Sustainable Architecture
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Lecture – 12
Flavours of Sustainable Architecture

Good morning. Welcome back to this lecture of online course on Sustainable Architecture. I am your course instructor Dr Alvokita Agrawal, Assistant Professor at Department of Architecture and Planning IIT, Roorkee. So, we have been discussing the characteristics and different aspects of sustainable architecture. We have looked at the socio-economic aspects so far and we also have huge environmental aspects.

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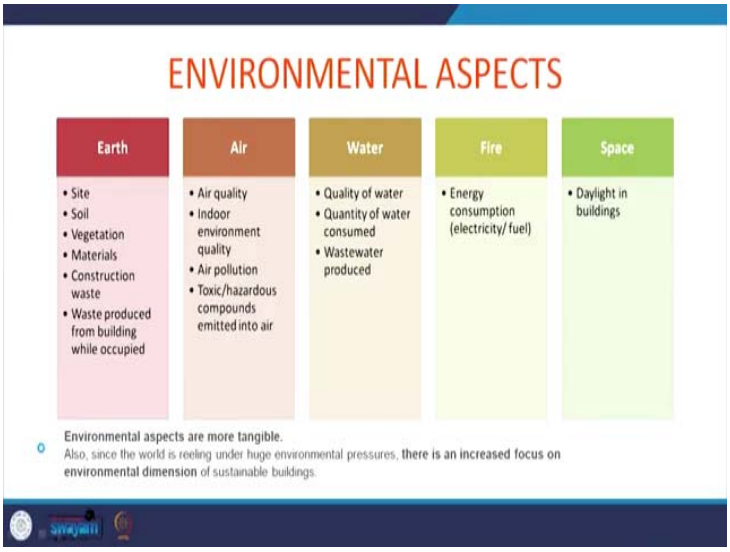

Now, environmental aspects are also the most tangible aspects as compared to social aspects. For example, identity of a place it is not a very tangible aspect. Though we understand it, we easily apprehend ited, but yet it is difficult to put in tangible forms while most of the environmental aspects are very tangible. All these environmental aspects can be clubbed in bins of the five basic elements of nature which are earth, air, water, fire which I say energy and space.

So, all these five elements are the elements which directly govern the environmental aspects of buildings. For example, when we are talking about the earth we are talking about site, soil, vegetation, materials, construction waste and the waste which is

produced from the buildings while they are occupied. So, all these come within the earth element of the environmental aspect. ~~Next~~Next, we have air; here we discuss about the air quality, the indoor environment quality in the buildings we talk about air pollution and the toxic compounds which are emitted into the air. All of that comes under the domain of air with an environmental aspect.

The next and one of the most important ones is water. So, we have quality as well as quantity of water discussed here and the wastewater which is produced and treated. So, all of that comes under water. And, in~~a~~ fire we talk about energy consumption and also energy generation for example, renewable sources of energy will be discussed here. And, in space we talk about say daylight in buildings. So, all of that all of these aspects are very tangible, they can be quantified, they can be calculated and hence an assessment can be made.

Now, so ~~far~~far, I have been talking about sustainable architecture. However, when we look ~~around~~around, we often look at buildings which are not called as sustainable architecture, but there are many interrelated concepts, for example; green buildings. Now, green buildings is a very common terminology which almost everybody is using. They are often synonymous, but there are slight difference, but there are differences between the each of these terminologies and sustainable architecture though the fundamentals remain the same.

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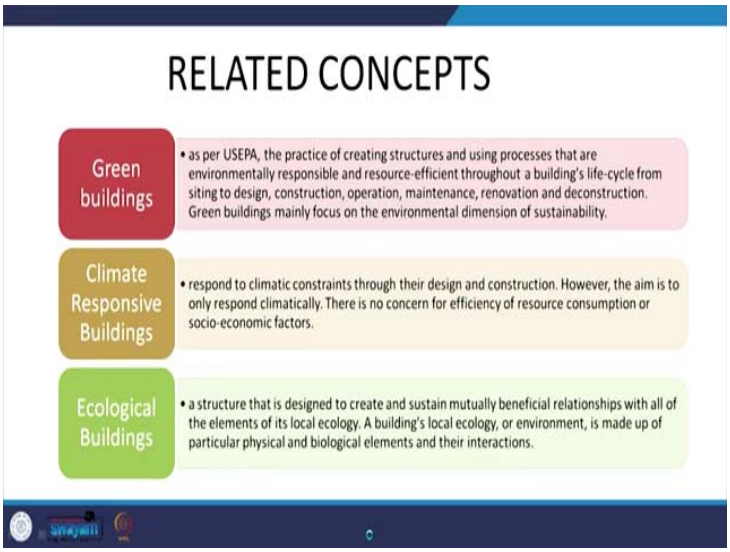

So, green buildings as per USEPA these are or this is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction at the end of the life of building.

So, here green buildings mainly focus on the environmental dimension of sustainability and the other dimensions which is the social dimension specially takes a little backseat. I am not saying this is not being addressed at all, but there is a greater focus on the environmental aspects when we talk about green buildings. The next is climate responsive buildings. Now, these buildings respond to climatic constraints through their design and construction.

However, the aim of these buildings is to only respond climatically. Fortunately, many of the climate responsive buildings traditionally qualify to be called as sustainable buildings because they do not ~~they not~~ only respond to climatic conditions, but while doing so, they use the best of materials, they use the best of the available resources and also the ones which are renewable which are easily renewed in the nature.

However, the main aim of these buildings is to respond to the climate of the place. Next one is ecological buildings, now these buildings are structures that are designed to create and sustain mutually beneficial relationships with all of the elements of its local ecology. So, the buildings local ecology or environment is made up of particular physical and biological elements and their interactions.

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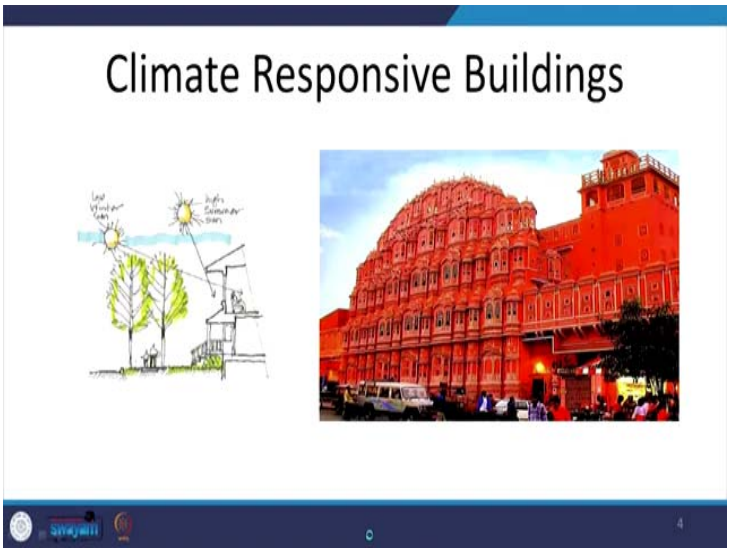

Now, these definitions will be more clear when we look at these examples. For example, for a climate responsive building Hawa Mahal is an apt example an appropriate example. Now, Hawa Mahal though it is resource intensive because it uses stone extensively, but it creates absolutely comfortable environment indoors because it responds to the climate.

So, that is what the main aim of the building was – to create climate responsive and thermallyly ~~comfortable a~~ comfortable environment indoors. So, this is climate responsive building.

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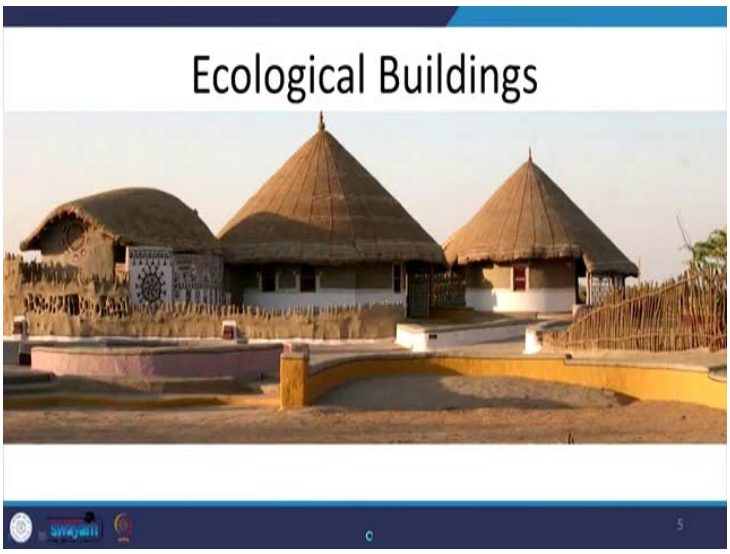

While this one is actually an ecological building now, it this entire building this entire setup merges with the surroundings. It consumes the materials which are most conveniently available locally and they use it in a manner that it does not affect the ecology around these buildings and such buildings only enhance the ecology around. So, they do not disturb the ecology around them.

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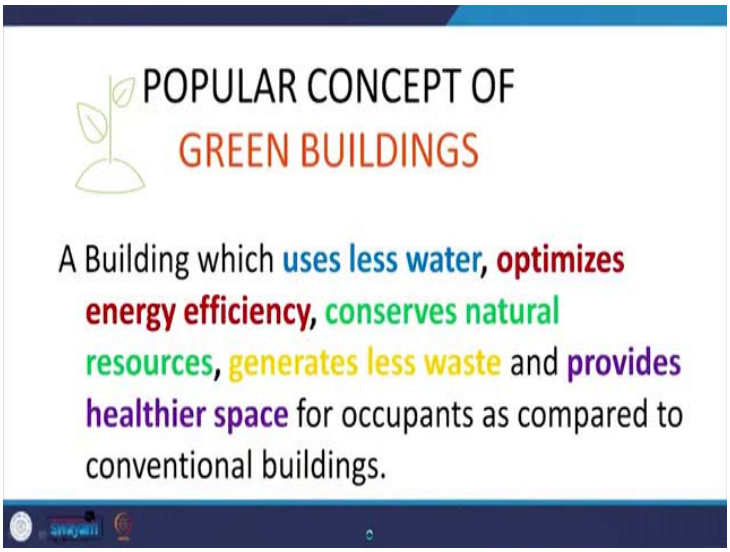

The most popular concept is that of a green building. It is a building which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for its occupants as compared to a conventional building. Now, out of all the concepts which are related to sustainable architecture green building concept has become very popular for few reasons. And one of the most important reason is that green building rating systems have come into place and because of these rating systems we can assess the performance of our buildings. We know where the building stands.

So, there is a benchmark there are comparisons between building to building and we know what performs and what does not. In this way people can monitor their performance vis-à-vis with others and get motivated. This has actually driven the market. Because of these rating systems green buildings are the most popular concept in sustainable architecture as a larger domain.

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So, we hear about green buildings and the rating systems almost every day. The fundamental reason I will repeat again is the measurement which is possible through these assessment tools.

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So, when we look at green buildings the broad categories of these parameters which are parameters of ~~assessment~~assessment, they are sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, awareness and education and innovation and design with location and linkages.

So, these parameters in different rating systems are being given different weightages. So, in some of the rating systems these vary from country to country. So, in some of the rating systems energy and atmosphere is the most weighted one. However, in some others the material and resources or sustainable sites are the most important ones and like that. In some cases awareness and education is totally absent and so on. So, these different parameters of assessment are present in different rating systems in different weightages.

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So, there are many--many rating systems in the world which are there, for example, BREEAM which was the oldest one to lead; we have GRIHA which is our own Indian one; we have Green Star; we have Living Building Challenge and CASBEE from Japan and a lot of these. We go to each one of these rating systems if we compare each one of ~~these~~these, we find a lot of similarities in the approach and the basic approach being that of measurement and verification and through this measurement we are able to benchmark the performance.

Now, green or sustainable is often used interchangeably and we have already discussed about the characteristics.

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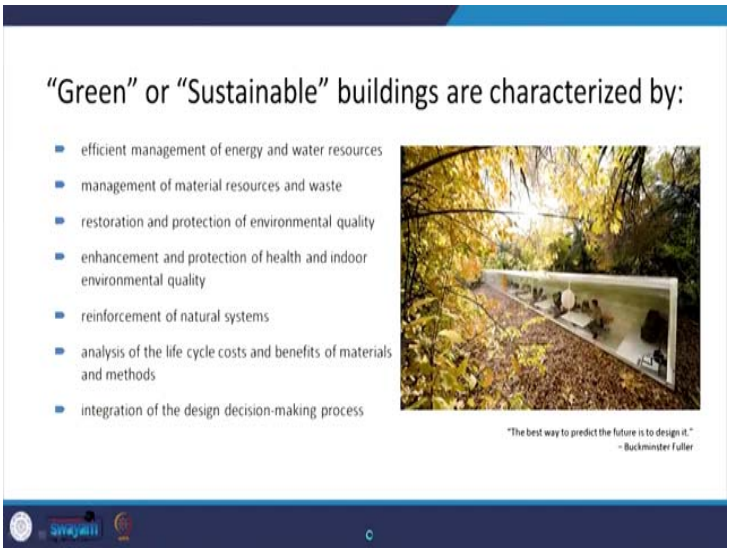

Now, if we are looking largely at the environmental ~~characteristics~~characteristics, we look at the efficient management of energy and water and also material resources. So, efficient use and management of resources; we look at restoration protection of environmental quality and the health and indoor environment quality.

We look at a reinforcement of natural systems and we are always looking at the lifecycle of the building not just in a part of a phase of life of the building and we are looking at integration of the design decision making process.

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If you look at the benefits of green building so, it is not just because the entire green building rating program measures, monitors and verifies the performance of building, green buildings come with a lot of benefits. There are individual benefits, there are regional benefits and there are global benefits. At the individual level it reduces the bills for energy and water, it improves the air quality and it reduces the maintenance which is required.

At regional level we are talking about the system such as water systems, groundwater recharge, we are looking at vegetation, we are looking at ecology, we are looking at waste management. At global level we are looking at benefits like global warming, getting away from global warming, climate change; we are looking at the forest protection and all these.

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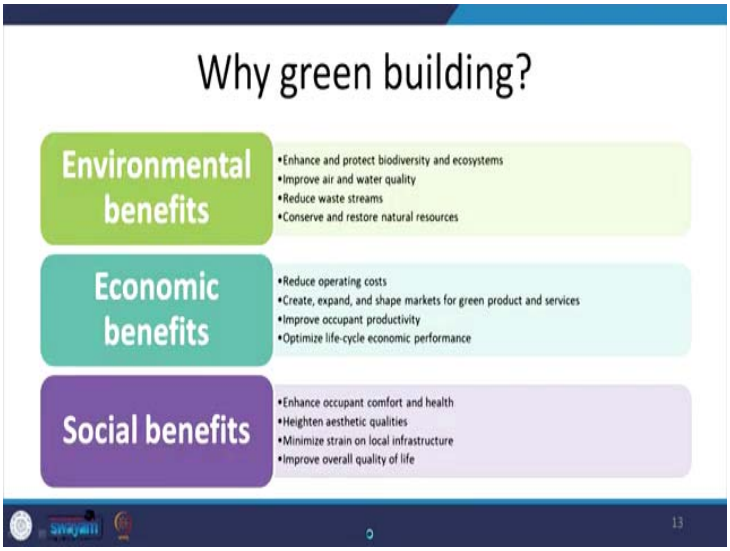

So, green buildings come with a lot of environmental, economic and social benefits through the characteristics and also the aims which we have set for green buildings.

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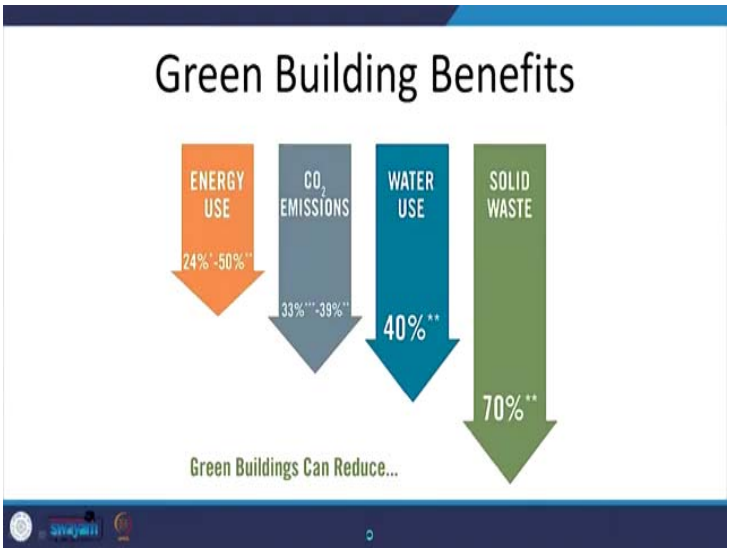

So, the green building in general reduces energy use by at least 24 and it may go as high as 50 percent that of course, depends upon how the buildings are being designed, but from a conventional building this is what we are able to achieve the carbon dioxide emissions are reduced by a third. The water use water consumption at times reduces to around 50 percent of the conventional one and the solid waste through the process of construction and afterwards is significantly reduced at times to 70 percent.

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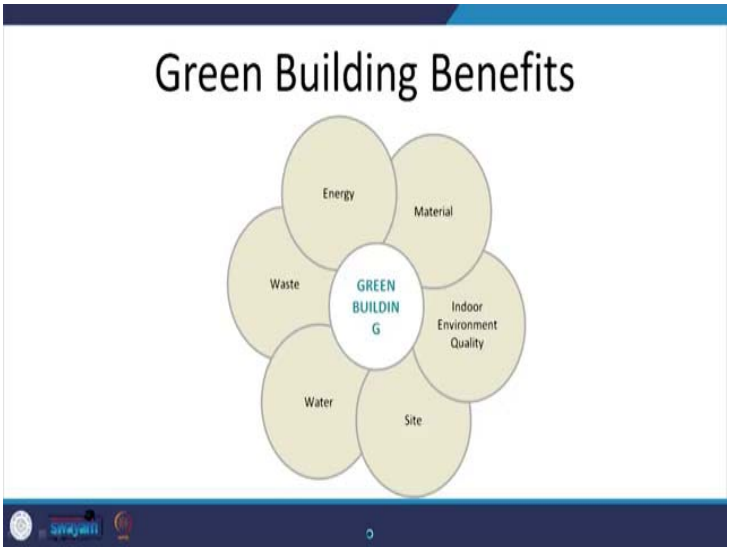

Owing to these benefits the green buildings become a hugely popular concept.

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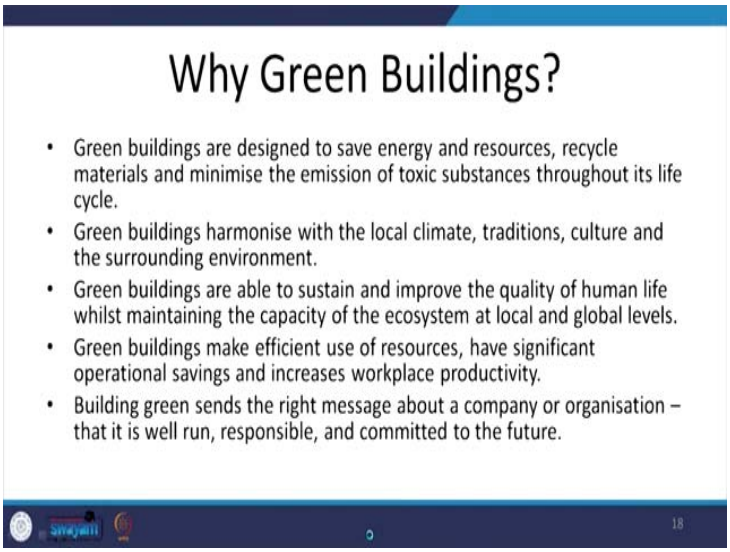

However, if we look at what sustainable building versus a green building ~~is~~is, we often have contradictory discussions, contradictory opinions on what the sustainable building and green building implies.

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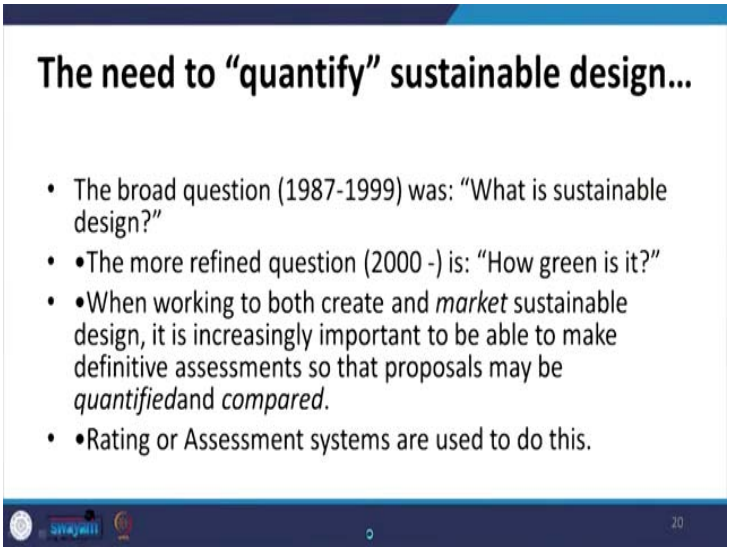

Now, green building often looks at the environmental dimension while sustainable building looks at all the three-dimensions in an equal capacity. However, when we go on to monitor it as I was mentioning initially also that environmental aspects are the most

tangible one. They are the easiest to monitor, they are the easiest to calculate, quantify and hence benchmark unlike the social benefits.

For example, place making, identity, sense of belongingness. Now, it is often difficult to quantify and hence we do not have the benchmarking or rating systems developed for sustainable architecture as we have for the green buildings.

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Now, when I repeatedly talk about this difference between green and sustainable let me clarify it by taking an example one which is a certified green building and a very highly acclaimed green building versus a sustainable building.

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So, let us start with this green building. So, the example that I have taken is of Suzlon One Earth. Now, this campus Suzlon One Earth which is designed by Christopher Charles Bonanza is also a green certified building. Now, Suzlon itself being the company which is involved in renewable energy, they have their entire campus which is 100 percent renewable energy campus.

They have installed windmills, they have added solar photovoltaic to generate the entire electricity usage within the campus, on the campus and part of it off the campus.

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So, they have all these on site and ~~off site~~off-site wind turbines and photovoltaics which cater to these needs.

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They have hybrid solar chargers which interchange between the mode of renewable energy from wind to solar depending upon the availability.

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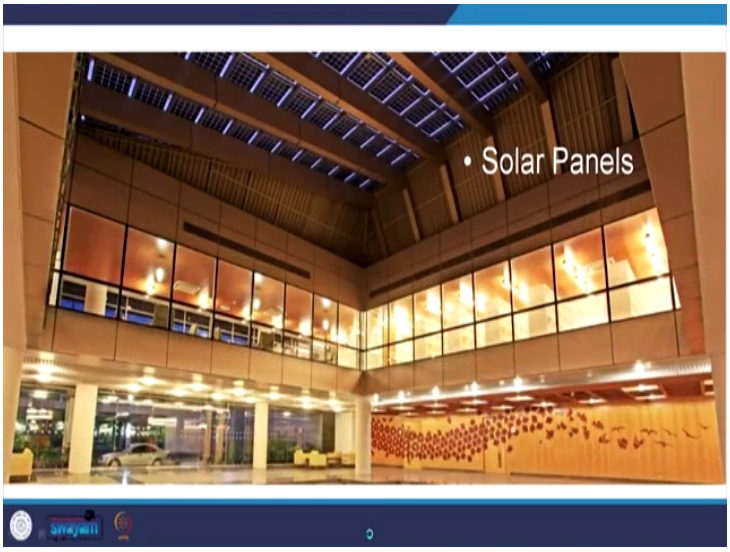

Huge areas are covered.

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So, that is the main point of this entire campus when and that it becomes a net 0 campus it does not draw any energy from the grid because they generate 100 percent of their energy on site or off site, but of their own. This is the production side; however, at the demand side they have managed with very good systems – the first one being the correct orientation of the building.

So, the building has been oriented in such a manner that all their workspaces are day lit almost throughout the day without glare and without direct sun penetrating into the interiors.

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The second important aspect is the use of materials. This particular building is constructed on a hillside hillock and the material which was used in the building was the one which was excavated from the site itself not 100 percent of it, but a large part of the building material came from the site itself.

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The next one is lighting because of the correct orientation and also the design for example, the skylights that we can see and of the windows at a high level the entire workspace is they lit without causing glare to the workspaces and without the use the

need of any artificial lighting throughout the day. So, majority of the workspaces are designed to ensure daylight.

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The next is landscape. So, they have used the native tree species all around the campus which are also requiring less of maintenance and water.

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The next and one of the most important ones is water management. They recycle the 100 percent waste water on the site and the same water is fed back into the system for users like flushing. So, there is a dual piping system. The water is also used for landscaping the

same water and hence the entire water consumption the loop is a closed loop with very little drawing of water from the ground or from the municipality.

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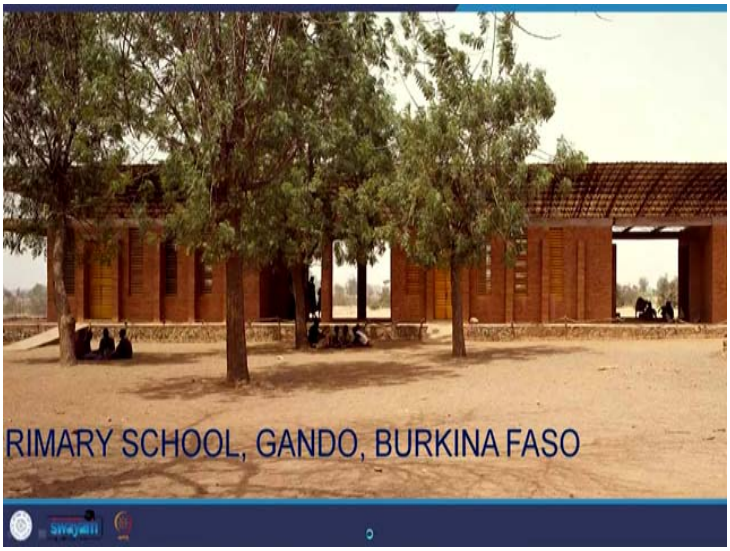

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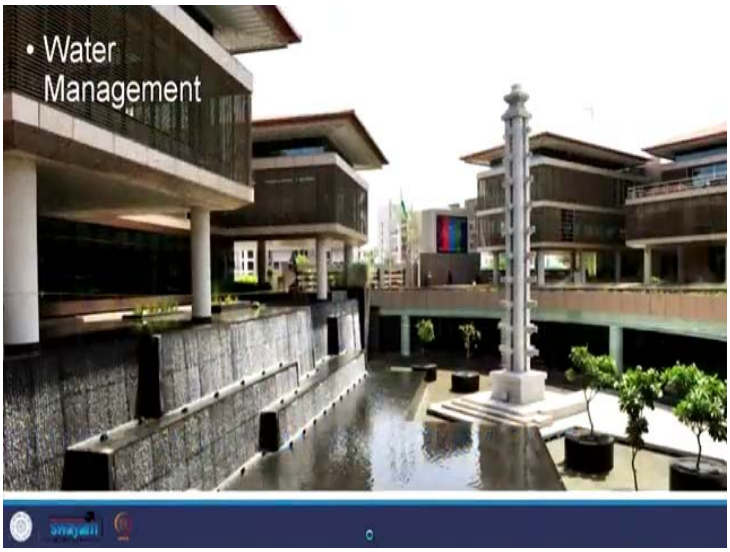

Now, we compare this building Suzlon One Earth which is a green building highly energy intensive, but generates 100 percent of its energy on site and off site. It consumes a lot of water, but recycles 100 percent of the water to keep it within the loop it has landscape which is managed, but the native trees have been used.

Now, compare this building with this primary school which is in Gando, Burkina Faso. This is a primary school which was built for the local children for the community.

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Now, for construction they have used these compressed earth blocks; these bricks which were made with the help of community participation. The parents of these children came together to make these bricks. The stone is locally available the climate is climatic condition is a very—very harsh and this school was constructed for a very underprivileged community which was living around.

So, the construction materials which are used are very low on embodied energy. They are made out of materials which available locally and the type of construction which is used which is this double roof.

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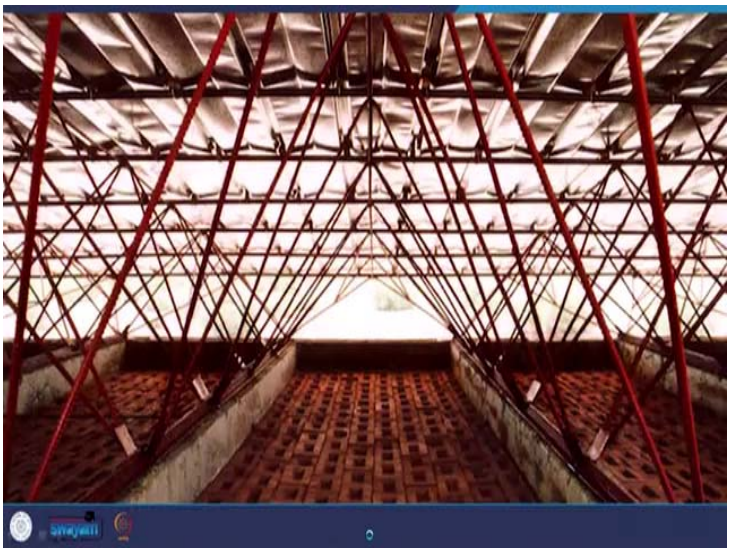

So, a brick slab roof and it has a double roof on top of it which helps to keep the indoor environment comfortable as it takes away all the heat; this cavity takes away all the heat which is accumulated which is gained from the solar radiation. So, this cavity between the top surface of the roof the second roof and the mass the roof mass helps to keep the temperatures low in this building.

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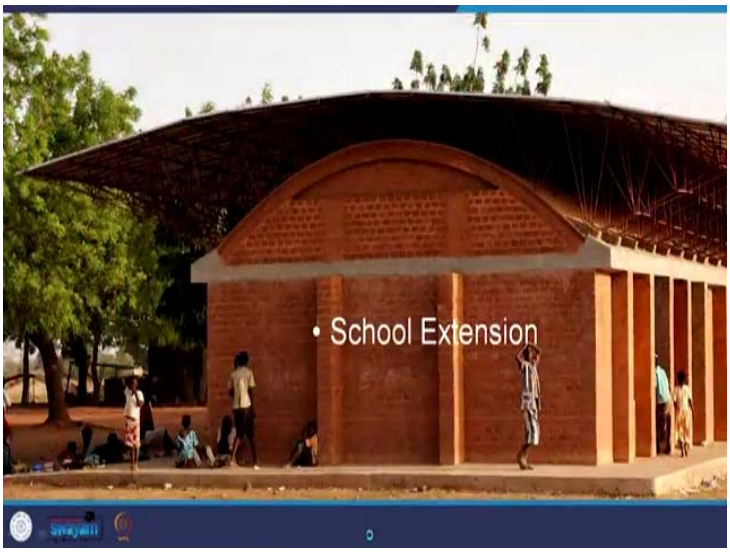

Now, this entire building was actually as proposed as a school extension and, served the community which was living around.

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The unique design of windows to ensure that the indoors are day lit and no artificial lighting systems are employed into this building. It is naturally ventilated without any mechanical systems based upon the thermal comfort needs of the community. And it provides a comfortable thermally comfortable environment indoors.

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The material which is these wood logs which are used to create the roof are also locally procured but, since it is a dry region not much of forest is available. So, this has been used judiciously not in huge quantities, the main material being earth.

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This is for roof where the indoors beautiful aesthetics has been achieved at no cost. So, this kind of arrangement these this beautiful aesthetic arrangement has been achieved without spending a lot towards materials and by engaging people by involving people in designing and also constructing.

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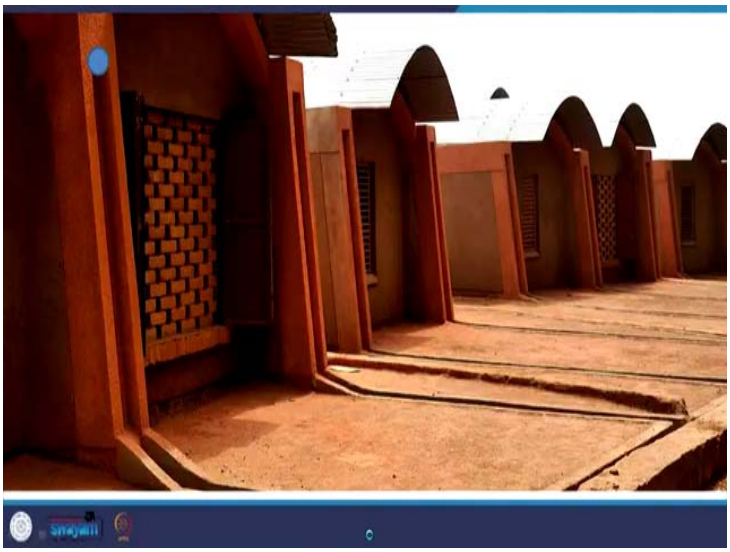

Thesesis is the these are the quarters for this staff where the water management has been ensured that all these domical roofs all these vaulted roofs through these vaulted roofs the water collects through these channels these drains and is collected in a center point and is used for consumption in this entire small complex of the primary school. So, no external water is consumed.

Now, if we compare these two buildings Suzlon One Earth in Pune and this primary school in Burkina Faso – one is an example where the consumption is huge, but the generation of the resource for example, energy is also happening simultaneously while on the other hand we have an example this primary school which consumes zero energy. So, it does not require to generate it. It consumes very little amount of water which the requirement for which is met through the collection of rainwater.

Besides that, it has an added benefit it has an added aspect which is fulfill which is of social benefit where the building is constructed for an underprivileged community, the people are involved in not just the designing, but also the construction. So, people own it. There is a sense of belongingness because people have constructed it, people own these buildings. It does not require to be secured,be secured; it does not require to be logged. That is why the building remains open all the time. So, that is in true sense a sustainable building.

So, the difference between sustainable building and green building is evident where for green buildings we are focusing only on the environmental aspects while in a sustainable building we are focusing not focusing, but the human beings, the users are at the center of it and for these human beings we create architecture which is environmentally responsive.

Another thing which we can see here is the affordability the economic affordability. Now, this office building of Suzlon One Earth is outstanding as far as environmental aspects are concerned, but it may not be affordable a model of affordability. However, this one is out and out affordable because there is no cost which is going in hardly any cost.

So, we very clearly know when we are talking about sustainable architecture and we are talking about green architecture, green buildings these are two synonymous very close, but distinct terminologies, distinct philosophies. In the next lecture ~~onwards~~onwards, we will discuss about some of the technical aspects of these green building.

So, we will shift our focus from sustainable buildings more towards green buildings because that is more tangible and more doable. So, we will discuss about the various concepts, technical concepts which go as part of green buildings and understand these concepts and how to deliver them

Thank you; see you in the next lecture. Bye-Bye.