Plastic Waste Management
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Lecture - 37
Plastics Resource Recovery and Intro to Circular Economy

So, welcome back. So, we continue our discussion on the Plastic Resource Recovery in this particular video as well and then we will try to get into we will try to introduce to you the concept of circular economy that is the goal for this next 30 minutes.

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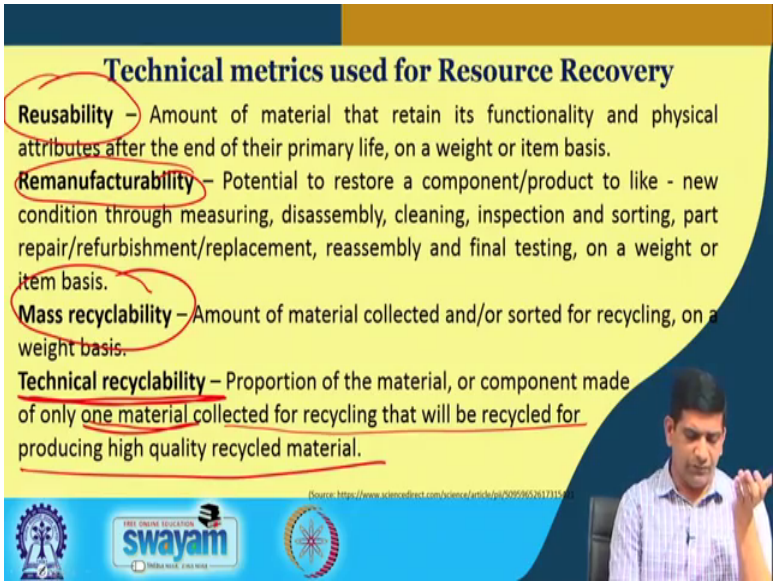

So, let us get started where will be left in the previous video we were looking at different aspects related to the plastic resource recovery. So, when we go for resource recovery of plastic or for that matter any particular material, there are certain technical mattresses we looked at those technical metrics we will try to look at them and try to explain each one of them.

So, one of the important aspect then we always look for is what is known as reusability. So, we try to look at reusability. So, what is the reusability? Its amount of material that retain its functionality and physical attributes after the end of the primary life on a weight or item basis. So, when you are looking at any particular material how much off its really available functionally and it still has its physical attributes at the end of life.

So, that is what how much of its is reusable, so, that is your reusability. Then remanufacturability which is like what is the potential of trying to restore a component and product to like new condition. So, in terms of refurbishment, many times you see when you go for buying something online on not that like Amazon or Flipkart or there are other websites which snap deal and all that they say that its a refurbished product.

So, refurbished product means it has been remanufactured. So, it had certain defects which has been fixed. So, its a potential to restore a component or a product to like new condition through measuring, disassembling, cleaning, inspection and sorting part repair refurbishment replacement reassembly and final testing on a weight or item basis. So, again remanufacturing or refurbishment is its a very common thing it happens. So, there is an old laptop or a old computer which has a part or two which is bad rest of it is perfect.

So, you put a newer product or newer part or you can get it from some other used computers which has these two particular parts is still in workable conditions. So, you bring them in. So, from those two computers you are actually producing the refurbishing one computer. So, one computer becomes useful and other is of a piece of junk, but our part of it can be recovered as well, but then this computer can be used for quite some time.

So, that is in terms of remanufacturing where we do the remanufacturing. Mass recyclability which amount of material collected and are shorted for recycling on a weight basis. So, how much material is there? Technical recyclability is a portion of the material. So, we just covered about mass. In terms of technical recyclability is the proportion of the material or component made of only one material collected for recycling that will be recyclable producing high quality recycled material.

So, its a proportion of material or component made of only one material. So, its which is collected for recycling that will be recycled for producing high quality recycled material. So, that is its your technical recyclability of that particular play hip for the particular stream. So, that is your technical recyclable technical matrix used for that.

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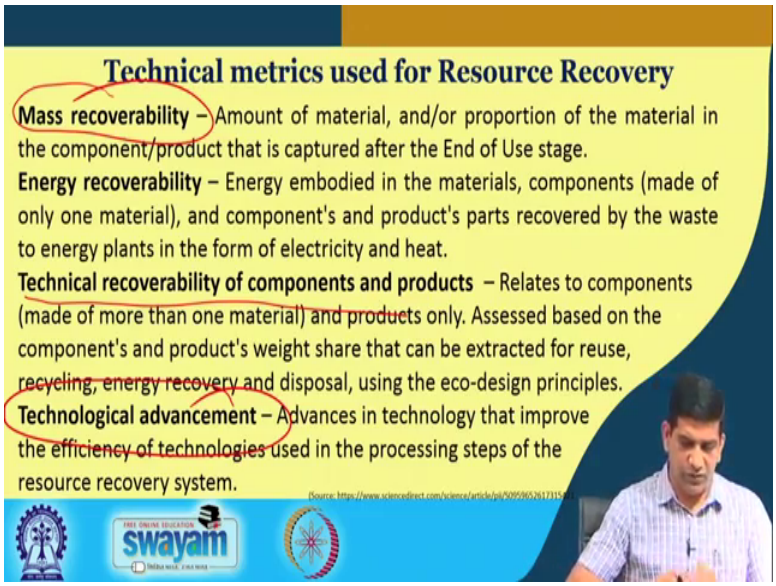

Now, there is also mass recoverability what is the amount of mass you can recover from that when you try to go for recycling or resource recovery amount of material a proportion of the material, that will be captured after end of users stage; energy where energy is embodied in the material.

So, component made of only one material and the components and end product products they covered for the waste to energy plan in the form of electricity and heat. So, that embodied energy that can be captured. Technical recoverability of components and products. So, if you have components which is made of more than one material and products, it is there it access assess based on that components and products weight share that can be extracted for reuse, recycling, energy recovery and disposal using the eco design principle.

So, that is should technical recoverability how much you can technically recover and then there are technological advancement because based on advances in technology some of the things which could not be recovered say few like a decade earlier can be recovered now.

Because with the advances in technology that improved the efficiency of technology used in processing, so, those things are also there. So, based on increase in technology, we can make use of we can try to recover more now because the certain technologies are available to make it possible which was not there earlier.

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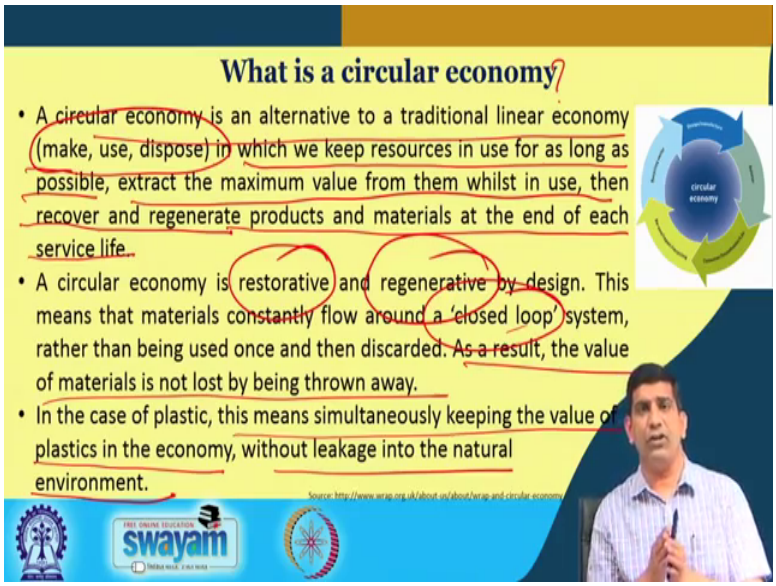

So, these are important stuff to use. So, that is in terms of the resource recovery. So, those are the different type of concept which is we employee when we go for resource recovery. And whenever we talk about resource recovery essentially what we are trying to do is, we are trying to become circular. Now what do you mean by circular is our economy right now is called a linear economy, most of it is a linear economy.

Now, what is linear economy? Linear economy is a focused on make, use and dispose. So, you start you produce things, you use things and then you discard things. So, you are not really bothered about after end of life trying to recover, reuse, recycle, bring it back to the economy, bring it back to the value chain and but that concept is not that much kind of a is in use. So, then that is why this whole concept of circular economy came into existence where we have now realized that materials are not they its we do not have an end finite amount of material supply.

At some point of time we need to start looking at our waste material to generate the secondary material. Part of it is already happening either we are using it as an energy source, we are using it as a material source, but in general those kind of is like a resource recovery has not really picked up in the country like India, we is still are struggling with certain aspect we are disposing a lot of stuff in the landfill in the dump site.

So, this whole concept of circular economy which also has you can say that inbuilt concept of a zero waste. Zero waste does not mean later decade really zero zero, it means

that you are trying to minimize the waste production as much as possible and you are recycling resource recovery as much as possible, you are being waste to energy in the form of anaerobic digestion, you are trying to go for carbon nitrogen for compost based on carbon nitrogen ratio. So, those are all the resource recovery part where you are trying to put things back into the economy either directly or indirectly you are not letting it go you are not making it a. So, like a linear economy you go more as a circular economy concept

So, now what is that circular economy which we try to explain right now? So, let us look at the definition which is the standard definition that we see. In terms of circular economy is it an alternative to traditional linear economy which is make, use and dispose. So, that is what the linear economy is you make things, you use it, in your dispose it. Here in circular economy we keep resources and use for as long as possible, extract the maximum value from them while in use, then recover and regenerate products and materials at the end of each service life.

So, that is kind of you are trying to recover the material, regenerate the product and material at the end of each service life which is not really easy it is easy to say then being done. Now the circular economy is a restorative and regenerative by design. So, you design it in such a way. So, it is a restorative and regenerative this means that material constantly flow around closed loop, material is actually flowing in a closed loop not going out of the loop rather they are being used once and then discarded, as a result the value of material is not lost when being thrown away.

So, that is there. In the case of plastic; that means, that simultaneously keeping the value of plastics in the economy without leakage into the natural environment. So, we have to have this plastic value in the economy and but we should not with should not be leakage into the natural environment because that will lead to kind of littering and all. So, we do not want to do that, but in we want to make sure that there is a like we should be like in terms of better plastic waste management, what are the steps we need to do in terms of moving towards a circular economy concept.

So, that is the concept of a circular economy. So, here also you can see in terms of the design here of the circular economy, you start with like designing and manufacturing, retailer, consumer and household reuse repair recycle, recycling center and then things

kind of goes back in terms of the whole circular economy concept. So, again if you look at the circular economy concept and the life cycle analysis concept that we I explained in the last video there is a lot of similarities, both are kind of looking at the similar stuff in terms of the whole cradle to cradle or cradle to grave concept.

So, in terms of circular economy it should be cradle to cradle. So, that is what we need to kind of like focus on when we talk about the circular economy where essentially you are moving from linear economy to a circular economy, which is helpful in terms of a managing the plastic waste.

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Now, as you can see there is in terms of plastic waste we have. So, you have these 2 bottles which kind of gets recycled and out of recycling it generates some of that material which is used for electric bulb and then you also have things in terms of the so, certain material, which can be easily recycled. So, those things are also there things can be recycled over here.

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So, these are just an illustration of different things that you can do, similarly here in terms of circular economy means recycling. Oop sorry it means the recycling, it means design the grading of the raw material, where you design things you produce manufacture as we talked about you distribute, your consumption, use, reuse and repair then you look at the proposed collection system as well since this was like we are looking at in terms of plastic waste management.

So, in what can be done and then again the recycling part. So, and then some residual waste going into the landfill of waste to energy plant. So, as you can see from the circular economy point of view; you have the raw material coming in, designing, production and distribution consumption, collection and then recycling and back into there. In traditional economy we kind of way twist here and then we just kind of dump it in a dump site. So, that is really does not work because in we in circular economy we want to put things back into the economy, that is the whole concept of doing the circular economy stuff.

So, let us fit what we are trying to explain so, far in this short video the same thing has been explained in a slightly different way. So, I thought I will you can watch this video on what the basic concept of circular economy and then we will continue this discussion. So, this video has an audio component. So, I will keep quiet for the next thing there on 2 minutes or so, which this video is and then you just watch this video listen to the audio

with the video and then we will continue our discussion on circular economy. Whatever we have said so far in terms of circular economy is will be repeated in this video with some more examples. So, that should be helpful to you. So, let us get started with that.

Again instead of UVS light like you be its a car or an apartment its just one idea that is part of the circular economy.

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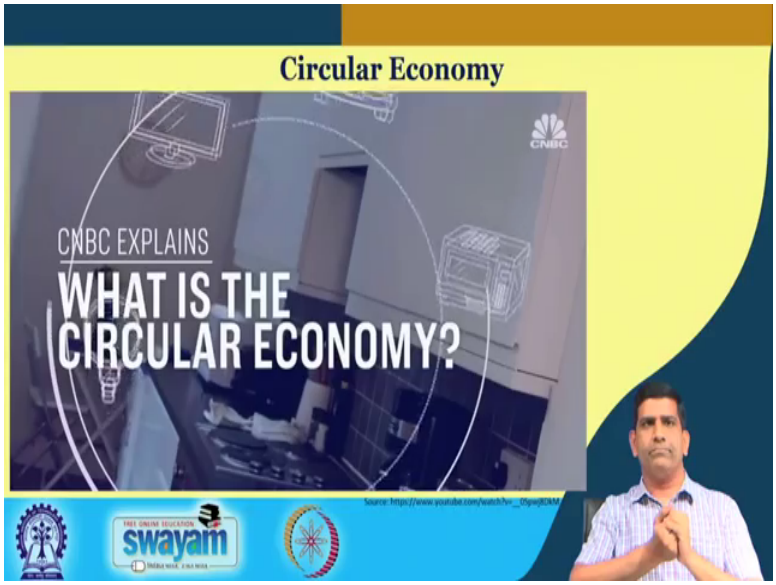

Before we can understand the circular economy, well it helps to define the linear economy. Most organizations today operate in the linear economy, which is based on a take make and dispose model.

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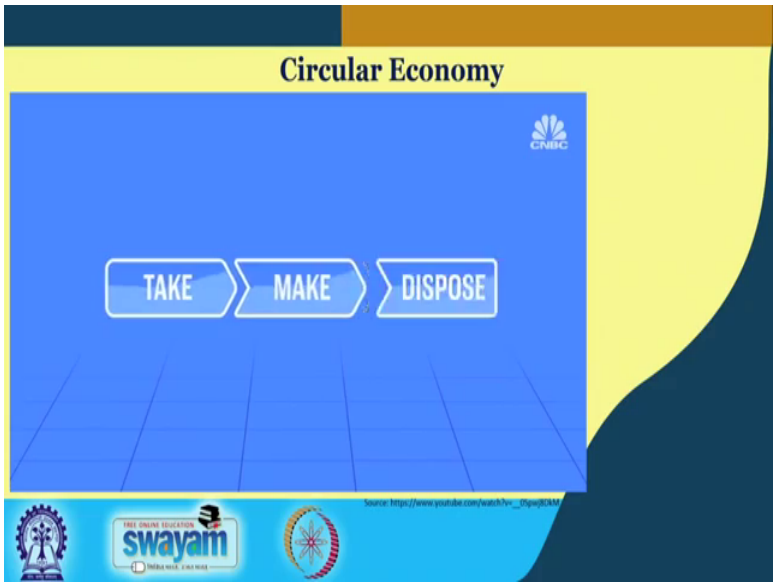

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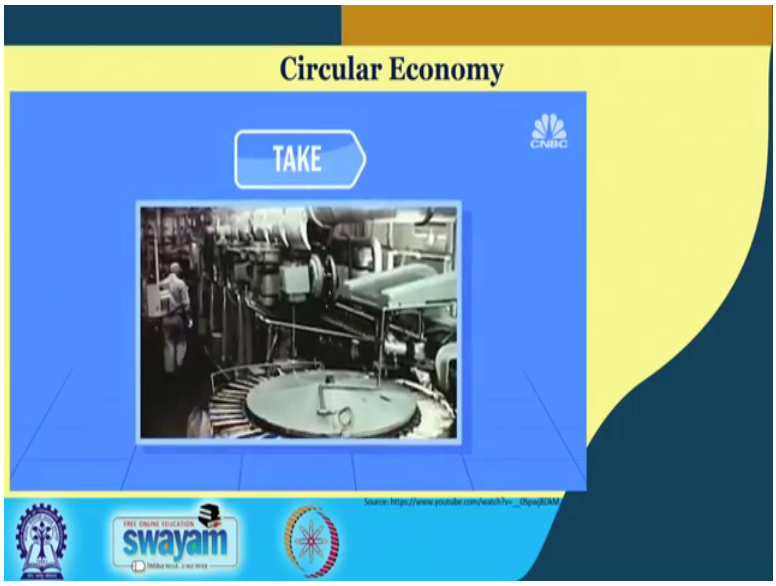

So, for example, a light bulb company takes resources like glass or metal to manufacture its products.

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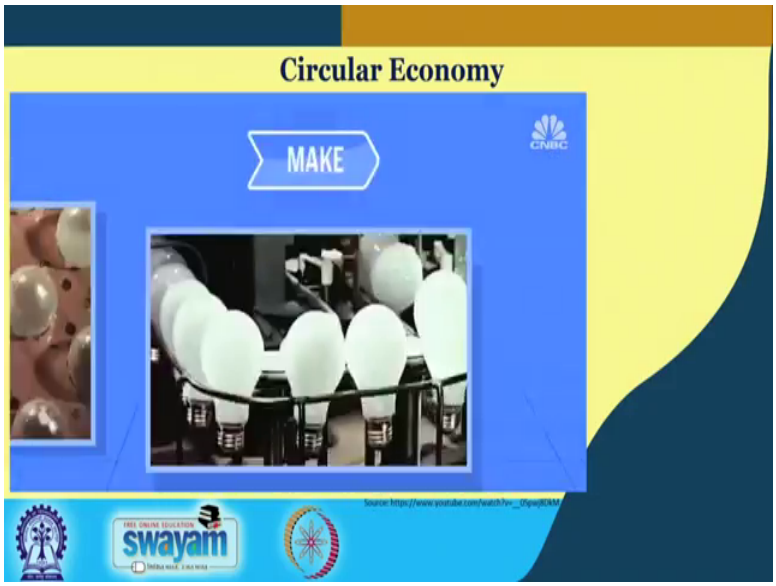

The company makes the bulb and sells it to a customer like me who uses it.

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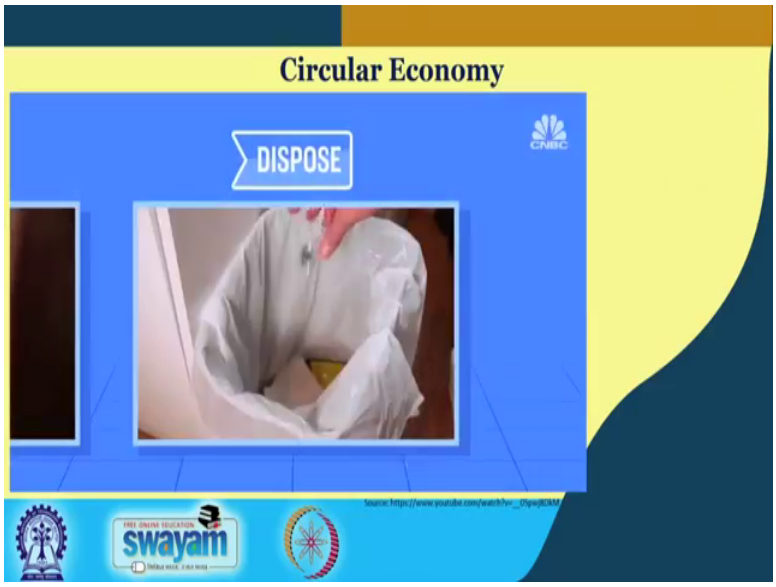

Once the light bulb burns out, I dispose of it. If likely neither the company nor I will ever see that light bulb again.

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For a light bulb company to make money in the linear economy.

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It tries to buy materials for the lowest cost possible and to sell as many bulbs as possible. This model operates as if there are infinite resources like glass or metal in the world. But you and I know that is not the case that is why the circular economy treats materials like they are finite. A company in this circular economy does not just recycle products, but maintains ownership of them all along. So, the model looks more like this.

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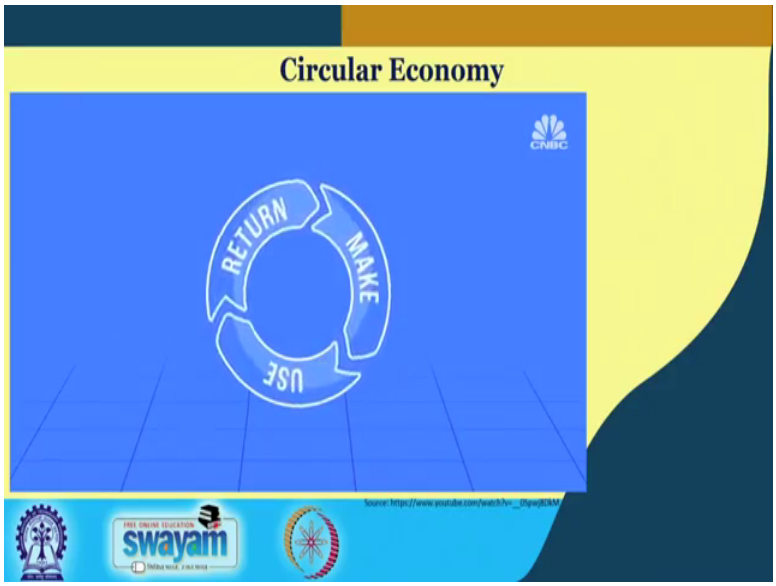

Make use and return let us go back to the light bulb example. Instead of buying bulbs this office in London leases its light from Philips lighting, it signed a 15 year lease for the service and pays a fee each quarter. Philips still owns the actual light bulbs and provides maintenance and replacements when needed no extra cost. This model gives Philips the incentive to produce energy efficient light bulbs and it saves the office money with fixed lighting costs.

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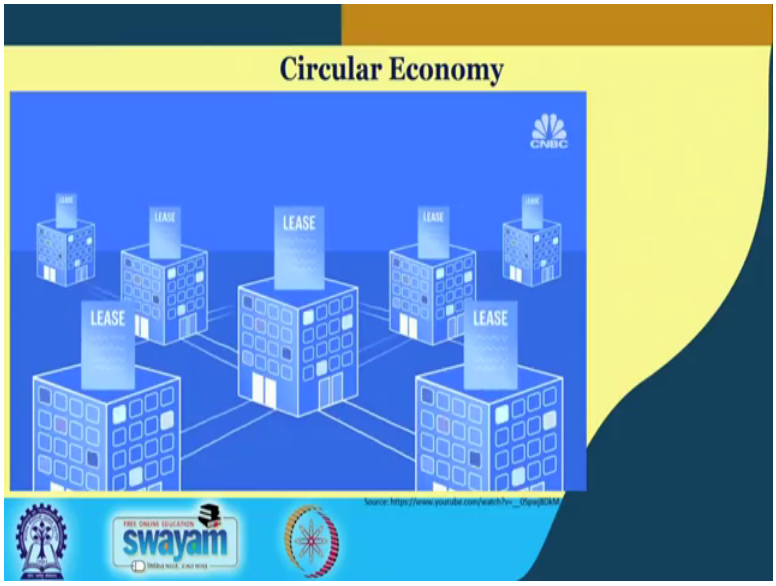

Its a radically different business model that makes companies more or like service providers than sellers of a physical product and it turns out lots of companies are looking for ways to get involved. Take each one of one of the world's largest clothing retailers. Its working on a strategy to become 100 percent circular. The company collects old garments in its stores and recycles them. Since 2013 H and M says, it has gathered more than 55000 tons of fabric to reuse for new garments.

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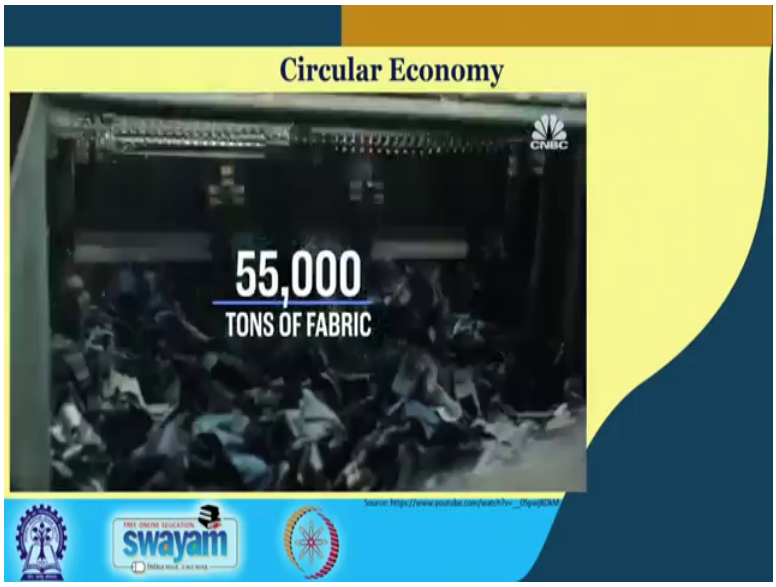

Some governments are getting on board with the circular economy too. The European Union adopted an action plan in 2015.

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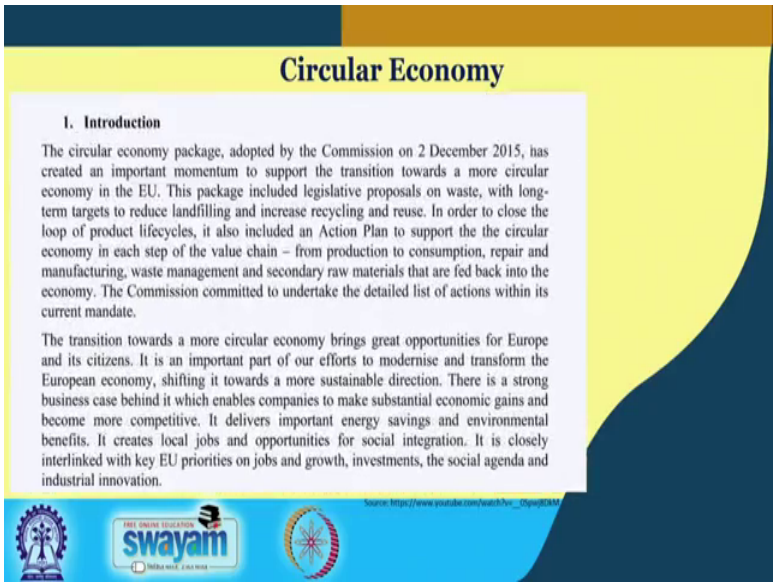

Aiming to make supply chains. You guessed it more circular this includes everything from production to consumption repair and manufacturing and waste management.

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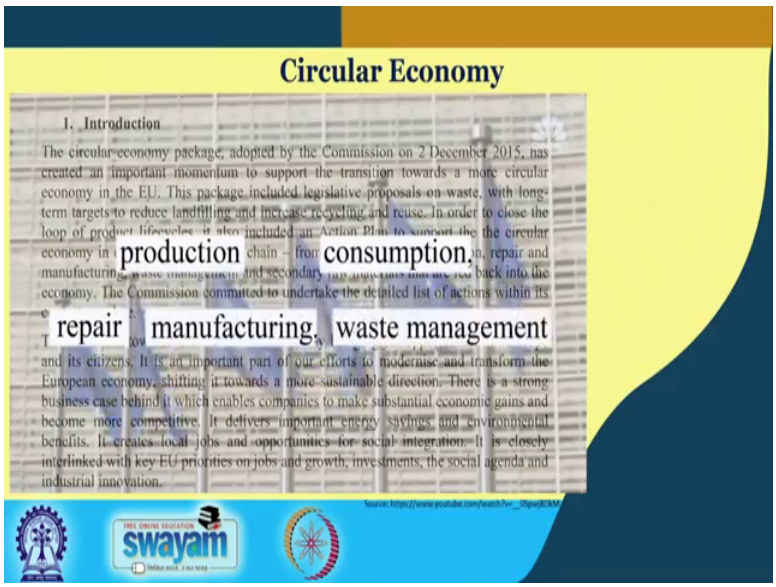

The point is not just to become more green and create environmental benefits.

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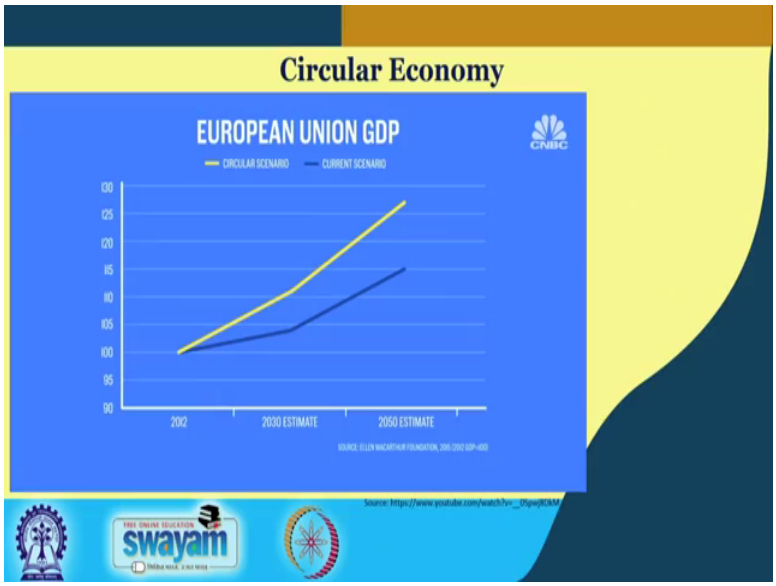

There could be economic benefits too. One report estimated a shift toward the circular economy in the EU current increase GDP by an additional 12 percentage points by 2015. So, moving from the linear economy to the circular economy also brings costs. Companies would need to redesign their supply chains and products in order for them to be used again and again. Manufacturers might be burdened when it comes to the actual logistics of disposing and recycling.

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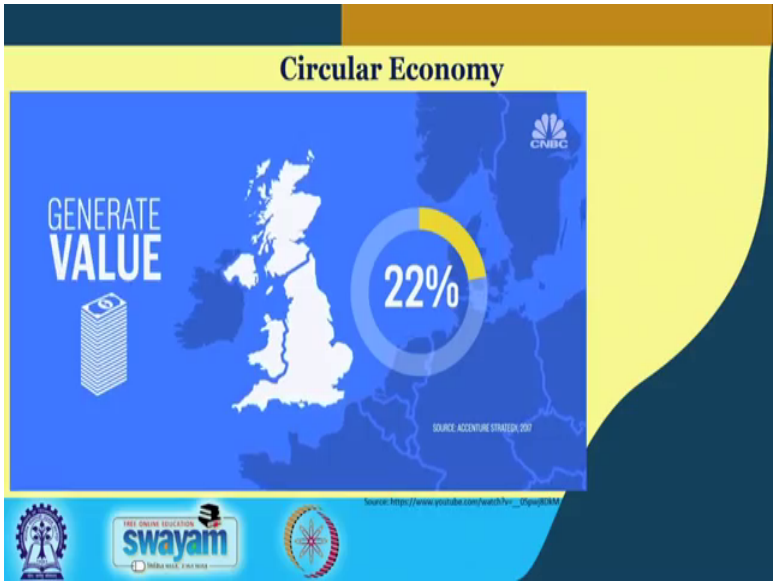

A recent report found only 22 percent of UK companies are trying to generate value from products that are returned for reuse recycling or refurbishing.

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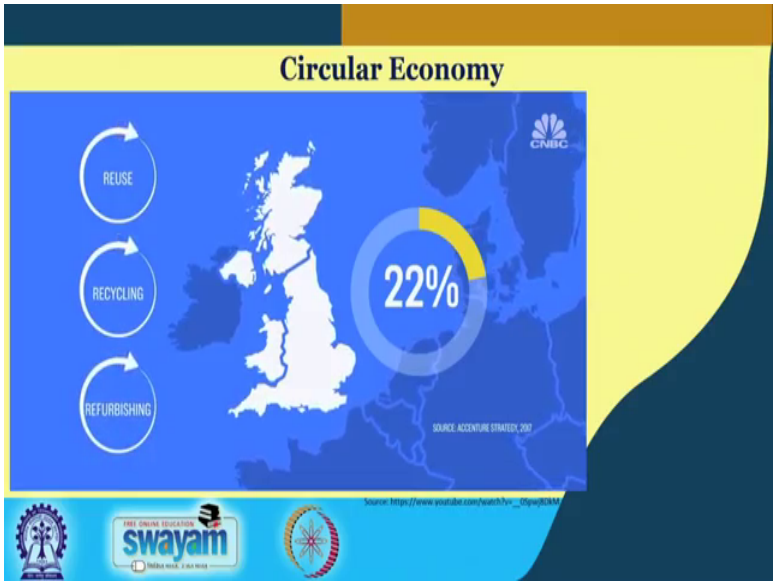

Its estimated the cost of transitioning to a fully efficient reuse and recycling system across Europe could be as much as a 108 billion EUROs roughly a 130 billion dollars.

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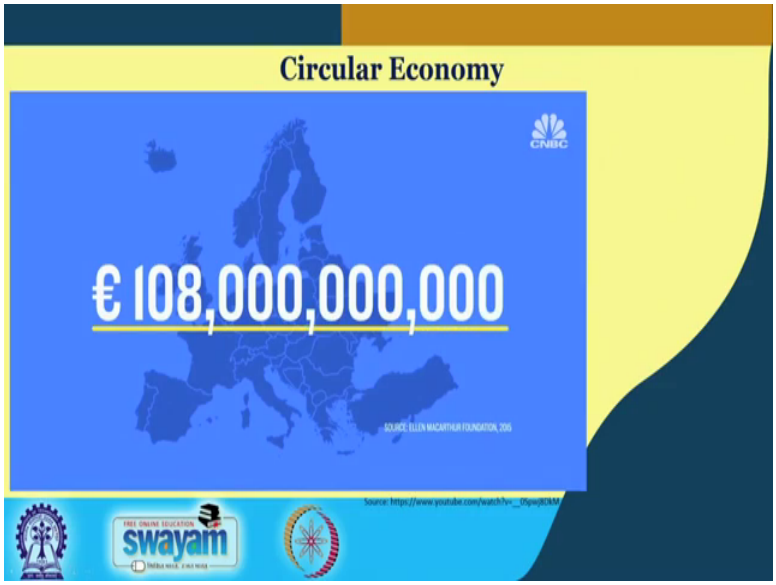

Cost is one thing, changing people's mindsets is another and that is what it will take for the circular economy to go from an idea to reality for everyone.

So as you saw it kind of trying to explain the basic concept related to the circular economy by taking the example of that light bulb, where right now we are buying the bulb, we are using the bulb and we are just throwing them away. The concept is rather than owning the bulb can be just as you saw in that particular office space, where Philips company if I remember correctly the Philips company is owning all the bulbs and whenever anything goes bad at the if its the responsibility of the Philips company to come and fix it.

And so, that is, so, we do not own we are just leasing it stuff and that is what. So, it would be kind of leasing of material for example, in your house you have a refrigerator from Samsung or LG. So, LG or Samsung is owning the refrigerator, they have leased it to us and if they are maintaining it. So, that will become rather than buying the product you are taking product on lease to your talk and taking product on the rent you can say and you are using it and then when its done, it goes back to the same company. So, the company owns it, so, we are just paying the money for the lease amount for that.

So, that way the company has that extended producer responsibility and the whole business model will change. So, it will be more from a kind of service based model where we are getting the service from the company rather than owning the product from the companies, rather than buying the product we are buying the service. So, we are buying the service of the refrigerator, we are buying the service of the washing machine we are buying the service of TV. So, the holes you think about that its the whole the way the economy will work needs to change, there is always a transition phase.

And as you saw just for the they were talking about 108 billion dollars 108 billion Euros of a newer economy and with this concept of circular there will be grown more growth like we sometimes we think like go for circular economy, we will actually be producing less; that means, less number of jobs. We are already struggling with the jobs in a country like India. So, we need to produce more jobs and with circular economy we will actually cut the jobs; that is the like when you look at in the first place that is kind of impression we get.

But when you go into the deeper; when you go into the deeper and liked it there will be newer types of jobs. It will be newer types of jobs it will not be traditional jobs that we know of, but again we have to make products, we have to rather than one thing is that

rather than dumping that product at the end of the life we will be recovering the material. So, it will be like trying to get the material out of that, putting it back into the economy.

So, its still the jobs will be there and in fact, the projection is as you saw in that video that GDP increase will be even higher if the country starts adopting this circular economy approaches. Only thing is that in between there will there is always a transition phase where things will be a little bit may be tough, but at the end of the day it will be much better. So, that is what we need to strive for, that is the whole concept of circular economy, the United Nations environmental program, the world bank and everybody is looking at this in a very critical way and this is a upcoming area.

So, maybe in 10 years 15 years from now, this whole economy will be different and so, you should be ready for this newer economy and that is why the one of the reason one of the kind of motivation for putting this concept or in this particular course easy to introduce to this newer area ah. So, that you at least be aware of what this whole concept of circular economy is all about and especially how it relates to plastic, because plastic again plays a major role in terms of circular economy.

So, we look at one more explanation of a circular economy concept again in a slightly different context and we will continue this discussion further. So, again in this one I will be keeping quiet let you hear this and then we will we will discuss it after the video is over. To a connection let us see what happens when you have finished using a PhD fossil depending on where you live.

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You can either put your PT bottle in your recycling bin or drop it at your nearest recycling centre a collection truck picks up your recyclables and take some sewer materials recovery facility, where all the feeds he place to get separators and fails at FLIGHT.

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The pet bottles and containers are loaded onto the conveyor and the new wash plants in just over 30 minutes the bottle is washed regulators and made into it recycles pet flakes.

The new plant can process thousands of bottles every day. Once there are fed flakes have been checked for quality they are ready to continue through the flights manufacturing plans.

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The our pet flakes which have come from the pet drinks bottles and other containers recycled around New Zealand. Now replace the majority of virgin or nearly pet in fact, state of the art high tech pet extrusion line in this process every roll of our pet foam is made in 3 layers.

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The middle layer of the sheet contains the outfit, but the outer layer on each side is actually a thin layer a brand new virgin pet. Having new pet on both sides of the sheet adds an extra level of food safety ensuring the food contact services of the final product will be no different than a product made entirely from new pet the newly made rolls of our pet film, then continue into flights latest technology thermo forming lines to complete their conversion and to new our pet containers.

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The containers are shipped to some of New Zealand's most iconic brands being filled with fruit biscuit salads meat or poultry, every pet bottle or container recycled at flight is given a new life. Saving the import of materials and reducing race to landfill flights containers are 100 percent recyclable. So, when you put them out for recycling the circle will continue.

So, what you saw here is how the plastic is being used in a contest of circular economy. So, starting from those plastic waste being sorted into different material, you saw similar videos per hour earlier as well we talked about this plastic sorting process earlier. So, plastic being sorted into different types and then the newer plastic product that is being made.

So, this waste product from plastic it was brought back into the economy and then we made the newer containers which you saw at the end those container could fit all those fruits and vegetables and other things that packaging material. So, they were again

number 1 plastic and this particular company which you saw the video the FLIGHT recycling. So, that was an example the previous example was on plastic circular economy in general with an example of that bulb and those textile material and this one as this course relates to the plastic this second video was essentially we were trying to give an example of how plastic waste can be used in the context of the circular economy concept.

So, that is what we looked into and I hope the video was kind of self-explanatory I do not have to talk more detail, but again it was essentially looking at the plastic waste recovery of the resource from plastic waste and bringing it back into the economy and making new products out of that. So, that is what circular economy is all about. So, its a circle try to bring things back into the system. So, with a concept of trying to have goal of having zero waste, so, we that is the whole concept of the circular economy.

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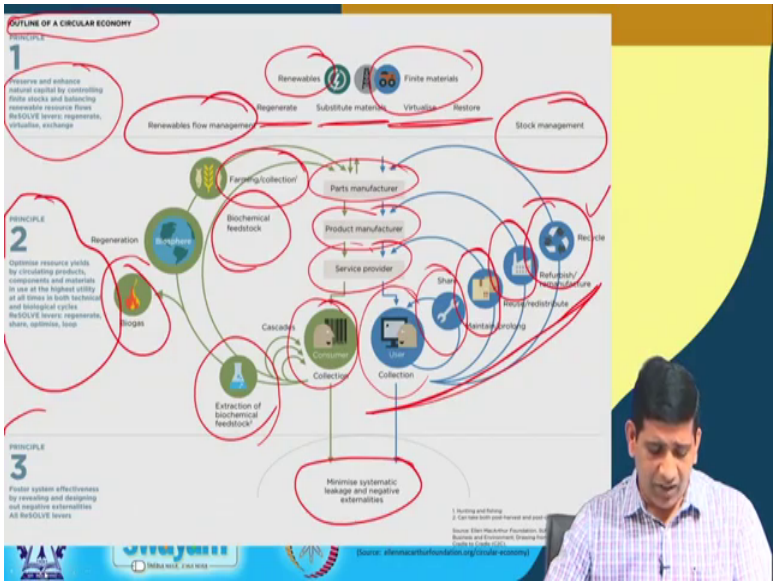

So, being said that if you the circular economy concept is started with this diagram which you will see, which is from Ellen MacArthur foundation website. Those of you who have more interest in the concept of circular economy I strongly encourage you to go to this particular website which is the Ellen MacArthur foundation, it has beautiful resources out there, several reports on circular economy, different aspects of circular economy. And this is a classical diagram which is used you will find in any report related to circular economy, this particular diagram will be there which is one of the first

diagram generated in Ellen MacArthur foundations documents which is used pretty much in many many places. So, again here what does it mean?

So, we will try to explain this in next few minutes. So, this is what is known as the outline of circular economy. So, this is what the circular economy is all about. You saw that already in those video. So, you have the idea. So, now, what is that? The first principle is you try to preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flow, resolve levers or regenerate virtualize exchange. Now what does that all these big big word actually what is the meaning of these big big words?

So, we what we are trying to do in a simple way, we are trying to preserve and enhance the resource recovery. So, whatever is the material resource that we are trying to use we and we the goal is the first principle is not let go it into the dump site or a landfill let us try to bring it back into the economy. So, that is the whole concept. So, you are trying to preserve the matter and enhance the natural capital, by controlling finite stocks the stocks are always finite and balancing their renewable resources flows and we have tried to regenerate virtualize in exchange. So, that is your the first principle.

The second principle is you try to optimize the resource yield. You try to look at your resource here by the circulating products, circulating components, materials unused at the highest utility at all times, you try bring it back to the economy and both technology technological as well as the biological cycle. And here again regenerate share optimize loop and all that. And third principle is the system effectiveness very real and designing all our are drilled and designing out negative externalities, again we try to use different types of lever.

So, in terms of the explanation as you can see, we have like we have finite materials, we have some renewables, the concept is we try to regenerate we try to substitute the material, we try to virtualize we try to restore. So, you start with manufacture the power part, then you manufacture product, then you provide service, then user uses it from the user we try to collect it after its usage. So, either you can share it. So, you can rather than you can have at end of a least kind of as setting where you share or you maintain, you try to reuse redistribute, refurbish, remanufacture, recycle.

So, that is the whole concept of the stock management where we are trying to manage our stocks in a way so, that less and less waste is produced. On a renewable flow management we have say it from the biological point of view we have some collection, you can extract our bio chemical feedstock, you can go for biogas production, you can have some kind of caskets within it in terms of recovering some resources.

You can have bio chemical feedstock recovery which kind of goes back again to the system, we can have farming collection and all that which again kind of both goes back to the system and in both these for the bios site or in terms of a stock management side, we try to minimize system systemic leakage and negative externality.

So, that is what its a kind of whole concept; the whole concept is try to use it within the system as much as possible rather than letting things go in a rather than letting things go in terms of in a disposal system.

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So, that was again by the circular economy kind of in general. In a specific to plastic which you kind of saw that video the second video as well, but in terms of the circular economy solutions in the plastic sector, we are looking at we have production of. So, you have consumer production of only essential plastic using renewable resources. So, that is what you try to do. Then consumer based on sustainable business model.

So, you try to recycle through manufacturing chemical recycling organic recycling, try to have some reuse program and energy recovery and whatever leakage try to minimize that leakage part. Then based on recycling and others other stuff that we do we kind of if needed we read redesigned plastic production and products then try to use renewable alternative source and of course, they starting with the fossil fuel base which we try to reduce and this renewable alternative we try to increase.

So, that is all in terms of trying to have this concept of the plastic being like reused within the same system, recycled and reused more and more within the system and when it cannot be recycled ultimately the thing will be to put it in a waste to energy plant that will be also kind of a resource recovery.

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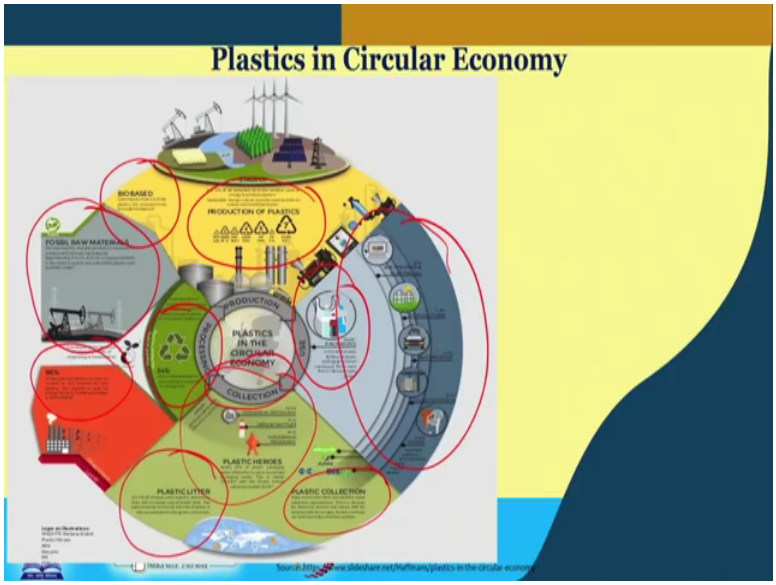

So, again another example how are plastics in circular economy. So, we look at this video and then kind of look at we will explain this slide and then we will stop this particular video. So, here we have 2 types.

So, we have essentially the plastic as we know of its partial raw material, its a fossil fuel based raw material. So, that is where it is in terms of raw material coming in then there is some bio based material as well. We have production of plastic different types as you can see 1, 2, 3, 4, 5, 6, 7 from PET HDPE LDPE PPPS and others which is present there and then production phase where you have some processing use phase then we have some collection.

Then we try to have a plastic usage in different type of sector, where we also like agricultural sector, electrical sector or automotive sector and construction sector and other sectors where the plastic is used and then after plastic use when its disposed, we have to collect it. So, there would be plastic collection, there is a issue of plastic litter and we are also trying to have some kind of a plastic heroes, which nearly 50 percent of the plastic packaging is its goes. This is nearly like a lot of plastic goes into the in 2 kind of non-recyclable system, so, we try to collect that.

So, in terms of 66 percent of the plastic are not yet reused only 34 percent gets a recycle. So, based on that the goal is to kind of increase this number. So, that is this whole interval if you look at the how plastic is in the circular economy into the production use collection and processing, right now we have only around 34 percent. Our goal and 64 66 percent is not being into the circular economy sector, which is that is where we need to bring them and we need to kind of include those 66 percent to be to have a better resource recovery, to have better recycling system in place.

So, let us stop this video right now on this particular note, we will continue our discussion on a circular economy and plastics in the next videos as well. Again I hope you are enjoying this course any question put it on the discussion forum we will be happy to answer and any feedback as well which will appreciate that there is a weekly feedback which you get linked every week. So, I hope you are putting it in there, where again since this is a newer course and there is no textbook.

So, we are putting up the pdf of this lecture material as well as several reading material. For every week there was reading material I hope you have gone through that because that is essential, you might have seen that few of the quiz questions could have been coming from the reading material as well. Which try to minimize that, but sometimes you may have some questions even in exams which is showing off from the reading material.

So, its better you look at that reading material, you do not have to read each in every line, but its always at least the big picture information from those reading material will be helpful and most of these slides actually came from those reading material as you will see many of these pictures are showing up there as well. So, with that note let us stop here and we will continue our discussion in the next video.

Thank you.