Life Cycle Assessment
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Lecture - 32
Design for Sustainability (Contd.)

So, let us start from where we left in the previous module.

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If you remember, we were talking about what are the components of a sustainable design. We also talked about the 3 aspect of sustainability. Again in this module we will start with kind of recapping what we have we how we have defined the sustainability, in just briefly first few minutes and then we will get into other aspects of different aspects of the sustainable design when we try to design anything what are the things we have to take care of in terms of the sustainable aspect. So, as you can see in this particular, if you remember we talked about sustainability it is started in early 90 when with the agenda 21 at the world summit.

So, that is on June 30th 1992. There was a world summit on that summit was called agenda 21 and that is where this whole concept of sustainability started and there in that

particular summit we had the representative for almost ninety percent of earth's population. So, people from each and every country including India was there a representative of the governments were there. And then they decided that the way we are making progress that is not sustainable anymore.

So, when we say it is not sustainable it means that we are using too much resource. And if the way if that is the way to continue will have problem in terms of for future generation. So, that is it was a single largest gathering of heads of states in the history of international diplomacy. And that is how this whole discussion on sustainability sustainable development global sustainable goal, and from that point onwards every year or every year and a half from time to time there is a sustainability related meetings happening, usually organised through UN our world bank and other organisations and they can try to see you how far we are making progress in terms of our sustainability goal.

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So, the agenda 21 that is. So, when we say sustainability earlier if you look about think about the industrial output when we say GDP for example, GDP which as you know recently we had our budget. So, GDP is stands for robs gross domestic product, but that GDP is only looks at the how much kind of more of an economic activity does not take

into account what is the quality of life. So, those and how happy are the people and how healthy are the people. So, that aspect does not get captured in the GDP calculation, so the sustainable development goals. So, people look at 19 that is early 90 meeting the first meeting they found at 6 broad topics where we should focus on the first one quality of life on earth.

So, having a very high GDP the country making lot of progress those are great, but at the same time the quality of life has to improve. So, the people should have access to basic amenities. As I probably said in an earlier module as well we need to have access to clean drinking water for the entire 1.3 billion people in India. So, that is that is more critical. Say even if we have a GDP of 12 percent 14 percent 16 percent whatever though although that is too higher of a number, but they even those numbers do not mean anything unless we have access of clean drinking water. We should not have to buy this bottle water in a railway station or rather we should have a clean drinking water in a stations in airports we should have access to that any public place we should have access to clean drinking water. So, that will be that, that will enhance the quality of life of general population. So, that is one example and, but. So, GDP numbers when they improve they give people they give government more money to invest in these infrastructure activities.

So, they kind of both are related. So, GDP high like a country growth is very much needed, but at the same time it has to be a balanced growth, where we also look at the improve our infrastructure improve the quality of life, have a better waste management system have better wastewater management system. So, that we are not polluting the environment same with air pollution control system. So, that will help improve the quality of life child labour issues, that is the social aspect as you know the sustainability is all 3 economic social as well as environmental from environmental, I do not want to see any environmental pollution happening. From social aspect we need to we do not want to see a in terms of a better quality of life we do not want to see child labour. We do not want to see if exploitation of certain sections of society. Or those like environmental justice issues. So, those things need to come in picture as well.

So, it is efficient. So, first of all the quality of quality of life on earth, and then efficient

use of earth's material whatever the material we have there is there should be an efficient use. When we say efficient use means better it is more like a better resource management. So, if you have a material you use that you do not throw it away in in a dumpster or anything you try to recycle reuse it again. So, that is the thing that goes into in terms of the efficient re use of earth's material. Then protection of our go global commons whatever is our common goal in terms of, for the majority of the population we should try to protect this protection of human rights, protection of animal rights, protection of different like sections of society. Make sure everything no nobody is taking induced advantage.

Then if you have like management of the human settlements if you have human settlements refugee colony's and all those kind of stuff they need to be managed they need to be helped and all that, then managing of chemicals and management of waste. So, that is whatever chemicals is being used that needs to be managed properly. So, that does not have an adverse environmental or human health impact same thing with the waste like a management of the waste. So, waste whatever waste is around that needs to be managed properly and that and ultimately having a sustainable economic role.

So, have a growth having economic growth is very important for any country otherwise the country will not prosper, but at the same time have a sustainable economic growth. So; that means, it is you have a growth which does not only impact like a fraction of the population the growth should be such that the entire population is making progress. So, our poor people are coming into getting out of the poverty line, people kind of affordability goes up they can also afford to go to good schools, public schools gets better and all those things kind of goes in to public transport gets better; so all that goes into our sustainable economic growth.

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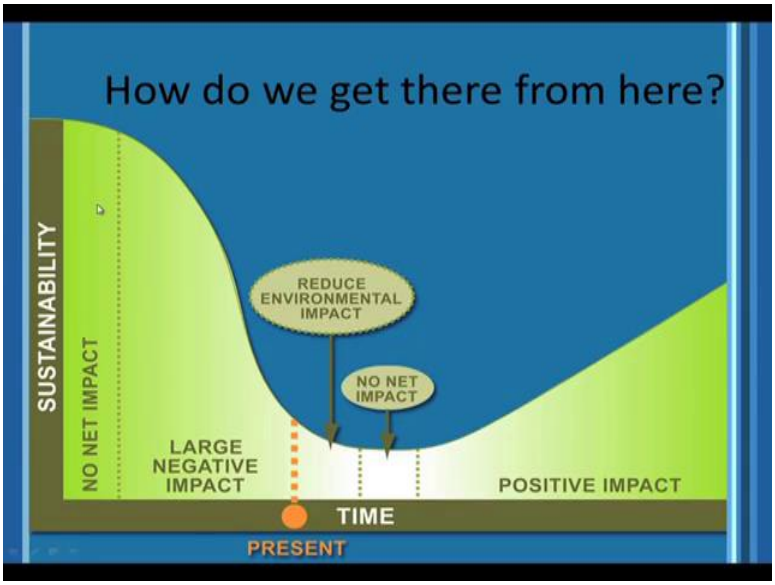

So, how do we get there from where we are right now? Right now ultimately this if you look at this particular sketch. This is your sustainability where we have no negative no net impact. So, there is no impact and right now we are in kind of somewhere over here, earlier we had more and more large negative impact with their environmental regulations throughout the world of course, the implementation of those regulations at some places needs a lot improvement, but at the same time because of large as you can see in this picture we are some we are somewhere has been shown a kind of the dotted line you see and the with that orange circle. So, we are somewhere over here. So, we have made some progress. So, there is not always all pessimistic thing we do have say even in the Indian context if you look at, we do have the clean water at least to habit is say 60 70 percent of the population we do have some sewerage network going on even talking from environmental point of view.

We do have air pollution control regulations we do have waste regulations; we do have a push on through the Swachh Bharat mission push on better waste management including both liquid waste as well as solid waste. So, things are working of course, it can work much better it can be it has needs to be speeded up, but there are some progress being made. So, we are things are not totally bad, like it is not totally gloomy scenario we should be and we should always in my view we should look at in a optimistic point of

view. So, things are tend towards going towards a better situation, but at the same time we need to take it in a we need to like a accelerate it and so that things start moving really fast in terms of better in environmental control better social control even the social inclusion.

So, like reduction of child labour, we do not want child labour and so those things are also human trafficking bonded labour. So, all these things are being worked on wherever it exits including in India and things are making progress the truth in some in some areas it is an incremental progress some areas of progress a little bit faster, but there are things are improving in overall if you look at. So, we are somewhere in this situation where things are started moving little bit and then we will go towards no net impact. So, we will have a reduced environmental impact we are trying to reducing the environmental impact then, there is no net impact, and then finally we want to have a positive impact on society.

So, that is from our all the activities we do that there will be a positive impact overall on the society. And that is that would be our goal for the sustainability sustainable development. So, what is the like in terms of looking at like how we can go there.

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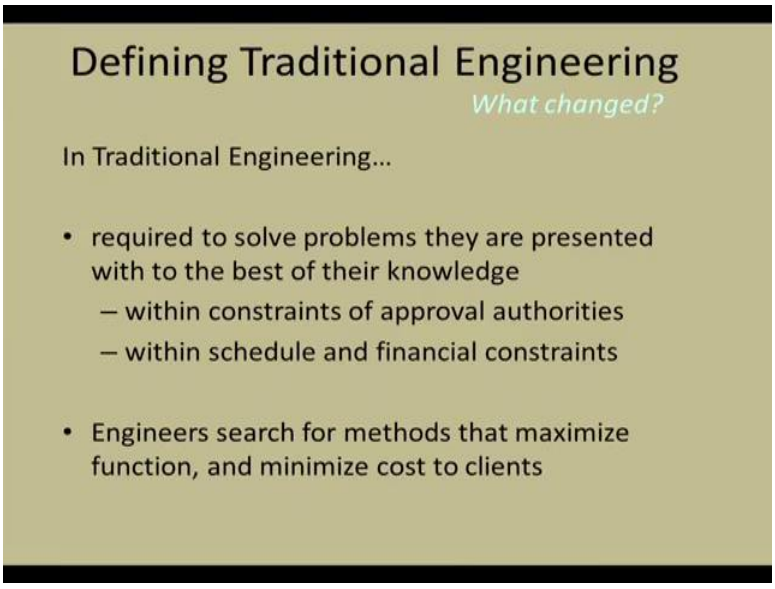

So, we have to change something. What we need to change we need to change our approach from traditional engineering to sustainable engineering that is in fact, book I suggested you the name title of the book is sustainable engineering. So, how will you move in traditional engineering we are trying to solve the problems that are presented to us to the best of our knowledge, within the constraint of whatever is the approval the regulations and will also with in financial and schedule constraint.

So, we are trying to solve the problem we are trying to engineers what as engineers what we do we search for method or search for methods that maximizes function. So, we every engineering design whatever product process whatever you make it is for a function. So, your design whatever design you provide should meet that function so that that is one thing and then at the same time we are trying to minimise the cost that is. So, we have to minimise the cost to the client. So, that is our goal as a traditional engineering maximize function minimise cost, but now as you move towards a sustainable engineering we have to start thinking little bit different.

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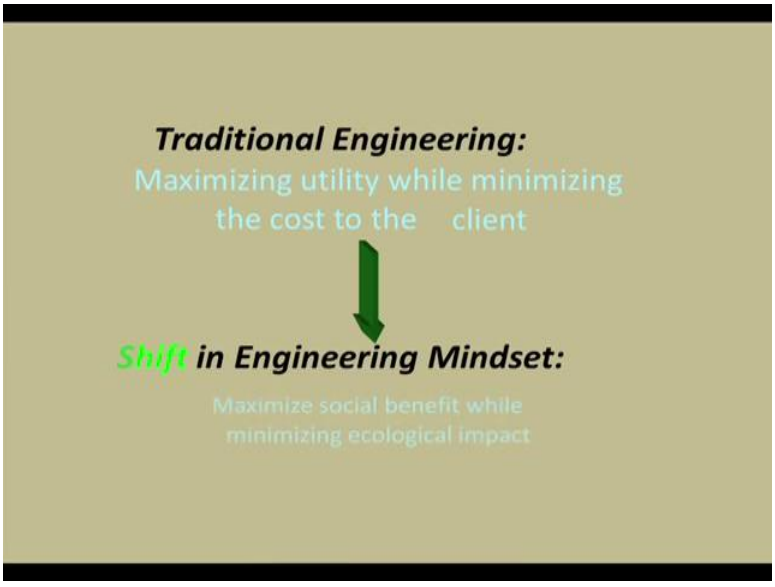

We have to start we go from this to this where from the traditional engineering, we are going to shift in the engineering mind-set. What how you will have the shift in the engineering mind-set we maximize utility by minimising cost to the client that is there

for the traditional engineering, but in the sustainable engineering we have to at the same time we have to maximize social benefit.

We have to maximize the social benefit, while minimising the ecological impact. So, the top the traditional engineering was more from a economic point of view, but now we are thinking in the shift with engineering mind set we are thinking that we need to have a social benefit. So, that is our social angle of sustainability and minimising ecological impact that is our environmental angle to the sustainability; so social environmental and your economic. So, all 3 needs to come together and that is how we can come up with a better sustainable design of a product.

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So, if you look at this particular aspect in terms of how do we track the progress? So, how do we go like in terms of making the progress or whether we are making progress towards sustainability or not. So, you need to look at the social effect, community activities employment rates immigration, weather those things are social effect economic activity is your business growth weather business is going employment rates inflation those things gives us the indication of economic activity then environmental effects environmental effects. So, whether your water has a do you have any water problem is smog warnings like this used to see do in the winter in Delhi hopefully this year we did

not see much. And environmental contaminations endangered wildlife whether endangered species, birth defects among the children that is born which we see from time to time from different parts of the country, death rates there are like if you have a certain area for example, we talked about that cancer cluster in Bathinda.

So, severe asthma attacks. So, all these things give and they are they are not directly they basic they are basically indicated. So, they are giving use the indication that yes things are not really doing very well. So, if you have if you are in Bombay or if you are in Chennai and you have a have beach closer. Beach closer means where do you go to the beach and there is an advisory saying that do not touch the water because the water is dirty because we had a sure overflow or whatever could be the reason, and that is not that is not environmental progress. So, these things like beach closers warning for the smog and environmental contamination endangered wildlife birth defect death rates severe asthma rates and there are some other there will be several other indicators as well. So, these give us some idea of how the environment is functioning in that particular area during that particular time. So, that is gives kind of an indicator.

So, with those things in mind, we have to design towards sustainable development. We have to design our product process towards sustainable development.

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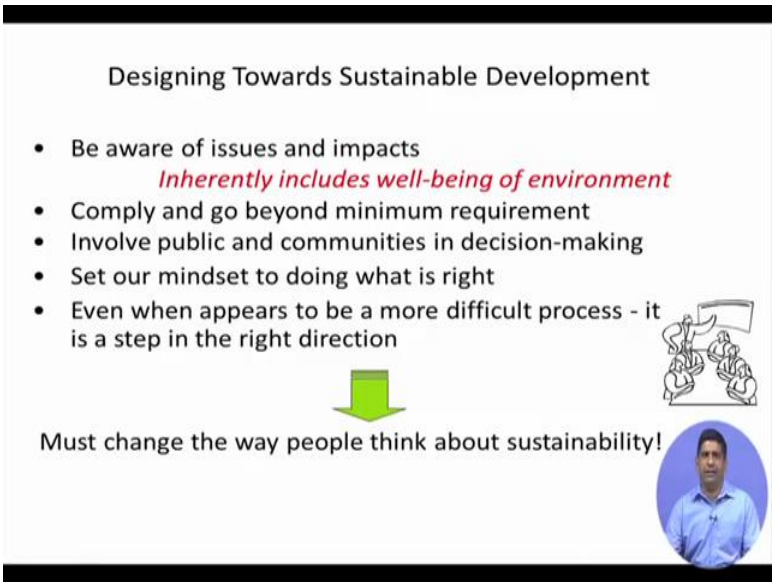

So, when we are trying to design it what we try to do is again if you remember if you I think I said that in the previous module as well where we cannot solve the problem of we cannot solve the problem using the same mind set which was used while we generated that problem. I come I am not saying it in a very in the correct phrase in a sequence of phrase may not be perfect, but this is exactly what albert Einstein said like when he was alive of course, and the essence of this is since the problem was created the business as usual is not going to work, if you want solution of the problems that we face today because problem that we face today is because of the mindset that we have today because the way we work today so, but if you want to solve this problems you have to think differently you will have to think outside the box and come up with a better solution.

So, being aware of like how to design towards sustainable development we have to be aware of the issues and impacts. And ultimately; that means, looking at the issues and impacts which includes wellbeing of environment, which inherently includes wellbeing of environment. We cannot comply and we just cannot comply and go beyond minimum requirement we have to kind of go we cannot just comply we have to go beyond minimum requirement we have to actually get better.

Involve public and communities in decision making that is another thing, we need to do like having the pub public and communities should be involved in the decision making and for that purpose people has to be like really educated, I will not say that not everybody has to be super-duper graduate degree or other stuff that people should have the basic understanding unfortunately, many developing countries including India we have still struggling with our literacy rate like literacy rate or illiteracy rate whatever you want to call it.

And the way we define our literacy is also very question mark because even somebody who can just put a signature is counted as literate, but which may not be there which may not be the true, because we have to really think about literacy in a in a different way, because the literacy as we can say is that is not only signing your signing a check or signing a sheet of paper literacy means you think they can communicate. They can contribute towards decision making by giving some input and so there are actually if you look at there were many in the old peoples in villages you will find the may not even

read and write, but they can they can give you better feedback than many learned people around there.

So, it is not only whether you can sign is what is the literacy is. So, what, but we need to involve public and communities in decision making, the that is very important what happens many times especially in developing countries and to certain extent in developed countries as well. We get we the decisions are made in the in the board rooms in like nice AC environment of the decisions are made and then the decision is passed from higher authority to the lower authority and when it goes to the field there is no ownership of that decision.

Say for take that example of any activities the government wants to do even say this toilet building activities. Now because of a lot of campaign and all that there is some appreciation that we need to have some sort of like a free from open defecation, but initially when this project is started several years back, and when I even today to certain extent in many parts of the country. These decisions are coming from top to bottom the bottom does not have much say in how the decision is made. So, even the design of the toilet 12000 rupees per house is that enough because 12000 rupees may not be enough. And what kind of design you need we cannot have the same toilet design for Kerala versus Rajasthan. For example, Rajasthan or Haryana we have water shortages there Kerala we have no water shortages there.

So, if you can come up with a better design for toilet in Rajasthan and Haryana where we can use less water or those kind of stuff and that is that it will help because that will be the long term sustainable solutions not and not like a just focusing on building toilet after toilet after toilet and these most of these the toilet that we have right now are very water intensive they need water to be fly for the flushing purposes, and then if they do not if there is stop working for some reason because there is no water in 2 in 3 4 months of the summer and by that after that it becomes. So, stinky the people do not want to go there or that is one aspect why the toilet us are failing and the people of back into the open defecation other aspect is since people were not there are always people in community, if they are not taken into confidence they always try to make your whatever the project you are doing, they will try to put you put you down they will try to delay and all those things

will happen.

So, for that reason it is always better to take people in confidence. And so that nobody has the question to say that we were not consulted and that is those things are kind of needed. And we have to set our mind set for doing what is right. So, it is that is very important even when appears to be a more difficult process it is a step in the right direction even if you have to think that this maybe a very difficult process it will take lot of time, but it still that is what needs if it is if that is what it needs to be done it needs to be done. So, what does that mean it means that we have to change the way people think about sustainability. We have to change the way where the way we make decisions, we have to get up to be more flexible to certain extent I am not saying we have to compromise on quality or we have to compromise on integrity or ethic values and all that.

Actually, we have to do it better we have to wish we have to become more competitive we have to become more ethically strong we have to more like a morally correct, but at the same time we need to start thinking more little bit differently in terms of how to make it a how to provide a solution which is sustainable. So, that is very important.

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So, how will you go about it first of all step back from business as usual, so it is if you have to step back from businesses as you as I was saying think outside the box. It is not business as usual anywhere anymore. We have to find ways to work with nature like how we can work with nature how to make that happen lesson the environmental impact we can like make the less environmental impact. Save energy resources like how to do that build on small success like piloting do not try to go for one big thing and then if it fails it and the technology and whatever you are trying to propose gets very bad names. So, you start with small successes and then keep on making lot of pilots and then you go for a bigger thing spread the word market your capabilities to both existing a new client.

So, the challenge here is you have to go beyond just the money it is not only the money which is important you have to go beyond the money to work with nature to listen the environmental impact save energy resources build on a small success. So, these are these are not the when we when we talk about them when we think about them they do not seems to be may not be that much challenging at least 2 people who are not aware of this field, but each one of them has to requires lot of effort lots of effort and to make something happen in this particular in this particular area.

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So, what professionals can do like people like you and me can do if you are a design

engineer we can reduce the material and energy use in our design many times we tend to over design the things. So, if you can come up with a better design, where we have reduced material usage and reduced energy usage that is always better. So, if say are coming if you are designing a charger or phone charger or battery for a cell phone or a smartphone if you can come with a battery which can which can get charged quicker or which takes less time to charge less energy to charge that is always better and with the same amount of power that is of course, it will be it will help a lot. So, those kinds of things we need to look at. Use renewable energy sources as possible like solar wind hydroelectric.

So, those are renewable energy. So, if possible that can be used as a renewable energy sources maximize the lifespan of the structure you can maximize the life span of a structure and reduce the construction waste generated that is another like reduce the reduction of construction waste even recycling of construction waste. So, in ultimate the waste that is being produced if you can reduce it or reuse it or recycle it that is always better, reduce or eliminate the hazardous waste generation that is also if possible if we have we can use something better material or environmental friendly material. So, we do not have to worry about this is hazardous waste.

So, that is always better if you can design something which requires maintenance minimum service; say- if you think about the success of this Maruti car. Maruti car the success or to the extent of this Japanese car of Toyota and Honda; there if you look at their success it is the success is because of it is a very low maintenance wake up it is once you have this Maruti car you just do it a regular servicing and all that and then it runs pretty good you do not have to worry too much about those cars. So, that is the reason why they got the popularities, similarly if we as a professional whatever we design if you can minimise the maintenance and service required people always like that.

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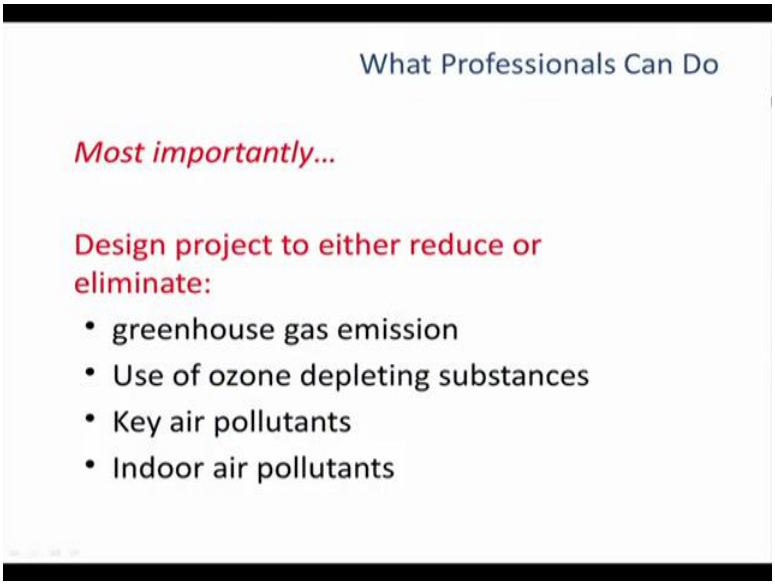

And most importantly we have to design project or project or for product with to either reduce or eliminate greenhouse gas emissions. Use of ozone depleting substance key air pollutants indoor air pollutants and these are all directly responsible for our climate change greenhouse gas. So, if you can reduce the greenhouse gas emission and use of ozone depleting substances like chlorofluorocarbons and all that. So, there are the list of ozone depletion substances which we are trying to eliminate from most of our products anyway.

So, and try to look at the key while reduce reduction in the key air pollutants the air pollutants the air pollutants indoor air pollutant. So, all these helps in terms of designing something better.

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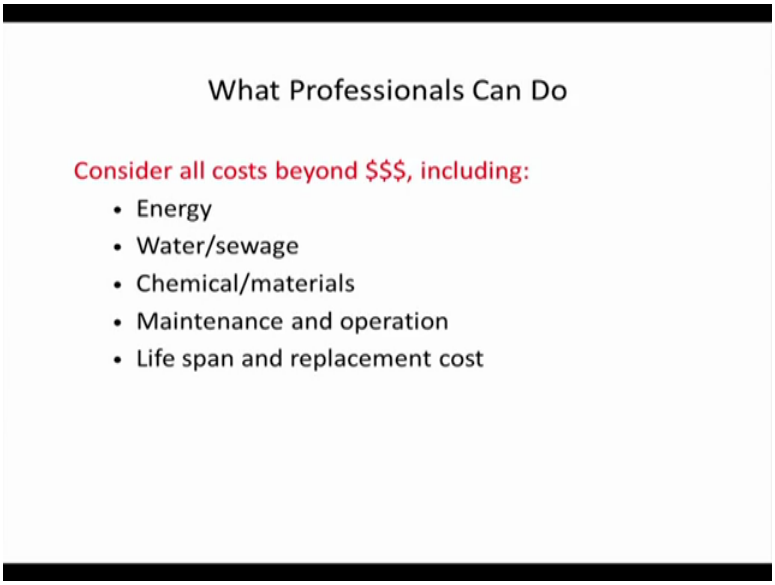

So, what professionals like you and me can do consider all cost beyond just the just the dollar that you see directly, the cost will include the energy cost will include the water is it the raw water requirement or the treatment of wastewater sewage the sludge that is produced chemicals materials maintenance and operation how long the product will last lifespan replacement cost. So, all these costs should need to build into in terms of looking at the overall economic footprint. So, that is that is like an economic footprint like when we talk about life cycle analysis, you are looking at the environmental footprint here in this particular slide when you talk about the we need to get the cost associated with all these activities we are essentially talking about us like an economic footprint.

And so for each one of those different like a cost we need to incorporate them. And this something like this exercise is also called life cycle costing analysis earlier we talked about life cycle analysis which was for the environmental part and for the economic part we call it life cycle costing analysis. LCCA that is also very popular and we do that.

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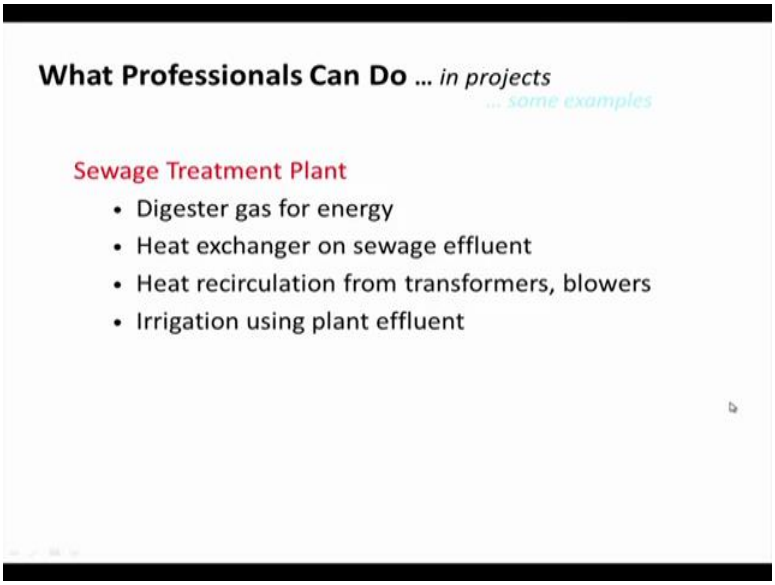

So, what professionals can do for example, in some examples for example, in sewage treatment plant, we can use a digester gas for energy because digester gas is lot of methane and that can be used for energy, we can use the heat exchanger on sewage effluent we can take the heat we can like as take the heat out and then we can use it for sewage effluent to dry it up heat recirculation from transformers and blowers. So, try to minimise the heat loss you we can irrigate using plant affluent whatever is the plant affluent can be used for irrigation as long as it meets the affluent treatment affluent standard. So, that can be done.

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So, those things in the urban development area we can redeveloped the brown field sites we can have use pervious payments in parking lots. That is another area where lot of research is being happening including at IIT Kharagpur, we have a professor working on pervious payments. So, that is will be, we can use pervious payment because it helps in the storm water system residential cisterns we can work on that. So, there we can have like 2 level rather than spend like flushing too much water we can depending on what usage you had we can use different level of flushing and can do constructed wetland ponds and all those kind of things in the cistern

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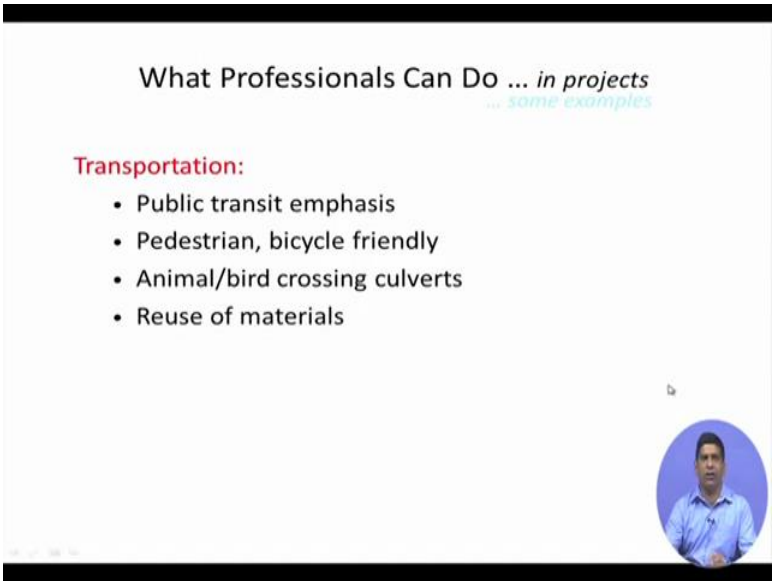

Some other examples like in transportation, we can use of public transport emphasis we can use pedestrian bicycle friendly animal or bird crossing culverts reuse of material and all those things can be done over there.

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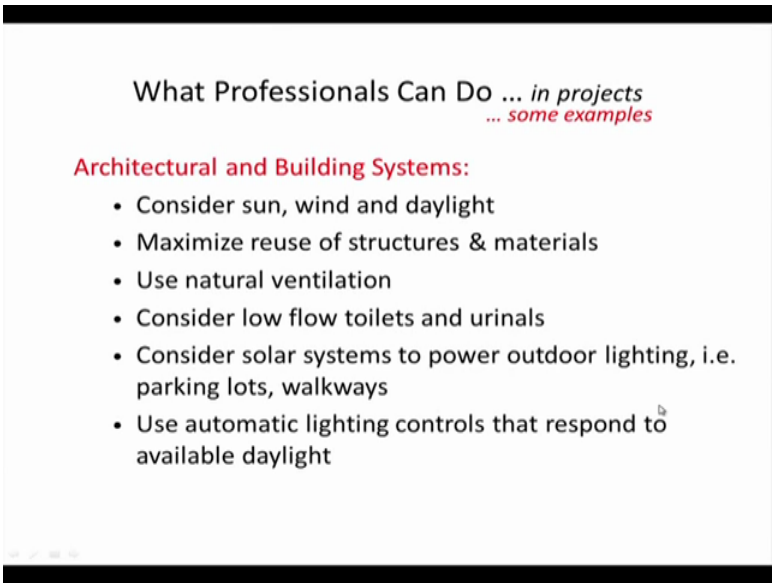

Agricultural and building system we can design the building and such a way that we can

have sun wind and daylight we can use maximize sunlight. So, that we do not have to use lights throughout the day. Maximize reuse of structure use natural ventilation, low floor toilet, us urinal solar system to power outdoor lighting automatic lighting control all those things can be done over there.

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So, how you do that you have to keep yourself up to date. You have to research and learn about new products and technology, learn from past project experiences stay up to date take courses like this from time to time and so that you can keep yourself updated about the new things happening conferences and events go to conference, and events look at the media and all that and that is how things needs to needs to be done. So, with that will try to wrap up in this particular module in terms of how we can go about doing a sustainable design and what are the tools and what are the approaches we need to take.

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So, from next in the next module we will start from here where we will trying to look at some of these newer development that is happening in terms of the lead program and another sustainable design parameter program that will see in the next module. So, I hope you are enjoying the module, keep up the discussion forum active we are here to answer your questions, if you have any problem with any aspect feel free to put your question up in this question form and would be happy to respond. And I hope you are taking all the quizzes and you will take the final exam as well.

Thank you and I will see you in the next module.