Sustainable Transportation Systems
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Lecture 38
Concept of Circular Economy

Hello friends. So, up to now you have concepts regarding EIA, LCA or MFA like material flow analysis. Those kind of tools, techniques you have studied. So, you can easily use those techniques to learn about different kind of projects associated with transportation infrastructure or transportation sector in fact you can apply those techniques to any kind of industrial activity or any kind of man made activity to learn whether it is impacting the environment in positive or negative manner or what kind of resources, it is resource intensive or resource efficient, energy intensive or energy efficient, those kind of conclusions are can easily be drawn by those techniques.

So, in that series, today we will discuss about the concept of circular economy. Because the present way of economic development is giving those kind of side effects which require us to study through MFA or LCA or EIA to learn about their possible negative impacts and how to mitigate those negative impacts.

But in total economic development if you look from philosophical perspective that in what direction our economic development is going on, and what can be done to make it more holistic or more environment friendly. So, for that today we will discuss about circular economy related concepts.

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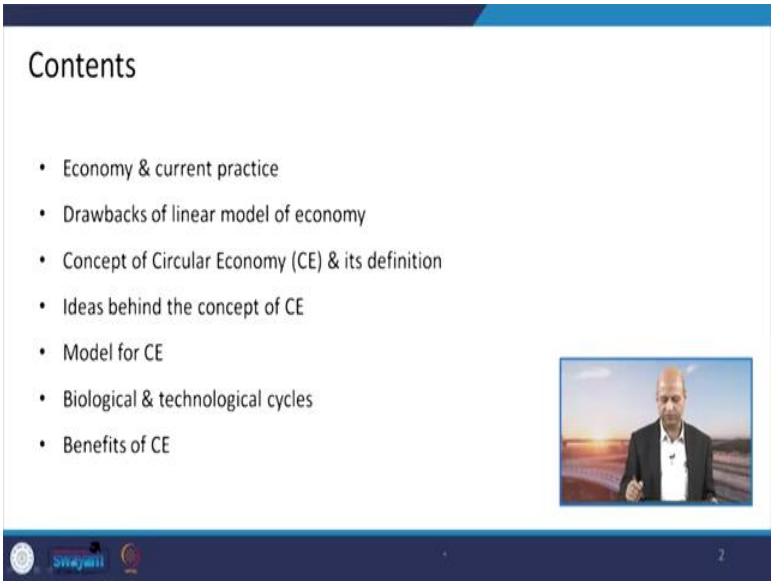

So, today's lecture is having these contents like we will discuss briefly about the economy and the current practices related to the economic sector and then what are the drawbacks of the linear models of economy, means a certain way of economic development is going on that is known as linear economic development from one point to another, like one direction, it is not circular.

Circular means it is coming back to where it started like in LCA you have seen cradle to cradle concept. So, that is not the case, but linear economic model is going from one point to another one. Concept of circular economy, then we have to see in terms of its definition, in terms of its concepts, conceptual understanding and then the ideas which are propagating this concept of circular economy and different kind of models which represent the circular economy.

And then we will also see like biological and technological cycles that depict the circular economy, concept and then some natural phenomenon from which we can learn some lessons. And then benefits of circular economy and ultimately, we will conclude it.

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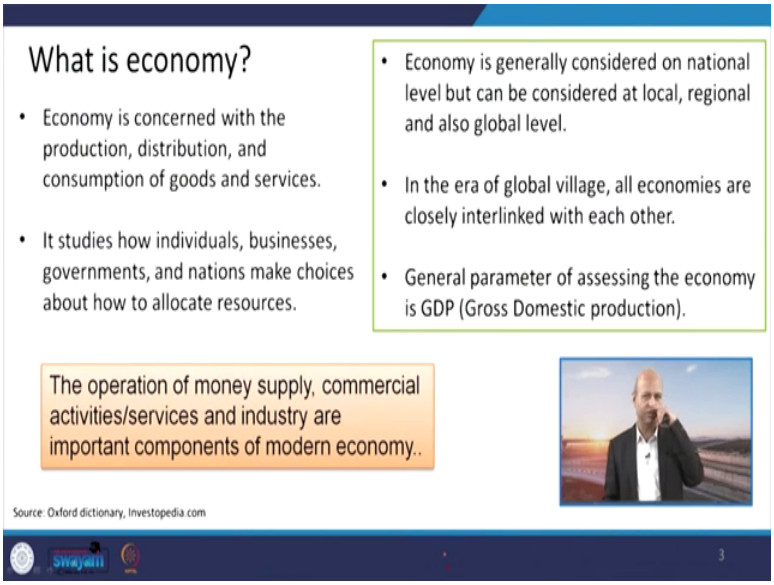

So, when we talk about economy what is economy basically? Every kind of activities whatever we indulge in, where we deal with some sort of goods or services or resources whether we are producing some goods or we are transporting some goods, or we are exchanging our services then we are talking about basically economy or we are doing some economic activity.

So, in general it is considered as a national level related economic activity or it can be local based economic activity or regional or at the global level, like nowadays we have WTO, World Trade Organization that looks after different economic related issues.

And then in this era of globalization or the global village which sometimes we call it, then all the economic activities are interrelated with each other. All the economies developing or developed economics they are closely interlinked with each other. They exchange some sort of goods or import and export kind of things are there, whether it is services or people or products or so many things.

So, when we talk about this measuring the economy then this concept which is very popular in terms of national economy that is GDP, gross domestic production, although there are other concepts also, which are emerging to depict the complete development which is known as like gross environmental products or environment services or how much we are caring for the environment.

Some people also nowadays talk about happiness in that, so there are many ways of looking at the situation or condition of an economy or of a country. But what we study as an individual or in a business activity or as an industry like whether it is government, any organization per say, means not only the individual but any organization, any association from very small unit to complex units like governments, etc.

So, we make choices about resources, we allot resources for one activity or another. So, all those kind of activities are basically economic activities and in modern economy, the money supply, commercial activities or industrial services, products, etc., they are the most important components of modern economy.

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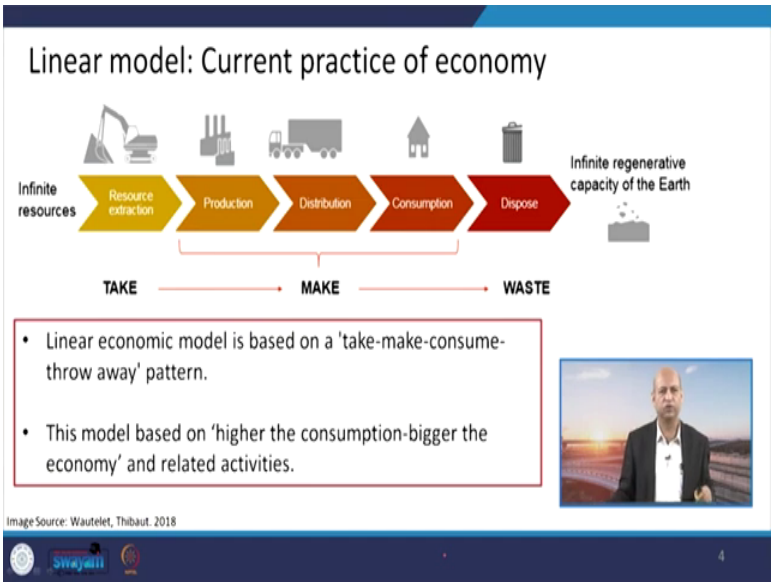

When we see the economic activities basically it reflects like it is a linear kind of action from, like we feel, means this particular economic model, which we are dealing with, it looks like there are infinite resources and we can extract any kind like, we can mine and we can take resources for n number of times.

This is the basic underlying assumption as if, it looks like that. So, we extract the resources and then we produce some sort of products, then we distribute wherever demand is there and then we consume it, whether food items, whether other materialistic related things and then after the usage, then there is waste so we dispose it off.

And this is kind of like, this earth planet is having infinite regress, this regenerative capacity where we can dispose of all kind of waste, so this is the linear model from A point to this B point, which is basically causing us several problems which we will look into in subsequent slides. So, this linear economic model, which is prevalent at present or which is very popular or according to which we are behaving whether at a very small unit of the village level or very complex unit of the national governments or international exchanges of goods and services.

Basically, this is the linear economic model, which works on like take, make and consume and throw away pattern. You just use and then throw away, so much solid waste is generated because of this economic model and that is why there are issues basically. Now thought leaders are thinking about it, whether this economic model is sustainable or not.

So, this model is basically based on consumption, higher consumption bigger the economy. So, you produce lot of things, you consume them, then economic activity is increasing and economic growth is there, this is the underlying assumption, which is really creating lot of problems which we will see.

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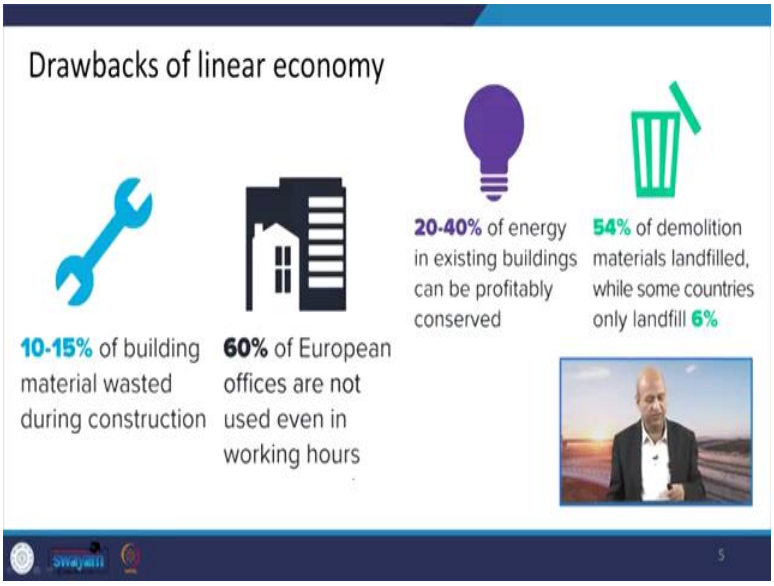

So, the drawbacks of the linear economy is like 10 % to 15 % of building material is wasted during construction, because we do not think in holistic or integrated way, we think that okay these activities are going on, so our economy is increasing, because we are, more products we use or we throw away, then we buy new things, then economy is increasing.

GDP may increase, but its effects on the environment, on other things of the society which we are not looking at, those effects may be very disastrous in longer term, when we are wasting 10 % to 15 % of the building material, so that means we are extracting a lot of virgin resources. We are mining the fresh resources so we are damaging our natural resources you can say.

Then 60 % of European offices are not used even during working hours. See the effect of this, means you are constructing so much space just to boost the economy but they are underutilized. So, that is not the good basically. If you think in terms of optimization of the resources, optimization of the energy and space, this is not the good way to look, to work at.

20 % to 40 % of energy in existing buildings can be, means profitably conserved that means over consumption of energy is there. There is no need but we are using those kind of energy devices or lights or so many things. Which are not needed that means we are wasting energy.

So, whenever we are wasting some resource or energy, we are basically pressurizing the resource excavation or mining or usage of those resources. 54 % of demolition of materials are landfilled and in some countries, it is only 6 %, depending upon what kind of economic models they are following and what kind of stage of economic development they are having. But 54 % demolished material if we are going, taking them to landfill sites, so again this is not the right way. Means, may be those kind of things could be some other resource, that is the concept basically which we will see in this circular economy.

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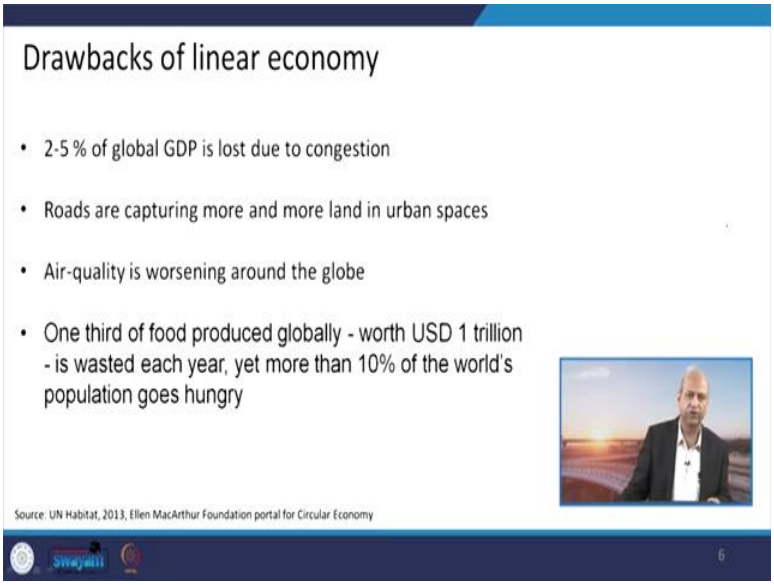

So, when we continue to see the drawbacks of linear economy, so you can see like 2 % to 5 % of global GDP is lost due to congestion of traffic. See this is a huge amount if you calculate in terms of money. When we are wasting so much fuels and we are inhaling so much polluted air that is again taking us to hospitals or diseases, so many things are there, so if you convert them into monetary terms, it is a huge loss.

So, congestion, this is related to our transportation system. So, that is a negative part if we talk about sustainability, this is not something which is making us sustainable. We have to remove these kind of problems. Then roads are capturing more and more land in urban areas, urban spaces.

Because we are having more private vehicles. If we can promote public transportation, reliable, and comfortable, and we can get rid of privately owned vehicles then may be we do not need so much land which is going towards road manufacturing, road construction and maintenance of those things.

Air quality is worsening because of these fossil fuel usage and the emissions as you know, greenhouse gasses or air pollutants and one third of the food produced globally worth, this is U.S. dollar of 1 trillion, it is wasted. There are, these are the resources where you can see these are the estimated figures, so this much of amount is wasted each year of this food produced, and which is more than 10 percent of the world's population, goes hungry.

Means on one hand we are wasting a lot of food, on the other hand there is population, sizable population which is going hungry. So, that is not the right way. This is not the inclusive or humanitarian way of looking at the things.

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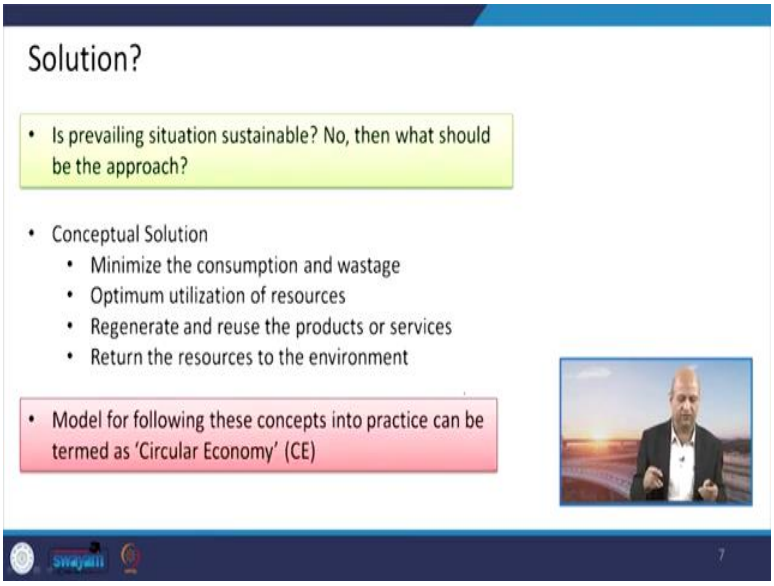

Now, if we look at this problem and the solutions. So, what are the solutions, whether this prevailing situation will continue or it is sustainable? If it is not sustainable then what are the options, what are different approaches, which way we can look at. So, the conceptual solution if we talk about then we should go towards those kind of activities, those kind of models of the development, which minimized the consumption of resources and production of wastage is also minimized. Very less amount of wastage should be there, and we consume less of the resources.

And then optimization of utilization of resources, means the wasteful way of life is not good, rather we should optimize and that is why in several countries nowadays some ideological movements are going on, minimalistic lifestyle, means we should not have so much things. There are studies that if we own many things our stress level increases because of managing those many things.

So, if simple life is there, which is the part of our ancient philosophy. Simple life, if we are leading then it is good for the environment, for the nature and for the society as well. Then the regenerate and reuse of the products or services, that kind of model, means the reuse of the

services or reuse of the products may be there, you may recall then although these are linked with the poor segment of the population.

But sometimes we are using, like our elder brother's clothes we are using. Some people will laugh in the cities, but in village level it is common. So, means if we are using those kind of resources for longer time, that means we are stressing less, the environmental resources.

So, that kind of life means reutilization of many things up to, its life span should be good. Otherwise, what happens if consumer society is there that consumer orientation is there, even if my mobile phone is working fine, I will go for another model. We are just discarding it, buying a new one.

So, okay this can contribute in economic growth, GDP, in present model, but it is really harming the environment, because whenever we are buying new things, we are also going towards this more consumption of the resources, more extraction of the resources. So, everything is interlinked to each other.

Then if you want to return the resources to the environment in terms of waste, so there is the way, like maybe in the form of, which can be assimilated in the environment. If we are discarding something which can be consumed or which can be degraded easily then it can be assimilated in the environmental components. So, those kind of state can be attained.

And then this model which follows all these concepts are basically practiced in new, this emergence of new concept is coming, so that is known as the circular economy, because we are starting from nature, taking something, using it and giving back to the nature in such a form, which can be assimilated by nature, ultimately. Means it should not be a kind of waste which is not used properly or it is causing more stress to the environmental components.

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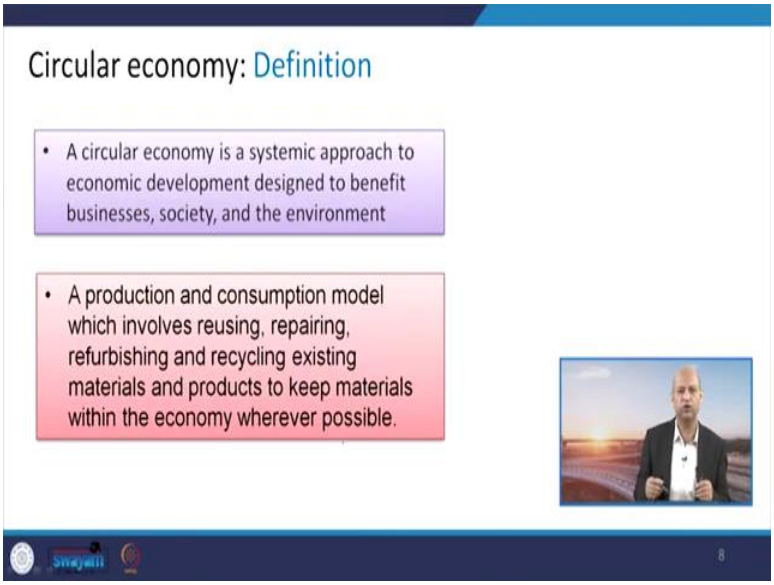

So, that way we are shifting our attention from this linear model of the economic development to the circular economy, linear economy to the circular economy. And the circular economy is defined when we talk about conceptual thing, then it is defined as systemic approach. Systemic, means as a system, all parts of the system are interlinked. Our body is a system.

So, if something happens to hand, our whole body is affected. So, that kind of systemic approach is there, so that organic unit or that systemic approach is there in the circular economy, and this also benefits all components like business, society or the environment. No segment of this whole system is harmed. So, that is the philosophy behind circular economy.

And then the production and consumption, so those are again involved in reusing, repairing, refurbishing or recycling, so four R's, even you can add more like reduction of the resources, reduce, recycle, those kind of things are there, like in solid waste management you might be hearing those very fancy R's.

So, here also like reusing something or if something is going in a wrong direction then again, we can put some repairing kind of thing and make it workable. Refurbishing and recycling of existing materials. Then products of the material or this economy, wherever it is possible we go for those kind of concepts. Whether reduce, recycle, repair and reused, those kind of philosophy, must be there. So, that it can attain its complete life and it is not discarded half utilized. So, that we can use it up to the optimum level.

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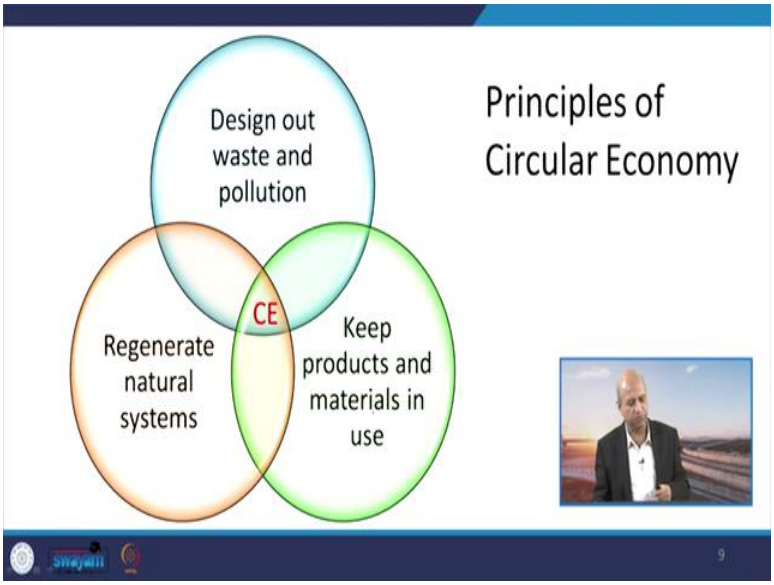

So, the principles of circular economy basically is depicted in this pictorial representation like the design part, the design should be like to make out the waste and pollution. It should be reduced, the design may be like, suppose you are designing a computer, so the dismantling of computer must be very easy, and whatever parts are there of that computer must be in the position to re-utilize in other things.

So, those kind of things, like car you are building, so design must be in such a way that you can dismantle is properly and various parts can be used for other purposes also. So, regenerate the natural systems, that should be there, key production materials in use for longer period. So, all these three components if they are meeting then this is the circular economy. All these three requirements are integrated then this is the circular economy basically.

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So, the conceptual diagram of circular economy. So, design, we should start from design stage only and then production of re-manufacturing. So, something which is discarded that should come here as resource to produce something else. Distribution, then consumption, use, reuse, repair, so more, for more time, collection in environment friendly manner. Recycling, so it should be recycled rather than discarded as the waste. So, that as I said means we do not need the fresh material for utilization of other services.

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The features of the circular economy, basically when we talk so it is like regenerative or restorative and then as an economic activity it builds and rebuilds the overall system health. So, a lot of, you can say it has this kind of traits or features resilience kind of a thing is also a part of this, and then those, the wastes which are produced, they are used as a resource.

There is nothing waste, means I remember one anecdote, in ancient university, one acharya or professor asked the student when he or she was graduating, that go and see and bring some plant which is kind of, without any use, which does not have any kind of use. So, student came back after several months, he roamed around but he did not find any plant which is not having any kind of use.

So, those kind of things, means in this nature everything has its use or value and there is nothing which is waste. So, in that conceptual understanding the waste also which we call, it should be a kind of resource for other things, other manufacturing things. So, consequently, we are minimizing the actual amount of the waste.

The concept of recognizing and importance of the economy like needing for the effective work at different skills whether big or small and business or education or all kind of sectors where we can interrelate all these aspects which are like waste reduction and minimum utilization of resources and maximum span for the utility of any kind of product must be there.

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So, when we compare this linear economy to circular economy through a picture, so linear economy basically, what it says, take, make and dispose. And this is like make, use and return. It is not like you are disposing, you are returning to some segment where it will be used or may consume and enrich, so whatever component of the ecosystem you are relating, that ecosystem must be enriched by that so called waste, because we will not call that waste in circular economy. We will call it another resource. Some resource.

For example, if you talk about power plant, school based power plants, so lot of fliers is there, so that is waste if you consider only this power plant related picture, but if you have another industry nearby which are manufacturing like bricks, etc., so that can be a resource for that. So, that way we have to think in that direction.

But in linear economy this is just the waste. So, you are just, natural resources extracting, taking away, making something and then disposing after usage. So, this is the pictorial representation of linear economy and circular economy. In circular economy, things rooted from one stage to another and they get utilized at several occasions.

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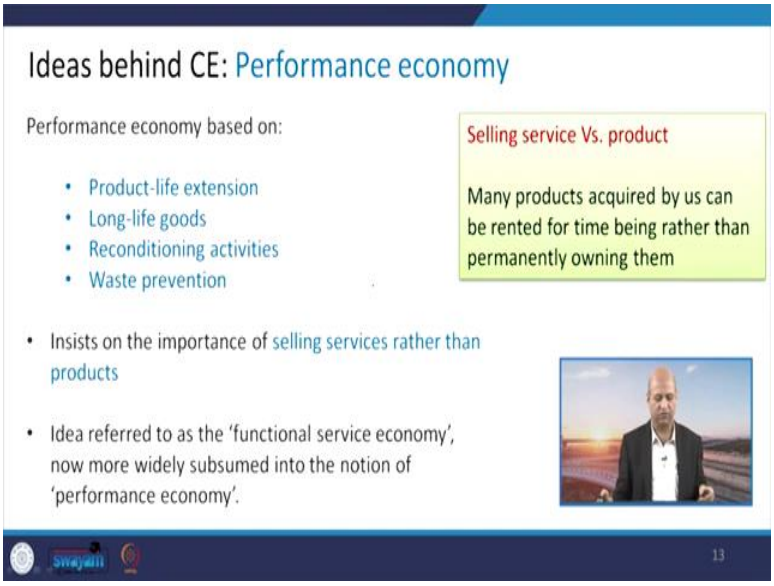

When we talk about this circular economy we also talk about performance of the economy, because the linear economy is a wasteful economy in reality. It is not performing in environment friendly manner. So, the performance economy is based on product life extension, it extends the life of the product, we used it for more life.

Long life goods and reconditioning of the activities that means at the design stage only you produce things like there is some advertisement of some tiles or something that "Dada kharide pota barte", so those kind of long-life kind of things may be there when you are designing that kind of concept, you can see.

And selling services versus the product, means it is not that you are just selling and you are forgetting, but some responsible industries, they are not only selling but they are buying back, because they know if it is disposed of mindlessly it will harm the environment. So, they take it back and maybe they use it for some purpose or as a resource for some other products, etc.

And then the waste prevention. So, we should prevent the waste, so those kind of policies should be there in industry as well as in service sector. So, selling service rather than products. So, that kind of insisting is there, importance of selling service, means it is a service, it is not just product sell and then wastage is created but it is integrated from service point of view.

Then functional service economy, then performance economy. So, when we are talking about linear economy we just talk okay this is, this product will serve you for 10 years or five years or something like that, then it is waste, but here, in performance economy, means performance may reduce and maybe it can be given to other stage, for example you are using a computer and after five years you find that that computer is not meeting your demand because you need more computational capacity, etc., and you just discard it.

Now it is a waste product, but in circular economy this is not the waste product. You can give it to some village school where it can be used. There they do not need such high computational capacity. So, that kind of things, reuses of products can be there.

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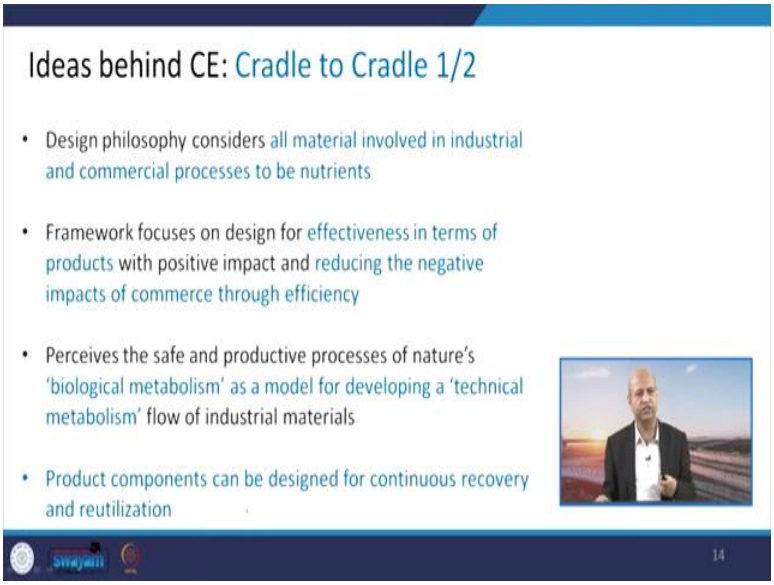

Then ideas behind circular economy also cradle to cradle, as you remember in LCA we talked about several like gate to gate or gate to this grave or cradle to grave or cradle to cradle, so this is circular economy, it is basically cradle to cradle. So, from we start like this processes and whatever thing like nutrients, so anything which comes, biological products, et cetera. So, it can be nutrient for another thing. Kind of organic waste you can say. So, this can be used as the nutrient.

So, even in technology also, as I said this computer, which was not fit for your usage, it can be nutrient in the school, so that philosophical outlook must be there, means it can be utilized, it can make better healthy system at the school level. So, biological metabolism, those kind of things and technical metabolism, these mimicry of biological systems to technological systems we can look at. So, perspectives must be there. So, nature centric or eco-centric kind of development we have to go through, this circular economy.

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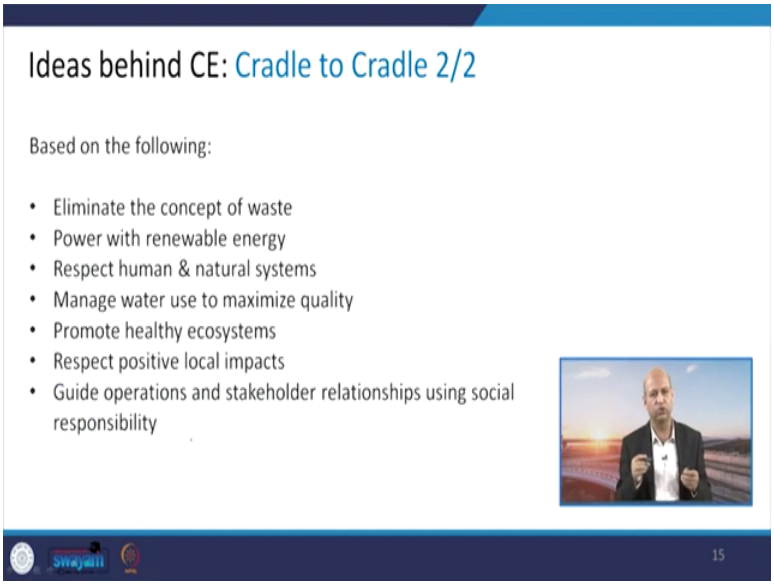

So, the cradle to cradle is basically based on eliminating the concept of waste, because we do not recognize anything as the waste, we say that it is resource for something else. If you do not know that is our limitation of the knowledge, otherwise everything is utilized for something else.

Power with renewable energy, so energy resources if we are having from fossil fuels, if we can shift towards renewable energy then it is the boosting like circular economy, because natural resources go for like wind or solar, they are cyclic in nature.

Then you can manage water and the quality and healthy eco-system or positive local impacts and guiding the operations and stakeholder's relationships as a social responsibility. It is not that I just sold one product and I forgot it, no, the responsibility goes beyond that, and we take care of anything, if there is repair is needed, we can repair it timely so that this carry-on functioning as per the utilization goals.

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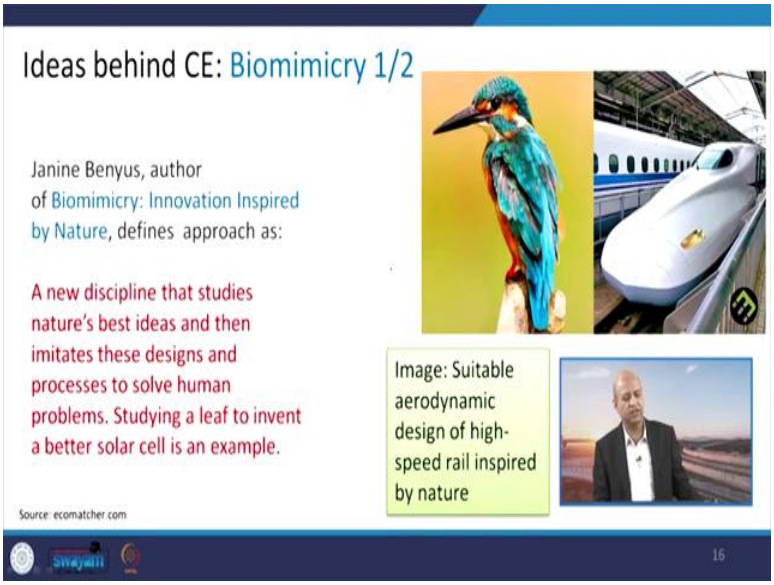

Also like as I said bio-mimicry, so there are new concepts of bio-mimicry, means you look at whatever different kind of habitat is there, animal's kingdom or in water flowing all those, fish, et cetera, you look at and see their aerodynamic designs so accordingly you can also implement those designs in our products of transportation. So, even like, perhaps many of you do not know but in Rajasthan airplanes are termed in local language as "Cheel-gadi" so what is "Cheel"?

Basically, like eagle, so the cart like eagle, so those kind of concept when visualization is there, you can think about those design aspects from the nature you can implement them as the products of our usage, daily usage.

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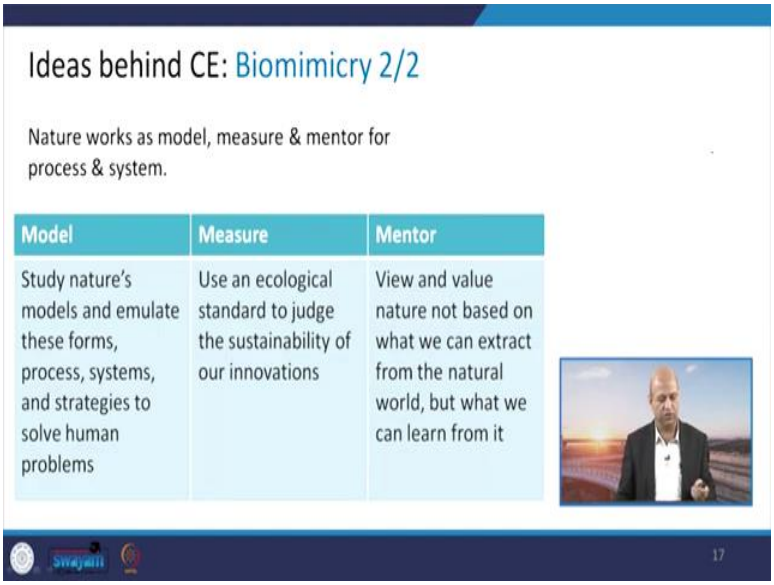

And then you can see like modeling stage and measurements in the ecological as the standards, et cetera, and then mentoring also. So, all these three components are interrelated to each other.

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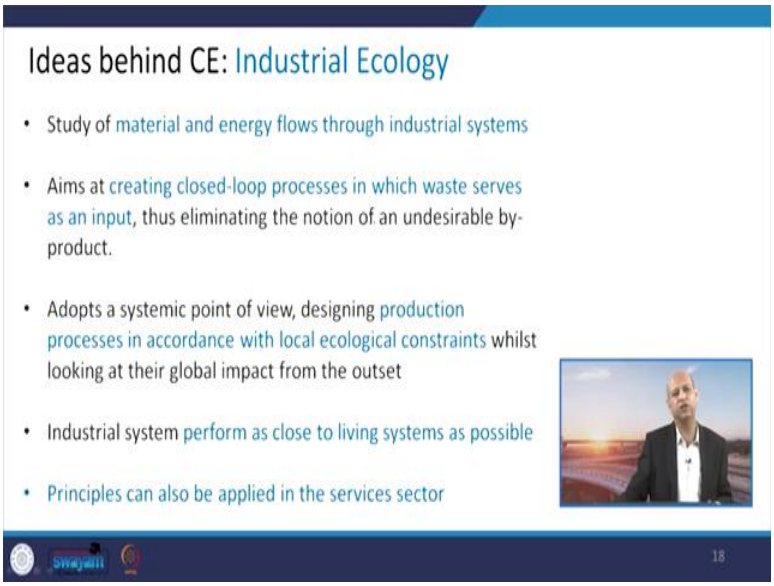

When we talk about industrial ecology, so basically this is also a part of circular economy when industrial ecology talks about like taking, as I said a power plant is there, have another plant for brick manufacturing, tile manufacturing, so use that waste of the power plant, that fly ash for manufacturing of the bricks. So, those kind of concepts in industrial ecology people use, in Denmark it has been used very successfully.

So, you have different industries where one waste product of industry becomes resource for another industry. So, those kind of concepts are coming these days very much and people are liking it.

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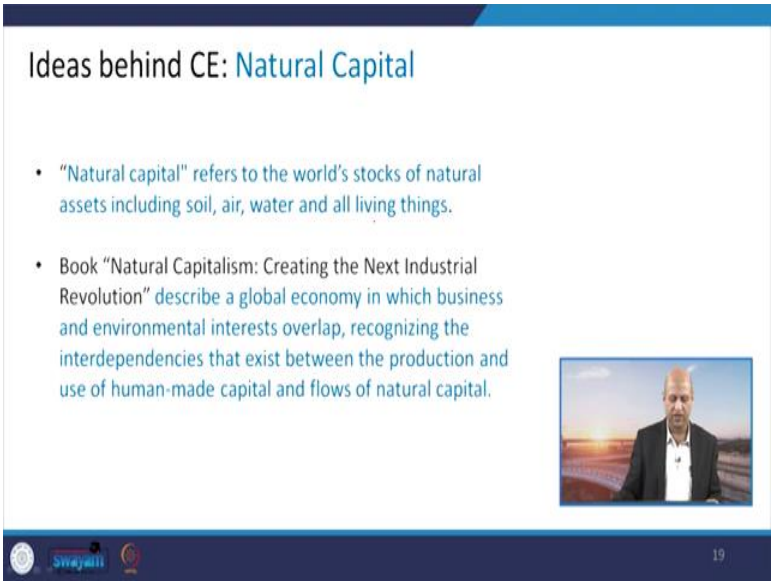

Natural capital, means nature is, like in ancient philosophy we call it "Mother Nature", but even if you talk about capital so natural capital must be referred, it is not just like you got something and you used and wasted. It refers to the world's stock, so natural assets like soil, air water, all these things have some value, it is not free, we have this misunderstanding that we can pollute air like anything, infinite capacity of atmosphere is there, it is not like that, which is not reflected in terms of climate change or polluted airs.

So, this natural capital has to be respected properly and that way this creating next industrial revolution is from this point of view of giving value to the natural capital and respecting it, so that we do not pollute something which is not free, it has some value, and we should respect that. That is why some people talk about like environmental tax. When environment is valuable and somebody is polluting it, so they should pay to clean it. So, those kind of concepts are coming up.

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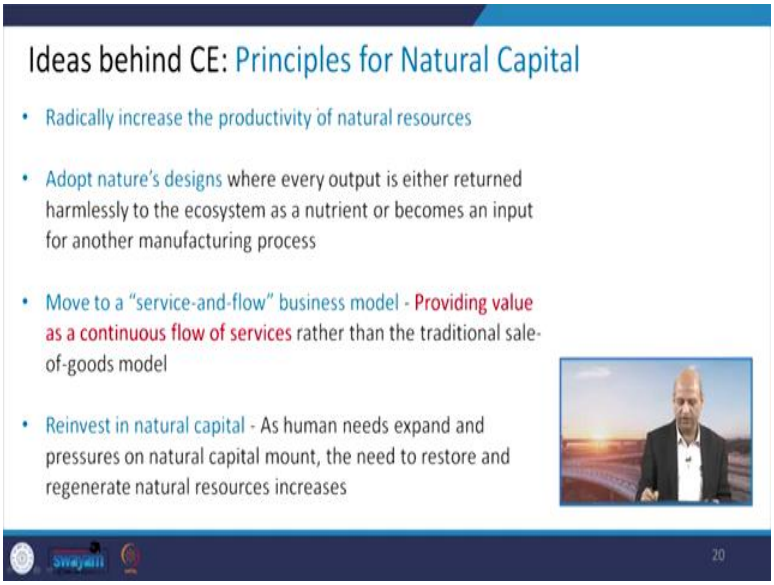

Then the principles of natural capital is basically like providing value as a continuous flow of service, mean any resource when we attach something value, then it becomes valuable resource, okay, otherwise it is there, it is lying there, if we are not finding some usage. But when we are attaching some value so that is why all assets of the nature is valuable because it can be used for one or the other purpose. So, that concept has to be taken into our mind.

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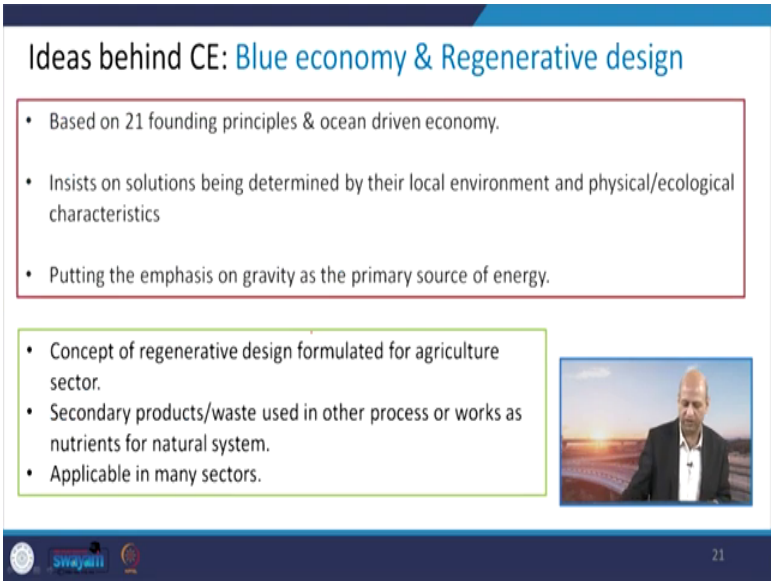

Then there are also some suggestions from different kind of thought leaders like blue economy and regenerative designs. They say that may be we should mine or like in sea, et cetera, there are,

a lot of resources are there, even food related things or whatever, there are so many things which can be taken from the sea. So, those, the shift of the land to sea may be there. Those kind of philosophies are coming up, and it can be regenerative because of the tidal waves, et cetera, that can be used to the resources of the energy.

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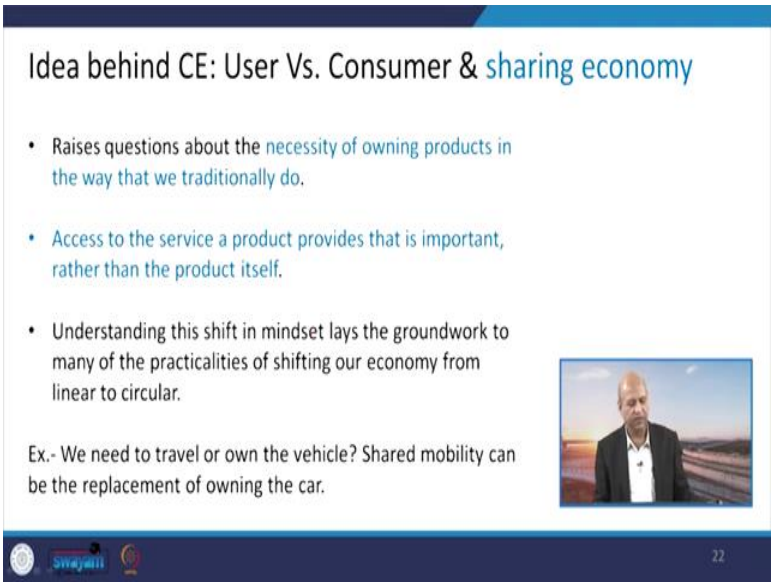

Then when we talk about this linear economy versus circular economy, consumer versus sharing economy, you might have heard in media reports like in certain cities, some people are having "Neki ki diwar" where you can hang your clothes, which you are not using. So, that the people who are in need, they can take it free of cost.

So, we are basically delaying that thing which could be waste and which could harm the environment, so if something is being used by other people. They do not need to buy the new one. If you are buying something new one then we are really stretching upon the natural resources. So, the consumer based economy and sharing based economy, so sharing based economy is better and that is the part of circular economy.

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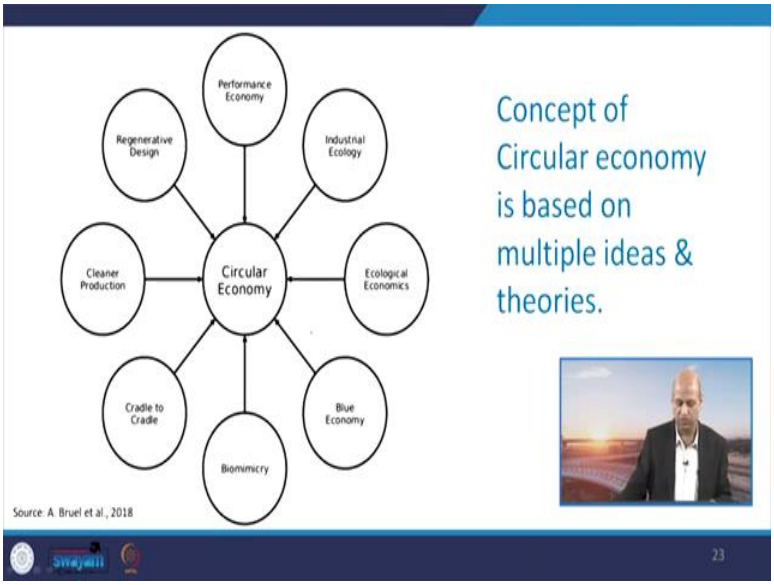

You can see all these ideas or concepts which are related to circular economy are, like industrial ecology or ecological economics, blue economy, bio-mimicry, cradle to cradle, cleaner products, regeneration design, performance economy, all these concepts which we have discussed very briefly, they are the part and partial of circular economy. Because they really reinforce this idea and they help us to go towards the circular economy.

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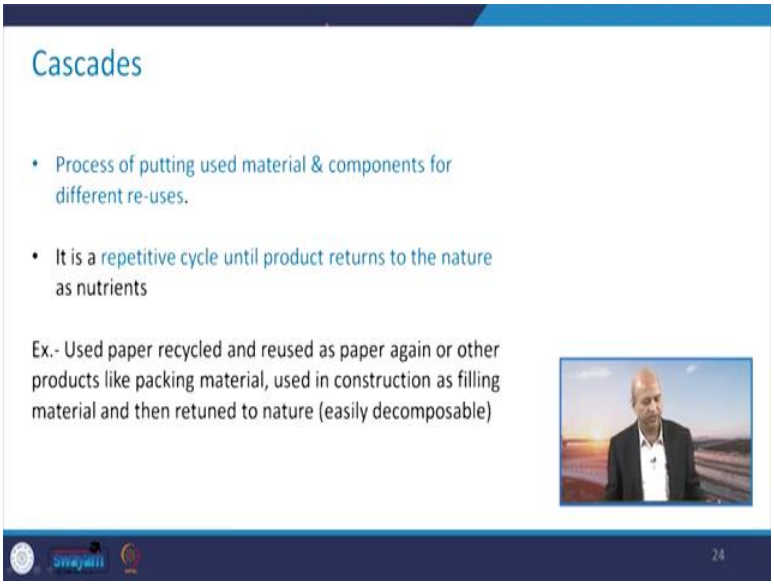

Then there are effects like step by step, so the process of putting like material and components for the re-usage, so one step then second step, in that way you can see. Like paper recycled and

reused for some other purposes like we can have some packaging material and ultimately it goes when it is not usable, then it is very easily decompose-able, then it goes to the nature, and it becomes the nutrient part. So, those kind of things must be seen.

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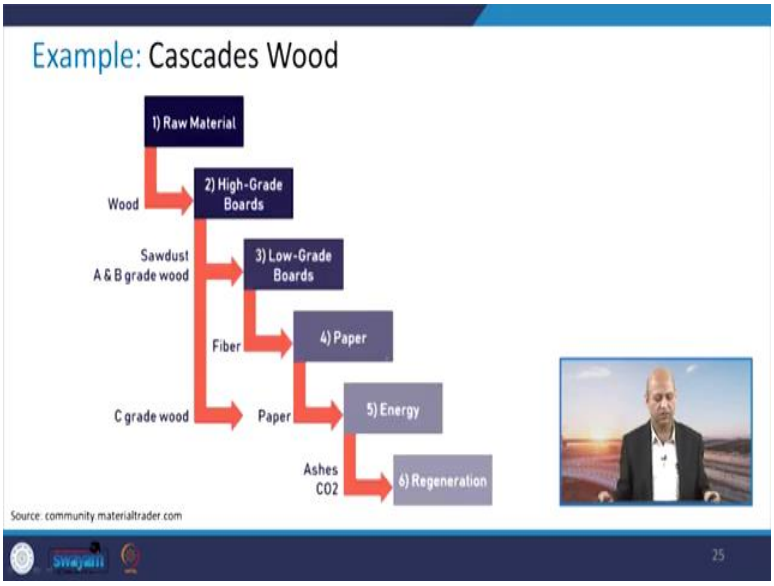

As you can see like raw material is there and wood, you want the wood, so high grade boards you can make but then there will be so called waste in terms of saw dust of A and B grade wood, so that can be used for low grade boards, so do not throw it away like a waste, use it for second level or second category of the boards, then you have, it is not fully used, but some fiber will be there, some dust, saw dust will be there.

So, that can be used for paper manufacturing and this C grade wood or this paper, that can be burned and this energy can be taken out of that, you can generate steam, you can generate, even electricity also by turbine, etc., and ultimately this is regeneration of those kind of, it goes to like CO2 and ashes. So, ashes can be used for landfill or something like that. So, it can go in that way which is very environment friendly.

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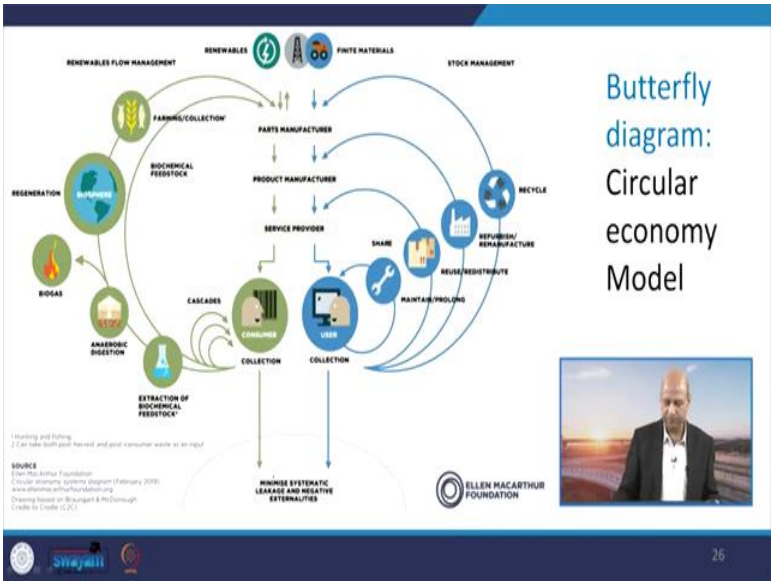

Then we talk about these renewables and finite material related philosophy. So, so many things are there, you can see butterfly diagram here, like bio-gas and then it comes back to this kind of biochemical feed stock as there. So, you can compare, then this sharing is there for this maintenance related thing, because when we are having our own vehicle, rather than sharing as a public transportation system, then we consume a lot of energy, etc. So, those things are there.

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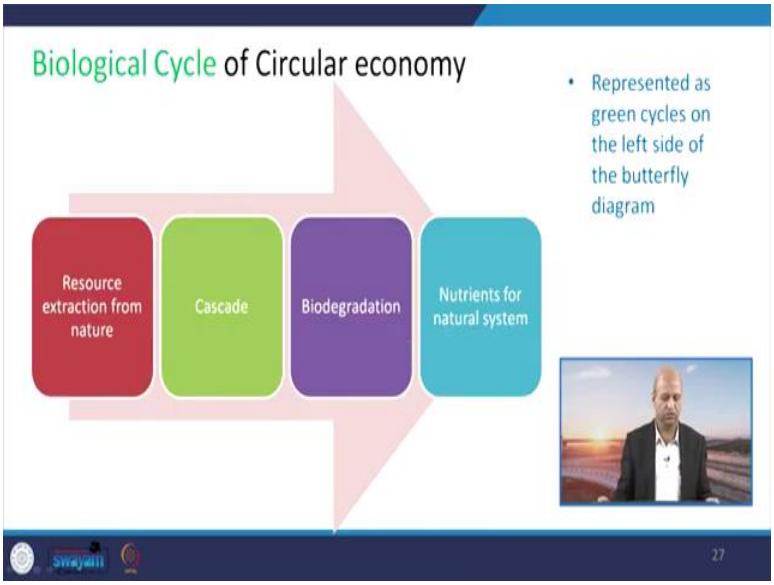

Then biological cycle of circular economy can be represented as this green cycle. So, resource extraction from the nature and then cascade related, we have seen this board, A grade, B grade,

so those kind of effects are there and then you bring at the bio-degradation level that so called waste material and it becomes the nutrient of the natural system. So, there is no waste but basically some usable product at certain stages and then ultimately it is a nutrient.

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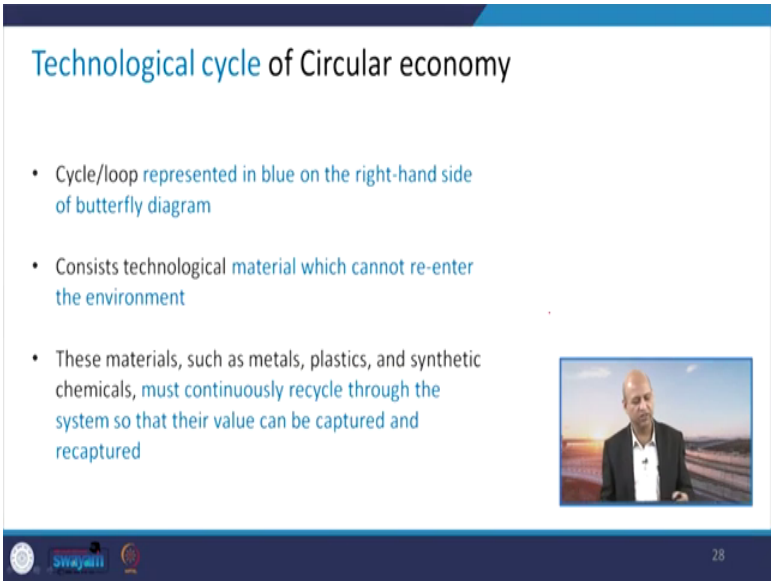

Then technological cycle is also in that way, you can see that one part of discarded material can be resourced for another which we talked so many times.

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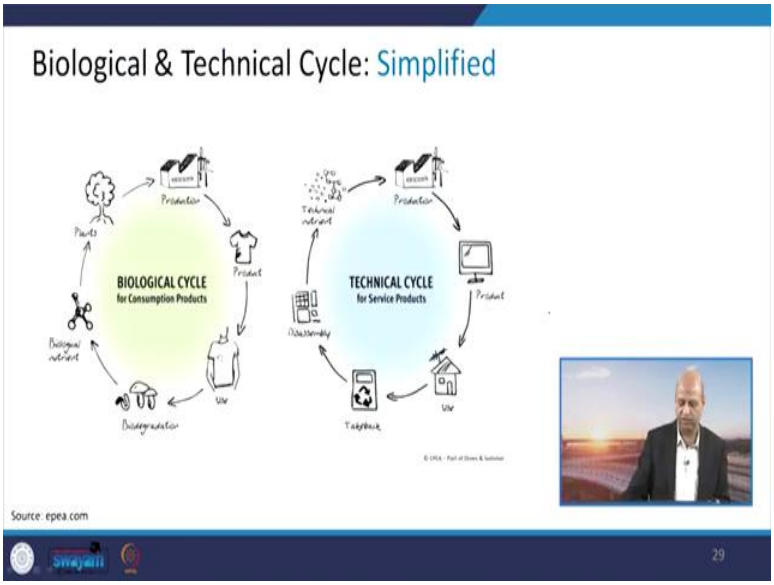

So, technical cycles like some production is there in the industry, then product is there, you can use it, then you take back and then you dismantle them and you can again use it for another kind of production, you just do not waste like landfill kind of thing. In biological, like some products is there, then it is used and biodegradable form is there, it goes to the plants as a nutrient, so those kind of mimicry can be implemented in technological cycle also.

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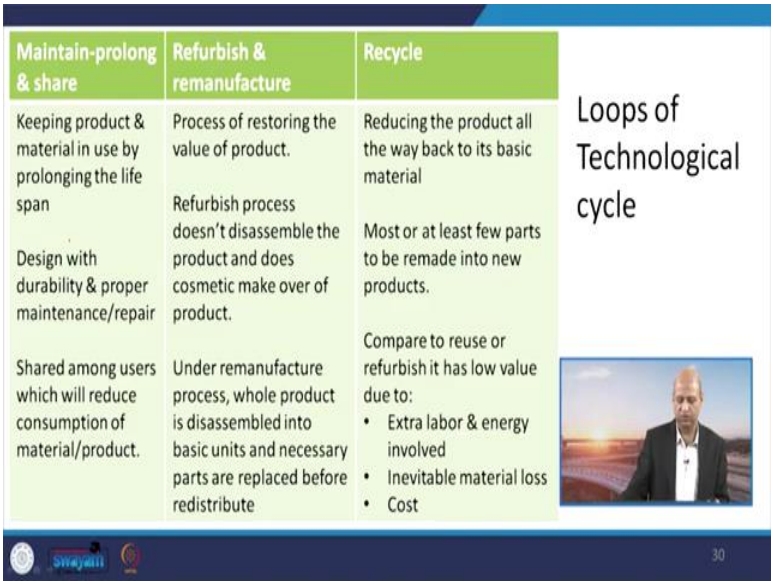

So, these are the loops of technological cycle when we talk about maintaining the prolong and share when we are sharing, then we are not discarding it as a waste. We can refurbish, re-manufacture, we can recycle so all those concepts we can implement.

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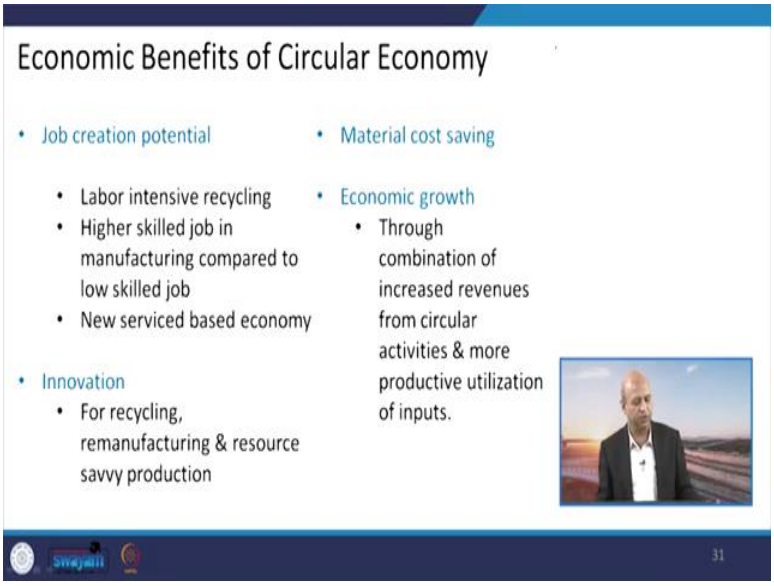

And the economic benefits are many for circular, of the circular economy because there are job creation, when we are using something and we are repairing it so there may be another, those kind of ancillary industries which will be known for repairing something. So, job creation will be there and the material cost saving is there, because you are not needing new thing again and again. Innovations can be there because when you are thinking of re-utilization of something then you can have certain ideas and economic growth happens because everyone is involved in this circular economy at different stages.

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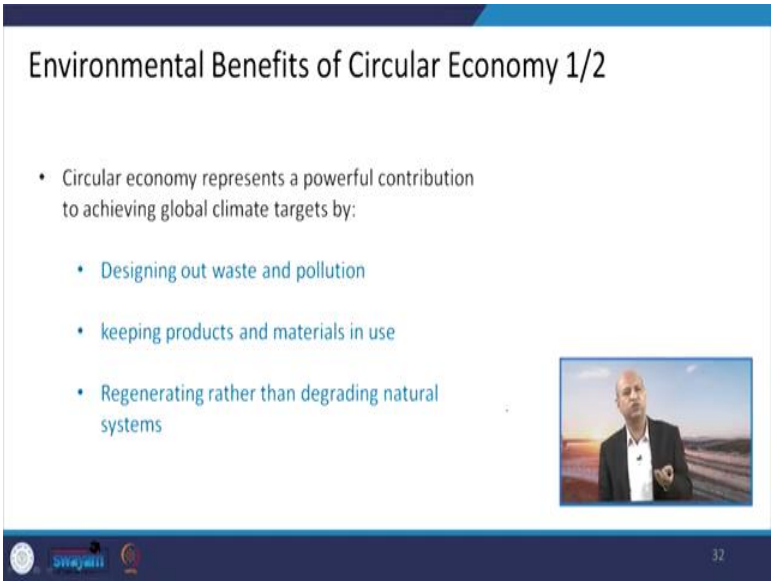

Environmental benefits are natural because when you are using less resources you are giving less pressure on the virgin resources, then you are not having waste but you are having some resource and you are regenerating them as a kind of utilized, usable product.

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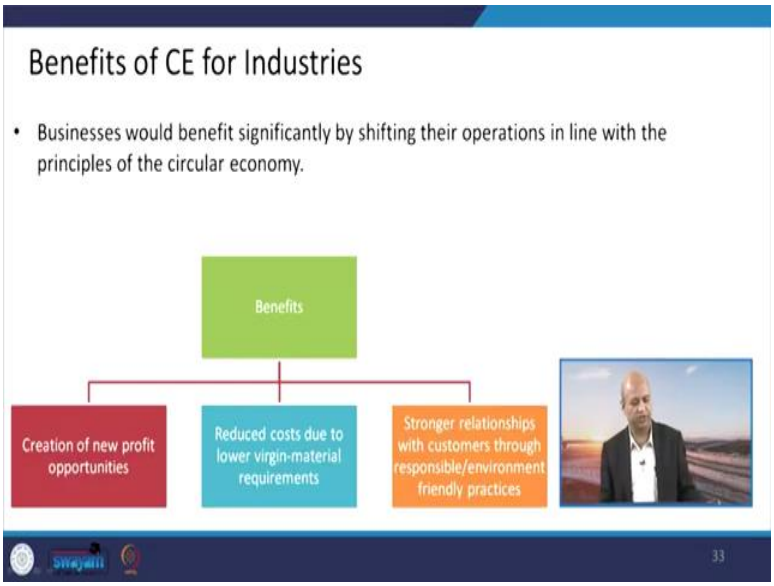

Benefits for industries are there like new profit opportunities are there, because when you are taking different kind of activities related to, in a systemic approach, then reduce cost for, of this material, because you are taking out as a waste, like road construction is there. The waste

material which is coming from demolition of the house, that can be used as some gravel material or those kind of things in the road construction.

So, that way you are not using the fresh material, so you are reducing your cost also, then stronger relationship of customer and the environmental responsible behavior is there when we are thinking and working in that direction.

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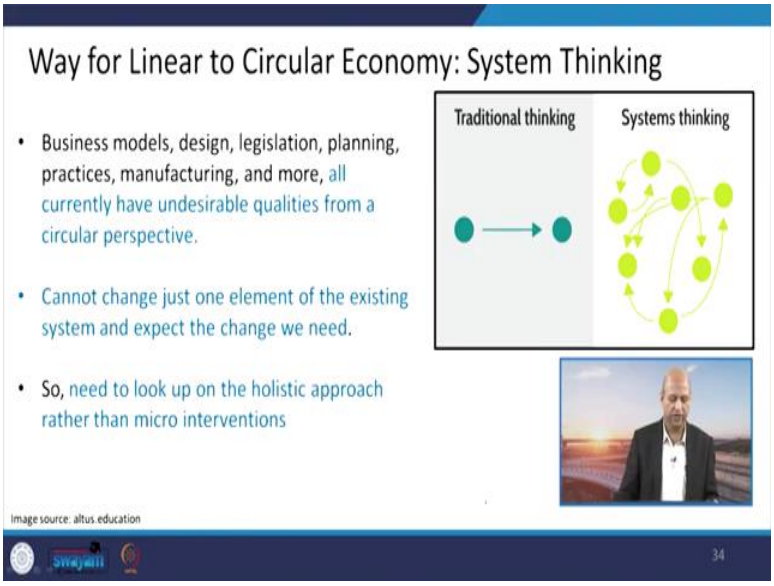

Then this way of linear and circular economy systemic thing, we see, so this traditional, not this traditional means only few 100 years, which is economic model, fossil fuel based economic model we are talking. So, this is, from this point to this point, but systems thinking is, it is related to each other. One point which go to another, then it is used, reused, recycled, so that way it goes in different stages and it passes through different hands. So, basically, it is also helping us to be more cohesive as a society, more caring kind of, sharing kind of society we are talking about.

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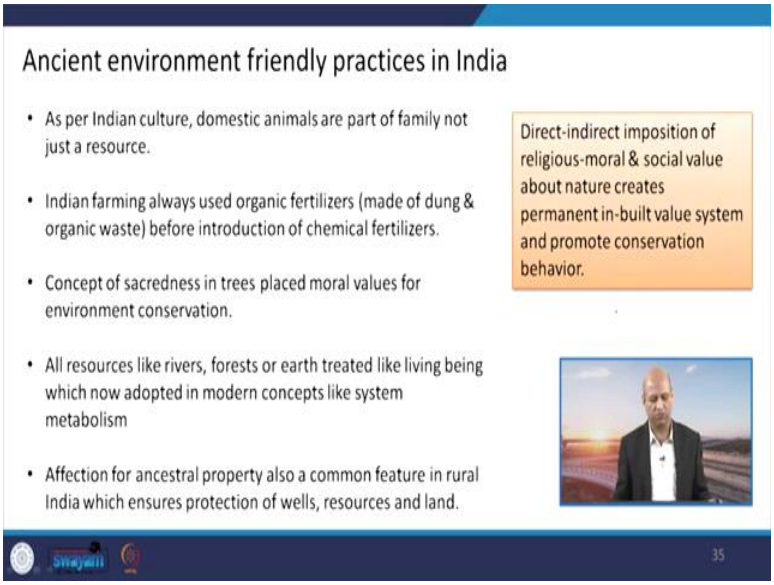

And this is not only the new philosophy but if you look at the ancient literature, ancient practices of the people you will find like in India also very much nature centric society was there, you can see like domestic animals are part of the family. Still if you go into villages, they take their, like even if bullock car is there, so those bullocks or goats or cows they are part of their family, like members of their family. They do not torture them, they take care of them very seriously.

So, they are not just, you are getting milk but you are taking care properly, so those kind of emotional bond is also there, and Indian farming practice was on organic farming kind of concept, unless these chemical fertilizers were started to be used, although people can argue that chemical fertilizer has given us great yield, so that we could feed our population.

But also, there are other negative aspects which are there, part of these chemical fertilizers, because of natural resources have been damaged very seriously, and this ground water has gone down and those are the issues, and then this sacredness of trees and natural things, that is why we call mother to the rivers and the plants. You can see several communities are there which consider trees completely sacred, they do not cut them, they do not kill animals.

So, those kind of philosophies have been in ancient times and even this, even today also you go to remote villages of Rajasthan, et cetera, you will find those communities where you will find these animals of forest running in their farms, et cetera, without any kind of fear. Deer, et cetera, you can see there, they do not fear, because they know these people are not going to harm them.

So, those kind of things are there and forest, rivers, we have created many kind of philosophical point of view about them, so that we can take care of them.

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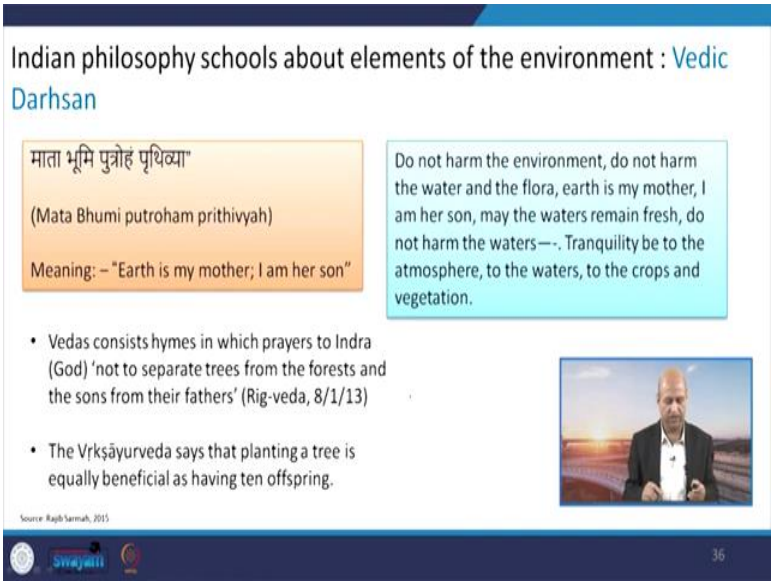

Then if you talk about like even vedic darshan, there are those, in those sacred books, there are many shlokas which gives this feeling that how they were treating like "Mata bhumi putroham prithivyah" means earth is my mother, I am her son. So, that way basically we cannot harm our mother, this earth mother or mother nature or mother earth. So, those kind of philosophies have been there.

In Rigveda there are so many shlokas which talk about nature and our relationship with nature, they say that not to separate trees from the forest and sons from their fathers, their hymns and prayers are just like that, and similarly like planting a tree is equal to 10 of springs or having those kind of things. So, those are the philosophies which keeps us very close to the nature and we can call it eco-centric philosophy.

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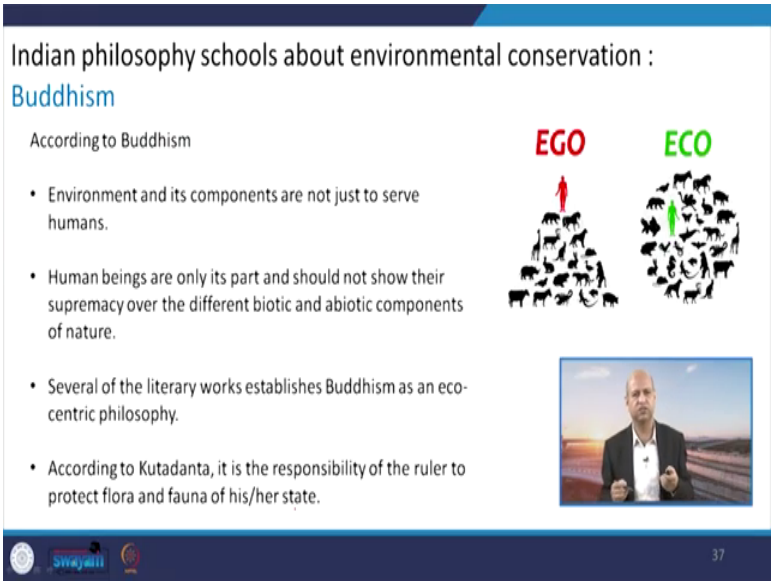

And this new modern philosophy which makes us like master of the nature, which has given so much negative impacts that is basically based on this ego kind of a thing that man is the superior thing and everything is to serve them. This is not the right thing but we are part of the complete eco-system. Here this man is also a part of, like other animals are there, they also have the right to habitat the mother nature, so we are just one of them.

So, we should know the coexistence and even this, in corona time you have seen if we do not become or we do not take care of the nature then nature bounce back in different ways. So, we should take care of the nature and the harmony with the nature is very important. Even in Buddhism you can see like environment and its components are to serve, means not to just serve the humans but we are part of the nature.

And several those kind of their philosophers have been there who have given like responsibility of the ruler to protect flora and fauna of his and her state, so there are many kind of sacred books or ancient philosophies which gives very high importance to the natural related resources.

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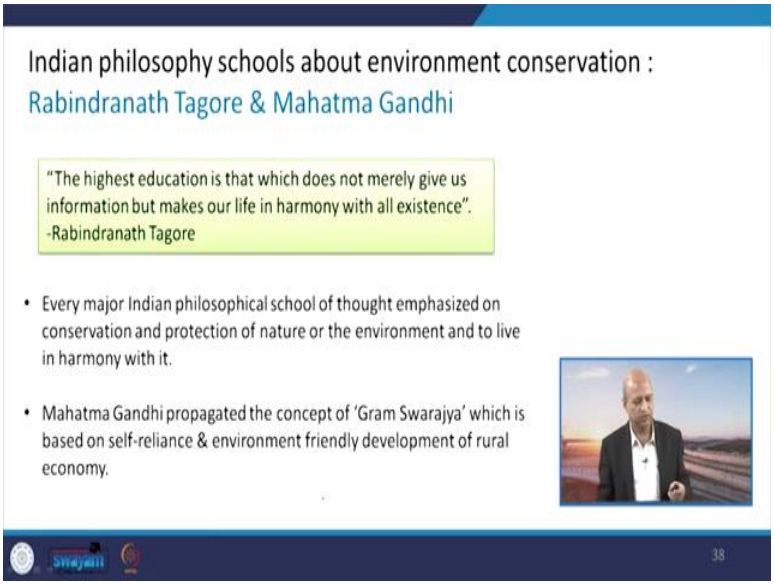

Even if you talk about these modern thinkers of our country, like Rabindranath Tagore, Mahatma Gandhi they also had this kind of outlook. Like Rabindranath Tagore said that the highest education is that which does not merely give us information but makes us, our life in harmony with the all existence. All existence means everything, even nature, means whether it is rivers or streams or mountains, plus animals, all things, the complete existence we should be in harmony with.

Similarly, Mahatma Gandhi's philosophy of "Gram swarajya" basically was this self reliance the environment friendly development of rural economy. So, those philosophies are basically eco-centric and nature centric and in modern way if we can call them circular economy if we want to think about this in this industrial era, if you want to implement that philosophy. We can call it circular economy.

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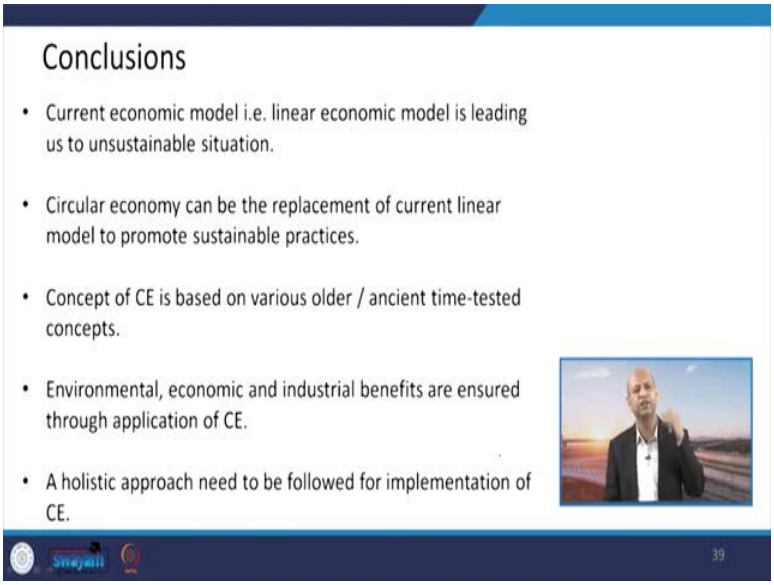

So, in conclusion we can say that the present model which is the linear economic model is leading us to various kind of problems in terms of environmental degradation and that is why it is unsustainable. You can see the climate change and so much pollution, all those things. So, the circular economy can replace this particular linear model and it can help us to travel towards sustainable practices or sustainable road.

This concept of circular economy is based on the new philosophies as well as ancient or old ideas which are time tested basically and the environmental economic and industrial benefits are ensured through the application of circular economy, it is not that only economic development is happening and our environmental degradation is going on at the same time. No, it takes care of environmental components, it takes care of economic welfare, it takes care of industrial related things which goes on in optimized manner.

So, the holistic approach or systemic approach, integrated way of thinking and designing our society, industrial society in terms of circular economy or industrial ecology you can call, that is the need of the hour to ensure the sustainable development.

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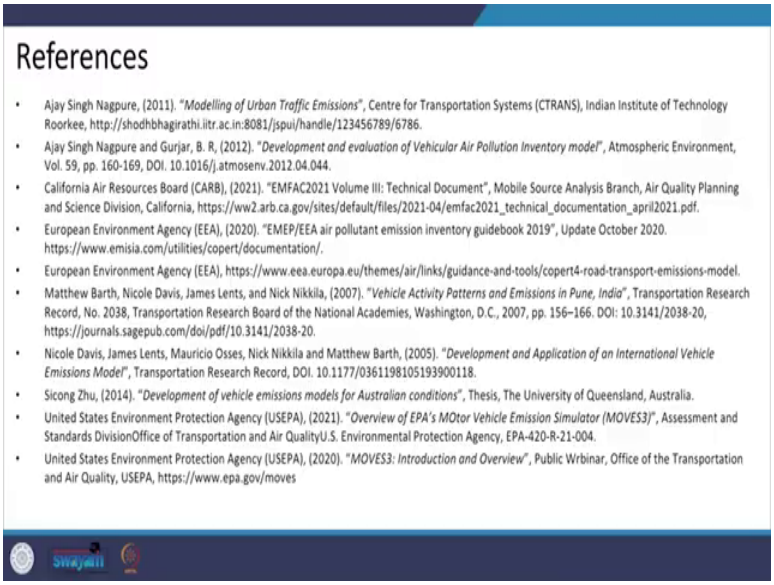

And these are the reference which are the basis of this presentation. So, this is all for today. Thank you for your attention. We will carry on this circular economy in next lecture also. So, see you again. Thank you.