Plastic Waste Management
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Lecture - 40
Plastics and Circular Economy - Case Studies (Contd.)

So, welcome back. So, this is our last video for this Plastic Waste Management course. So, hope you survived the course so far good. So, we will carry our discussion on the case studies of Circular Economy and Plastic as we were trying to discuss the concept of circular economy, which is one of the newer concept and of course, the plastic waste is also a newer concept. So, let us continue.

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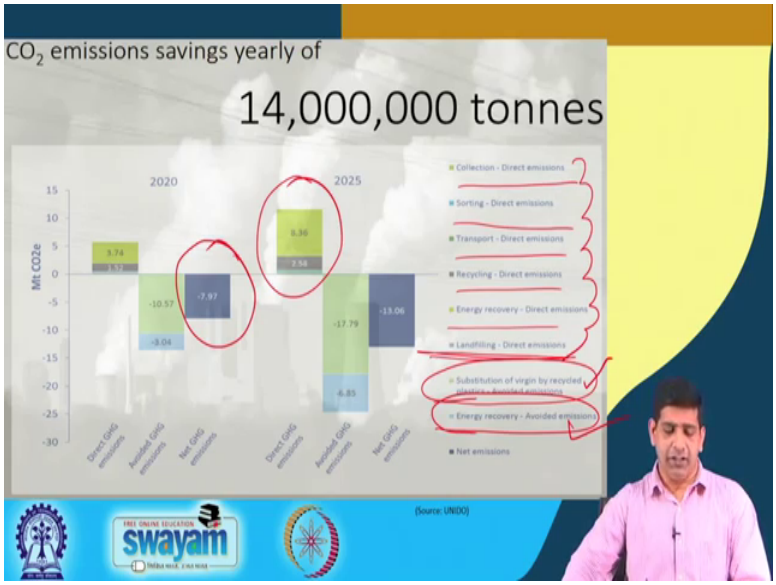

So, there are in if you think about that if we can recycle this plastic from different this was a unit or report and you have the copy of the report as part of the reading material. So, it tends of talks about that, if you can take all the plastics which is their in globally present and if we can recycle it properly and use it for whatever cannot be recycle, can be used for waste to energy purposes, we can save nearly 14 million tons of CO 2 emissions.

As you know CO 2 emissions the carbon dioxide emissions is considered the global warming which is we have the climate change the areas which used to does not get too hot are becoming hotter year by year our temperature is becoming higher and we are also

its climate change actually global warming sometimes confuses people, global warmings things that things are getting warmer.

Its actually the more better term is the climate change, things may get hotter as well as can get colder. So, it is the extreme temperature events or extreme rain events, which we see happening in our Indian context as well we said to sub like rain last year we had during the rainy season this past rainy season we had the extreme rain events at several places, flooding, recently few years back we had that big event in Uttarakhand where a lot of damage was there.

So, and with all this climate change whether its because of the CO 2 emissions carbon dioxide emissions, it is a greenhouse gas, it creates an impact on the environment our global climate changes are not there, some of them are manmade some of them are not our and take a natural as well. So, natural events also leads to these changes and mother nature keeps on adjusting to that.

But that is climate change global warming is a huge topic will not go in great detail there, but what we want to illustrate by this particular slide over here is that, if we can manage this plastic properly we can save 14 million tons of CO 2 emissions we can avoid 14 million tons of CO 2 emissions. And then here it talks about in terms of metric ton of CO 2 equivalent that is coming out. So, we can go for if it is done properly it can reduce the GHG emissions by nearly 8 7.97 metric ton of CO 2.

And similarly here direct GHG emissions by 20 25, avoided GHG emissions and the net GHG emission will be in the negative and that includes if we collection shorting, transport, recycling, energy recovery landfill, which landfill will create some emissions substitution of virgin by recycle plastic that will be avoided emissions, energy recovery will be avoided emissions. So, these will be kind of where we will see the emissions happening because of the collection events sorting, transport recycling, energy recovery where we will have some in landfilling will have some direct emissions as well, but if we can substitute version by recycle plastic.

If we can do energy recovery from plastic that will save lot of the lot of greenhouse gas emissions and then net emissions will be more in term in terms of saving of close to 14 million tons. So, that is a lot of saving in terms of greenhouse gas. If we can manage

plastic waste properly and if you manage the whole waste different types of waste properly of course, you will have more.

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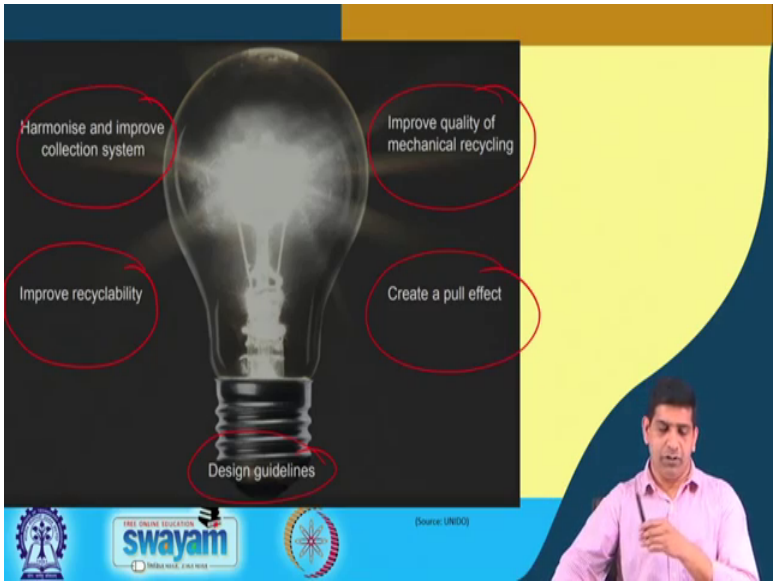

So, what we need to do to achieve that? We have to harmonize and improve the collection system, we have to improve the collection system, we have to improve the recyclability, we have to improve the quality of mechanical recycle and design guidelines for all of these and create a kind of systems effect, create a pull effect, bring all of these different thoughts together to create an effect so, that a plastic waste is managed in a better way to create this reduction in greenhouse gas emissions.

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Better product design this is for example, makes plastic recycling easier if you can design the product easy. Say if you have a simple material this if we can have a container which is all are just say for example, this could be entirely made out of HDPE or like the one particular type of plastic. So, if it is just one type of plastic its easy to recycle.

If it has multiple plastic blended together it becomes difficult to recycle. So, if you can do that if you can make plastic recycling easier, you save 77 like 77 to 120 EURs for each ton for plastic waste collected. So, that is a lot of for each turn you are saving close to if you take the average of these two close to around 100 EURO per ton.

So, that is a like significant amount of money. So, 100 EUROs per ton can be saved for each ton of plastic waste collected if the material is simple. If its a simple material its a simple design. It may not the thing is that it does not may not look very cool, it does not look very appealing, but it is easy to recycle. So, are we have to come up with a optimization where things look appealing at the same time it is should be easy to recycle as well. We should not just to make things look like fancy, we should not lose the recyclability of that.

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But based on this in terms of the other case study earlier we looked at Unilever, now if you look at from the European Union and as you know from environmental aspect. European Union is one area where they work on most of these environmental activities, environmental initiative it happens in European Union first.

So, a vision for Europe's new plastic economy they are looking at its smart innovative sustainable plastic industry, where design and production fully represent respects the need of reuse repair and recycling. So, the design will keep in to aspect that whatever we produce it should be easy to reuse repair as well as recycle and bring growth of jobs to Europe, cut you use greenhouse gas emission as you saw earlier. If we can really do it better, we can cut greenhouse gas emission and so, they come up with certain goals that by 20 30 all plastic packaging placed on EU market is either reusable and can be recycle in a cost effective manner.

Its not only to be recycled; it should be recycled in a cost effective manner because many things are recycled theoretically, but practically they are not. So, with say multilayer plastics and other stuff people can make that we can take different layers away, I have separate and then each layer can be recycled against theoretically its correct, but practically it does not happen because it becomes too costly to recycle that. So, the goal is to have either reusable and can be recycle in a cost effective manner by 20 30; changes in production and design higher plastic recycling rates for all key application.

More than half of plastic waste generated in Europe is recycle that is what they want. More than 50 percent of the plastic waste in Europe should be recycled and sorting and recycling capacity has to increase. So, that if that happens will create 200 000 new jobs it will spread all across Europe.

In Indian context we are talking about jobs. So, whether we have the proper job data, what is our really job figure there is lot of discussion going on in India in terms of job in terms of the data. But we also there are issue of people not able to find good quality jobs. So, if we can it will take time and things are that there is a stigma attached in India in our country related to waste management sector, we think that that is not; I should I can produce the garbage, but I should not I will should not touch it after I produced it.

So, that is, but the waste management sector can bring in lots of good quality green jobs. If we can have if we can implement proper technology, newer technology and there does not have to be most of these recycling business is not really that dirty.

If you look at we showed you some videos in this class and if you look at on YouTube there are several videos on this class and you can several videos available related to plastic, recycling paper, recycling metal, aluminum and all those recycling and you can see that people like a were mostly diploma holders or sometimes even bachelor degree engineers and those people are running those plants. And they are because its totally automated plant and but it still they requires people and we can have labor related jobs there as well. We can in since we have a huge population we need all kinds of job.

So, its a it can create a lot of job, and at the same time we can recycle those material and bring it back to the economy, we do not have to worry about this landfill. So, we do not have to worry about this plastic going into reverse Ganga and all that and so, that is kind of its it would be a win situation for if we invest in that area.

Again as I said in one of the previous video with this Swacch Bharath mission, lot of awareness has come into general public, but it is a high time now to really build the infrastructure to support that awareness. Because awareness is good, but we need infrastructure in place, we need systems in place to really implement those policies. So, that we can do that source segregation, we can do the recycling and that will only happen if we have those kind of in infrastructure means that we should have a proper collection

system, proper collation truck, people are trained we have companies which can recycle this plastic or paper or glass.

So, managing waste management companies needs to come up, pretty much in every can every town and cities in India, we need lot of in infrastructure development is required and huge investment is required which needs some sort of government support. If you think that everything can be done by the private sector especially in a waste management area it does not really work, it has not worked in if you look at the history of waste management in every country, where it is working nicely today you will see that government was involved at least in first few decades and then they gradually backed off and left it to the private sector.

Because it takes time to make money and private sector needs to make money really fast, because we do not have big player who can afford to not make money for several years and still be in the business and because those are the practical stuff and we need to take those into consideration.

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Again in Europe more plastic recycling will help Europe's dependence on reduce dependence on imported fossil fuel, cut CO 2 emissions. Export will rise with a global demand for more sustainable way of processing end of life plastic. Innovative solutions are developed to prevent micro plastics from reaching the seas. EU is taking a leading

role in global dynamic with countries engaging in cooperating called the flow of plastic into the ocean and taking the medial action.

Market for recycle innovative plastic is successfully being established to clear growth perspective. So, that is where its incorporate some recycling content there as well.

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New plastic economy is coming up, eliminate problematic or unnecessary plastic packaging and move from single use to reuse packaging model. 100 percent plastic packaging can be easily and safely reused recycle or composted by 2025. So, that is a goal is there. Circulate the plastic produced by significantly increasing the amount of plastic reused or recycled made into new packaging or our products.

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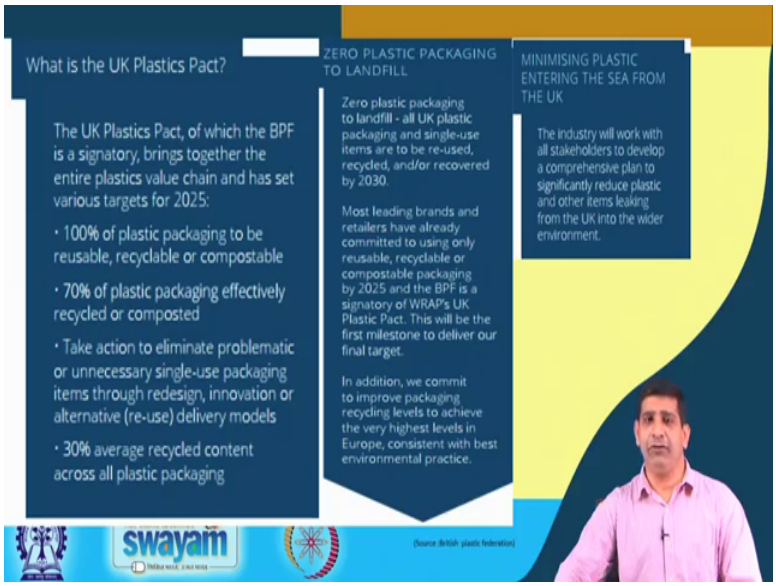

What is UK? There is a UK plastic pacts as well which is looking at is which is they are looking at British plastic for federation is which is who is a signing has signed this signatory of UK plastic pact. They bring together entire plastic value chain has set a target for 2025 that 100 percent of plastic packaging to be reusable recyclable compostable.

70 percent will be effectively recycle, take action to eliminate problematic or unnecessary single use packaging from there. So, 30 percent of average recycle contain across all plastic packaging so, by 2025. So, these are like good goals good even if they achieve say even they achieve 60 70 80 percent of that is a huge progress and then rest can be achieved as well, but we have to work towards this particular goal not just make the goal, but we have to work towards that goal.

And zero plastic packaging to landfill all the plastic has to be recycled by 2030, most leading brands have already committed to using only reusable recyclable compostable by 2025 and then its a UK plastic pact which is British plastic federation which is the government which is the industry organization.

So, that is what we need the we need industry on board when we make these kind of policies. In country like India we draw we do not do that we just that we just make an announcement that by this date we will stop using single use plastic good, but where, but who will do that its the industry who will do that its the industry who will come up with

the alternatives are they really ready for it, can they really do it by 2022 or 2020 whatever. So, we need to get the industry on board before we make this policy decision.

So, that is what all the stakeholders needs to be together and then we need to have it. This is because everybody is its not governments responsibility, everybody is in is involved, everybody should be involved and that is what you see mostly happening in European whenever those countries where they trying to make progress in this area.

They are looking at highest level of consistent with best environmental practice of; and they are also minimizing plastic from entering the sea from the UK we log to develop a comprehensive plan to significant reduce plastic other items leaking from UK into the wider environment. So, as I mentioned to you earlier we will be doing some work with national geographic this summer where we will be looking at how much plastic is leaking into river Ganga from all the way from Gomukh to like from to West Bengal like Ganga Sagar area that how much plastic is really leaking into river Ganga and those will try like of course, will publish that later on in some form or other so, you will have that access to you as well.

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There were certain reforms there are create extra funding of course, everything requires funding. So, they were funding the reward good design. So, having a design kind of a encourage people to design better stuff, helped development of recycling systems. So, those things are there.

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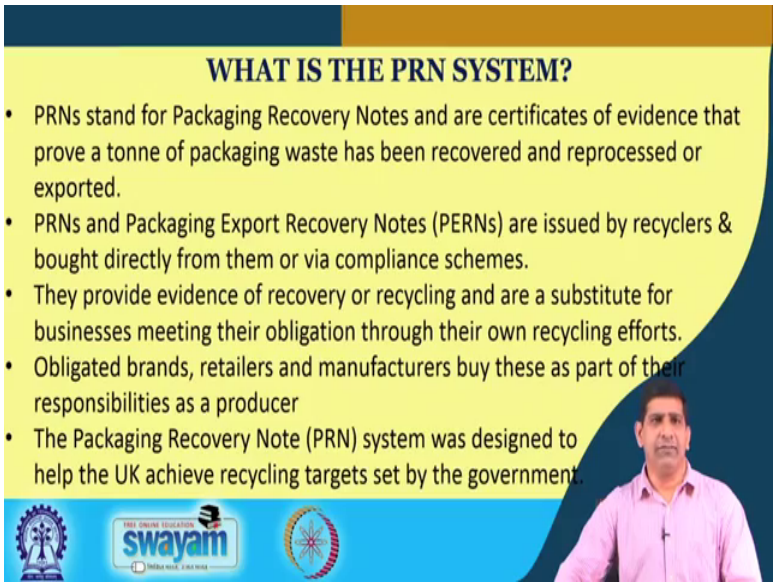

What is PRN developed? A PRN system which is the Package Recovery Notes and certificates and then also packaging export recovery notes. So, they are issued to recyclers and bought directly from them via compliance scheme they provide evidence of recovery and recycling. So, basically they are making its some sort of documentation to make sure that it is really happening; because whenever you have a goal you have to document that whether you are going towards that goal or not.

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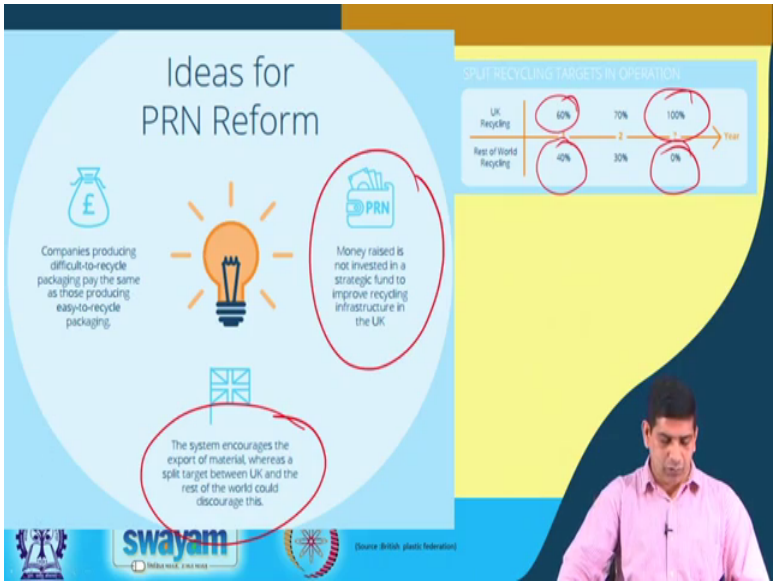

So, these are some of those initiative in that particular areas. In terms of PRN reforms they are looking at companies producing difficult to recycle packaging, they have to pay the same as those producing easy to recycle packaging. So, they have to. So, right now money raised is not invested in a strategic fund. So, that is their thinking that system will encourage export of material, where is a split target between UK and rest of the world to discourage this. So, they are trying to recover this is not an ideal way. So, they are trying to work on and reform it.

So, those who are making easy to recycle they should get incentive, those who are making plastic which is not easy to recycle they should have some sort of penalty. So, those kind of things are there. There is some split recycling target operation UK is 60 percent and then UK wants to rest of world recycling is right now 40 percent and then gradually UK wants to go towards 100 percent recycling within UK and then 0 percent sending it to outside. So, that is what the goal in terms of British like a United Kingdom or UK.

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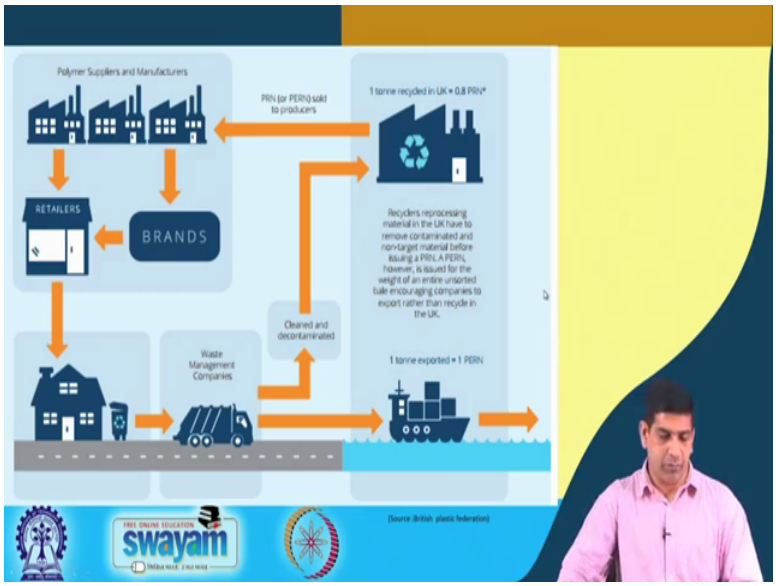

The different British plastic foundation this comes from there, where they are looking at polymer suppliers, retailers brand, waste management companies that they have their say selling this PRN or PERN into products one ton of recycled in UK is 0.8 PRN which is. So, recycling processing material UK have to remove contaminated and non-target material before is doing a PRN. Its a suit for weight of an entire and shorted belt

encouraging companies to export rather than recycle in UK. So, that is what they want to work on not to do that because they want to recycle within their own country.

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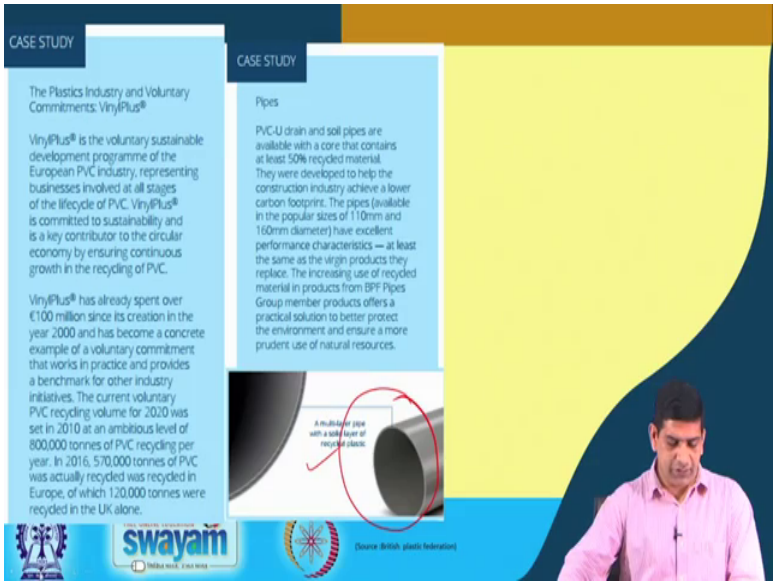

So, the plastic industry and voluntary commitment. So, this VinylPlus is a voluntary sustainable development program for European PVC industry, where they are looking at like a drain and soil pipes available with a core that contains at least 50 percent is recycled material. So, here they have 50 percent recycled material and they were developed to help construction industry lower carbon footprint.

So, pipes are available in popular sizes and they have the same characteristics as the virgin plastic. So, it has to be good; increase use of recycled material makes product offers a practical solution. So, you can recycling it and multilayer pipe with a second solid layer of recycled plastic is there as well. So, these are those things are happening by different companies out there. So, this is a one example of that.

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Chemical recycling is also happening where chemical recycling provides a second solution for residual plastic waste. So, they are chemically being recycled. A modular chemical recycling machine that reduces plastic waste into Plaxx; Plaxx is actually its a product which its a feedstock for a steam cracker it can also be starting point or production of plastic as well as industrial wax. So, it is it turns plastic back into cracker or feedstock virgin quality polymers can be produced you containing this recycled material.

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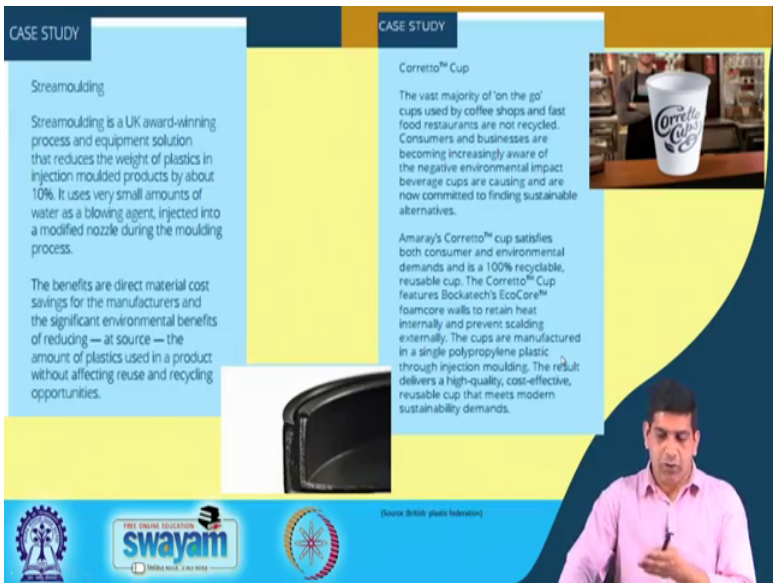

Then corretto cup which is another steam molding UK award winning process, they are doing some injection mould products by about reduces the weight by 10 percent. It uses a small amount of water as a blowing agent injected into the modified nozzle.

So, benefits are of course, the material cost saving, significant environmental benefits of reducing because you are using 10 percent less plastic the amount of plastic using product without affecting reuse and recycle. So, its vast majority of that on the (Refer Time: 20:18) cup used by coffee shops and fast food restaurants are not recycled say it becoming increasingly an environmental impact.

So, this cup satisfies both consumer environment, because its a 100 percent recyclable and its it has a core reformed core walls to retain heat internally and prevent scalding externally. Say does the purpose manufacture in single polypropylene plastic, so, its one particular type. High quality cost effective reusable cup and then of course, its sustainable demand as well.

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So, that was on UK and other example if you look at Ontario which is in Canada, they were looking at strategy for Waste-Free Ontario.

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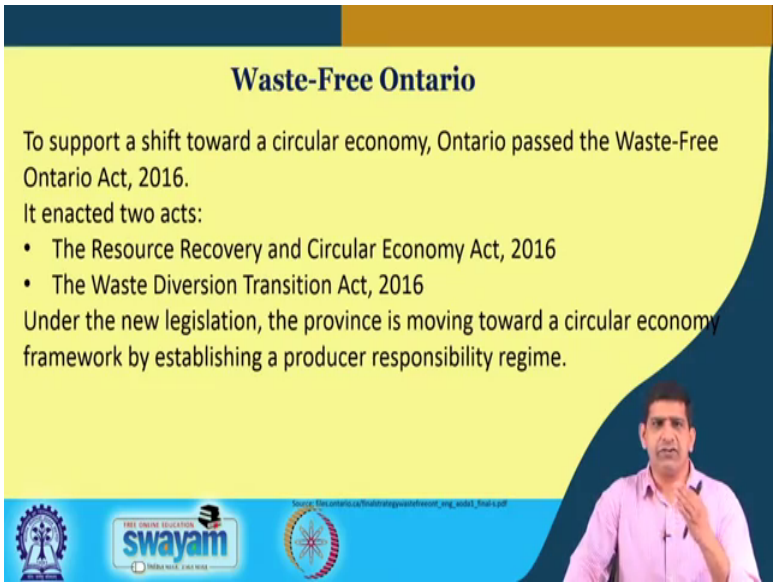

In we will go through this a little fast you can you have those materials available as a reading material as well. So, they pass they are looking at trying to go towards circular economy the Party Ontario Act Waste-Free Ontario Act there are two things the resource recovery and circular economy and waste diversion; again moving towards the circular economy with the extended producer responsibility regime.

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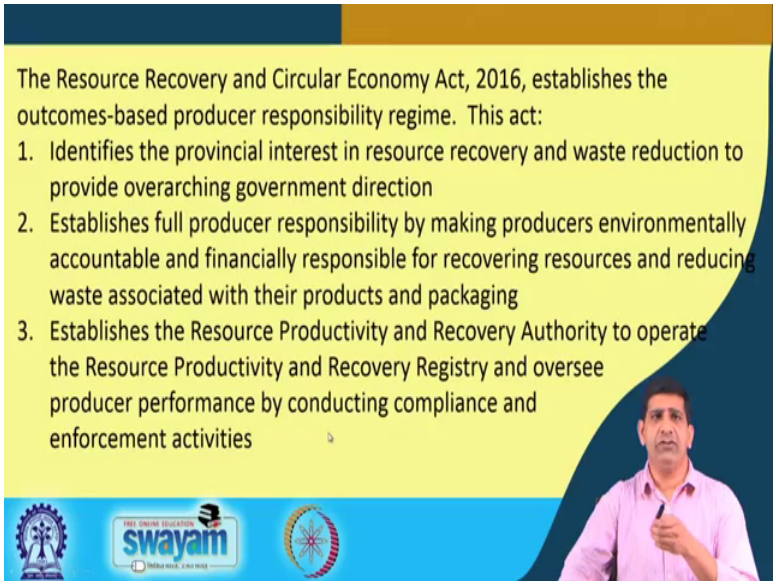

So, what they do a since they are trying to look at resource recovery and waste reduction provide overreaching government. Establish full producer responsibility making

producer environmentally accountable financially responsible. Established resource productivity and recovery authority. So, what is again as I was telling you this is again the government is not just leaving everything to the private parties, the government is setting up an authority which will oversee the producers performance.

So, there will be a like a small quasi government body which will facilitate of all these implementation of these rules.

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And they will look at transition from current waste diversion program to new produce a responsibility form framework. Waste diversion program was were trying to keep things away from landfill and so, they were are these are now merged under this Resource Recovery and Circular Economy Act. So, its once this is enforce existing programs they operate will those waste diversion programs will actually merge with it.

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So, they will no longer be active. So, the vision here is to wear waste is seen as a resource. So, its again to recover reuse and reintegrate it to achieve circular economy; goal is to achieve a zero Waste Ontario or zero greenhouse gas emission from the waste sector.

So, 30 percent divergent; divergent is the waste which is not going to the landfill 30 percent in 2020, 50 percent by 2030, 80 percent by 2050. So, again they are not just saying that in 2 years will not send anything to landfill even a country like province like Ontario which has been working on waste management for more than 30 for almost 40 years now they are also not saying zero landfill from tomorrow unfortunately in India we do that. So, because if these things do take time.

So, they look at they are saying 80 percent divergent by 2050. So, they do realize that 20 percent of the waste will is still be going to landfill, because it is the technological limitation in the infrastructure limitation which hampers you can come up with a lofty goal, which is it unrealistic goal and then you will not meet that goal anyway because its unrealistic to start with.

But if you have a realistic goal and if you walk towards that goal, the chances of meeting that goal is much easier. So, that is what you see in most these kind of strategies that is the reason I picked up these examples which are kind of these places whether its UKs its,

but Ontario is better and Unilever initiative is of course, much better. So, that is why these examples have been taken into consideration.

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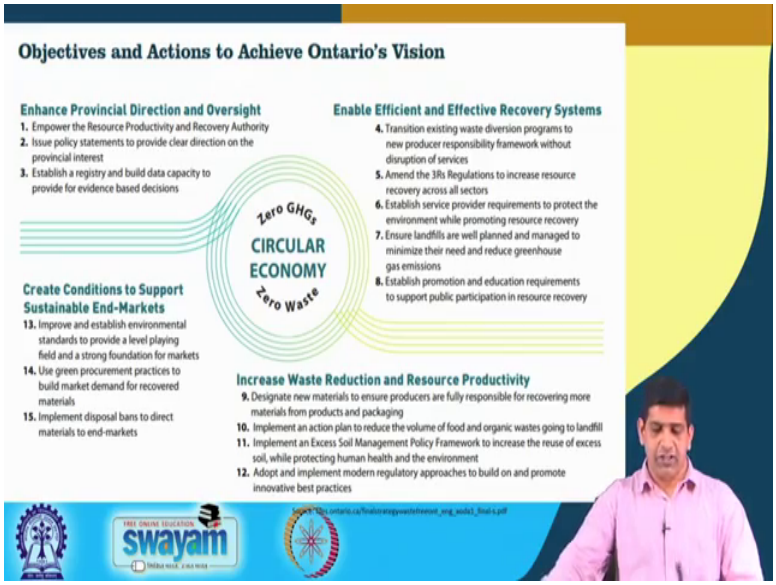

So, here the goal here and these are the iron its coming from that document. So, you can read this from that document I will not read line by line, but the basic thing is that they want to have provincial direction and oversight. So, there will be a provincial government office, which will take care of that create conditions to so, that sustainable end market. So, the government will help create those conditions.

So, improve their environmental standards, use make the policy in such a way enable efficient and effective recovery system work on the waste collection infrastructure, increase waste reduction and resource productivity. So, that is try to have new materials which insurance producers are fully responsible; implement action plan, implement access soil management policy framework, adopt and implement modern regulatory approach. So, those are again the governments initiative in these areas to have kind of zero waste or circular economy approach.

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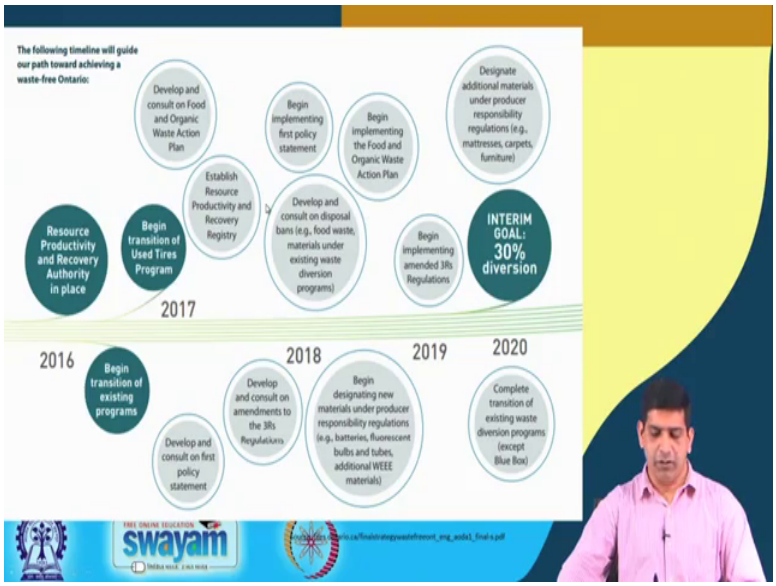

So, right now this its kind of these how they will progress, this is kind of their goal; interim goal of 30 percent diversion, the following timeline will guard towards waste free Ontario. So, right now they are looking at forced and food and organic. So, this is not only for plastic waste this is kind of more general plastic waste is also part of that. So, resource recovery food waste recovery implement the develop a disposal ban like food waste ban, material existing waste diversion.

So, which started in 2018, then they are looking at 3R regulation which will come this year, then by 2020 they have complete transition of existing waste diversion program to this circular economy framework. So, this is how they will move in terms of achieving your waste free Ontario.

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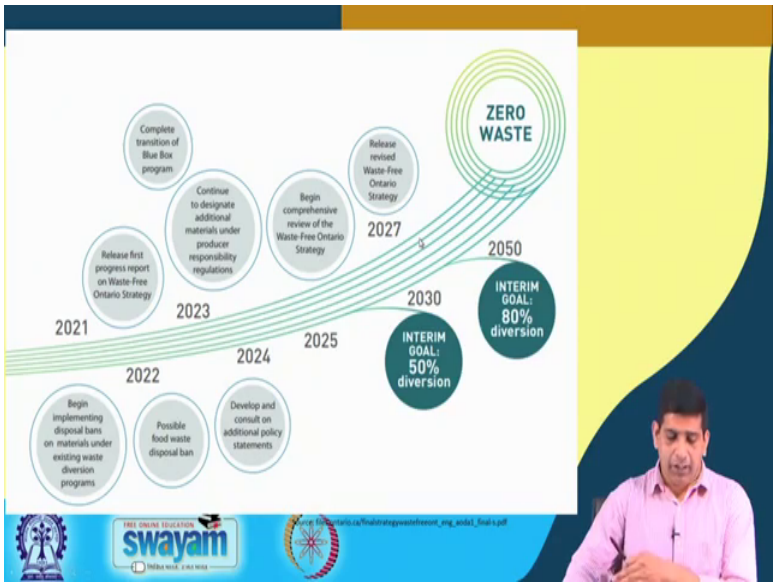

And from 2021 onwards as you can see up to 2050, they will implement disposal bands for then complete blow box program blow box is a recycling program then there would be producer responsibility regulations, comprehensive review of strategy then finally, looking for zero waste which is a goal of around 80 percent and then if by 2050 and then zero waste after that. Zero waste means no ways to go into the landfill, it does not mean zero waste being produced.

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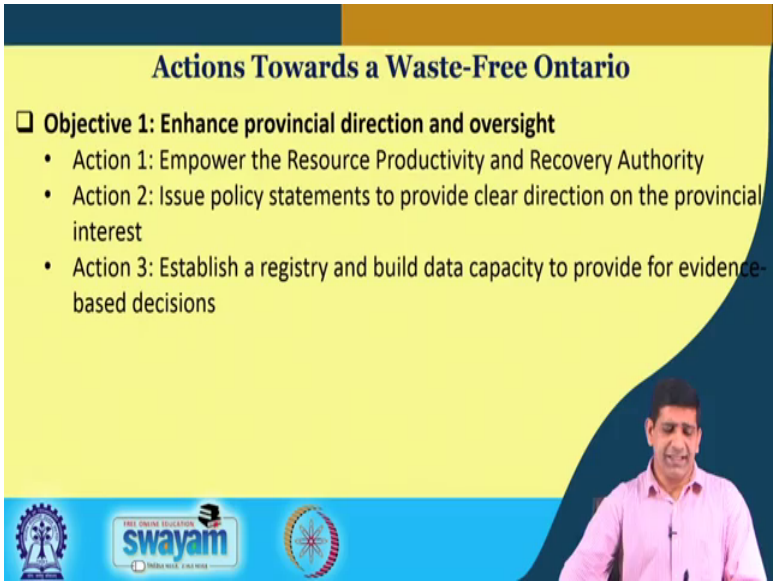

So, as you can see there are lot of the it will go for resource productivity and policy is registry.

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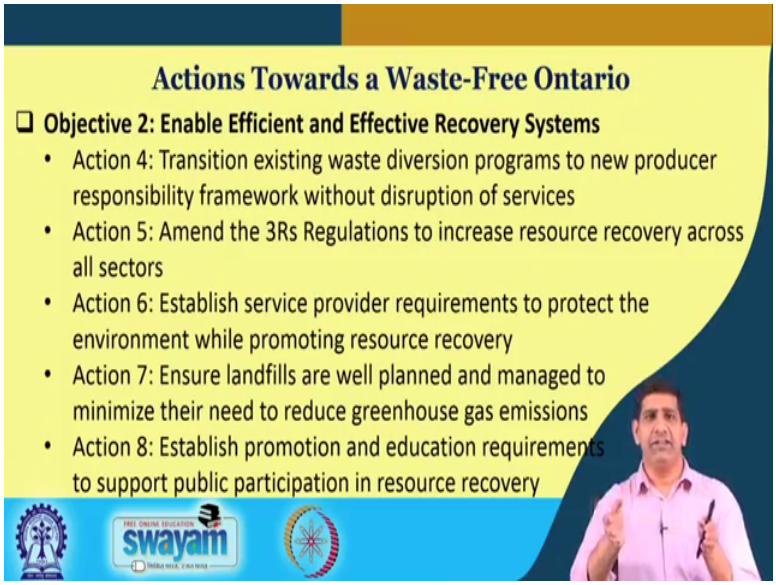

And data capacity in efficient recovery system move from newer kind of approach, less dependency on landfill, promotion and educational requirement, in established service provider requirement looking at resource reuse recycle. So, those things will come in picture; again you have this copy of this policy in your reading material. Increased waste reduction, improve resource productivity where they will look at the newer material easier material to recycle, reduce the volume of food and organic ways to implement excess soil management which we talked about and build innovative based practices.

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Create conditions for sustainable end market, where because you have to make end market so, that you can recycle you can sell this kind of stuff.

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So, there are the thing is done. So, this was in Ontario things this is another example from Austria which is in Western Europe.

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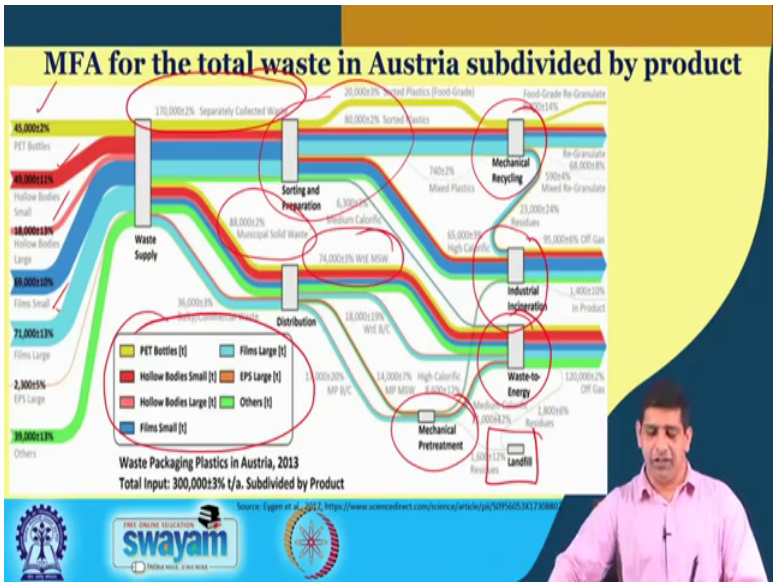

So, a circular economy of plastic packaging, which is they looked at in terms of how it is being done in Austria. So, they do the material flow analysis for total waste in Austria. So, you can see for the different types of bottles here. So, PET bottle, hollow bottles is small large films different types of plastic films. So, here the different quantities PET, hollow bodies, hollow large is small. So, this is how much it is being generated; then it is separately collected waste. So, waste supply then they it goes to the sorting which is it sorted out part of it does end up in the municipal solid waste. So, it is and from municipal it goes to the waste to energy plant, Austria Vienna has one of the world's best waste to energy plant.

So, plastic is mechanically recycled there are some industrial incineration and there is some waste to energy plants and then there is some part of it mechanical pretreatment as well and then little bit of it also ends up in the landfill. So, they looked at the entire waste package plastic in terms of how the plastic is moving in the system. So, these kind of studies are very very useful, but we can again for all these we require good quality data.

One thing we need to really work on is having better data quality a better data not only on jobs. I am just have a joke here and not only on the jobs data which is making a lot of news, we need we are having kind of course, there are issues with the jobs data there are of course, we have a poor data. And same thing we have poor data in most in almost all sectors in environmental sector also our data is very poor.

So, here as you can see over here, they can track the movement of plastic why this is important? This is not to create this fancy graph for a paper or a publication or for your thesis or for your project report, this helps us to identify where are the issues. So, as the plastic is moving into this chain where are the issues that we can address to make it more environmental friendly why there is a leakage why there is so much of plastic is going into the landfill?

So, first we need to know how much is going to the landfill. So, there of the different things that is happening with the plastic waste, where what percentage goes to different sectors that is very very important to know and once we have those data then we can design a remedy for it. So, first to understand any disease you need to do the blood tests and urine tests.

Doctors cannot write prescription without having proper diagnostic. If any doctor writes you a prescription without having proper diagnostic if he is very experienced sometimes we do have. So, those kind of doctors based on their experience they do that, but in general its you need to have proper diagnostic done in terms of blood tests, urine tests, X ray see it whatever city scan depending on the type of disease you may have then if you get that prescription that prescription is more reliable.

So, unfortunately we many times we just write the prescription without understanding the problem and so, this is this picture is understanding of the plastic issue in Austria and as you can see it has been nicely done. So, that is the reason I wanted you to. So, that we need to create these kind of graphs for every state in India, maybe big cities in India Delhi, Bombay all those we can create these graphs and you can see where are the problems. So, that we can address those issues otherwise we will be just shooting arrows in dark.

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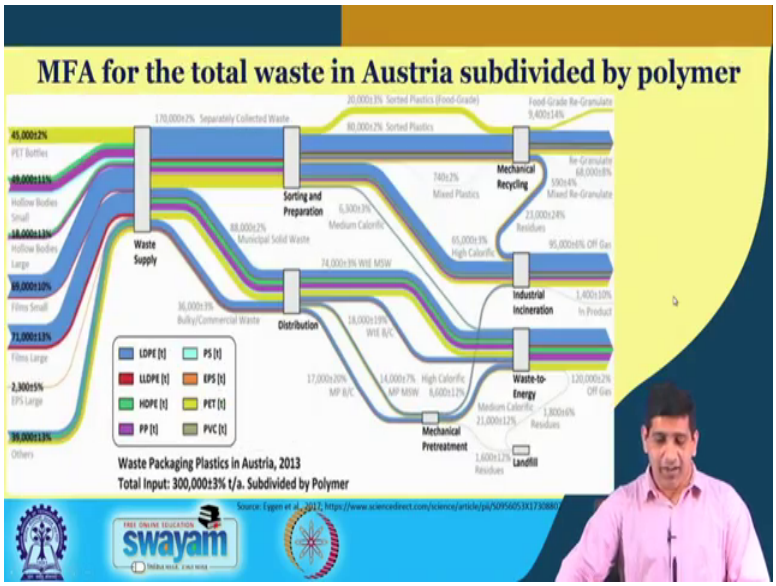

So, then again this is a the more detail LDPE LLDPE polystyrene EPS PET PVC similar graphs for different and where things are being and ending up. So, similar stuff I will not spend too much time.

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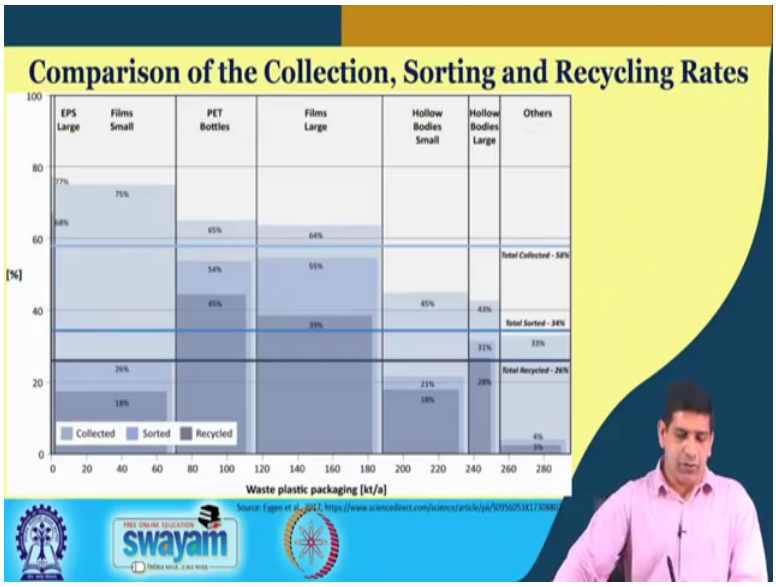

So, if you look at comparison of collection sorting and recycling collected is light grey, then like at the bottom is the recycle part, then we have the collection and there on top is sorting. So, as you can see more and more PET bottles, large films or recycle and hollow bodies bottle hollow bodies small they are also collected and sorted, but its the recycling

rate is a bit low compared to PET bottles or large films. So, this is again how what is happening with that plastic. So, that we can look at wherever is the lacunae in terms of while it has been not recycle we can start working on it.

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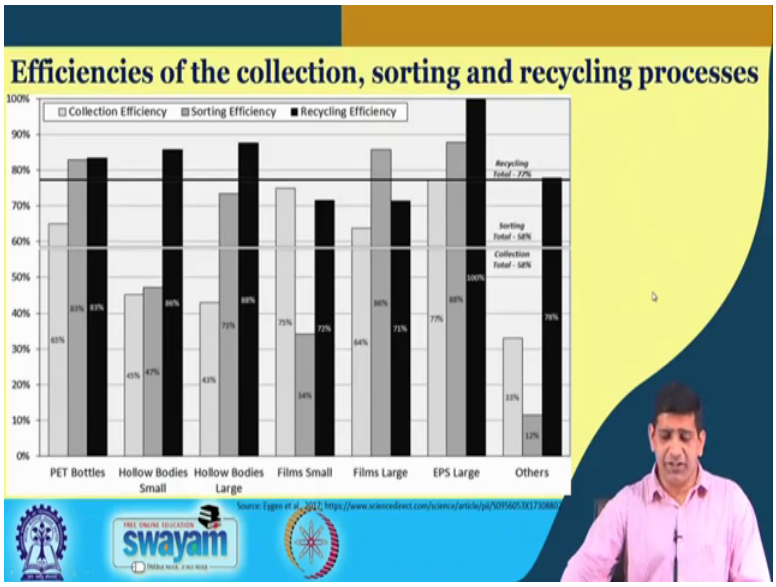

So, they also looked at the efficiency of the collection sorting and recycling process for the different types of plastics, different types of stuff as you can see. Again PET has pretty high recycling efficiency, the hollow bodies is small also they were not collected properly and sorted properly, but amount out of what PET bottle is kind of high in almost all three and all three they are pretty high.

But if for others as you can see the collection is collection efficiency seems to be low for hollow body small and hollow body large its for films small and also EPS large, but for certain areas our collection is this efficiencies low in certain cases sorting efficiencies low.

So, those where we have as you can see over here collection efficiency and the sorting efficiency, which is the collection is this one sorting is this one for each one of those. So, as you can. So, we can identify the bottlenecks and then we can address try to address those issues, so, that is helpful in terms of.

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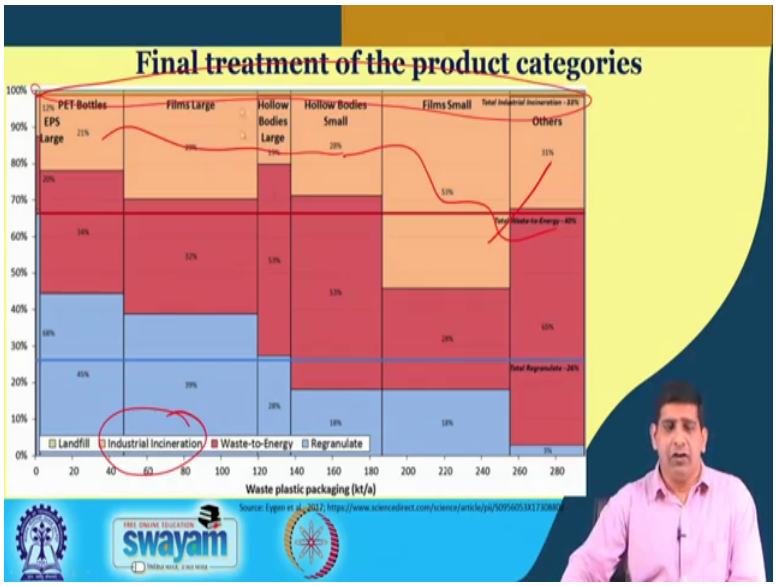

And then you can look at final treatment of the product similarly by whether it is going to the landfill industrial incineration you can waste to energy is a big thing in Austria. So, you see a that red color is waste to energy, the blue one is regranulate recycle and light that the top one which is this part is on the top one this part is our on top not here not this side. So, this is our industrial incineration use directly in incineration. And landfills is that light green which you see on the top a little bit on top here that is the landfill.

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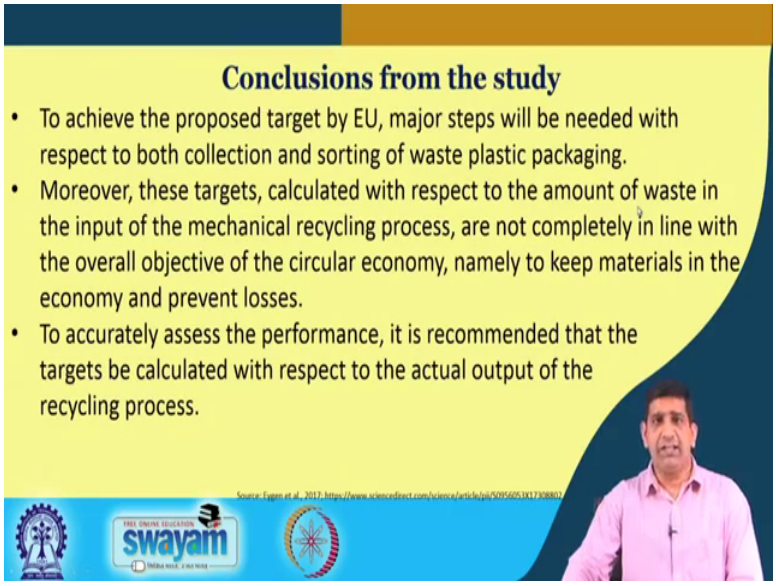

So, that is on the top which is very low, but a low amount is going to the landfill many must lot of it is going to the waste to energy plant because Austria has like big waste to energy plants. So, that is kind of summarizes the different case studies. So, we will just look at the some kind of take home messages. So, conclusion from the European Union. So, proposed target by European Union major steps is needed in terms of collection and sorting.

These targets look at with respect to amount of waste in the input of mechanical are not completely in line with the overall objective basically keeping materials in the economy to prevent loss. Accurately assess the performance we they have to look at the targets with respect to actual output of the recycling process. So, those some of the limitations are there.

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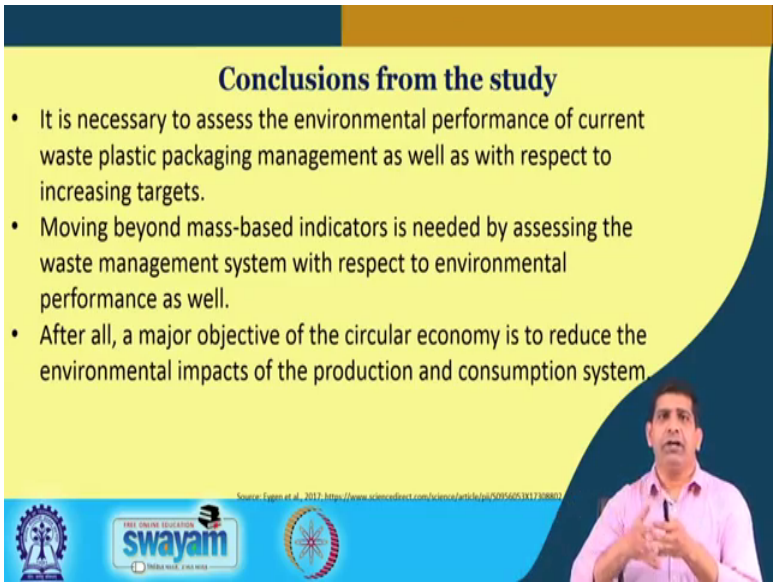

Look they have to look at the environmental performance from a current plastic waste management as with respect to increasing targets, moving beyond mass base indicator with respect to environmental performance, they should look at environmental performance as well. A major objective of circular economy is to reduce environmental impact of the production and consumption systems. So, that needs to be incorporated in this kind of study two.

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So, overall its in terms of this particular video or this particular week, we are trying to build there is a lot of incentive in terms of lot of approaches are being used, lot of initiatives have been taken to build economies of to support projects initiative that promote economics of recycling infrastructure.

This holistic approach is needed; it is not only companies to come up with their own material, but its the entire system of collection recycling the systems approach; think local as well as global. So, that is important because we are all connected. So, plastic waste causes global pollution, but solution needs to be delivered at a local level, so, if there are a long lasting impact.

So, intervention should always reflect localized infrastructure, which we shall vary around the globe. So, because if we come up with if we design an intervention based on European infrastructure and try to implement in India that does not work unfortunately some of our waste management rules do that. So, that is what we need to look at our local infrastructure and then design our design our solution accordingly.

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Collaborate; collaborate to innovate collaboration between suppliers, packaging, manufacturer brand owners to bring the circular economy and always think long term. Companies have to will to invest for a longer term significant commercial reward will be there, but again I will say that for the initial years they do need support, they do need support from the government hand holding and government has to act as a facilitator for the bringing all this stake holders together.

So, with that we have looked at this course. So, thank you I think I hope you enjoyed the course I did enjoy putting these material together. As I said in the very beginning of the course there is no textbook this is a brand new topic, I think this is the only course of this nature in India right now and being offered anywhere in any institute in India. So, that is the reason we wanted to put this course and so, that we can all learn together and I am still learning every day there is newer things are coming up on plastic waste, whether you follow Facebook or news articles or Google or YouTube everywhere there are lot of newer and newer information is coming.

So, again this course is just a starting point this is by taking this course you are not an expert of plastic waste management, I am not an expert of plastic waste management as well. So, I am also learning. So, we are all read this is a lifelong learning kind of because things are moving so, rapidly newer and newer stuff is coming in.

So, few years down the line many of the things we talked about will have a different perspective because new things will come up in the market, new kind of discussion will come newer technologies will come as well. So, I hope that part of many of you will be part of those new technologies.

Again, thank you very much and I hope I was able to do justice to you for this course, I tried my best thank you and maybe I will see you again in some other course in future.