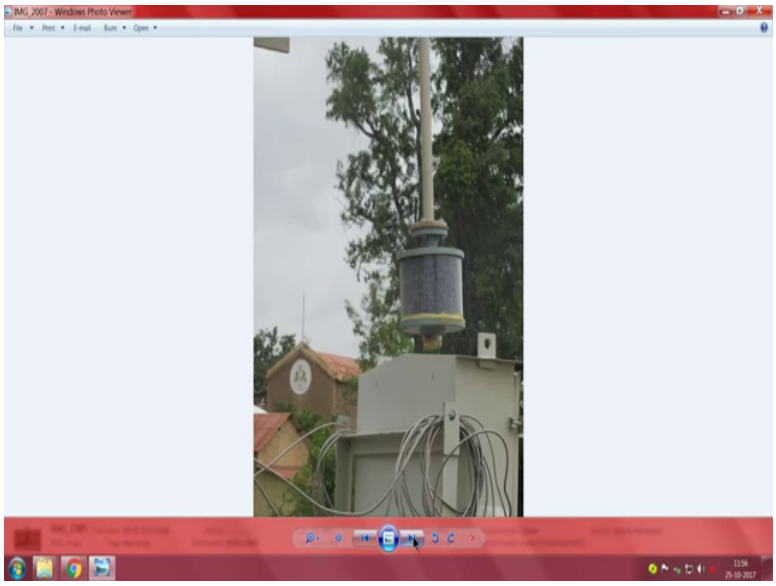


(Refer Slide Time: 05:13)

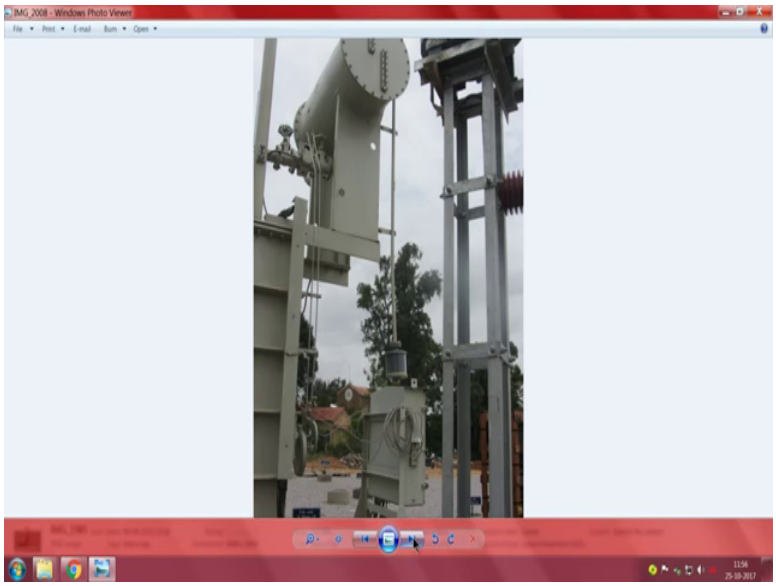


(Refer Slide Time: 05:15)

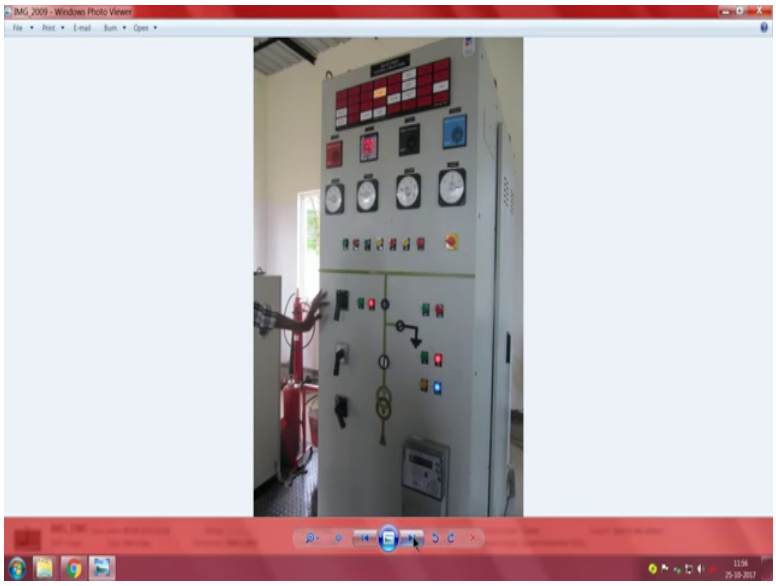
(Refer Slide Time: 05:16)



(Refer Slide Time: 05:17)



(Refer Slide Time: 05:18)



What interest me is the panels which control all these power. You seen that compare to that small tiny what do you call preview modules are one which you are likely to see in your lab per control, it is a little similar. And you have a huge audio visual and initiator system which is built into that.

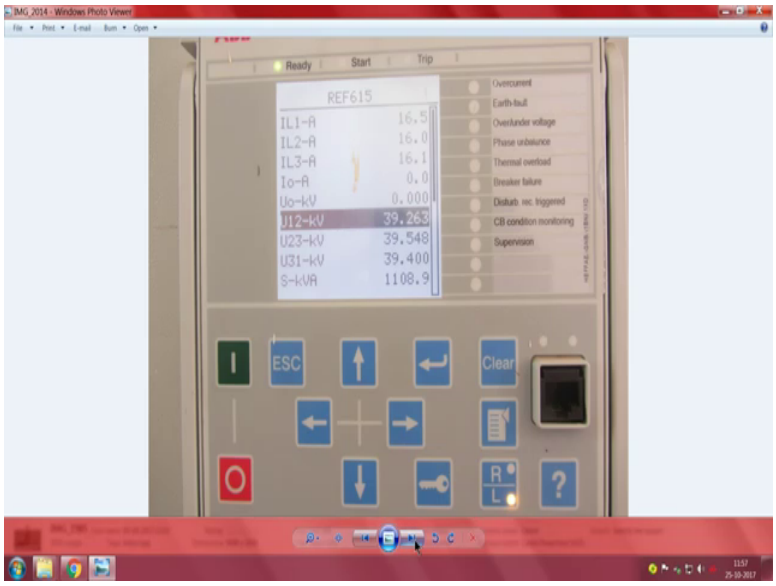
(Refer Slide Time: 05:42)

So, I will just skip all this fast because it would not make to much sense to you.

(Refer Slide Time: 05:44)

(Refer Slide Time: 05:44)

(Refer Slide Time: 05:46)



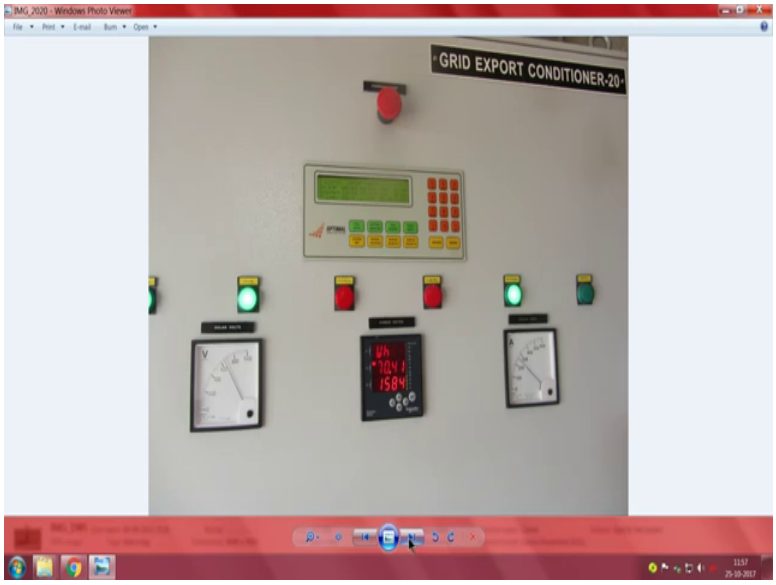
(Refer Slide Time: 05:47)

When I come back, you will be able to.

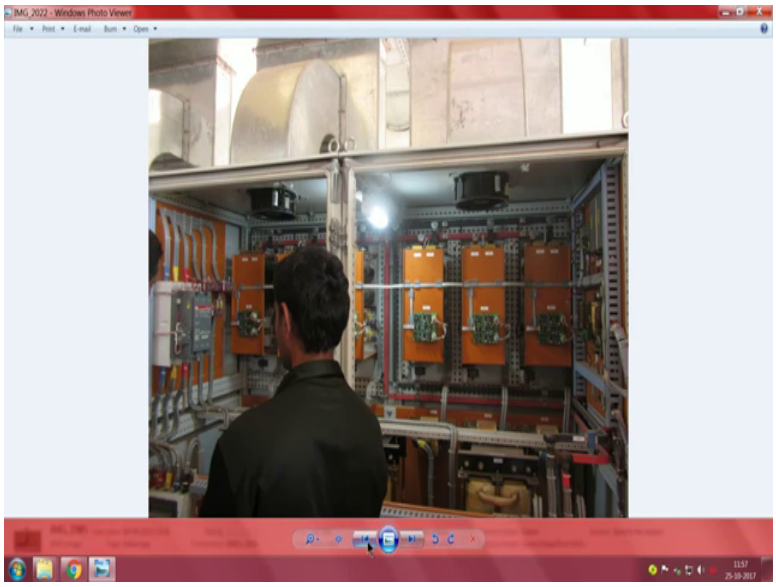
(Refer Slide Time: 05:49)

I would like to acknowledge that the whole thing has been taken from the installation which has been carried out by Bharath Heavy Electricals Limited. And you see here this is the solar cells, these are all the devises which carry the current.

(Refer Slide Time: 06:12)



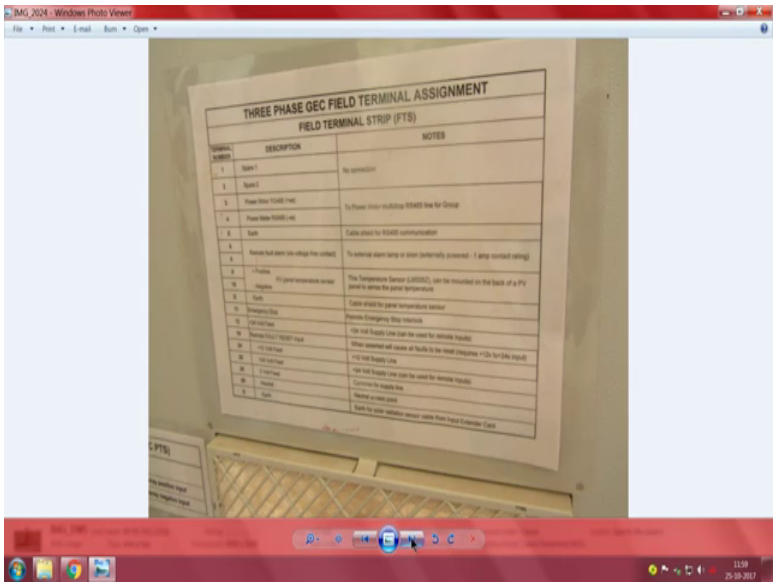
(Refer Slide Time: 06:15)



And most important is when we current it something to the grid, we need to condition the things. One is one basic things simple thing is the voltage. But then voltage does not tell us the full stories. So, you need to track the grid 100 percent and very close to tracking is there. And this is the amount of protection and backup that is required while that part of it is true you have a look at something here. Can you see something, I will see, if I can enlarge it. So, it is obvious is it not? In the cooling, in the small thing I have showed you is about just like that know I mean use the simple air conditioner or you can even have a panel mounted air conditioner which will take cover of it.

But when the power keeps increasing you have no choice, but get into proper ducted air conditioning. And you see here you have a small exhaust fan which takes in. And these are probably metal clad proper metal clad fans which can take a I think you know they are all rated for may be 200 degree centigrade, there is no issue. Even in the case of fire or in case of any run away there is no problem, but typically inside temperature do not exceed may be around 70 degrees. So, this is about cooling full racks.

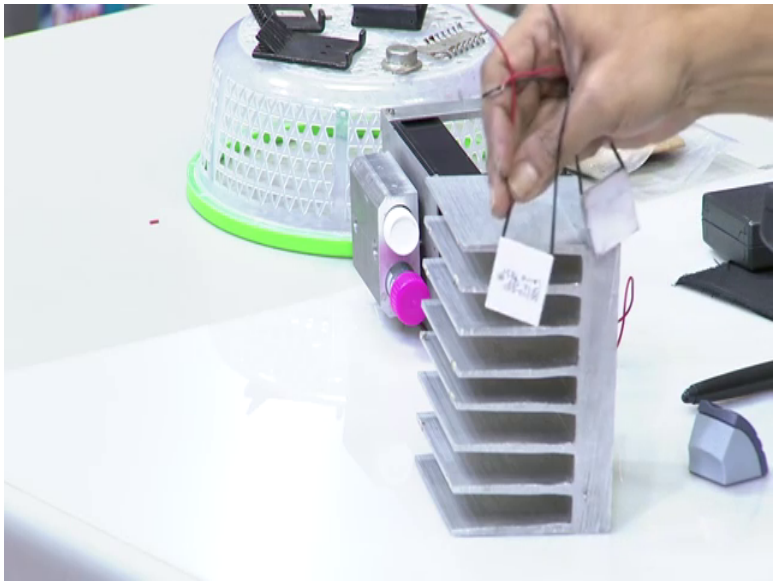
(Refer Slide Time: 07:52)



(Refer Slide Time: 07:53)

Now this will come to the interesting, but this is the back of the installation. You see something here which is very, very opt. Keep having a closure look at it, may be in this corner I will be able to see oh I could not capture it here because the actual ducting and all is here on the right side top corner. And you see this beautiful devices what we have here. It is a peculiar long wide fan and little like what you are likely to find in your air conditioners. It is not an axial fan, it is not a simple radial fan also it is a longish thing which is most of your rooms and all when you enter, you would have seen this what is called the air cut in. So, it is something little similar to the air cutting fan. But what it does is here it takes all the ambient air from outside and it passes it through the ducts. Now, here is where thus special type of heat sinks and all which I have shown you make sense. I will just show you one of this.

(Refer Slide Time: 09:24)



Sir, can you play switch on the other camera. You see here things like this rare phase of it is where all the electronics set. The other phase what you see here is where there is a chute and there is ducting. Now, if you see go back to my monitor, you see in the monitor you will see that probably inside here now is where these exhaust I am sorry these vertical blowers are attached here, and the thing is exhausted. There now you see it the back and the left side you see what it is here, here you will notice that there is a lower air filter. This air filter assembly is required because when you are trying to exhaust things from here where does the what you call where does is get all the air.

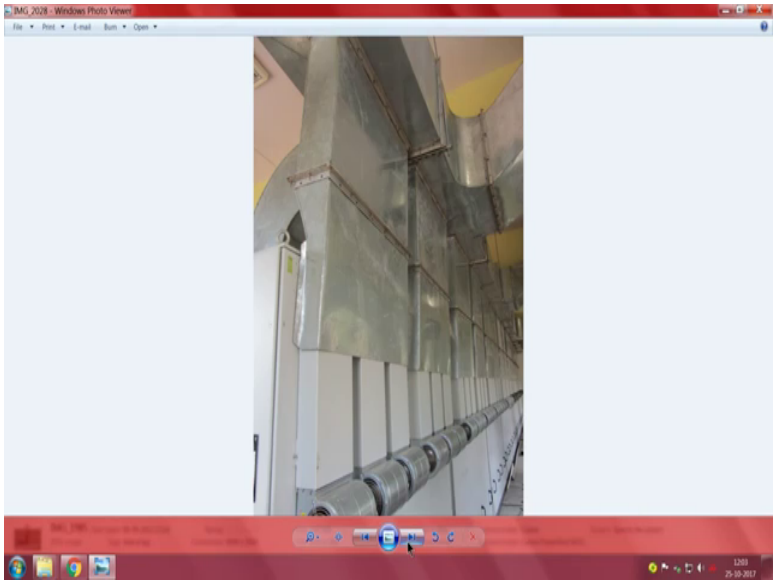
So, somewhere in these wherever there is a little gap you know they have install those filters. So, filtered air enters this. And as you that is not sufficient this much of various types of power electronics are required. And this orange colored thing is there know probably that is where the what you call I do not know is some part of the wiring all the what you call power devices sit here. So, these are all the control what do you call switching on and off devices. And at the back we have this coolers.

Now, ac cooling is important whatever you say under part load a inefficiency can be of the order of 15 percent, so that much of heat is goes off is inefficient. You can closer look. Now, you can see here on the top you have those various types of things you know which ducked the air. And then underneath here is probably where all the cabling sits here. So, cooling is real.

(Refer Slide Time: 11:35)

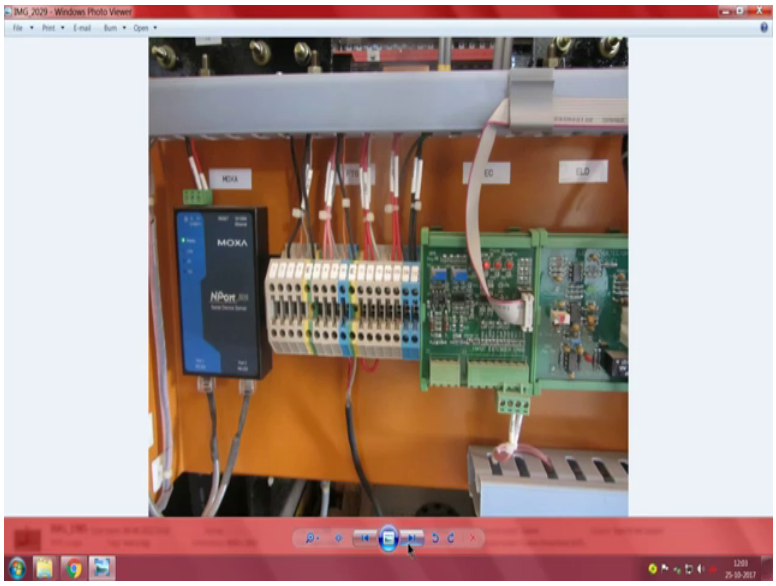
And you see the amount of from each of these lot of ducting takes place. All these air is collected and taken here and the whole thing has to be exhausted. So, somewhere in the corner, you find all set sub devices to make sure that air is ducted it follows a proper pattern.

(Refer Slide Time: 12:02)



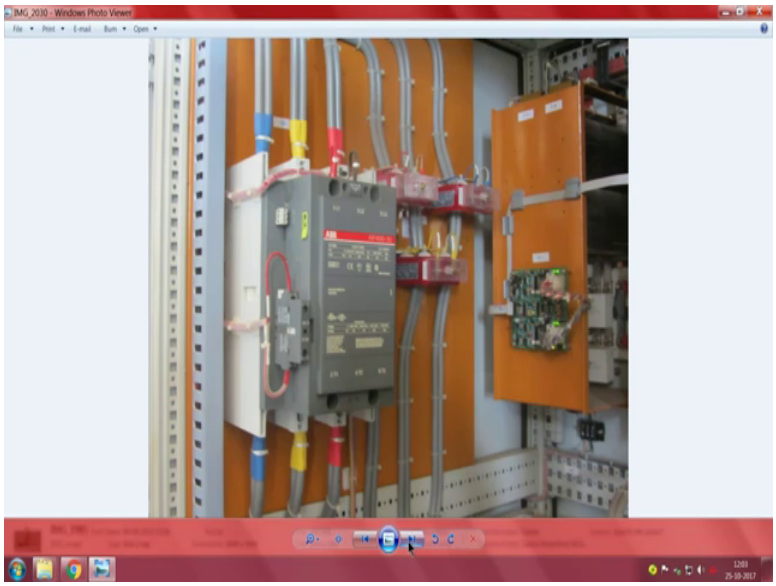
This is a reality of heating.

(Refer Slide Time: 12:09)

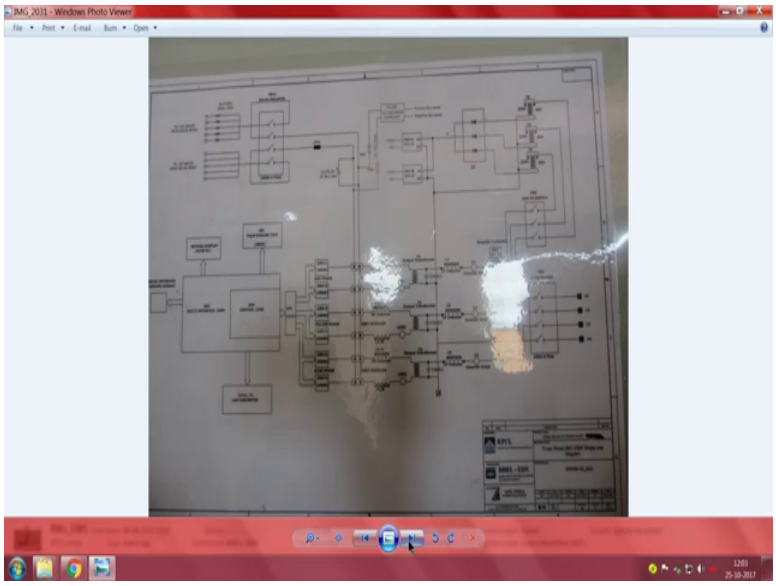


And at the same time everything should be manageable.

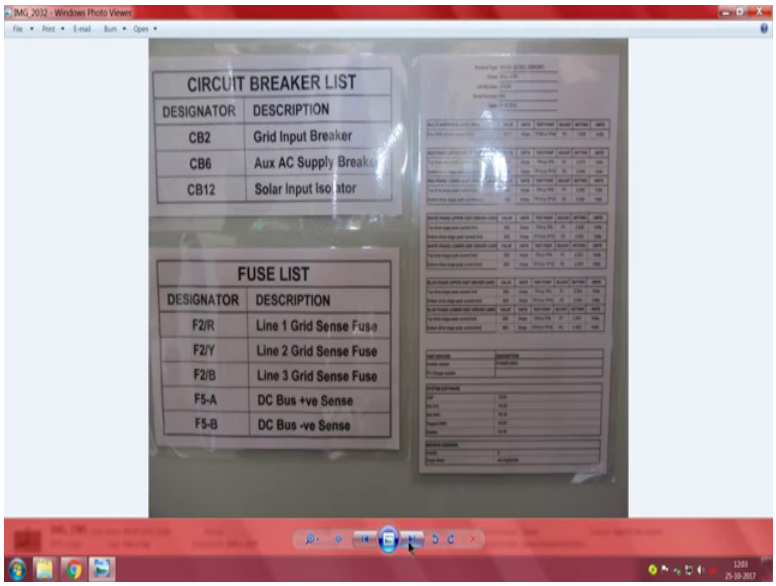
(Refer Slide Time: 12:15)



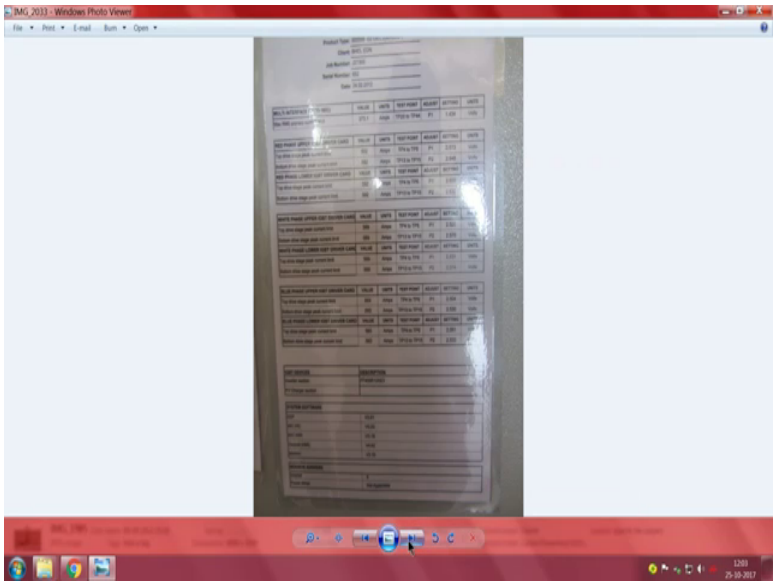
(Refer Slide Time: 12:17)



(Refer Slide Time: 12:18)



(Refer Slide Time: 12:18)



(Refer Slide Time: 12:19)

So, I think what all I wanted to show you has been you know covered in this that is me, that is my colleagues at this Indian Institute of Science, and this is the huge panel which is there. Now, one more thing also here not related to this, you track this one no, and then tracking is not like active tracking. It is very much possible probably they have considered all the thing, they have done all the studies and found out affixed orientation and depending on seasonality, you are able to make it.

(Refer Slide Time: 12:50)

(Refer Slide Time: 12:51)

There are other sundry this things.

(Refer Slide Time: 12:52)

I will go to this main thing.

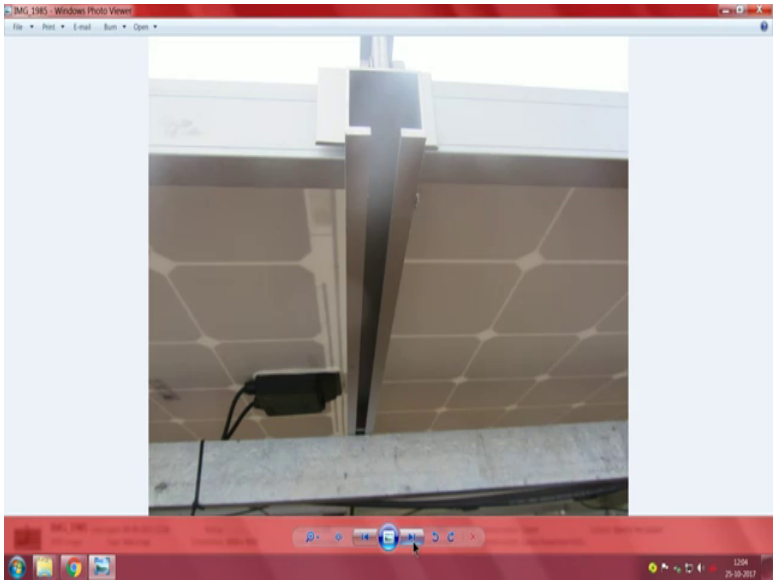
(Refer Slide Time: 12:53)

You have seen this something; oh it does mean it is on small batteries to keep the system running the monitoring system the switching systems needs once again a huge amount of backup. These are all special batteries collection of what you call cells and all that to make sure they work.

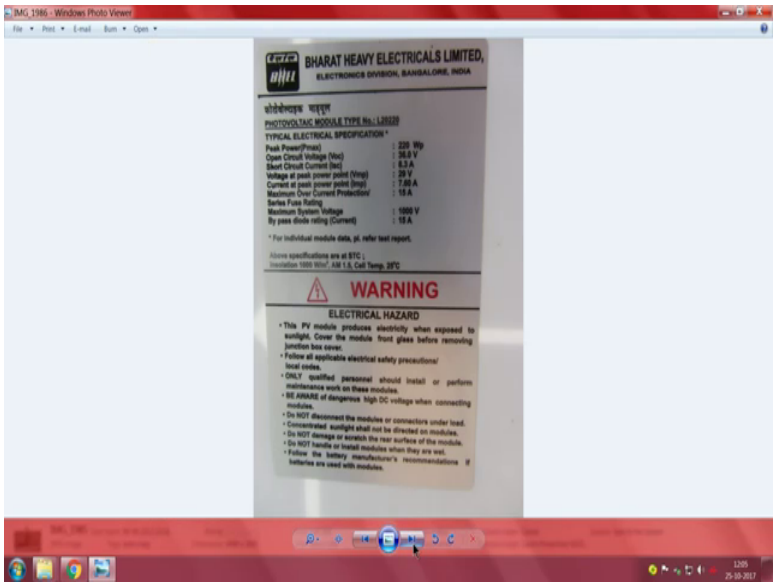
(Refer Slide Time: 13:22)

I think this is enough.

(Refer Slide Time: 13:24)



(Refer Slide Time: 13:27)



(Refer Slide Time: 13:28)

Incidentally, I just wanted to show you a few of the other things. You see here this one is directly under the panel. While top of the panel is protected, and there is a glass and all that; under the panel they sort of what you say protection with reverse polarity, they have diodes inside, similarly they have static discharge devices and so on all of these things are involved in it.

(Refer Slide Time: 13:57)

So, I just want it to since I have the picture I thought I will show you. You seen here some I think only trained people will know what it is; obviously, all I can say is a

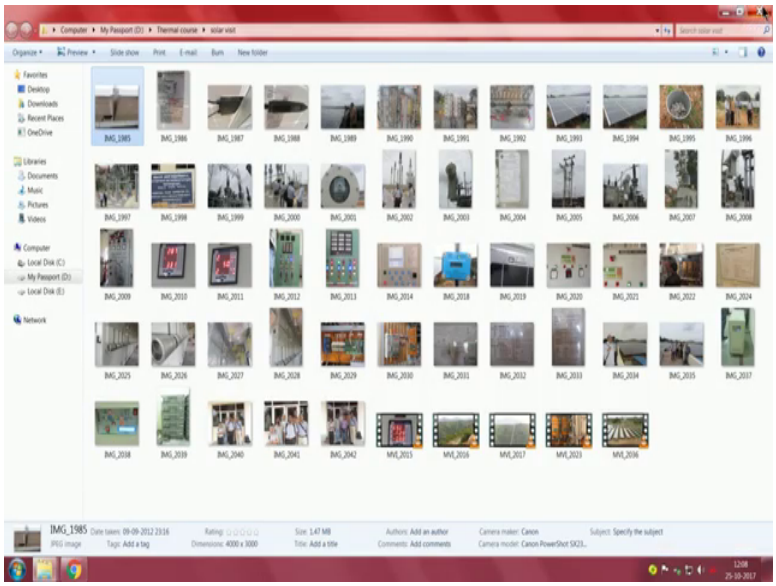
connector and then I should stop beyond that know. This is the inside the equipment whether you like it or not we end up with all sorts of this terminations. Something red and something black, and there are all you have seen that you know several screws here. And then do you see something it does look like a diode. And there is a heat sink here. And the heat sink miraculously is not black neither is it gold color, I am sorry neither is it what you call silver color it seems to be given some other layer it is it is not actually it is not gold it is some other what you call anodic modified anodic layer.

And if you see here very carefully lot of care has be done and trying to isolate these devices and see how well they share the current and all that. So, you cannot do anything in isolation. So, the over the wall does not work. You need to make sure that all of them are done concurrently; somebody sits and makes all these drawings and all that. So, the way we mount these stud mounted diodes are I do not know at the moment all I have to do is says that you need take tremendous amount of care to make sure that is there I think this is over.

And then something loosely related in which I showing there is this is the yes you have guessed it the earthing point. So, they have put some loose you know I mean what you call stones we call it here as a [FL]. I do not know this is called electrical [FL] it is nothing to with [FL] you know. So, the stones have a particular what do you call aggregate is all kept here and then you see here there is strap here there is one more strap here.

So, in a very what do you call complicated way it is all you know water is fed into this and that is small meter which I have shown you earlier is used for monitoring if there is a any leakage in the earth path. You have seen that. Obviously, even at the tremendous voltage and all that know a reasonable thing is this is about the reasonable thing. Actually it is on end around 0.1 to 0.2 milliamperes is probably what is tolerable up to 1 milliampere. The moment it exceeds any of this then something is wrong, and then they need to switch it off.

(Refer Slide Time: 17:11)

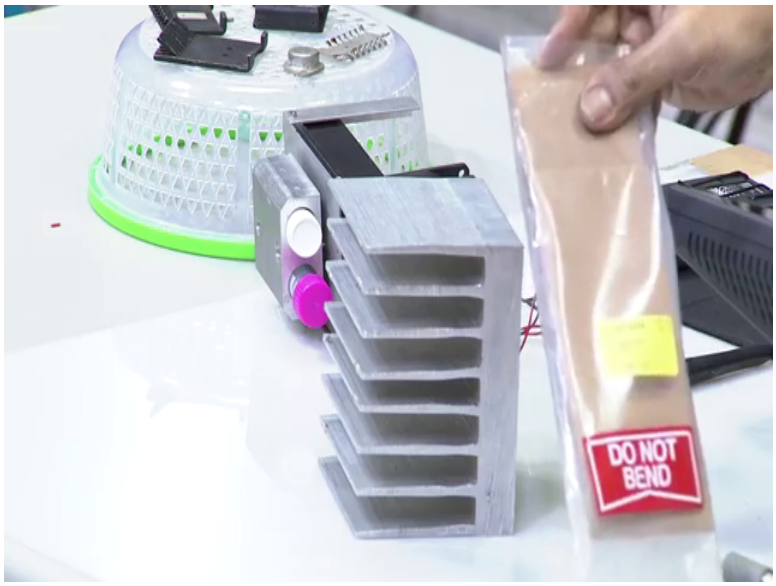


So, what we will do is I will now close it because we do not need to see this anymore. Now I will see show you something else here.

(Refer Slide Time: 17:26)

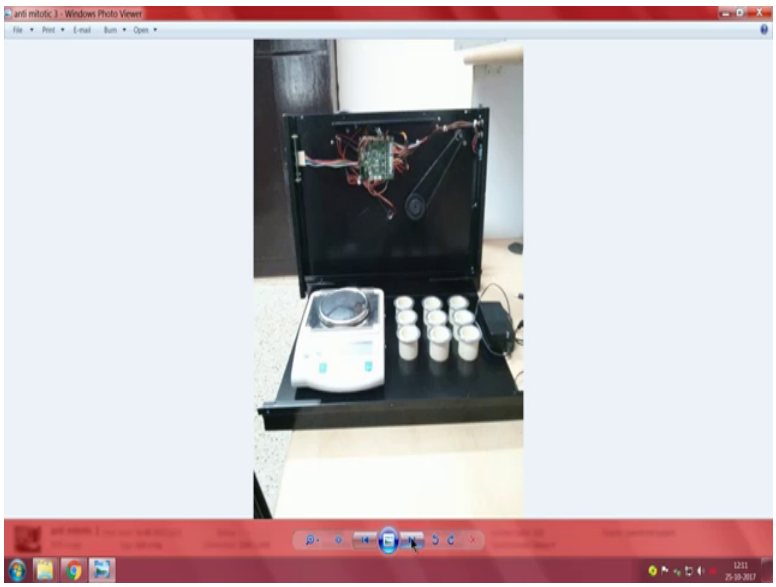
So, this was part of a biomedical equipment this is where, so if you can see my there is what you call please switch on this camera sir. These are the Peltier modules, which need to be used for whenever you need to do both heating and cooling at the same time. There on generally supplied in a protected condition like this. So, if it is in my hand I do not know if it is already spoiled anyway. We have all this small devices.

(Refer Slide Time: 18:16)



Now, you see here we have small cups in which some what do you call some reagent or something is sitting inside.

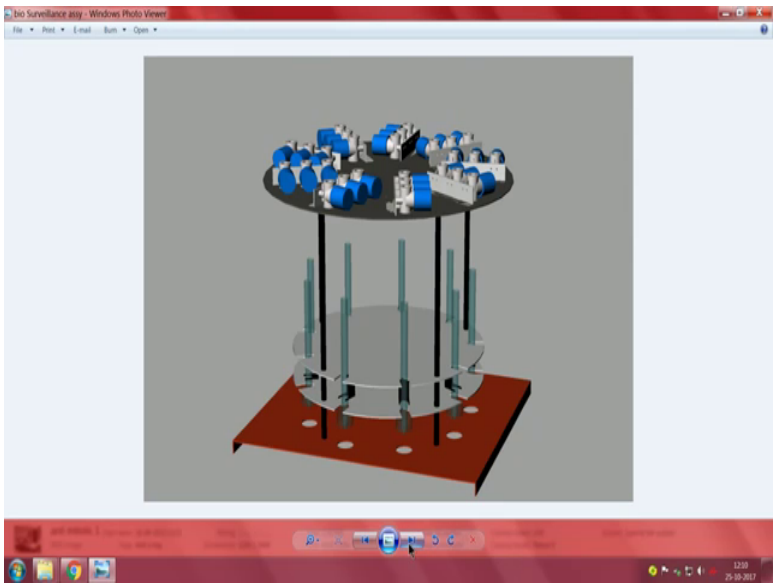
(Refer Slide Time: 18:38)



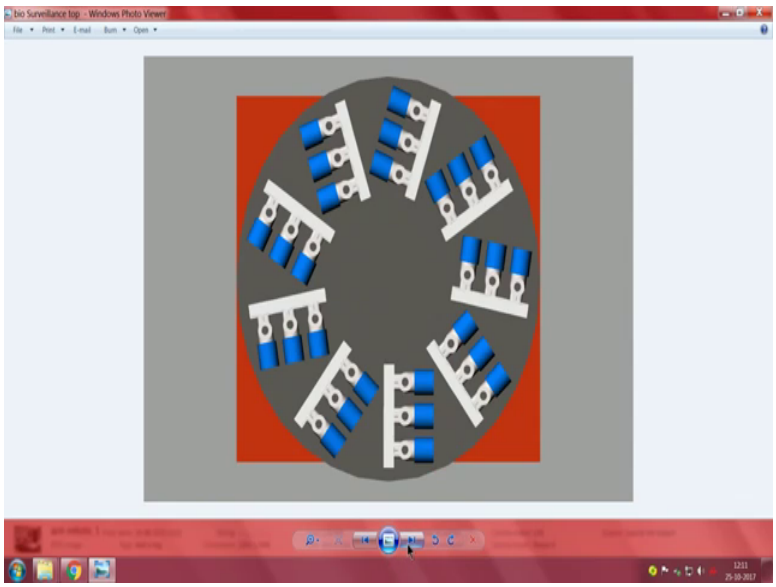
And eventually these have some liquid or I will say some medium in which growth takes place and then some chemicals are added and so on and what is called anti proliferative action of some naturally occurring herbal medicine. So, they can be used in cancer cure. There is made in it. My interest is not talk about herbal and other effective and all that

what we need is you see here there is small motor here that is connected to the carousel here. So, next picture shows you.

(Refer Slide Time: 19:18)



(Refer Slide Time: 19:21)



(Refer Slide Time: 19:22)

fully assembled unit here.

(Refer Slide Time: 19:25)

Which can you see here all thing is enclosed in a dust protective environment. And if required we can even probably make sure that external oxidation does not takes place we can probably include any you know wanted what you call air or you know particular type of air it could be dry or it could be moist and so on. The issue here being each of these small cups has a mesh at the bottom and there are some specially hybrid seeds that have been in grown and they have certain properties in which their growth rate is affected.

Now the thing is we need to closely control the temperature this device. In such a case, using a Peltier makes effect. So, we use the Peltier we can lower the temperature after collecting all the things they can be brought in a cold chain. After loading it here we can see the action whether you can maintain it that ambient or we can maintain it at our body temperature which is typically 37 degrees. And we can raise it because body has a natural mechanism of raising temperature locally, and how well these thing work with other things.

In such a case we have no other option, but use a Peltier thing. But you cannot talk of using this Peltier in the huge monsters what you call 5 mega watt panel system we are talking about 5 milliwatt, yes, 5 mega watt, no, it is a matter of scale. I will close this.