Carbon Accounting and Sustainable Designs in Product Lifecycle Management

Prof. Deepu Philip
Department of Management Sciences

Dr. Amandeep Singh Oberoi
Imagineering Laboratory

Dr. Prabal Pratap Singh
Department of Management Sciences

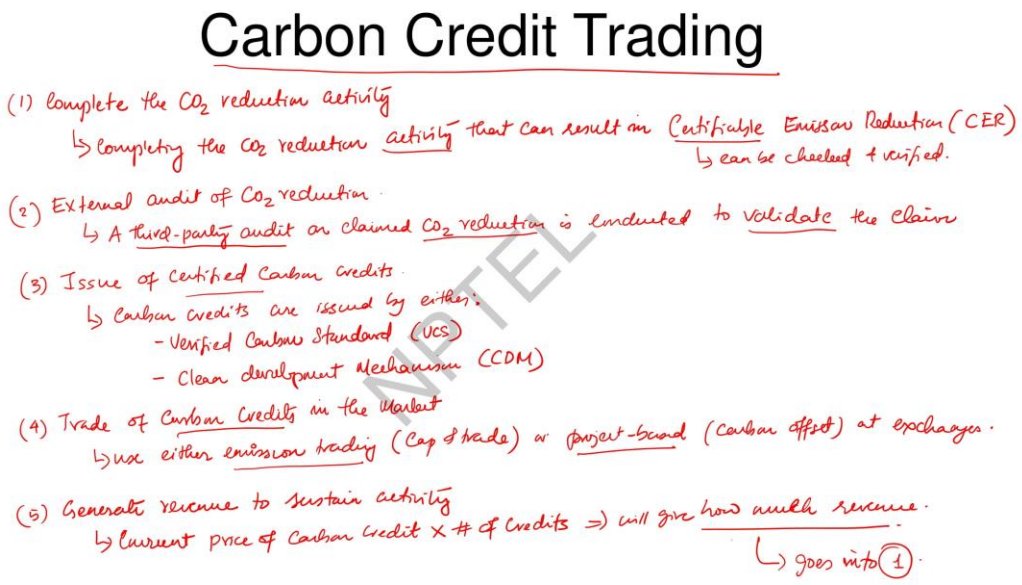
Indian Institute of Technology, Kanpur

Week 02

Lecture8

Carbon Credit Trading

Good afternoon. Welcome again to yet another session of Carbon Credits and Sustainability for Product Lifecycle Management. So without wasting much time, let us get into the topic today. You have already seen what is a carbon credit. We have gone through the definitions of it and how it looks like. We have seen that.



So, now we talk about how do we trade Carbon Credits. And again, the fundamentals we are talking about, more details we will discuss later. But here is the important steps, okay. So, the first step is, you can think about this, it's about, let's talk about this five-step process.

So, first one is complete the CO_2, carbon dioxide reduction activity, that is the first part. So, what it does is, the idea is that completing the CO_2 reduction activity, that can result in certifiable emission, reduction, or the word that is used is CER. And somebody says, I am working on CER, that means. We are already focusing doing some activity. That will actually reduce in certifiable.

That can be so certifiable is in a sense, can be checked and verified. So if I say that, I have reduced 10 tons of carbon dioxide and somebody can come and check it and verify it and issue me a certificate that yes, this person has done something like that. Once this is done, this first step is done, the second one is external audit of CO_2 reduction. So what happens is, a third-party audit on claimed CO_2 reduction is conducted to validate the claim. So, what we do here is, we bring in a third party, an external person, third party person who comes and audits the claimed CO_2 reduction, okay.

And then validate it. The person says 10 tons of carbon dioxide reduction, Is it in fact 10 tons or is it less than that, more than that, etc. Then comes a third one, okay. Third step, that is the issue of certified carbon credits, okay. So, what happens here is carbon credits are issued by Ether, okay.

There are two options, okay. Verified carbon standard, it is also known as VCS. The other one is called as the Clean Development Mechanism, It is known as CDM. So, the carbon credits, the certificates can be issued, once the third party conducts the verification. But there are issued by either one, is the VCS, the verified carbon standard, or it is by the CDM, the clean development mechanism.

The fourth step is trade of carbon credits in the market, this is the fourth step. So, what do we do here? So, use either emission trading, which is called cap and trade. There are other details to it. We will talk about it.

Either emission trading or project-based, which is known as carbon offset at exchanges. So, like a stock exchange, there is an energy exchange or carbon exchange. In the carbon exchange, you can trade the carbon credits, okay. That is the market, you can either do

emission trading, emission trading is cap and trade, that's known as cap and trade. Or it is like you have, you know, you have stock, bond, etc.

You can do similarly emission trading, which is cap and trade. Or you can do project based, which is known as carbon offset. Both type of trading can be done at the exchange, which is the carbon exchange or the energy exchange. Then comes the fifth step, which is generate energy to sustain activity. This is the next step, so the thing is, the current price of carbon credit multiplied by number of credits will give how much revenue, okay.

Then we use this revenue to sustain, what the carbon reduction activity we are doing, okay, so, this revenue gets pumped onto the CO_2 reduction activity, So, from here, goes into one. One is here that we talked about. So, you have an idea of what are the five steps that is involved in carbon credit trading.

We will get into more details later, but now you know the basic idea. Now, let us talk about the next part, which is the system dynamics and benefits. And since this is, we are in India, what are some of the possibilities for India. We need to take a quick look into it and we actually would proceed from there.

So, there are four success stories. We have discussed this in different courses also in different places. But these four success stories are very important. The first one, this one

that you see is in Chalpadi in Andhra Pradesh, and this is in here, we have exported 900 tons of carbon credits in 2004, okay. This is one of the first initiatives to Germany. okay.

And the worth at that time was dollar 4200 or so worth. okay. And the activity, what was the activity? The activity was replacing diesel with oil extracted from Karanj, it is a forest tree, okay. It is called Pongamia Pinnata, that's the name of the tree, but it's called Karanj locally. In the local language, it's called Karanj.

That is taken and the oil is extracted out of it, that oil was used to replace the diesel, so instead of running the diesel pump, they used this oil. So that way your carbon, because diesel has much more carbon footprint, you have to dig it from the earth and take it out. The second location is called as Handia forest, okay. Handia Forest, this is in MP, Madhya Pradesh, okay.

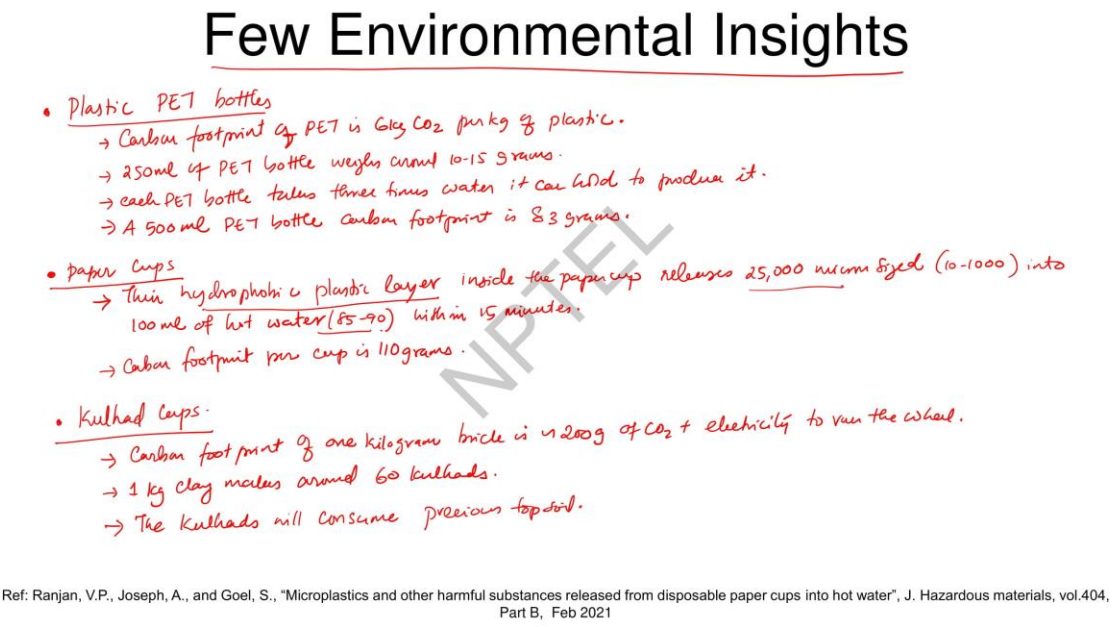
So, the activity was 95 villages together, okay. Restored around 25,000 acres of degraded community forests, so that's what they have done. 95 villages together, they restored around about 25,000 acres of degraded forest. The earning potential is $300,000 per year in 2015. So, we don't have the exact data of how much they have earned out of it, but they had a very huge earning potential as part of this.

Community forest, which are for, which is in the buffer zone, which are being recreated. The third one is, Jalgaon, Nashik, this is in Maharashtra, okay, So, the activity is conversion to micro irrigation system, okay. This is called as MIS, micro irrigation system from flood irrigation system. The location was about 5,000 hectares of banana plantations, okay.

And the outcome, what came out of it is about 11750 tons of CO_2 equivalents was resulted out of it. So that much of carbon credits were taken out of that, okay, and that was sold and money was made out of it, how much funds were created, we don't have the data yet but that's there, so this is the the last one is a Jalinga estate that is in Assam, okay. So the logic is around the activity, what is the activity around 1100 hectares of fully organic tea, okay. This was in 2003 along with 225 hectares of forest to absorb CO_2.

So, the activity, the outcome achieve carbon, So, what does that mean? So, you are, there is no net carbon emissions. So, this is called as zero carbon footprint, okay. So, there was no impact on the atmosphere at this point because of this activity. So, that means the tea production of the gelling gas state is a completely carbon neutral process.

So, that whatever the carbon dioxide they are emitting, they are also capturing and sequestering onto the ground or terrestrial sequestration.



Ref: Ranjan, V.P., Joseph, A., and Goel, S., "Microplastics and other harmful substances released from disposable paper cups into hot water", J. Hazardous materials, vol.404, Part B, Feb 2021

So, with that, now let us get into some Few Environmental Insights. We need to look into this, how this will actually impact or how the environment will benefit from it, so, this is taken from Rangenetal, this microplastics and other harmful substances, general hazardous material. You can read this for details.

But three details I wanted to give or three imports I wanted to give is, number one is called as a plastic PET bottles, okay. That is the polyurethane PET, okay. You guys know what it is, okay. So the PET bottle is, so the carbon footprint of PET is 6 kg CO2 per kg of plastic. So if you produce 1 kg of PET plastic, then, polyurethane, tetrafluoride, whatever that PET is called, that's a weird tetrafluoride, something like that.

That is, 1 kilogram of plastic gives you 6 kg of carbon dioxide equivalent, okay. Carbon dioxide, so, that's one part, 250 ml of PET bottle weighs around 10 to 15 grams, okay. Each PET bottle takes three times water it can hold to produce it, so, if you have a water bottle, which is 250 ml, okay. So, if you take this water bottle, which is a 250 ml water bottle, this water bottle will take us 750, it will take 750 ml of water to actually make that

bottle, which actually can hold 250 ml of water. So, last part is a 500 ml, PET bottle carbon footprint is 83 grams, okay.

So, as typically, let's take this carbon plastic PET bottles, you can see that how much of an environmental impact it actually creates. So now people say, let's ignore plastic bottles, let's make paper cups, okay. That sounds like a better option, but the main issue of it is this, the thin hydrophobic plastic layer inside the cup, inside the paper cup releases 25,000 micron sized 10 to 1000 into 100 ml of hot water that is 85 to 90 degrees within 15 minutes carbon footprint per cup is 110 grams. So, each cup has a plastic layer inside, thin hydrophobic plastic layer is inside the cup, and that can reduce 25,000 micron size particles, 10 to 1000 of them, into the 100 ml of hot water within 15 minutes. The water temperature is 85 to 90 degree celsius, so, when you take that water, you are actually taking plastics inside. Let us now talk about coolant cups. This is the one that is made of the mitti or the soil. So, let us take some examples carbon footprint of 1 kilogram brick is about 200 grams of CO2 plus electricity to run the wheel.

Okay, then 1 kg clay makes around 60 coolants, so, if you have 1 kilogram of this clay brick, it is about 200 grams of carbon footprint plus whatever the electricity to run the potter's field, okay. That is the carbon footprint and 1 kilogram of clay can give you 60 culverts. But understand one thing, the clay, the culverts will consume precious topsoil. So this clay that is taken from pond or river or any other place, which is actually the precious topsoil, which is a nutrient soil that you take it out and use that to make coolers or the mud cups.

Obviously, yes, this is a much better environmental option compared to both the pet bottle and the paper cups. But it is not fully environmentally friendly. It still has a carbon footprint. It also has, when you burn, when you bake it, that baking one is not considered as part of it yet, but also you remove, you degrade the environment by removing the precious topsoil. So among the three, coolant cups would have the lowest environmental impact. But unlike the popular belief, coolant cups are not fully environmentally friendly compared to pet and paper cup, pet bottles and paper cup, it is more better environmentally friendly.

So with that, we come to the end of this lecture. And the next class, we will take up more advanced topics about how the supply chain, the value chain, how sustainability is added into that, and how product lifecycle management, which the value chain is very important. And with that, we will go into advanced topics, advanced models after that.

Thank you very much for your patient hearing.