Strategies for Sustainable Design
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Lecture-15
Current Scenario of Sustainable Design: International

Hello everyone. So, we will discuss about current scenario of sustainable design in today's lecture, at international level.

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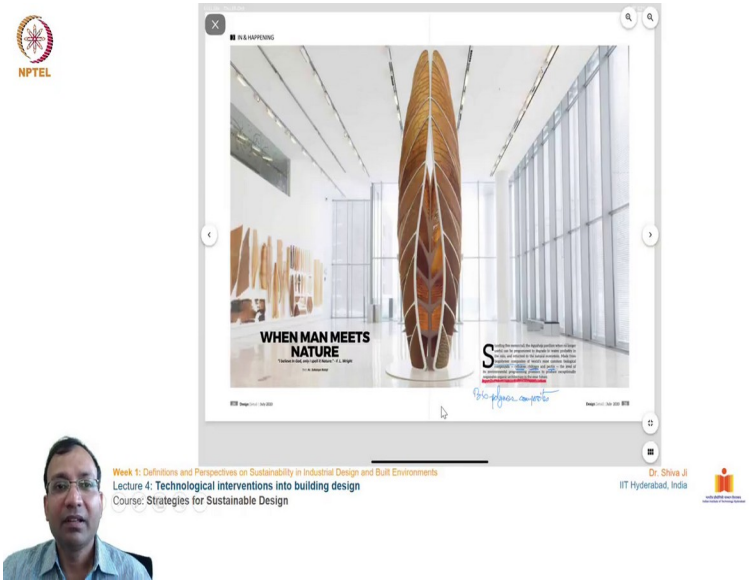

So, if you see, this slide over here, so this is biopolymer based composite material was used to fabricate this structure and this is almost a five meter tall, and this structure is fabricated out of a cellulose, chitosan and pectin which are the naturally occurring compounds. So, this structure is designed out of that. The biggest characteristic of this structure is that, it responses to the surrounding.

It has the capacity to breathe, it has the capacity to bloat, it has capacity to absorb water, and so, this is quite compatible for the, there a use as organic matter in the building structures. Though, it is just, an innovation from an architect and her team, but this is very praiseworthy, there is a word in terms of, using organic materials for, fabricating structures out of them.

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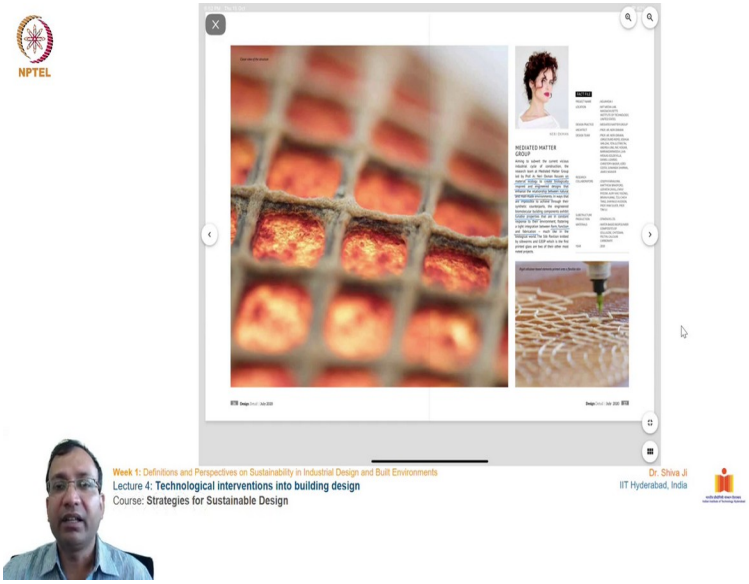

So, here if you see this is the architect Neri Oxman, she has done this work at MIT Media Labs in MIT, United States. And with this one, she has a 3-D printed and a whole structure out of it. So, if you see the biologically inspired and engineered the design has come up from the inspiration of using a natural materials. So, this is the very very, where we are a designing this manmade environments. So, in such a environments, these kind of materials can be utilized.

So, here if you see this bio molecular building components, they exhibit a some tunable properties, so, which we can tweak, with which we can a play with, and the form function and fabrication of it, in walls, an innovative, understanding of this material, innovative application of this material. So, this is an wonderful exercise what we can see over here in this right bottom image, so, this is a, this structure is being 3-D printed over here and it looks a flexible skin.

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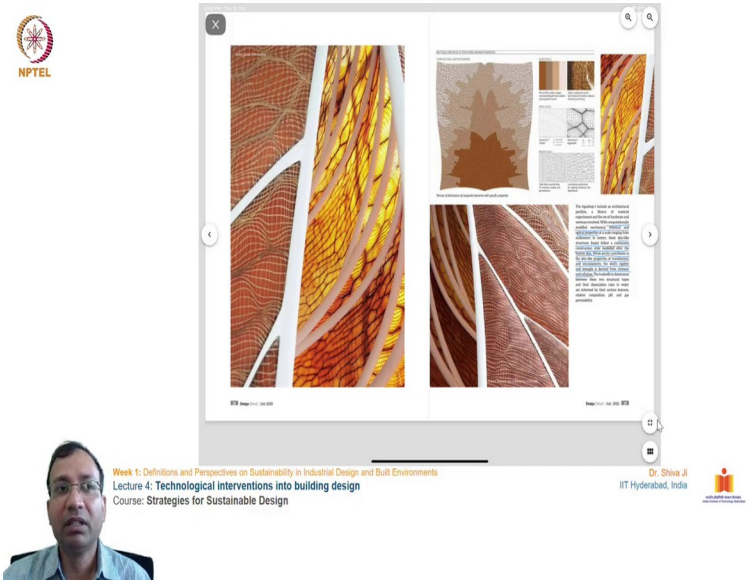

So, if you see, this has some inspiration taking from the, a leafy breathable structures, where the structure is supported from the, beneath using a, the tubular structures, we support the overall membrane part of it. So, computationally, if you see, this is a modified, with a mechanical, the chemical composition and using a optical properties of this material, this overall effect you are seeing over here.

So, it breathes like a natural skin. And the structure what it has is, follows this, a human skin maybe a leaf life structure. It has some properties a translucency and visco elasticity. We have seen a certain amount of rigidity is also there and certain amount of flexibility is also there. And that happens because of the property of all these chitosan and cellulose which is used in its fabrication.

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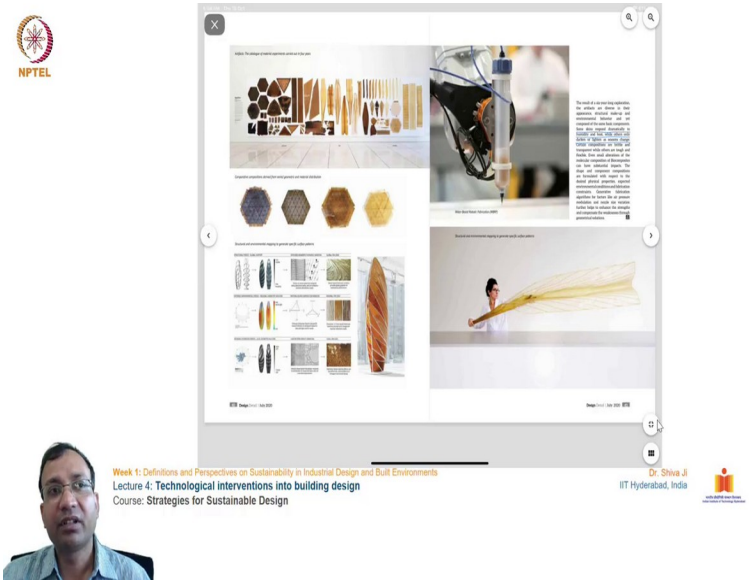

So, if you see the based on the explorations and based on the density of the fibers, this has evolved into a structure of this scale and it has see in this right bottom figure so, you can see the structural and structural strength of this material how long it can sustain itself. As a independent a structural member in any bigger member. So, as the skin response to the humidity and heat, and heat and so does this material, because it has some properties of a breathability.

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In the next example, I would to showcase over here this chili sculpture is made out of a completely using a scrap materials, so it promotes recycling, it promotes reusing the waste material. And this is created out of the scrap material completely.

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This is another project taken from a Netherlands, say it is a museum project, which sits near or close to a water body and rather the site, itself is kind of interacts a lot with the water body. So, the water streams are flowing through this water body and this is a renovation project which was undertaken by this team over here from the Rotterdam and they used this green roofing, this strategy to minimize the heat load and integrate this design into the landscape.

So, they have used this as a renovation and they have integrated this into the beautiful surroundings of this place over here. This museum utilizes the water safety principle and it helps conserving the water on the site also.

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So, as you can see over there in this illustration, so, this is the overall site which is inundated with water in the most part of it on the bottom side, and there is a water stream which flows from beneath the site, from the building itself. And as a strategy, the architect has utilized this water stream to bring the temperatures down in the summer months. And they have utilized material conservancy principles to reduce the amount of waste generated from this energy and reduce the energy consumption also.

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So, with a blown up view, you can see over here, how it has organized this activities and functions in the building, which minimize the energy consumption as the overall term. So, it takes the advantages, the biggest advantage of the site because it is close to a water body. So, it utilizes that as the biggest feature of this design itself.

As you can see over here, there are water base to power generation units are also installed to generate power for this museum over here. It uses heat resistant glass, it uses green roof for added installations and a heat buffer, reducing the overall energy requirements of the building it uses this biomass based stools to that maintain temperature, on this, in the winter times.

On the warm days, water from the river flows through the same piping to cool the buildings. As I said earlier, the water from the site itself is utilized for bringing, for controlling the temperature in the summer months, here, willows are used also to absorb the waste water and substances it contains, such as nitrogen and phosphorus, these substances usually acts as a nutrients to grow on the site itself.

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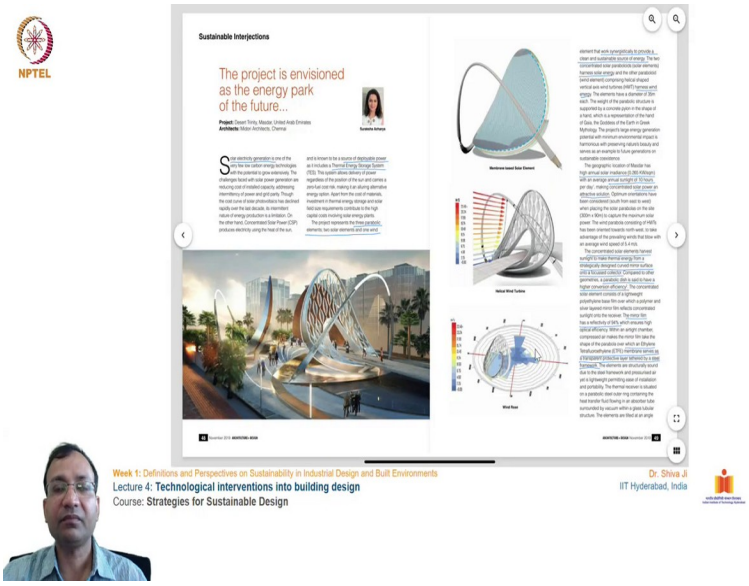

Another example I have taken over here, this is energy park, this is a, this has been, being implemented in the city of Masdar in the United Arab Emirates. So, this is designed by an architect and her team from Chennai. Here, what they have done is the utilization of the solar energy to convert it into the power. So, as these gulf countries experience extreme heat, and extreme a glare, so that is one of fitting places to have more number of sorrel harvesting units.

So, she has used it as, deployable power system, which harvest energy from the sun, thermal energy storage system also. It is works as, for the power generation as well as storage system also on the side. So, you can see this the peculiar structure of this design, it is designed to have a concave surface with the, using hyperbola and parabolas. So, that to maximize the heat gain out of this structure with minimal use of this material.

So, it works synergistically to provide a clean and sustainable sources of energy and it harnesses solar energy and it harnesses wind energy also, so you can see in this, in the next slide, I will show you there is the third unit also which harvests wind power. So, if you see this, the region receives very high solar irradiance.

So, that is the purpose and mostly in the summertime, the sunlight stays there for longer period of time per day. So, how this can be made into a attractive solution, attractive destination for urban feature, urban landscape unit. So, that is very interesting to observe through this design.

So, the concentrated actually solar elements harvest sunlight to make thermal energy from a strategically designed called mirror surface onto a focused collector.

So, the this collector you see which is a passing from here, so this is heated by the glare which gets concentrated from this, is the surface, the glass surface of this, these are dishes. So, these are held up parabolic in shape and they have higher conversion efficiency. The middle films are coated with the, a very high reflective coatings up to ninety five percent of this they reflect.

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So, here if you see this third unit, which is right here in the middle of it, this harvest the wind, wind velocity and convert that into energy. So, it has a composition of two solar panels plus one wind panel. So, this uses is lightweight durable ETFE membrane, coated with miller, mirror film which is a very lightweight as well as very effective for such purposes. It uses fluidized sand, it uses steel as a membrane, as a main structural system, it has wind turbine system, it has, it uses carbon fiber reinforced plastic

CFRP also in it, is blades to make them lighter as well as very efficient and strong. And piezoelectric tiles are also used to generate energy, while having people who will be the visitors. So, by the footfall of the visitors, that tile surface also generate some amount of energy. On the landscape it uses obviously the native species sand and previous, a pervious paving which collects water which allows water to seep inside the floor.

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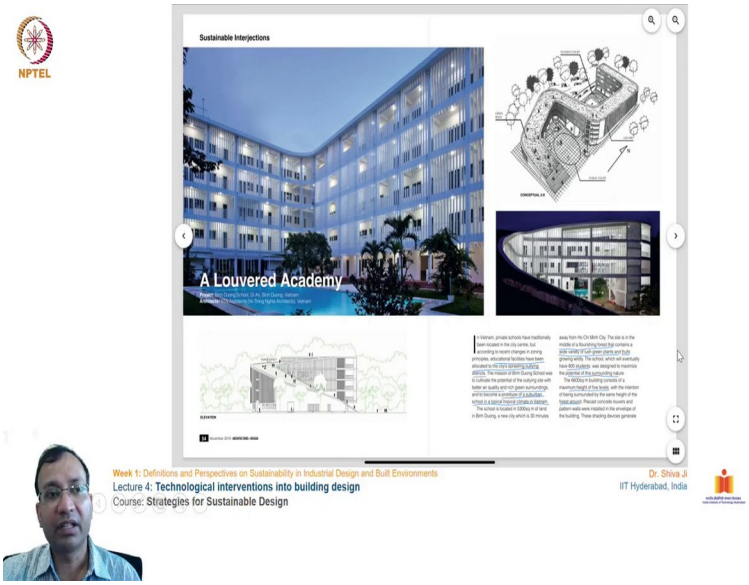

In the next example, this is a, an academy building, this is from Vietnam. So, you can see in this sketch over, in the in the lower side, this also utilizes, this terrace garden concept to minimize the overall energy requirements for this building it uses, fins and membranes to permeate, or to allow permeation of wind without harming too much with the, direct sun. So, there is this courtyard, corridor planning arrangement all across this surface you can see over here, which allows the greater amount of wind but it prevents the direct heating also of the interior spaces.

So, this is basically an educational facility, this is situated in a outskirts of the, of the, that town. So, it is located in rich green area, forestry area, and it utilizes that climate also to, for it is like a greatest advantage. So, it utilizes the wind pattern and the solar orientation. So, here if you see the wild variety of lush green plants and vegetations and fruit trees are also a kind of planted and it houses around 800 students for their education.

And it has the abilities, it has that potential that integrates with the landscape to see from here the students can climb on the top of this building, gradually from the ground level itself. So, you can see over here, this green goofy concept in this illustration, and there are interesting courtyard, courtyards carved out, surrounded from a building from three, three sides. So, here and here.

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Some more details of it, it uses, obviously, a passive design building, like a strategy, it uses ordinary reinforced concrete frame structure with the brick and mortar to have the mass of the wall and which reduces the transmittance of the heat also in the daytime.

On the external vertical louver and pattern walls, this they have used a, you can see over here in this particular image, it creates this shadowy pattern. So, it allows the light, permissible amount of light to get inside the corridors, inside the workable area, but it prevents the extra glare also, it prevents the heat component also.

It allows that air buffer to get created over here. So, these louvers help reducing the warming temperatures inside. So, visual connection is also established. Here you can see this, the double height penetration is left just open, so that the students can see through and the landscape can be visualized with the greatest efficiency.

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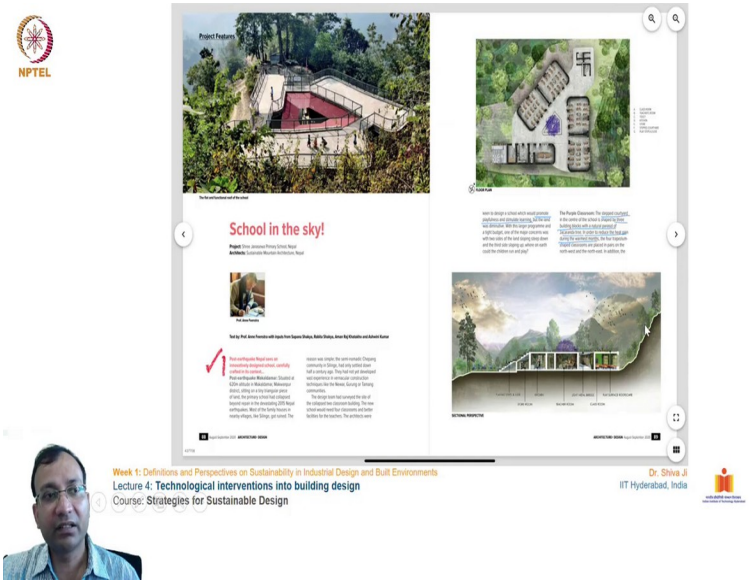

This another example is taken from the country of Nepal. This school is also present on the outskirts of the town and it enjoys this hilly terrain, but the hilly terrain offers a challenge also like where the children are going to play? So, in that kind of a setup, the designers the architect team has deployed, has taken advantage of the roof of the structure of this building to create playing areas and having a bigger surfaces where students can safely play around as well as at the same time they can enjoy the view of the valley and the mountains.

So, this promotes playfulness and stimulates learning in a natural setting. It uses that stepped planning that like a terrace, like a terrace forming we have seen from the mountains. So, it enjoys it, it utilizes that strategy to have a stepped courtyard planning, to have it in this school building. And there are three major blocks you can see in this plan of the building which allows this ventilation, cross ventilation from the middle of these blocks which allows greater air movement in the a warm months.

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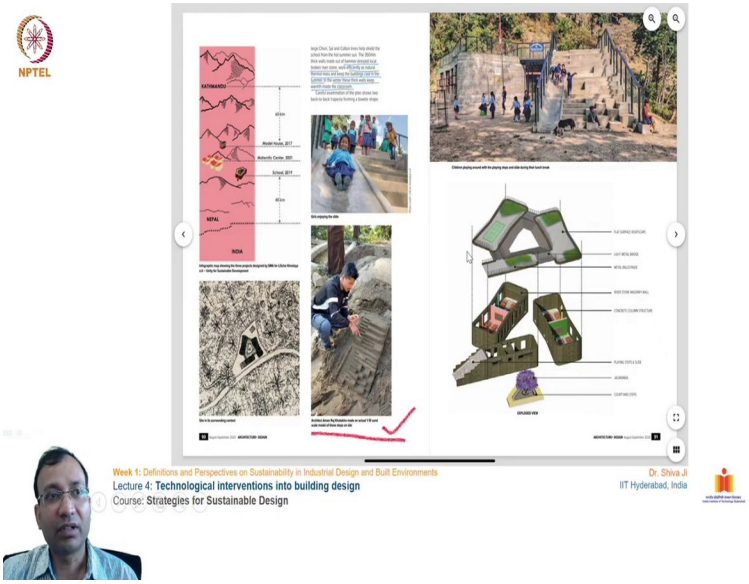

You can see some playful incidences over here, like how children are enjoying this structure. And you see this architect, Aman Raj, he has created a one is to ten, model of this portion of this building in the sand itself on the site. So, you see how he has taken advantage of these sliders as well as steps, as well as steps on a lake of the greater risers to have them arranged in a seating fashion, a ghat kind of a place and an arrangement where children can stay on these terraces and they can play.

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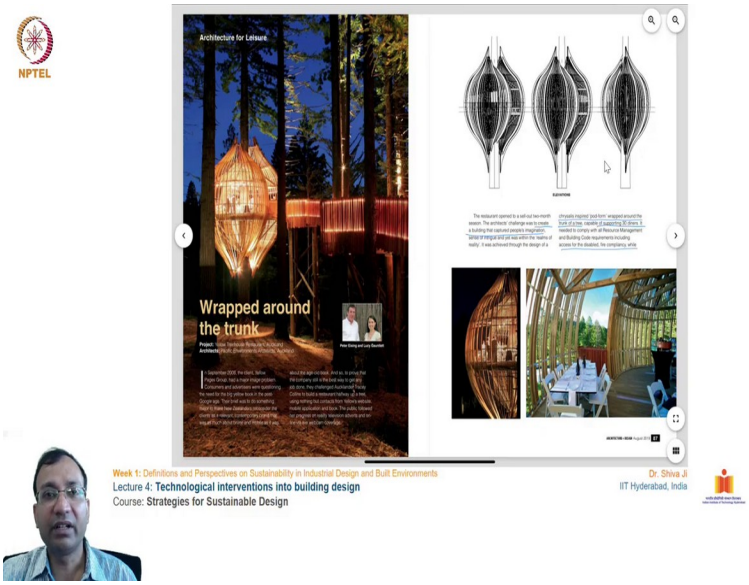

The next example I have taken is from a Auckland. Here, the architects has visualized kind of a wrap around these vertical trees. So, without disturbing the site, without disturbing the landscape without creating any manmade structure of a concrete and brick in the ground they have utilized to stay these, utilized these the tree trunks to stay afloat on the sides of these tree.

So, it is a bubble kind of a structure you can see created in a timber which they have wrapped it around and they have created interesting dining spaces inside these bubbles. So, this has, in the recent time has catched the fancy and the imagination of the public over in that country and even internationally. And it is an afford, we can see that afford, how to pay attention, how to pay respect to the nature, how to pay respect to the vegetation and trees and evolve our, our designs around them.

So, it is a little, it may not last there forever, but at least it gives us kind of an intention, how we can without harming, without much harming, a landscape and the setting, we can still evolve a creative solutions, out of these varying context, which are offered by the landscape and that particular place. So, at a time, this one structure offers a support for 30 diagnose at a time and it gives them an ample, an ambience to look around this green wooded area and all of the services they have kept at the ground level.

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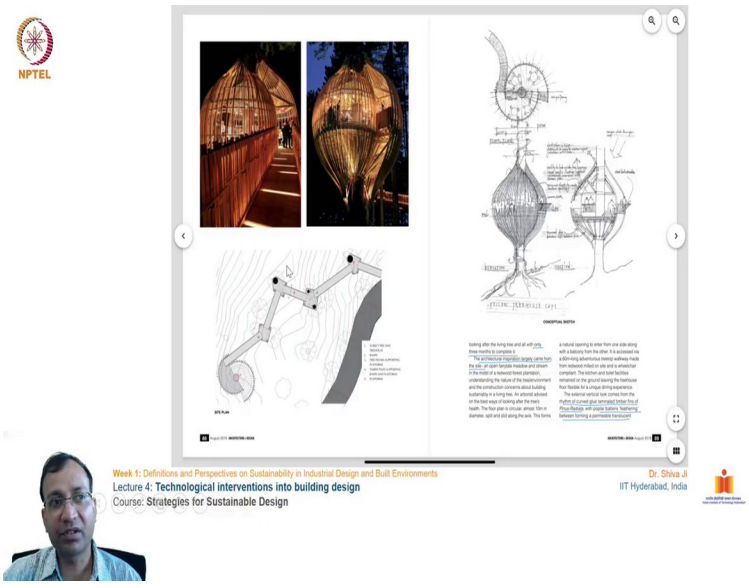

So, the only main service part took, takes place on the top of these are structures. So, you can see some exploratory sketches over here how they have visualized to have this wraparound structure around these trees. These are the some pictures in the night time, how it looks interesting to have them in this wooded area over here.

And it took a very short time of approximately three months to complete this work over here and since then it has become an inspirational piece of, of creativity of an architecture, of an adaptive, an architecture to evolve in these context of sustainability, because sustainability demands to design in the rhythm, in the gel with the, in the sink with the nature and this is how this, these are the some of these designs, which have been executed at different places across the globe.

So, the minds, the attention given by these architects and designers opens up this, this debate, why cannot we do this? Why, why cannot we undertake such examples in our own places, in our own contexts. So, this is an inspirational design pieces I have brought to give you a glimpse of what is happening at the international level, in the system building area, where they have used this kind of a permeable translucent structures, which do not create a rigid and a solid boundary between interior and exterior rather they completely go gel with the nature and that place.

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So, you can see over here in this cross section, how this structure is actually planned. So, in this one, the inner surface serves as a, here is the main seating area, these you can see these three

tables over here and two tables over here. And then from here, you can go down and you can come up.

So, this is how it was fabricated on the site with the scaffolding and it uses acrylic sheets on the top to create, to allow sunlight inside and to give clear view of the night sky also, since, this project is situated in the middle of a nowhere, middle of in the, in a forest. So, it is very fitting to enjoy the night sky. This user is this, this uses this philosophy to protect trees and develop our designs around their own existence, so, that trees also can survive.

So, this is a, this other sustainability question what they have achieved is to the selection of materials, the little reliance on the outside energy sources, they have used a natural ventilation and lighting systems, they have tried to leave a minimal footprint through their design and this is how they have designed their structures, they have done the selection of the materials which are more routed to this particular place.

The ability part of it like how easily it can be fabricated without external intervention or the requirement of a heavy machinery etcetera. And then accordingly they have done this priming, programming and the counsel of that place that Auckland they have approved. And now in the recent times, it has become a piece of a visit and I think it is one of the very successful product projects, which have come in the recent times. Thank you, everyone.