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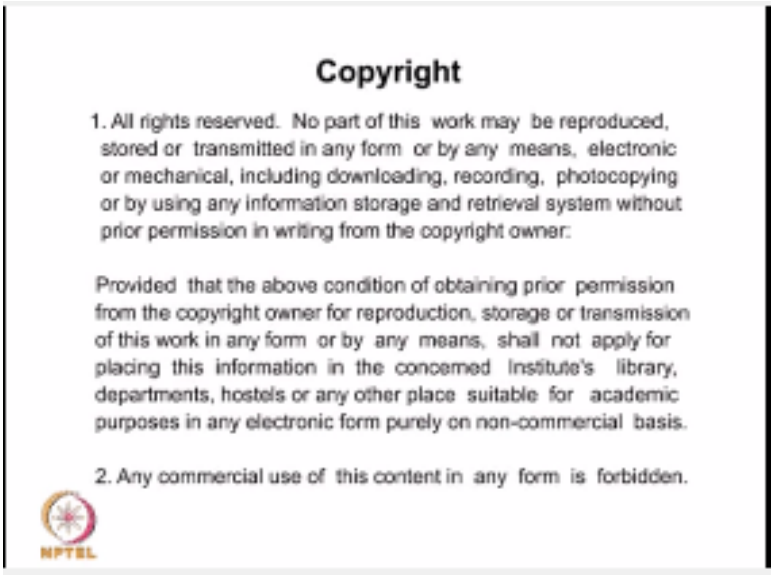

Global Supply Chain Management

Lecture-26
Green supply chain design-part

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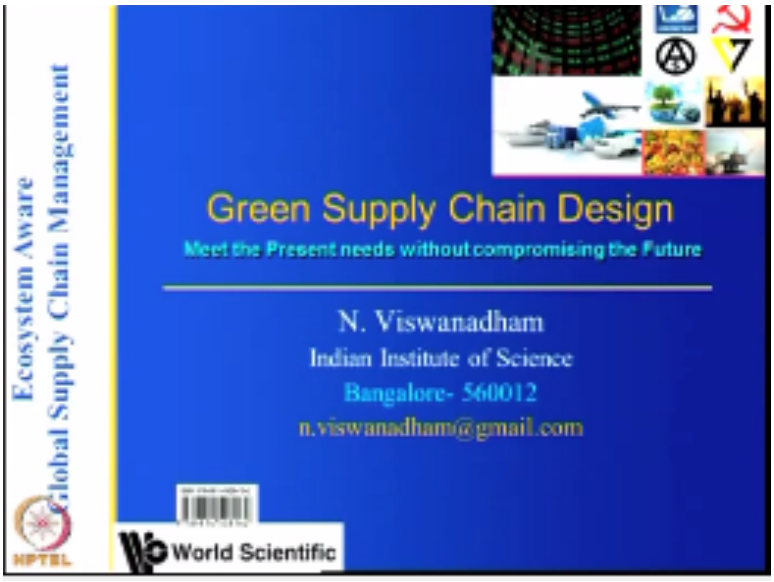

We are going to deal with a very important topic this is the green supply joint design you know there is this topic of the green everywhere and also this is also about the climate change and there is a lot of literature talk Nobel Prizes and so on and climate change but the fundamental thing that we are going to deal with in the next four lectures including this is about how do you design a green supply chain.

What do you mean by where as we know is the supply chain means this is the end product of a supply chain is any product or a service so if you want to the product to be green that is it meets all the specifications of the green parameters then how do you design such a supply chain it is not only the product design but also the processes on which the product is manufactured they have to be green so this is the difficult task.

That is what we are going to deal with in green supply chain design in the next three or four lectures but the one quotation is the meet the present needs without compromising the future so they did the idea of this statement is that you basically have industries like fertilizers or cement or pharmaceuticals or even food but all these are there to meet the present needs they give you products and services that present that give they present it but what happens with term.

Is while producing the manufacturing processing also produce greenhouse gases they produce lot of pollutants so all this actually they are going to have affect the atmosphere in other words it is compromising the future because the future water is polluted the future atmosphere is polluted that increases the logo it recreates global warming and along the associated problems with that so

the idea here is to meet the needs of the present without compromising the future in other words to you want to use only so much of resources that are needed you do not want to pollute the atmosphere you want to recycle the materials you want to basically reduce the amount of carbon content in your in your atmosphere.

So with all this if you add to your supply chain design of meeting the they demand supply matching all these factors like useless resources use it should generate less carbon content it should generate less pollutants it should be it should be recycling the products that you create should very safe level and the process is manufacturing processes that you have should be able to use the recycled materials so all this is basically about green supply chain design which makes of course the supply chain design tough and that is what we are going to deal with in the next three lectures.

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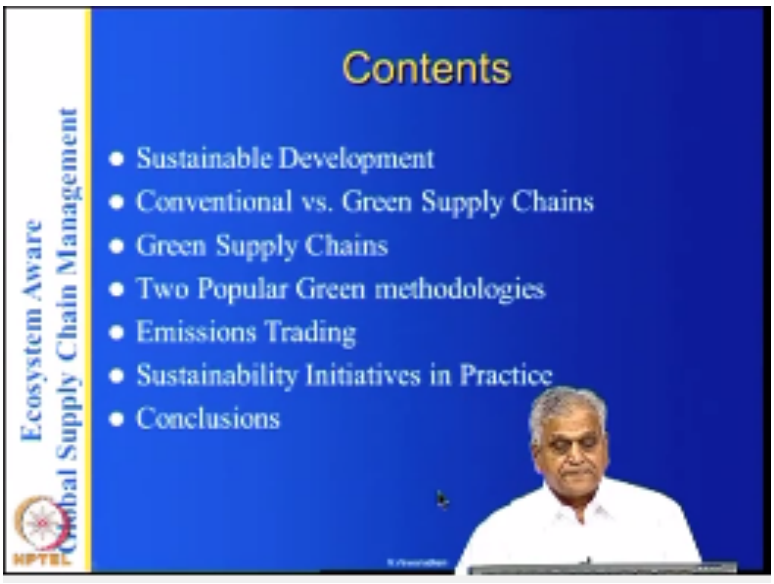

So the contents are first two lectures are sustainable development what do mean by sustainable development and what is the difference between conventional engineering supply chains this is an important topic because there are standard methodologies that are available for conventional supply chain design there are software packages available optimization then ERP moves SAP and a lot of companies would supply the software packages.

But how do what are the difference between both of them and how do you talk about what are three in supply chains and have what are the methodologies of designing agree in supply chain

and there is what is called emission trading here are two popular methodology one design to use you can use methodology the other one is you want to do comic carbon trading and what have the sustainability indices or initiatives in practice In other words what is the status of the industry today so we will come through some examples and finally conclude this.

So what we are going to do Is an introduction to the green supply chain design although we do not design the supply chain we will do that in the next class but in this will forget the fundamentals of sustainable development and green supply chains.

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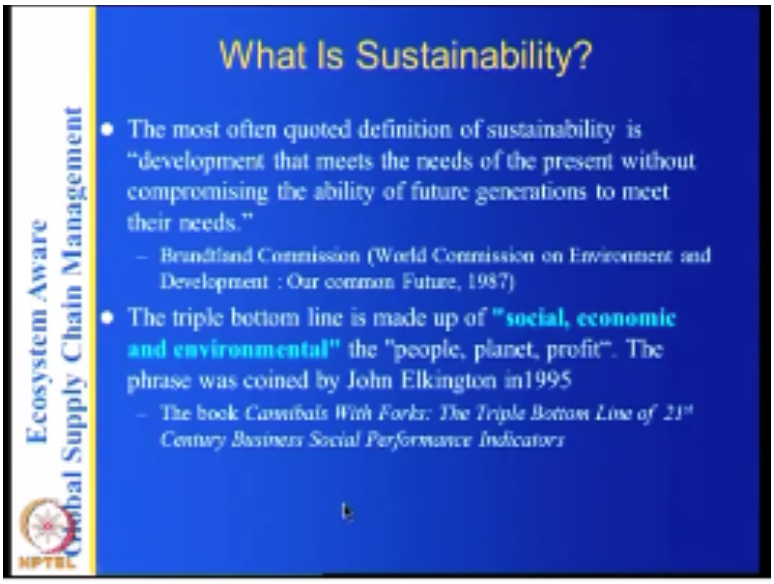

So what is sustainable development what is sustainability let us the most often quoted definition of sustainability is development that needs that meets the needs of the present without compromising the ability of future generations to meet their other words while you are doing your work do not compromise the work of the future generations this is basically often-quoted definition and it is from boat Land Commission of world Commission.

On Environment and development our common future in 1987 and from that time onwards this is often quoted and that became a standardized definition of what sustainability means so it development that mean that meets the needs of the present without compromising the ability of future generations to meet their needs now in the case of supply chains which is our topic today we are going to do development of present products without compromising.

The resources without compromising the atmosphere without compromising on the products and so on so basically that is what it means in our context that is also what is called at the triple bottom line the triple bottom line is social economic and environmental the people planet and profit and the phrase was coined by John and Clinton in 1995 the book cannibals with forks the triple bottom line of 21st century business social performance indicators that is the book by John and in 1995 and the triple bottom line is another three words that are very famous.

In sustainability so here you can see there in socially that you need to feed the people or create food for people you need to give them all the conveniences house then vehicles and other services like IT and all that and you have to improve the economy in other words the agriculture

manufacturing and services and also you have to keep your environment so clean so the other issue is the three social they are the three triple bottom line Is it is it possible to meet all of them or when you meet one or two of them the other gets compromised let us see you this.

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So the definition of sustainable development is adopting business strategies and activities that meets of the enterprise and its stakeholders while protecting sustaining enhancing the human and natural resources that will be needed in the future so that is basically the definition for an enterprise and here is the triple bottom line that we this ones the strategic focus here is where you want to focus on a lot mental protection.

We want to protect look at the social well-being we want to look at economic development so in other words you have the three circles economic development social well-being and environmental protection now you can see that they do all the three circles meet in this small area maximum benefit focus areas that is the area where you will have the triple bottom line that is met this area this is the area where the triple bottom line.

Has met but you can see most of the time if you want to develop industries for economic development and also provide jobs where all these all the people that is for social well-being these two objectives means that you have to develop industries so once you have develop industries you have to move materials you have to basically have production processes and so on and which means you have to use resources like water far as power.

And so on and that means they you are using some of the environmental products here so you can probably change the biodiversity you can also remove some of the forests to make either agriculture or a manufacturing plants and also you may you may generate a lot of gases while using transportation for moving materials so you can see that when you are meeting these two objectives then the environment gets spoiled.

That is the one for example means to any government wants economic development and social well-being and environment to protection nowadays has become a priority area.

And so on so if you want to meet all the three objectives if you want to meet all the three objectives then your focus area becomes limited but that is what we are going to deal with here so if you look at this is the triple bottom line that we are talking about we are doing one type of crisis that meet both economic development social well-being and environment reproduction the challenge manager economic growth was reducing the use of resources and the case of emissions growth so you want to you want to economic growth so you want social well-being but you want to use a minimal amount of resources and also limit as less emissions as possible that is the definition of sustainable development.

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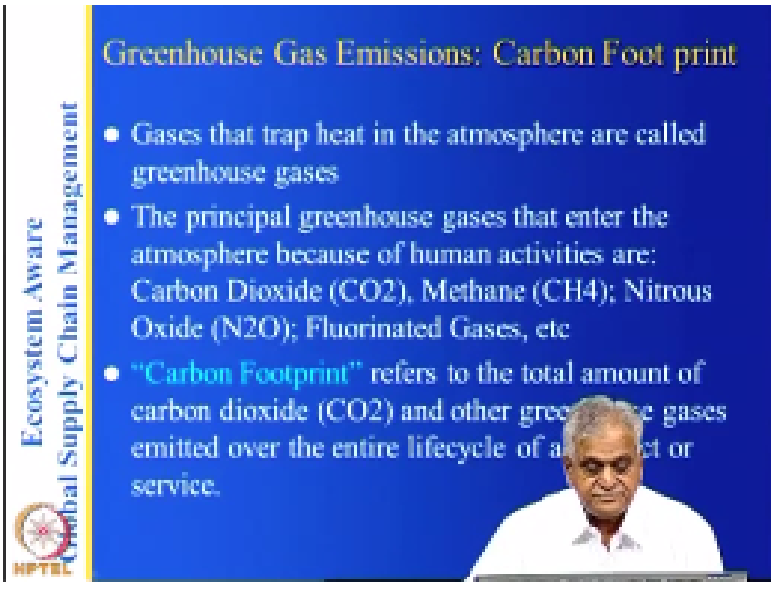

So what are greenhouse gases and the carbon footprint so gases that trap heat in the atmosphere are called greenhouse gases the principle clean house gases that enter the atmosphere because of

the human activities or carbon dioxide methane nitrous oxide and fluorine all gases fluorinated gases these are they these are all called carbon footprint and the carbon footprint refers to the total amount of carbon dioxide and other greenhouse gases emitted.

Well at the entire lifecycle of a product or a service so if you generate an automobile so if you take an automobile from design till the production of the automobile what is the kind of carbon footprint and from on the automobile starts functioning you to have patrol and other things and it emanates a lot of gases when it goes on the roads and so on so what with the carbon footprint of the automobile you need transportation device.

Whether it is a car or a truck or this one has virtually the promulgates a lot of GHG gases so that becomes the entire life cycle of the product or service if you are taking.

For example I information technology IT services in storage now if you are storing data in servers and that requires power and which means that the data storage is not unity there are a lot of gases that come in out of this so if you want to minimize the amount of power that is used the amount of carbon that carbon footprint of a service system then you have to carefully choose and have their methodologies available.

For that so for each product you have a carbon fact rate and for each service there is a carbon footprint for example in your travel there is a carbon footprint if you come from home to office there is a carbon footprint so if you want to minimize that carbon footprint well in a stop coming on a car if you walk then there is a minimal if you bicycle then there is a way you are minimizing the carbon footprint if you take a shared share tap instead of coming your own your own car then you are minimizing your carbon footprint so basically there are several ways which you can respond instead of using a gasoline car if you use electric car then you are minimizing your carbon footprint so there are several ways in which this carbon footprint can be minimized.

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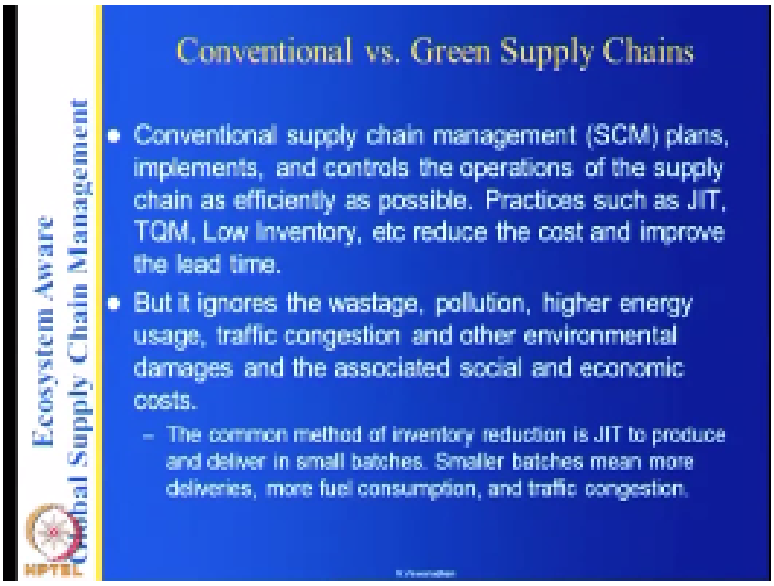

So what are the conventional versus clean supply chains in conventional supply chains or the conventional supply chain management plants implements and controls the operations of supply chain as efficiently as possible so in other words if you look at the earlier supply chain design so you want it to be low cost you to meet the customer needs you know want to minimize as much less inventory as possible and you want ever seen to be just in time and you want high quality.

Products and so that is the kind of thing that so but to do this to maintain this kind of efficiency in your supply chain you basically ignore the wastage the pollution the high energy usage traffic congestion and other environmental damages and the associated social and economic costs so you are talking of industry you have the universe apply to inefficiency and that is applied to inefficiency basically to give products at a lower cost to your customers but we are ignoring.

You are using more resources you are wasting a lot of resources and also there are a lot of associated social and economic costs so the common method of inventory reduction in JT is just enjoyed what is just in terms just-in-time means you do not keep any inventory in the factory from the suppliers all the material comes as you need it in other words you have a batch of products you are manufacturing in the morning you get that much batch four in the morning by a truck and whatever is needed for the afternoon you will get another truck.

This is coming so basically the units deliver in small batches when you delegate these things and small batches which mean more deliveries so weather the truck is full or not you are going to deliver more number of times which means more for your consumption and more traffic

congestion and more GHG cases so the efficiency of the supply chain which is charity which is followed universally everywhere then that creates problems more and more GHG cases and efficient supply chains JIT just-in-time does not mean that the supply chain is green.

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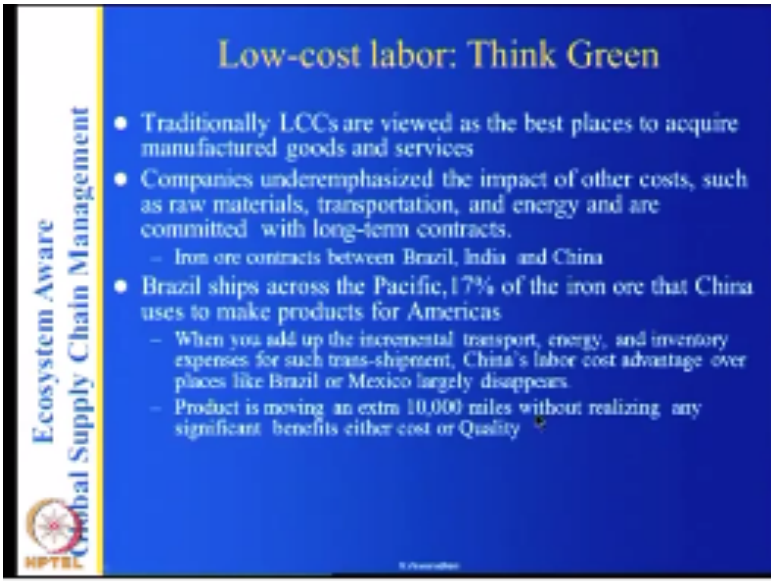

So and then another factor that is very common is outsourcing what are people doing nowadays instead of manufacturing in their own countries they are outsourcing to low-cost countries.
So the low-cost countries are viewed at the best places to acquire manufactured goods and services this means China Vietnam Thailand and so on so basically all the United States products are made in these places and they are shipped to the United States or Europe so companies under emphasize the impact of cause other costs such as raw materials transportation and energy and are committed with long-term contacts.

So for example you want I do not know so I do not know comes from Brazil India and it goes to China now Japan so basically when I do not know them and said it has to be shipped and this ship has to travel over the seas for 10,000 tens of thousands of miles and which means that you are emitting lot of name gases so but what about the cost of cost of transport below although it has no cost at in India or Brazil but when it comes to term comes to China or the United States.

You have to add the transportation cost the cost of spoiling the environment and all that if we do all this then the cost advantage that you may have may disappear so most of the times the so-called outsourcing it has been the people who are looking at only the cost unit cost in the place

where they are buying it they are manufacturing it so for congratulations across the Pacific across the Pacific 17% of the I do not know of a China uses to make project.

Produce for America's so what I what China does is it actually imports I do not know and it makes products it got very few directors it can be automobiles it can be anything and they actually these products are all imported exported to the United States again so if you add up the incremental transport energy inventory expenses or such pride shipment China's labor cost advantage.

Disappears so you know which you yeah you know if you add up all the ecosystem cause then a transaction cost then it will disappear product is moving extra ten thousand miles without making any significant benefit either cost or quality so you are not shipping any value any product and while shipping also you are not making any value addition.

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So that is the kind of problem that you that people have in terms of the outsourcing many companies with the advent of the green initiatives the companies are thinking local what do you mean by this in leading electronic simply that used to make all its products in us we do not we are let U.S bond products in China is now moved more than half acts were to Mexico so basically transportation miles have fallen by eighty percent and in wet trees.

And supply chain risk or reduced so it need not have to be shipped I did not add a tile or time has reduced so the inventory on ships as well as the inventory that people have to creeper because of for the uncertainties in the travel times the standard deviation of the standard times there have all come down so more companies from Europe are sourcing from Turkey and nearest rather than from forest so there is a some kind of awakening in terms of the companies.

When you are doing JIT the name of efficiency then you are spending you are basically spending lot more on transportation which involves a GHG cases you are causing traffic congestion and when you are outsourcing in the name of low cost low cost acquiring low cost products from low-cost countries so you are actually spoiling the atmosphere by emitting GHG gases throw ships through the transportation and so on so that is the kind of this one that is happening more and more companies are favoring shorter supply chain markets.

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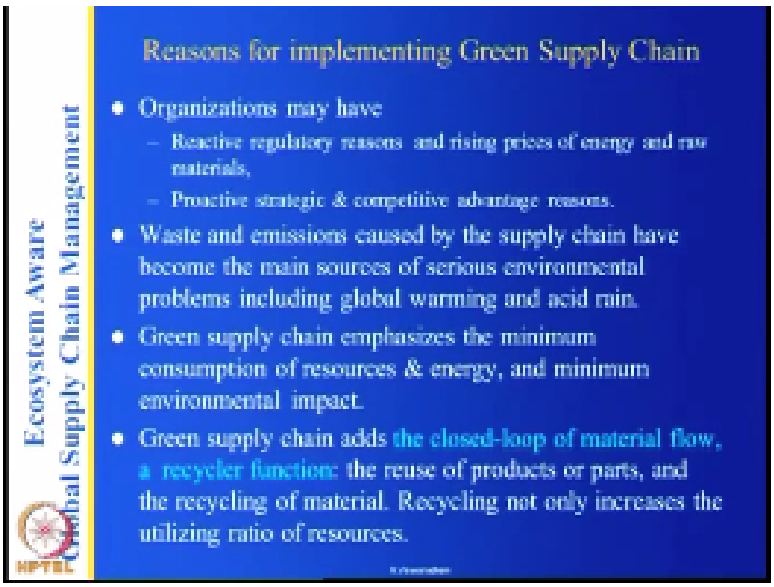

So why are you why are people implementing or the green supply chain organizations may have reactive regulatory regions in other words their or every country almost is regulating saying that what our products that are making has to be green whatever services they are providing have to be green and they calculate what is called a carbon footprint and their taxes what are called carbon tax and all that so there are regulatory resistance.

For the companies and raising prices of energy and raw materials so there are materials for example the resources like I do not know or cement clicker and all that they are increasing

because the whole time but the past century people have been using this and the resources have diminished so the price of energy and raw material increase so people want to reuse the materials and also our reduce or make the efficiency.

As much as possible and prior to strategy and competitive advantage reasons if you if you say that I am green and if you the products are green then you may have a competitive advantage because the customers sensitive customers to green may go for a green product rather than you know rather than other non green products so based on emissions caused by the supply chain have become the main source of serious and why dementia.

Problems including global warming and as the green supply chain emphasizes the minimum consumption of resources and energy and minimum environmental impact that is basically the fundamental thing use as little proposed resources are possible recycle as much of the product discarded product as possible and use have minimum environmental impact Green supply chain adds a closed loop of material or recycler function and the reuse of products or parts and the recycling of material recycling not only increases utilization ratio of resources it increases the recycling utilize utility ratio of resources.

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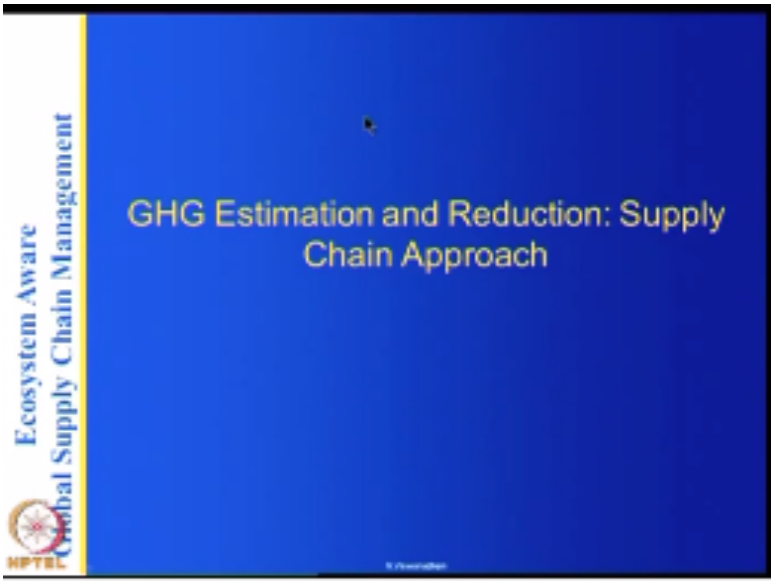

So how do you estimate GHD under estimation and reduction what is the supply chain approach.

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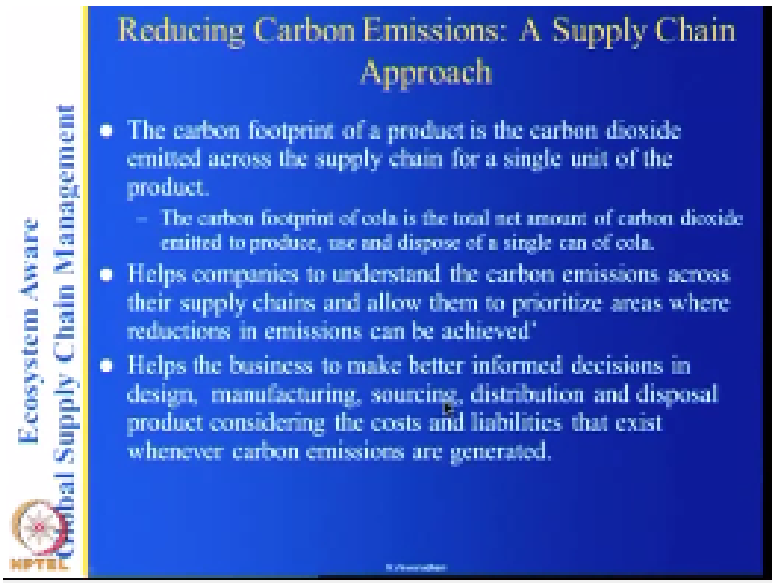

They are choosing carbon emissions the carbon footprint of a product is the carbon dioxide emitted across the supply chain for a single unit of the product so the carbon footprint of cola is the total amount of carbon dioxide emitted to produce use and dispose a single item of Cola so if you take a coca-cola you have to if you have an aluminum can how much is the carbon footprint. To produce the aluminum can how much is the this already liquid call a liquid this one how much is the for manufacturing how much is for storage in the refrigerator before you actually drink it how much is it for dispersing it off so if you add all this that will you get a footprint of Cola Tech's communities to and the carbon emissions across their supply chains so should map the carbon footprint then the it will understand the carbon emissions across.

The supplies allow them to prioritize areas where reduction in emissions can be achieved so if you look at the entire supply chain then there could be some areas where you can possibly reduce the carbon footprint supposing you are producing an automobile you are you are basically having a lot of automobile components supposing you procure all the automobile components from some other country then you know and then those companies are also green.

Then you are reducing the footprint while if you come by ship while bringing the material to this one then you are reducing the footprint so if you have manufacturing process is green or reducing their number of emissions and so on then the it is green so you can basically look at the

entire supply chain then you can see where your reductions are possible sometimes the reductions may not be possible supposing your electricity that is supplied.

To your factory is from a coal this one so the number the amount of emissions that for general use in a power it is called scope three editions emissions you cannot do anything with them so you have to basically find out the areas where you can reduce the helps the business to make better informed decisions in design manufacturing sourcing distribution and disposal of products considering the costs and liabilities that exist whatever carbon emissions are generated so basically you heard if you look take the supply chain approach then you basically have a better information.

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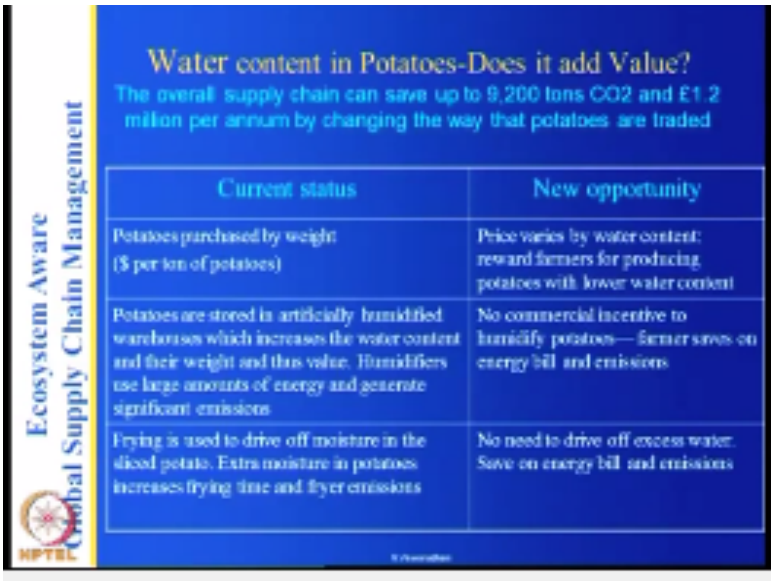

So let us take some more examples look at some examples supposing you look at what happened 10 did what I do that is it value there are other words if we take potatoes ordinary potatoes that you eat every day and there is a lot of water content in them because otherwise the potato gets dry and it gets sacked so it gets spoiled so potatoes purchased by weight that is what all of us do you buy either kilograms or pounds or whatever and it is dollars.

To a ton of potatoes but what happens is usually what letters are stored in humidified warehouses which increases the water content because the potato absorbs the water content and it increases the water content actually that water content actually increases the weight as a potato which the

farmers basically since it is sold by weight the farmers are happy about it because they get more money but what happens is when you are using.

The humidifiers large amounts of energy you are using large amounts of energy and you generate significant emissions now supposing you are using the potato to make fries so frying is used to drive off the moisture in a sliced potato so the extra moisture in potato increases frying time as well as frying emissions so if you look at the left-hand side the current status is that you have potatoes and if you want them the note a remind first you need to keep it.

Is called water content and water content is the one that that shows whether the potato is good or bad and humidified to keep the water content high and that means you are adding more emissions to the atmosphere and also while frying the potato to drive out the moisture you are again emitting extra gases GHG gases but supposing we have an opportunity so person pay price varies by the water content and while farmers.

Were producing potatoes with low water content in other words put them in humidifier atmosphere scriptum in temperatures find storage methods without human without amplifiers.

To basically keep the potatoes safe and good and no commercial incentive to humidify the potatoes and farmer saves energy bills and emissions and no need to drive off excess water and you are frying it say one energy bill and emissions so basically if you declare that low water content potatoes are high-quality potatoes and you reward the farmers accordingly then you are saving the gases so this is this is the an important example of a supply chain after the poor post harvest potatoes that you can see so he says the water supply chain can save up to ninety two hundred tons of co2 and 1.2 pound to two million pounds per annum by changing the way potatoes are traded.

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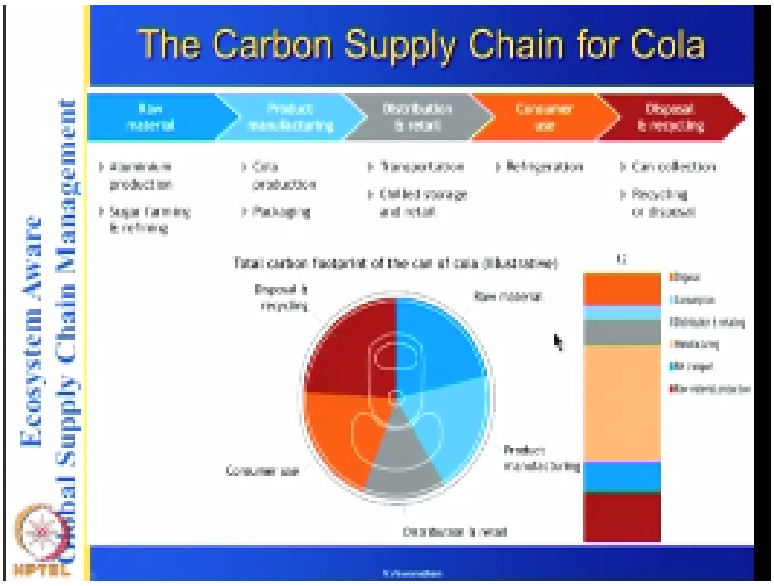

So let us look at the carbon content of a cola suppose I do have a Coca Cola but there are material is for the Coca Cola can this aluminum and you requires performing and refining that is the raw materials and you have the product manufacturing the kola production and packaging and distribution of the retail which is transportation and chilled storage and a consumer use you put it in the refrigerator and disposal is can collection recycling.

So if you look at the total carbon footprint for a kola then you will find that the raw material has this percentage and whereas distribution and retail it is consumer uses this and disposal and recycling is this so you ever think that you are basically disposing of you may say aluminum while recycling but you are spending the carbon so the total carbon content here is not only from the raw material and manufacturing it is also in distribution and retail and you can see the consumer use is more than distribution and detail because you keep it in the refrigerator to keep they took it the coca cola cold and also dispersal and recycling so here if you want to look at the percentages or the these are the kinds of percentages .

That you get in and so the if you look at here if you want to save on this you can ask people you need not have to refrigerate you save so much of this one if you are basically find a cheaper way of disposal and recycling you can save here and of course in manufacturing and distribution and all that there are some cut by amount of carbon printed that is unavoidable but there are some which you can avoid.

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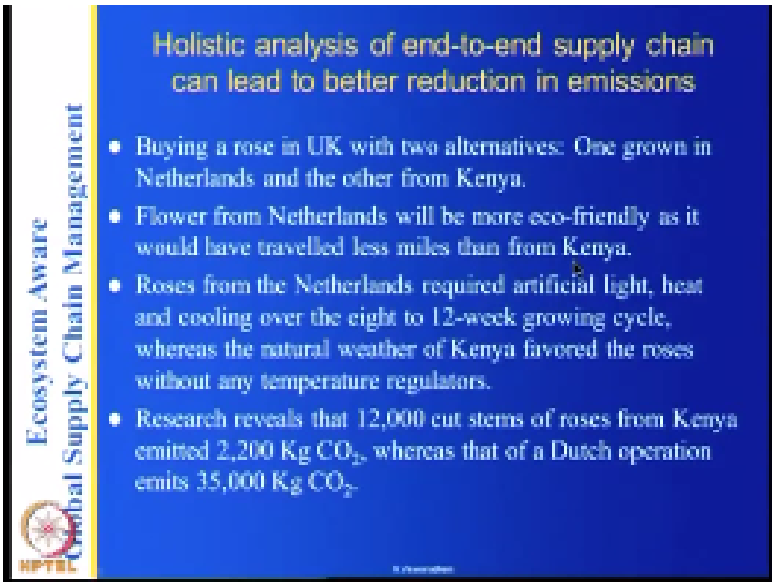

And also if you can we do the take analysis end to end and supply chain you may have better reduction of the emissions for example you are buying roses in UK there are two alternatives one grown in Netherlands or the other in Kenya so the if the popular belief is that the one flower from Netherlands will more economical eco-friendly as it would have traveled less miles than Kenya alright you are buying this all this business in UK.

So we made them ants roaches are more eco-friendly but if you look at if you look at the entire supply chain that if you look at the house roses are produced roses from Netherlands require artificial light heat and cooling for 8 to 12 week growing cycle whereas natural weather in Kenya favored the roaches without any temperature regulator so in Netherlands you have to keep it in or artificial this one you spend a lot of energy and increase.

Greenhouse gases of this so if you added all this research edibles that 12,000 cut stems of verses from Kenya emitted 2200 kg of co2 whereas that of touch operation image 35,000 kg of co2 so basically you know the kindness it is not just the transportation or the final distribution.

That you have to look at the manufacturing process if it is or always how it is produced and all that when you do all this it may be it may be that you may find that the table sorry was what you thought that because Netherlands is closer to UK so the market with more eco-friendly to get it from noise alert the new the Netherlands but Netherlands has because of soil conditions and all that it has to do you know artificial atmosphere which requires a lot of energy.

And similarly if you look at the refinished logistics in India it is they have the they have a need for an Orchestrator but they the situation is this in India the photo industry is clustered around it is in Chennai in South Mumbai in West and Jamshedpur in East and gorge in north and the demand is distributed across the entire nation so you have at the forks you have the production facilities and whereas you have the demand at the entire nation.

And so you can see there are producers of automobiles in the south and they sell cars to the north whereas their automobile prodigy producers or motorbikes producers in Gorgon which is Delhi but there they also market in the southwest in East and so on so dream collaborative logistics among OEM moving the finished vehicles from factories to retailers is possible now what happens is if you look at these are finished to make a logistics finish to make a logistics is very expensive .

That is because the vehicle takes ten days from north to south and it has to return empty so on the other hand suppose a while coming it does not carry anything because there is no collaborative logistics supposing while going it takes the vehicles from north to the south and while coming it picks up from southern manufacturers bring them to North the hell you are doing a good job of collaborative logistics.

So the truck carrying finished vehicles from a factory to the south to a retailer in the north of India usually returns empty the emissions and cost could be optimized if truck carries vehicles from a factory in north to the retailer and South in other words you they may do both ways by proper planning for example Indian railway network can be leveraged for national wide vehicle distribution with reduced emissions.

Because anyway we railroad is less nice more clean than the trucks so that so what the Indian finish to the vehicle logistics means is that it needs an Orchestrator an outside body who can basically look at the railways which can have they finished with logistics providers and it can use

an outsider who is an Orchestrator he deals with all the volumes for vehicle logistics there will be most economies of scale as well as it is green this one so basically.
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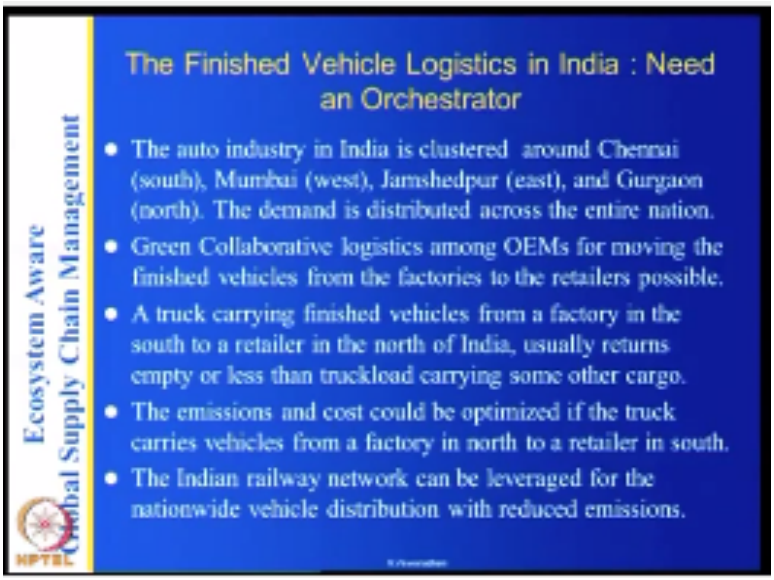

When you look at the entire logistics or the entire supply chains then you get lot of advantages in terms of this one so hastily there then you are talking of the supply chain this one then you have talked of three scoops of GHG protocol they say JG stands for here.

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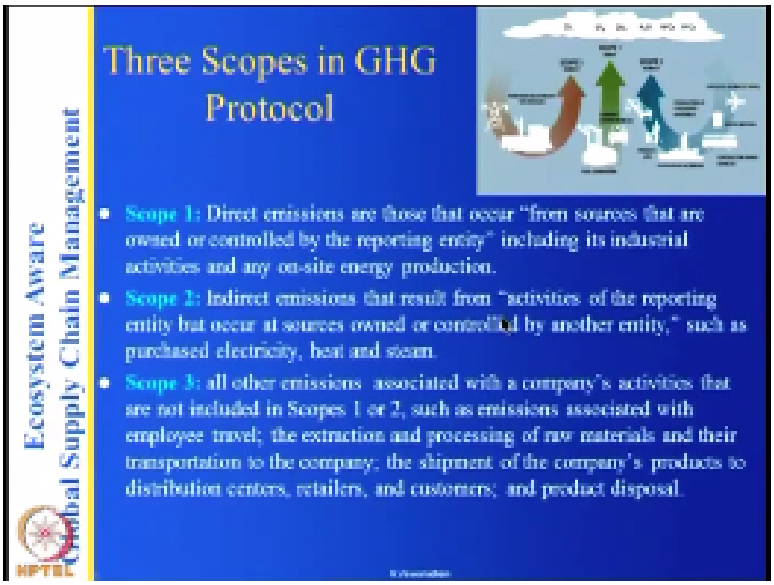

Now here you have you have the three things here the three scopes of HD gases so you have your own scope one that is this is your factory and you produce all these gases ch4 and sulfur. Carbon dioxide and all that now when you have the electricity the power that generates for your factory that is coke do in other words you may not generate this electricity but it could be somebody else who is supplying power for you if it is coal-fired or it is hydrolytic solar whatever it is it has some GHU gases associated with it so that is called scope and scope 3 yes the rest in other words in the supply chain.

You have suppliers who have basically the GHG gases in their production process they supplied to you through to either trucks or train or you know whatever then their GHU guess is associated with that and so on so you have three scopes you are on this one then your power GHG gases and the ones for the rest of your supply chain direct emissions are those that occur from sources not our world are controlled by the reporting entity including the industrial activities or any outside on-site energy production.

In other words if you are having your own power plant then that comes under scope one if you look at Scott - there are indirect emissions that result from activities of a reporting entity but occur at sources warned are controlled by another entity in other words the reporting entity that occur the emissions that result from activities of the reporting entity but occur at sources wound are controlled by another such as purchase relic city heat or steam and so on.

And who has to go through this one or all other emissions associated with company's activities that are not included in scopes one and two such as emissions associated with employee travel extraction and processing of raw materials and their transportation to the company the shipment of company's products to distribution centers retailers customers and product disposal so this is called three includes all others.

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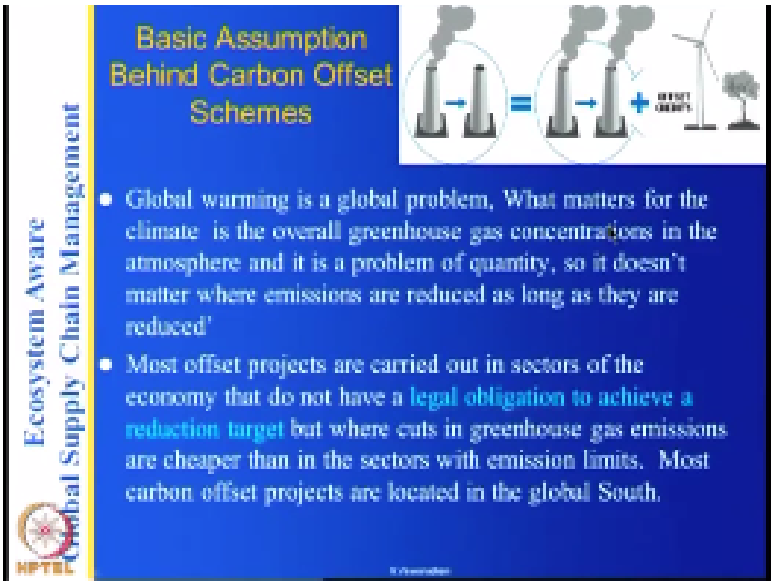

So basically people talk about scope one their own and they say talk about their carbon emissions but it is important one looks at all the scopes one two three so the basic assumption behind carbon there what are called carbon offset schemes what are carbon offset schemes supposing you are generating carbon and there is somebody else which is generating the carbon you are generating this carbon you are set it by having a solar plant or a windmill.

Then you know as much as this is removed from your carbon footprint in other words whatever you are saving because of this solar energy or because of the wind windmills whatever is energy is removed from you and that is calculated as your carbon GHG carbon footprint so your own carbon footprint plus ever you have created to avoid the carbon footprint indirectly through other energy sources that these actually removed.

It is offset and this will becomes your carbon footprint so let us look at it global warming is a global problem what is the idea here in other words you can basically produce all these gases say in one country you can have a solar or a windmill in another country but so but still it is all calculated as for this formula so global warming is a global problem what matters how the climate is warming all greenhouse concentrations in the atmosphere and it.

Is a problem of quantity so it does not matter where emissions are reduced as long as they are reduced so in other words you can be have this plant in India polluting in India and this you can have in Antarctica and then also you get this benefits so it looks strange but that is what it is so

this is what is called carbon offsets so most offset projects are turned out in sectors of the economy that do not have legal obligation to achieve a reduction target but their cuts in greenhouse gas emissions are cheaper than in sectors where emission limits with emission limits most carbon offset projects are located in global South in other words how most of these offset projects are located in global South.

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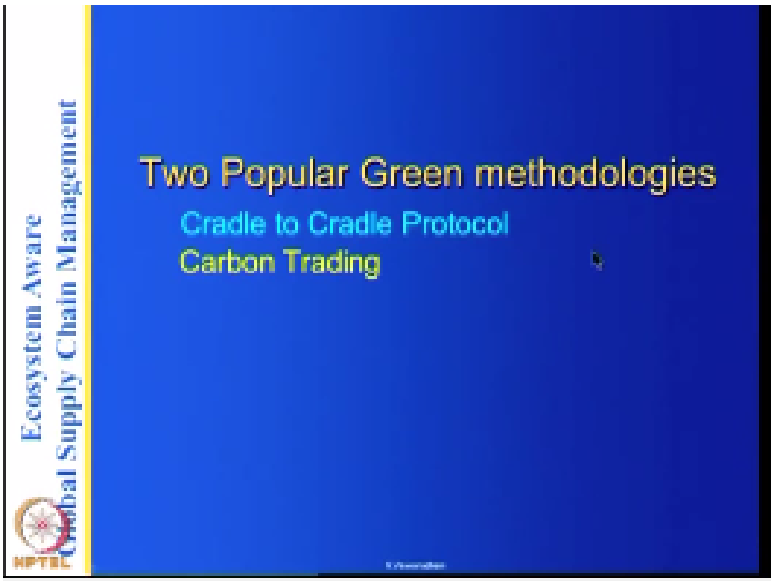

So if they have two popular methodologies for the clean methodologies one is what is called a cradle to cradle protocol that means from birth to death to rebirth and another one is the carbon trading.

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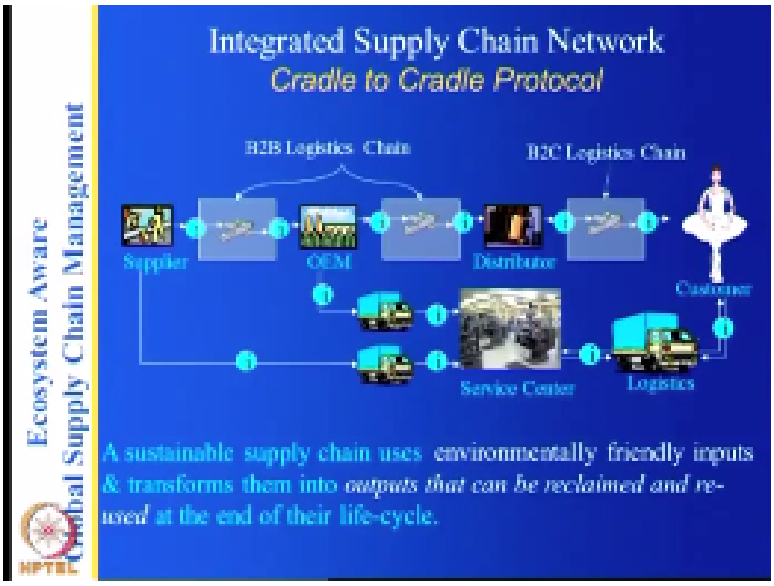

So let us look at this one if you look at the supply chain here it starts with suppliers and there are why I am over you know equipment manufacturers there is a b2b logistics that happens between them and you have distributors and logistics associated with this and you have retailers and customers and so on there is b2c logistics here business to customer logistics chain.

So the logistics are different but everything has the carbon footprint so our suppliers our carbon footprint logistics have carbon footprint you know I am sell carbon footprint and so on so this is what is called the forward supply chain so you have this forward supply chain and whenever the customer has disposes this or he has a repair to be done it goes to what is called a service center and service center gets the spare parts from the suppliers and manufacturers and services.

This product and it gives back to the supplier to the customer now this service center could be treated as a refurbishing station where it collects all the disposed of items and it can do refurbishing or it could do disposal and so on so basically this is a cradle to cradle protocol in the sense that you are producing designing and producing something and using all these materials back again into this is called remanufacturing and so on.

So the sustainable supply chain uses environmentally friendly inputs and transforms them into outputs that can be reclaimed and reused at the end of their life cycle so first of all there are two points here the first point is you have this forward supply chain and when you displace it off you give it and then use the use it for the material it does that is one point recycling the second point is you make your you have to design this product so that as much of material that you have used

is reclaim herbal so that is the fundamental problem here in other words your green design is not ordinary decide the in design has to be designed in such a fashion such most of the material that he have used the list you can reclaim it so then it becomes a cradle-to-cradle protocol.

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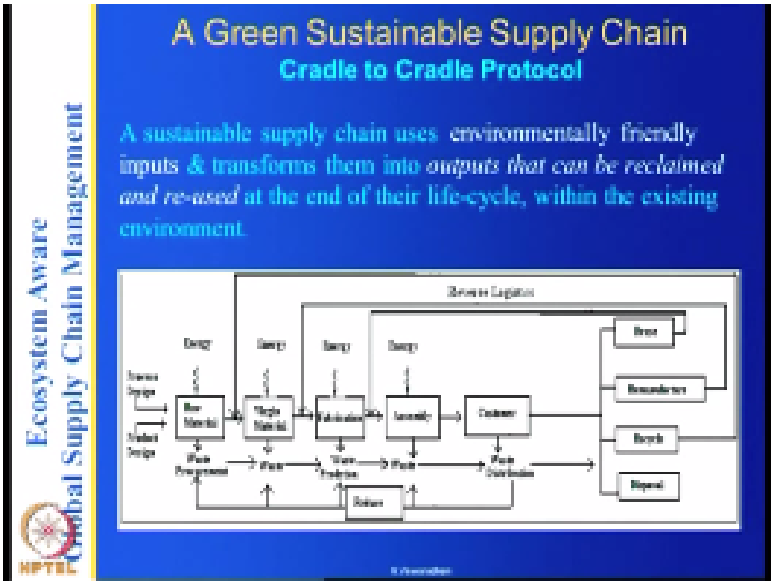

So you have a cradle-to-cradle protocol here which is a sustainable supply chain use as environmentally friendly inputs and transforms them into outputs that can be reclaimed.

And reused at the end of their life cycle without existing within the existing environment so if you look at this one you have the raw material you had a virgin material you have fabrication assembly customer and what happens here is the whatever comes at the waste in other words as you are using the raw material you convert it to a product there is a waste and similarly in the virtual material based fabrication there is the waste assembly there is the waste and so on.

All this you try to reduce the waste in other words make your products as efficiently as possible so that you reduce the waste this waste could be the inspection if you are making products which are not good then you know they have to be dismantled and then during the inspection and also you are using the energy here in all these processes you have to minimize the amount of energy that you use and there is the process design.

There is the product design now products are to be designed so that you are proud of your then whatever you get out of this can be reused remanufactured recycled and when you disposal so in

other words you want to minimize the amount of disposal the amount of useless material you want to use as much as possible but this so that after the reuse it goes back to the suddenly after re fabrication it goes back to this one after recycling it.

Goes back to the you know they do this materials so you will have the raw material plus this recycled material which gets into the factory here so the point here is that you have what is called the b2b b2c logistics but there is what is called reverse logistics the reverse logistics is the one that you use the recycling and remanufacturing and reusing and all this and so on so basically it greens a green sustainable supply chain to Cradle to Cradle protocol and in sort of environmentally friendly and transforms inputs into outputs that can be reclaimed and reused so that becomes a part of the design and it is also called the cradle to cradle protocol so what we will do is we will continue this lecture there thank you.

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