Glass in buildings Design and Application
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Lecture - 28
Daylighting Strategies-Techniques-Part II

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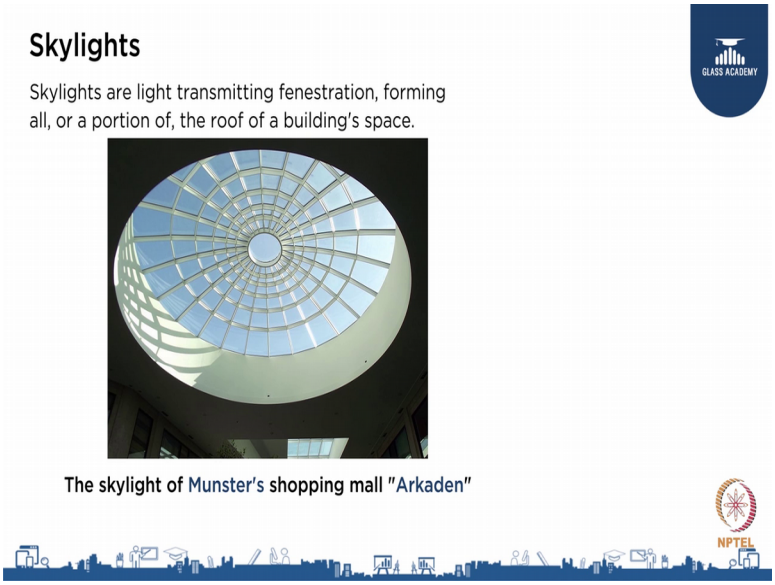

So, skylights are light transmitting fenestrations, which are horizontal and which are on the roof of the building space. So, the advantage with skylight is that they can bring light from the top as compared to the windows which bring light from the side. Windows would generally have some orientation so; it might not be able to bring light throughout the day. But skylight being open to the sky or viewing the sky, they are very good in capturing the light throughout the day and also in illuminating the space in larger spaces throughout the day.

However, this skylight also has problems that it can get too much of sunlight when the sun is there at very high altitude during the summer. So, a skylight glass should also be carefully selected, you would like to have high visual transmittance and low solar heat gain coefficients for the skylight. Now, let us see how we can further enhance the functionality of the skylight. So, one of the techniques is called lens guides.

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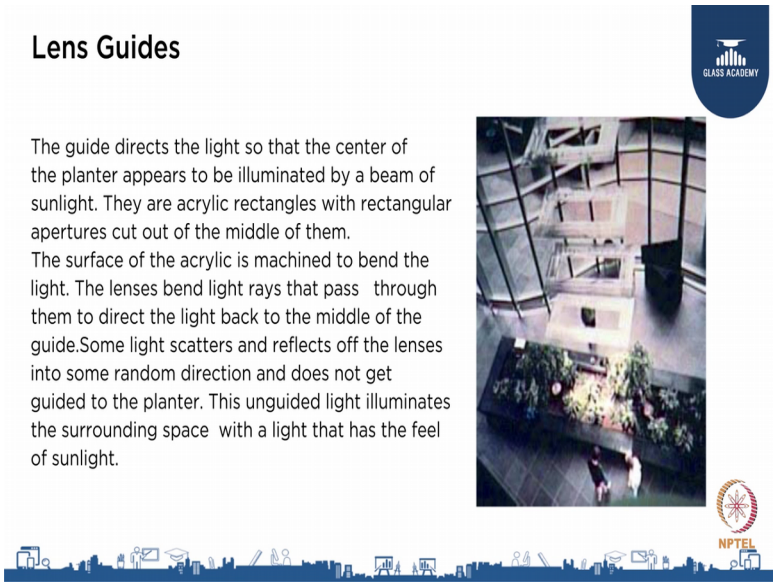

These guides direct the light coming from the skylight and they can focus some of the light and bring it to a piece of art or some installation at the bottom and can illuminate it, and the remaining light can be diffused from these lenses all around so, that it can give more light to the volume of the space inside, and to the facade which is opening inside the building. So, this unguided light illuminates the surrounding space with a light that has a feel of a sunlight, whole interiors get very nicely illuminated.

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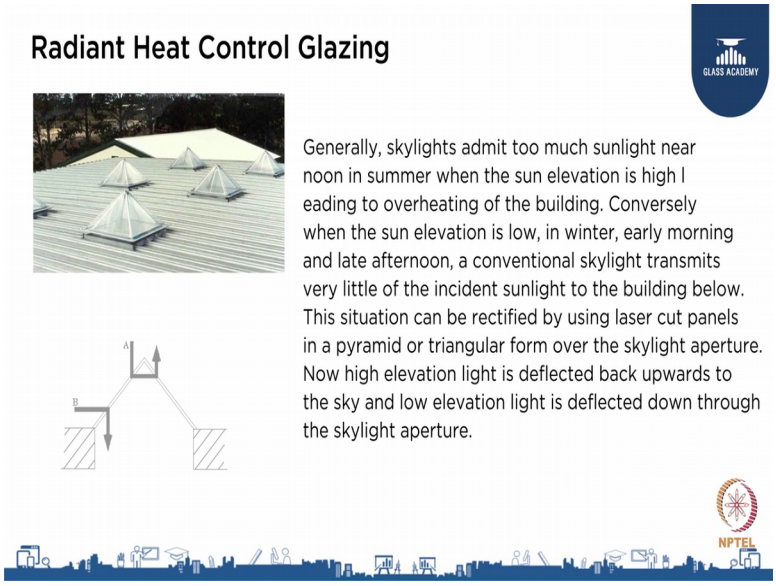

This application of laser cut panels, which is applicable to skylights, in this we have these pyramid shaped skylight and these surfaces are made up of laser cut panels. How do they help? The low altitude angle in winters or in the morning that sunlight is bent and brought inside and the high altitude one which is there in noon or during the summers is bent twice and is sent back to the sky. So, this system automatically controls which angle is admitted and which angle is reflected back.

There are lots of interesting commercial technologies that are coming, which have movable elements which can close that is stop the radiation from coming inside or control how much radiation is coming inside just like louvers. They are not only control they can also redirect the light in two different directions depending on the time of the day, where the sun is and depending on where if you want the light to be redirected.

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There are also interesting systems like sun tracker skylights, which can track the sun and reflect the light and bring it into this space. Here are some of the installations of sun tracker skylight.

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Now, in both these methods whether it is a lens guide or some kind of a tracker or some kind of louvers, the basic principle is just like a vertical fenestration. That there is an opening and we are trying to control the amount of light that is coming through these openings. But, what if we do not have a possibility of an opening or we want to have a smaller opening and bring light into the deeper spaces into the building.

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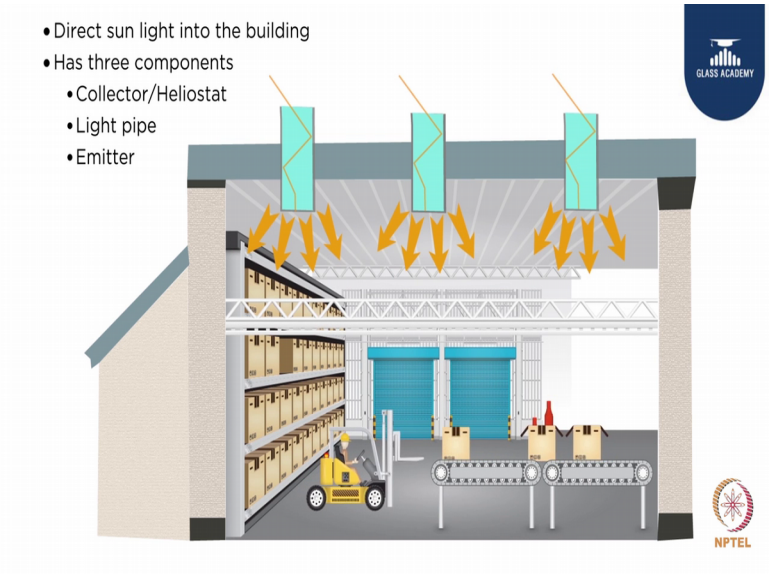

So, there is a simple mechanism called light pipes. In the light pipes basically there are three components one is a collector where the sunlight is collected, then there is a pipe in

which the interior surface is highly reflective. So, the sunlight which enters into this pipe keeps on getting reflected again and again and it emerges from the other end where there is a diffuser which diffuses the light into this space. So, like this we can bring light from one part of the building into deeper parts of the building, and we need not have a hole into the wall a full window or a full skylight we can bring it inside from different ways.

So, let us see one of the possible ways is this, here the light is being captured and then it is put into this light pipe and the light pipe is bending. So, light is actually coming from the walls and it goes inside the false ceiling and then again it is the diffuser is in the false ceiling. So, inside it looks like as if it is just an artificial light in the false ceiling, but actually it is a light being captured from the roof taken through the side walls into the plenum and then brought it, at the interiors just as if it is from a ceiling. So, there are various ways light pipes can be installed.

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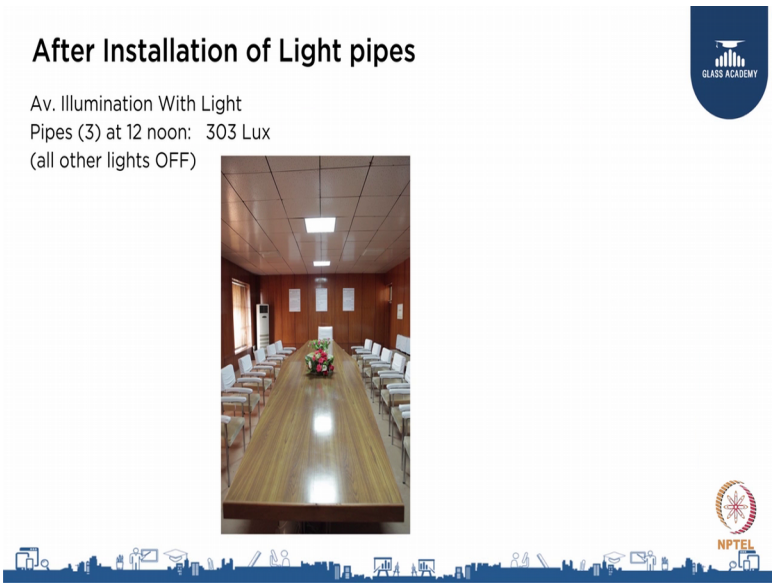

Now, the basic problem with light pipes is that these pipes are rigid. So, once we have installed you cannot move them and because they are not flexible and they cannot be moved during the operation, you cannot have a system which tracks the sun. It would be great if we can track the sun so, that we can capture more daylight and bring it inside this space, and it will be even better if not only we capture the sun, but if you can concentrate the light.

So, that we need a smaller sections of these light guiding devices light pipes or whatever and bring it inside this space.

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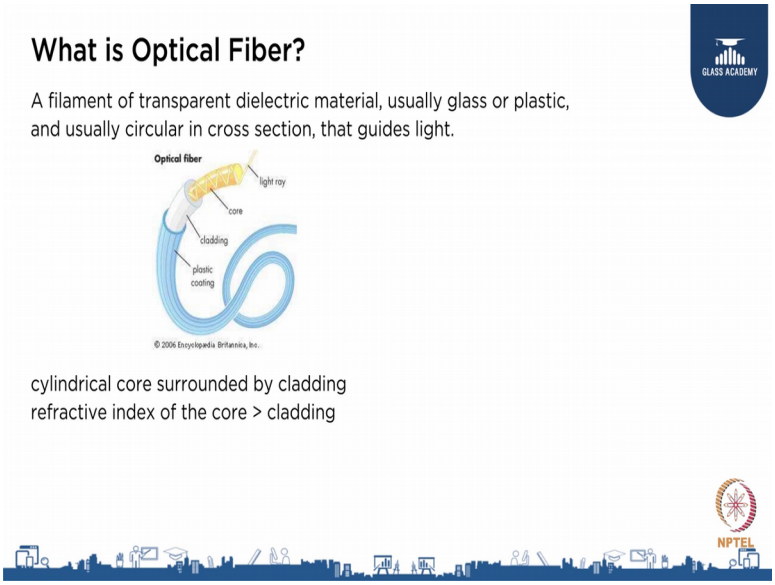

So to achieve that, we can use fiber optics. Now fiber optics is basically a transparent dielectric material, usually glass or plastic and usually a circular cross section. It has a cylindrical core which is surrounded by a cladding and the refractive index of the core is more than the cladding. So, what happens when the light strikes the core and cladding interface, it gets totally internally reflected and this total internal reflection is quite efficient. So, this light keeps on getting reflected and emerges from the other end of the fiber.

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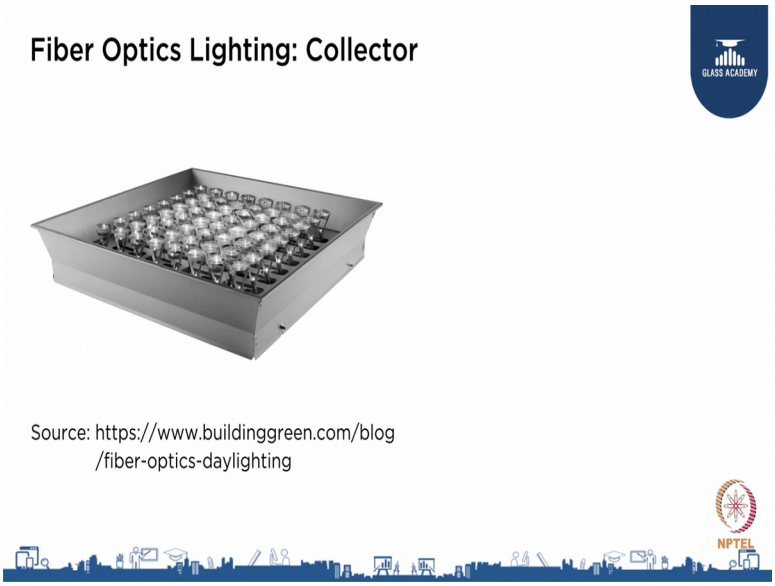

So, what we can do we can have a collector like this, which has lenses, these lenses concentrate the solar spectrum or the sunlight into the fiber and then the fiber takes this and brings it inside and then there can be a diffuser which diffuses the light.

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In this picture you can see some collectors which are installed on the roof and these collectors can track the sun so, that you maximize the amount of light that is captured.

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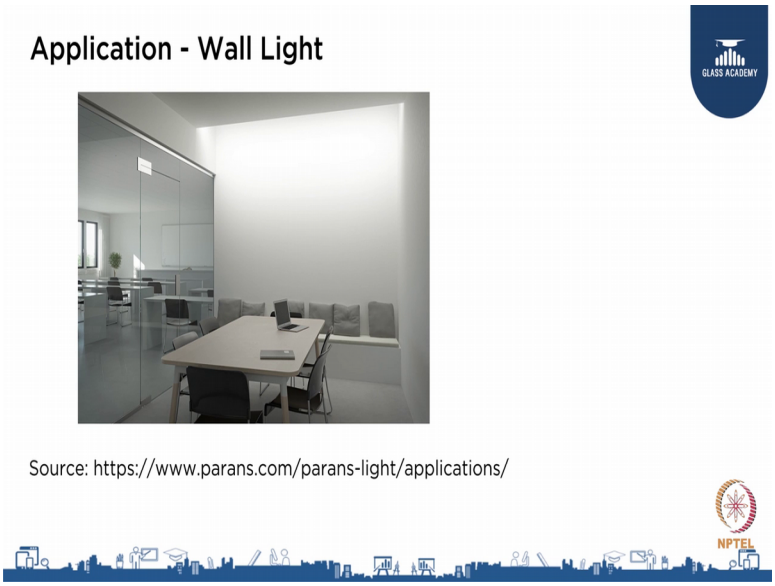

Now, when it comes inside there are various ways they can be put into the building, here you see that it is illuminating the wall and here you see that the light is coming from the ceiling.

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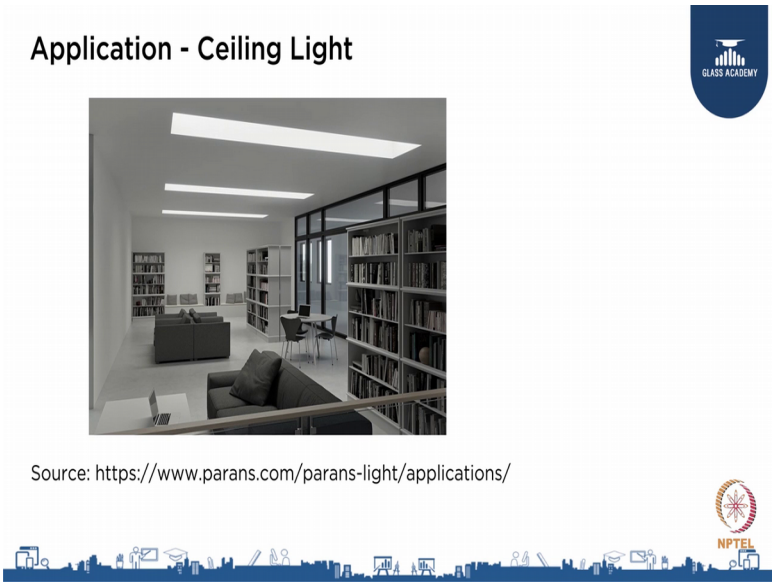

This looks pretty conventional kind of lighting and it looks as if the light is coming from an artificial source.

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source: https://www.theguardian.com/world/2013/nov/06
/rjukan-sun-norway-town-mirrors

So, you have seen lots of ways by which we can improve the performance of our building facade and bring in more daylight and control it, you might be thinking that its too much of work.

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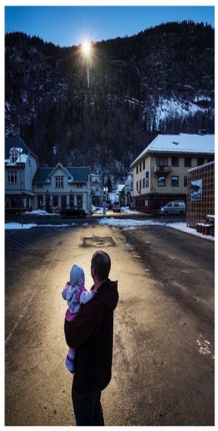

source: https://www.theguardian.com/world/2013/nov/06
/rjukan-sun-norway-town-mirrors

But just see this daylight is so, important that people in this small village in Norway, they were really deprived of the daylight most of the parts of the year because they are located at a place which is surrounded by hills. So, they would get very little daylight illuminating the wall and here you see that the light is coming from the ceiling. This

looks pretty conventional kind of lighting and it looks as if the light is coming from an artificial source.

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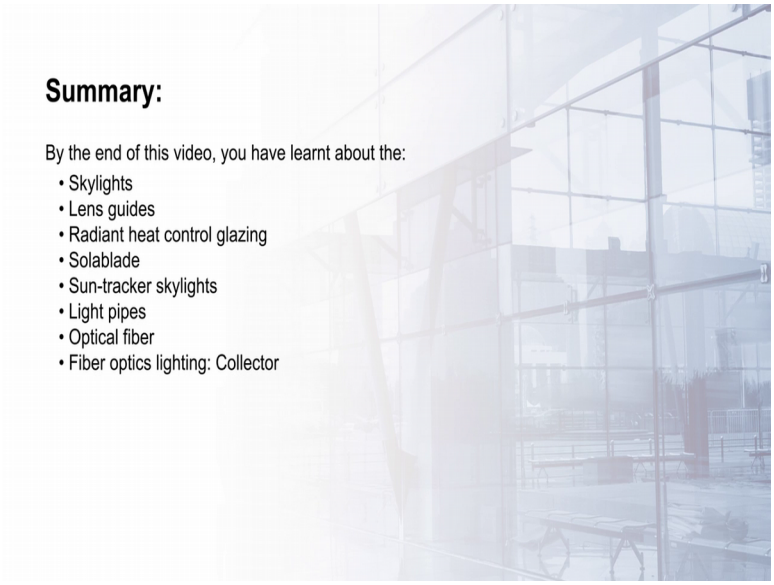

Thank you.