Sustainable Transportation Systems
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Lecture 55
OpenLCA – An LCA Tool

Hello friends. So, today in the series of understanding in a quantitative way, the sustainable transportation systems, we will discuss about lifecycle assessment tools or software. So, in that particular way we can understand the objective analysis. Means, we already know the conceptual understanding of sustainability aspects, then the sustainable transportation systems. But when we want to make some decision.

So, we want to have informative, way of looking at the things, objectively looking at the things so, that we can have some numerical value some score, so, that it helps us to make a comparison between different options. So, in that way we can use some software or tools which can help us in deciding the sustainability degree or sustainability intensity of a particular option. So, the lifecycle assessment is one way as you know and the lifecycle assessment can be carried out by different tools.

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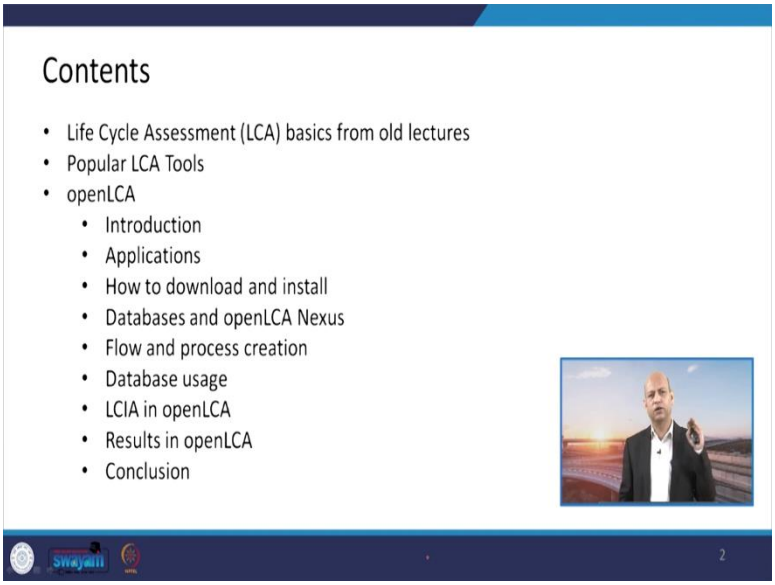

Today we will see a few major popular tools and within that we have one tool which is known as openLCA. So, openLCA is a software. So, we will discuss in detail about openLCA. So, the contents of today's lecture is basically we will revise a few things about lifecycle assessment which we have already covered in old lectures. So, we will see those basics and then we will come to the popular LCA tools which are many people use those tools because of their some positive aspects in terms of database, in terms of user friendliness, all those things.

And then within that, we will, discuss in detail, the openLCA tool. Other tools you can go through, you can search, you can in some software like browsers like Google, etc., you can do that search and then you can go through other tools also. But openLCA tool, today we will discuss about its conceptual understanding, its theoretical part and in next lecture, we will apply it.

So, that you can get through the complete, basics like A, B, C, D of everything, which are related to openLCA. So, first we will discuss about the introduction then the applications which can be related to the LCA tool, the openLCA tool, and then we will see how it is downloaded and installed, so, that you can use it on your system. And then what are the databases which are available, which are used in this particular tool.

So, we will discuss about those databases. Where they are available? How can we download them? How can we integrate within this tool? Then flow and process of creation of that particular tool. So, that, like, you can say running it in a basic way. And then the lifecycle impact analysis is carried out by using the databases which are available and those databases are available in free mode, open mode as well as like payment basis.

So, depending upon the quality of the data and nature of the data you can choose whether you are okay with the freely available or you have to buy. So, depending upon the situation you can go through that option. And then we will see the results in what form the result results are obtained when we run this openLCA tool and then how does it really help in making the decision so that way we will conclude. So, when we go through those old LCA related concept. So, we have already defined what is the lifecycle assessment or LCA.

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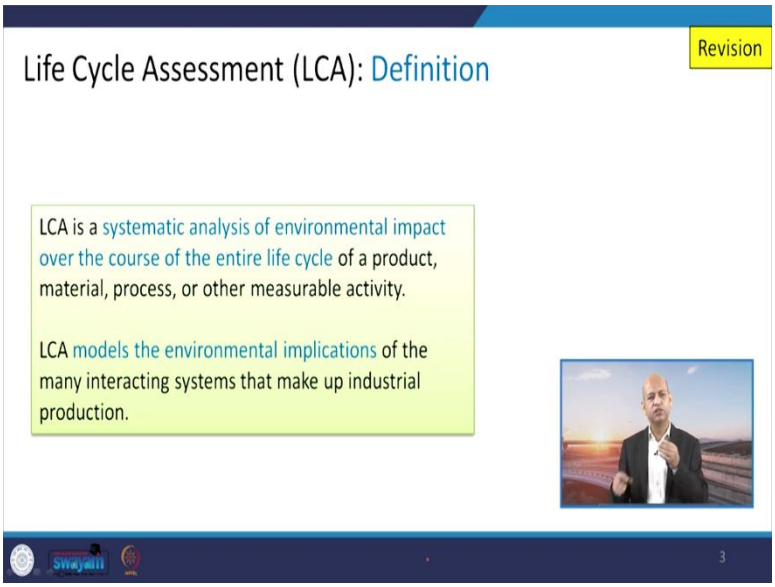

So, this is nothing but a systematic analysis of environmental impact over the course of an entire lifecycle of a product or process or material or any other measurable activity or entity. So, this is from beginning to end you can say, so, like Environmental Impact Assessment we do in a particular stretch or a particular activity, but in LCA, lifecycle assessment, we really capture everything from, like mining of the resources.

Then production of that particular product, then taking it into market using it and then discarding it and maybe recycling or reusing all those things. So like cradle to grave, you can say, the complete lifecycle we assess, and that is known as the lifecycle assessment. Because it gives then the complete picture of weather how much greenhouse gases will be emitted.

How much negative environmental impacts will be due to that particular lifecycle of the product and then positive uses are there like socio economic etc., but the complete lifecycle assessment is to be carried out. Then there are LCA models which are like used for modeling the environmental implications of the many interactive systems which make the complete process like industrial production of a particular thing or its uses in the practical real world, all those things.

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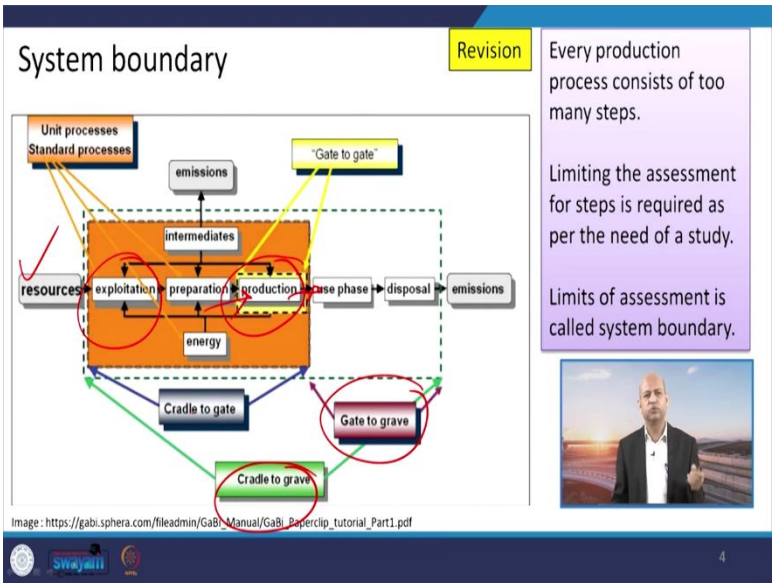

So, when we do the LCA, then we have to define the system boundary because LCA can be done even of a smaller stretch also. Not only the cradle to grave or that kind of thing, but within for example, you extract the resources then you use it in some way manipulate it, then you prepare it for a particular use. So, you take to the factory. So, in factory you produce something.

So, in that factory you can do LCA from gate to gate like input and then output. So, gate to gate entry and exit that kind of LCA can also be carried out. Or you can do the complete resources and the disposal part. So, cradle to grave. Then you can also do like gate, exit gate to the disposal part. So, gate to grave, cradle to grave also can be done. So, you can do several permutation combinations.

So, accordingly you have to set the boundary. So, that is the system boundary basically and then every production process consists of several steps. So, that is why we can, disintegrate it into several parts and the limiting the assessment for particular steps is required as per the need of the study because you do not need to go for everything, if you want to, see the impact within that particular factory then gate to gate LCA can be a good activity or good way of knowing the things.

Or if you want to know like, when something has gone out of the factory and when up to the disposal. So, what will be its impact, total environmental impact, then you can go for gate to grave kind of assessment. So, according to the need and the requirement, you can set the boundary and you can use it.

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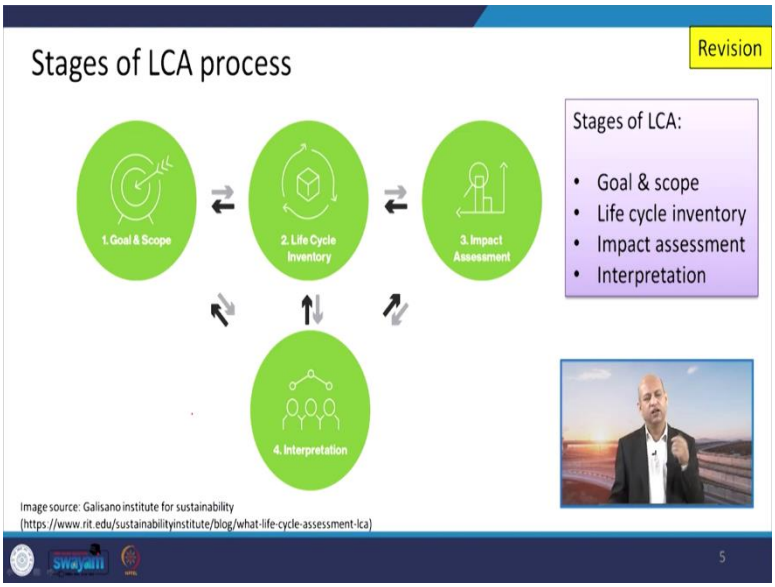

Well, so, different stages of LCA process as we already have discussed, these are goal and scope, setting of the goal and the scope and then the life cycle inventory, because different kinds of things have different lifecycle related attributes and then we do the impact assessment because of their several impacts in terms of emissions, in terms of their effluent so and so, and then we interpret the results whatever results we get because of that assessment.

So, we interpret it, we give in in certain way we present it in terms of charts in terms of tables, etc. So, some values are there some trends are there and those really help us to make the final decision choosing some product or process whether it is good or bad in comparison to the available options.

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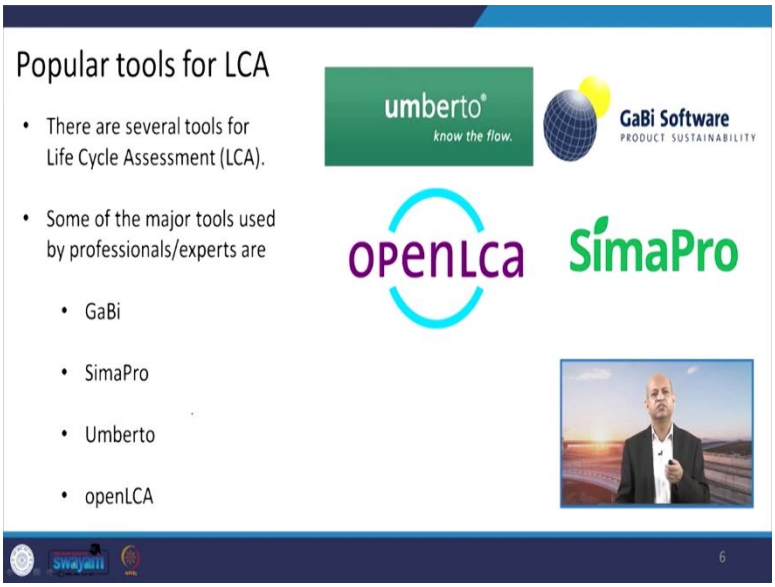

So, if want to use some tool or software which are popular for LCA, then basically you can go for like GaBi or SimaPro or this Umberto or openLCA. So, these are the popular tools which people use according to they have different kinds of attributes.

But you can see fundamentals of those software and which software is better for you and it also needs different levels of resources. So, accordingly you can decide. So, you go through all the software whenever you have time, but today we will discuss in detail about openLCA software.

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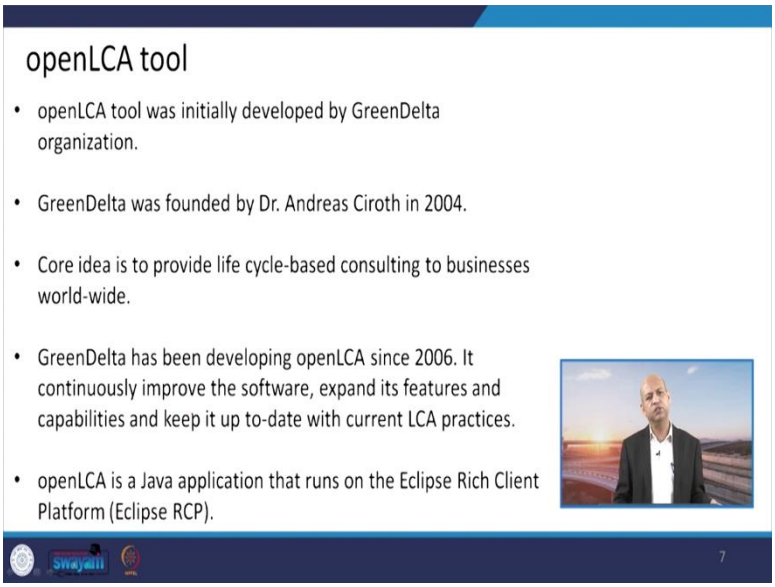

So, the openLCA tool or the software when we talk about basics of this tool, when it was developed, why it was developed? Then we know that it was initially developed by this

GreenDelta organization. And it was founded this particular organization, GreenDelta was founded by Doctor Andreas Ciroth in 2004, and this core idea behind this particular software was to provide the life cycle-based consulting to businesses worldwide.

So, that was the basic idea. And then it has been developing several versions since 2006. This particular organization and it is improving continuously the software is being improved and expanded in features and capabilities and different kinds of other attributes you can say. So, it is kept up to date depending upon the challenges, opportunities in the LCA practices related things. And this is basically a Java application tool and it runs on the Eclipse Rich Client Platform, Eclipse RCP.

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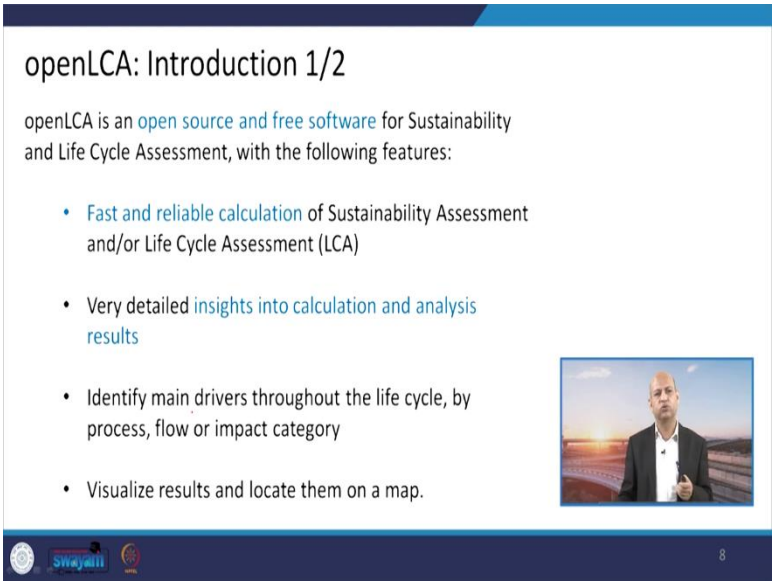

So, these are the basic things about this openLCA and when we talk about like, whether it is paid or freely available. So, as it is also reflected in its name, it is open source, it is free software you can use it you can download it you can play with it as per your requirement and it can give sustainability and life cycle assessments with different features. It is fast and reliable in comparison to several other available tools or its calculations are like robust and it gives different aspects of lifecycle assessment or sustainability assessment.

And then it gives very detailed insights into calculations and analysis results. So, several things are there. So, that helps you, to build the real insight to make an informed decision. It also helps in identifying main those primary drivers throughout the lifecycle stages, in terms of processes, in terms of flows or impact categories. Then it also helps in visualizing the results in different ways, charts, tables, etc. And it can help us to look at things on a map. So, visual, those are aspects are also there, which are good in this particular software.

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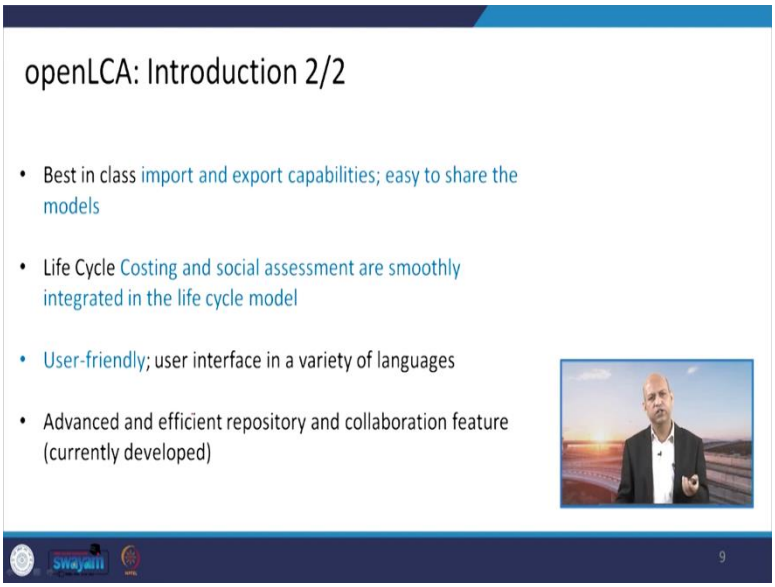

Then, this is best in class when you talk about importing and exporting the capabilities of different results and easy to share with different models. And then this lifecycle costing and social assessment, they are smoothly integrated in the lifecycle model when we talk about this openLCA. It is also user friendly very simple to use, and the user interfaces, have different languages.

So, that is also one very important aspect that if somebody does not know English they can use in their own languages this particular software, then the advanced and efficiency repository is available. So, the collaborative features are there and they are developed they are up to date. So that way also it is good.

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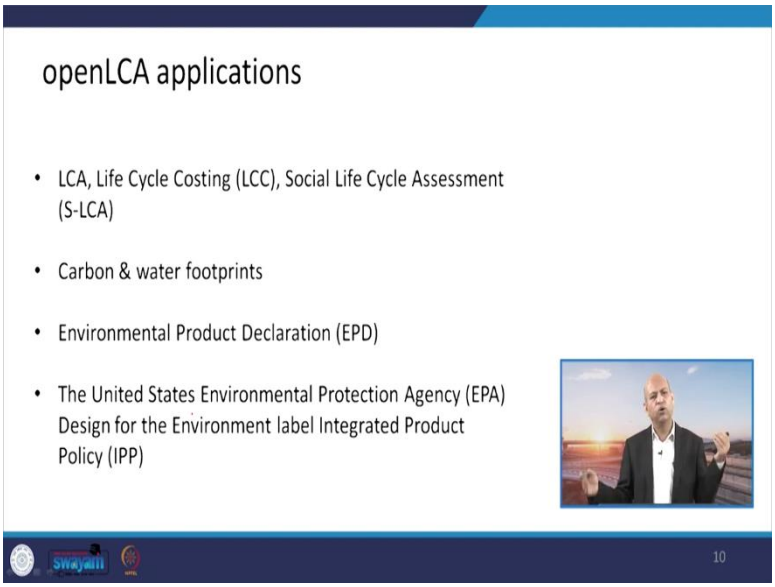

Then when we talk about this particular software in terms of like lifecycle costing, social lifecycle assessment, all these are the parts of this carbon and water footprints they are also given, Environmental Product Declaration related aspects are also there then this United States Environmental Protection Agency they have several guidelines like design for environmental label integrated products policy, all these are integrated in this particular software.

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Well, when we talk about databases which are used in this particular software, then several databases are available, which are helpful for running this particular software. And they are, you can see this European Commission related JRC and then you can have this IDEA, or arvi,

SOCA. So, there are several available data databases are there. So, different databases have different attributes but whatever needs are of yours accordingly you can select the database.

Also, there are some limitations for example, some databases are paid ones you have to buy. So, if you do not need very fine database, very detailed, and you just want to see kind of preliminary study, then freely available databases are good for you do not need to buy but if you want to go much in detail, then maybe some pay database you have to access so you have to pay and you have to buy it. So, and these databases can be accessed at the openLCA Nexus website. So, they are all these links are available, so you can just click and download the database.

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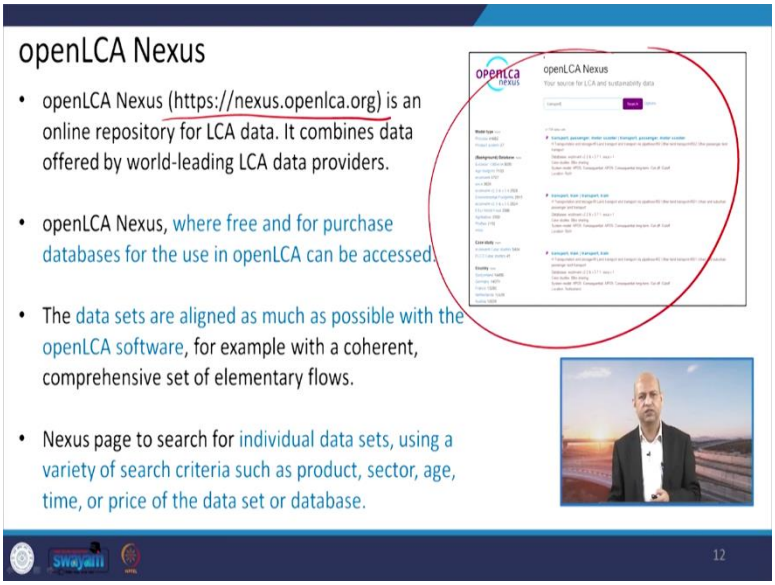

Well, when we talk about this particular openLCA Nexus website, so this is the website you can see, you can go there and this is an online repository for LCA data as we have just discussed, and it combines data offered by world leading LCA data providers which we have seen the names etc. Then, these data are, these data sets are aligned as much as possible with the openLCA software so that you do not need to process them further.

And it is kind of ready-made thing you can use and these are very coherent and comprehensive set of elementary flows are ensured. This nexus page to search for individual data sets, using a variety of search criteria like products or sectors or age, time, price of the data. All these variables are there which can help you to go to the real which is helpful database for you.

So, you do not need to go for differences you can just screen and as per your need like sector based or country-based data you can go. So, this kind of this window is available at the openLCA Nexus when you go searching.

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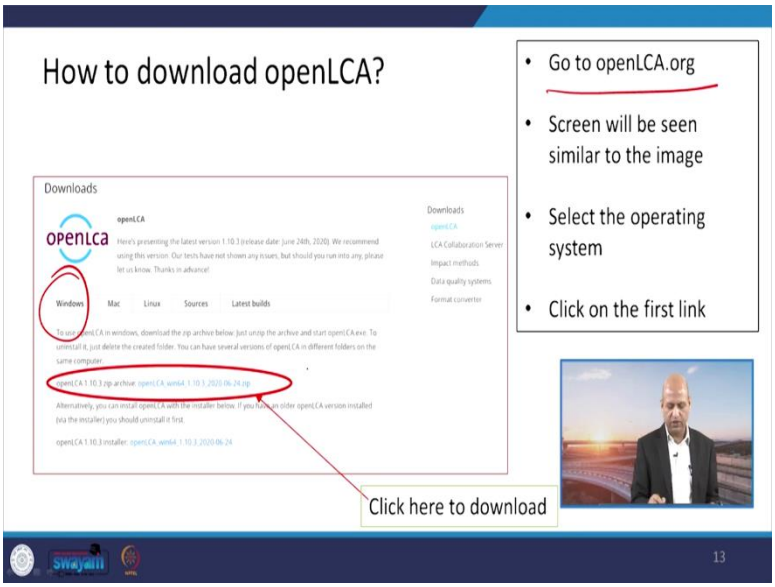

Well, when you go to this website. So, how to go to this space openLCA organization and then this screen will be available. So, select the operating system. First of all which operating system is available for you Windows, Mac or Linux, or those kinds of things. Like if you have Windows then the first link which is like openLCA 10, 10.3 zip this you can click to download this particular software.

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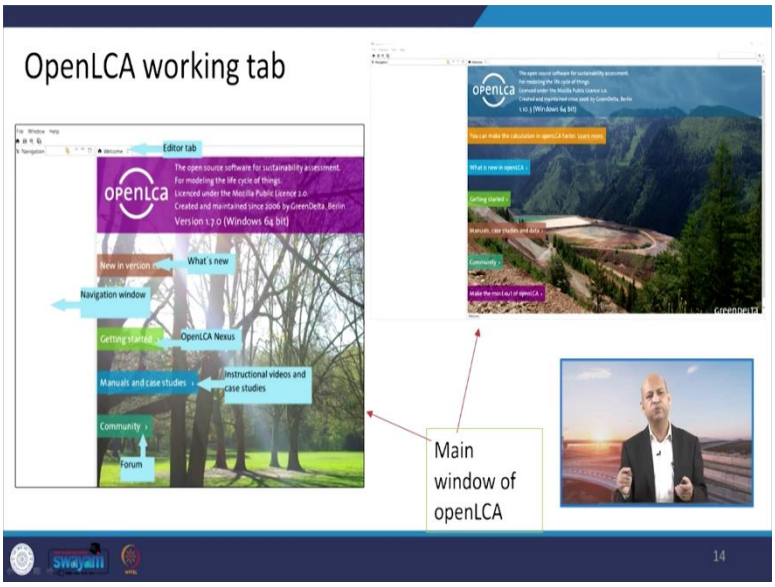

Then you see this main window like this and there are many buttons are there like new in versions which kind of version is available. Navigation window is there, openLCA and Nexus related things are there different kinds of buttons are there so, you can go through that.

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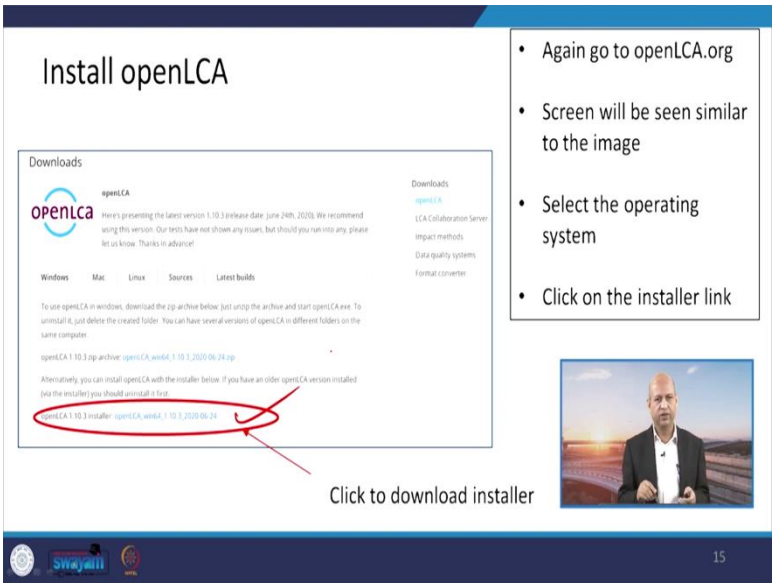

Then for installing you have to this open the installer first of all so that you can successfully install after downloading. So, the installer link is there and you click that it can help you to the installing this particular software.

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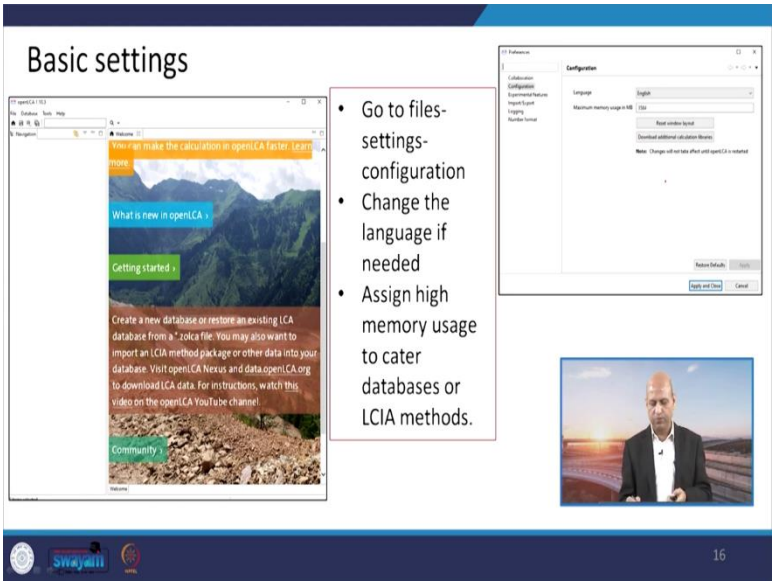

Then you have to go to basic settings. So basic settings basically are the file settings configuration. So, you have to do configuration in terms of language, in terms of high memory usage or database related things. So, this kind of window is available.

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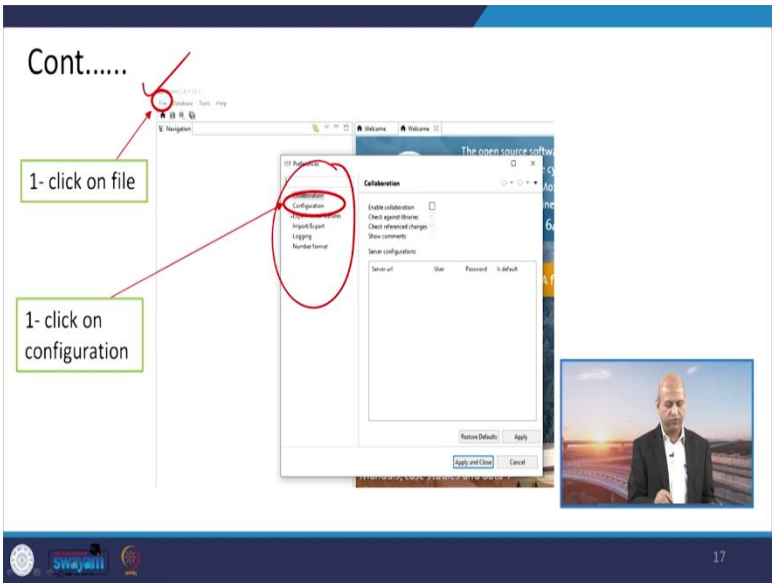

If you look at in detail then you can go like this particular file you can choose then it will give this kind of popup window there you can have this configuration so click on the configuration.

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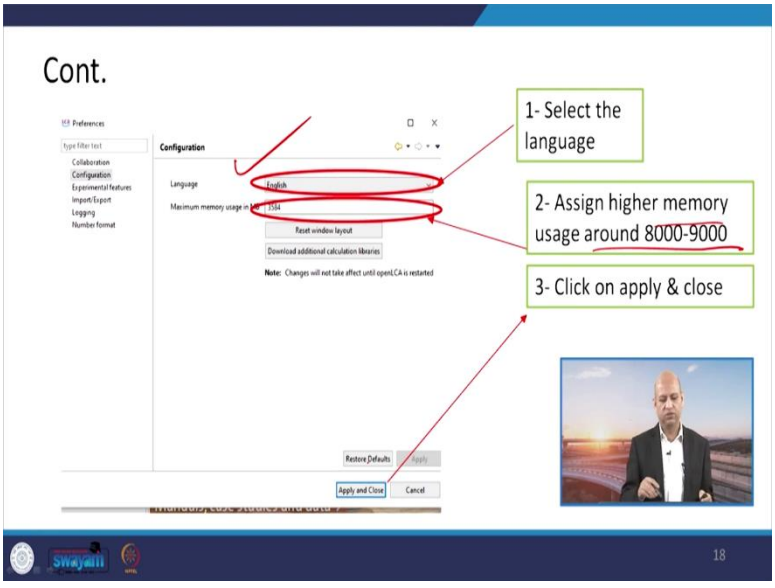

And then you can select many things like language, then maximum memory usage depending upon the systems you are using. So high memory usage around it at 8000 to 9000 is also available. So, depending upon your system you can choose. Then click on Apply and Close. So, first you choose and then apply so that you can configure it properly.

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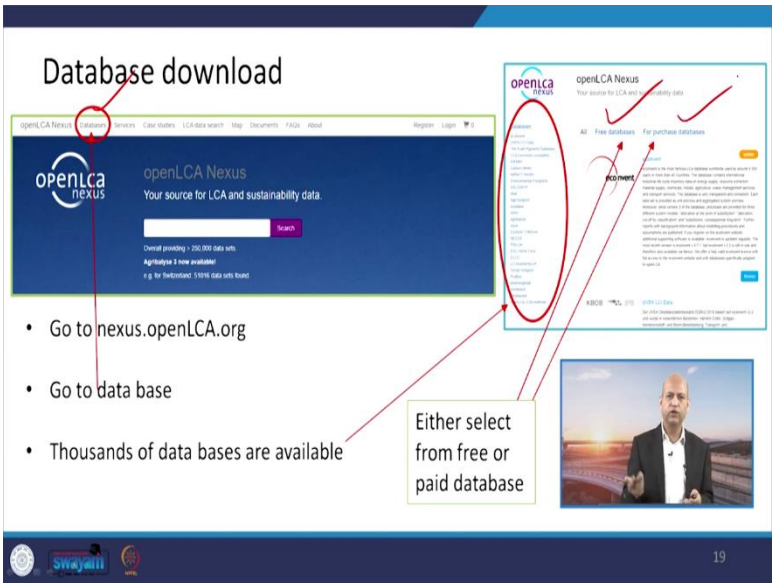

Then you have to select the database which is useful for you so go to this particular Nexus site and go to this database; next button to this open which we have gone earlier. So, databases you just click there and you will see several available databases the list is there. And it is also like free database and the for-purchase databases those kinds of buttons are also there. So according to your requirement you just click.

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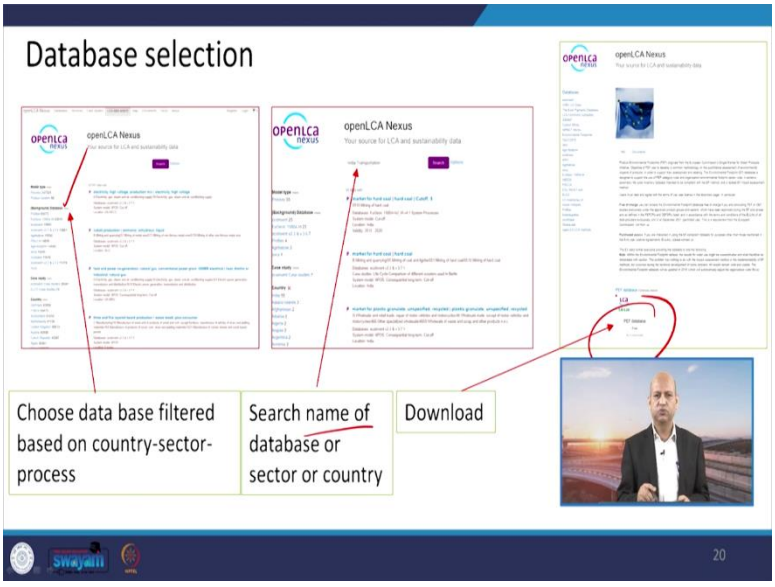

Now like the database filtered based on country or sector process that kind of thing is also available there. So choose that button then go here and you can search the name for the database or the sector or the country accordingly you can search here which is available. And then you can this you can download from clicking here.

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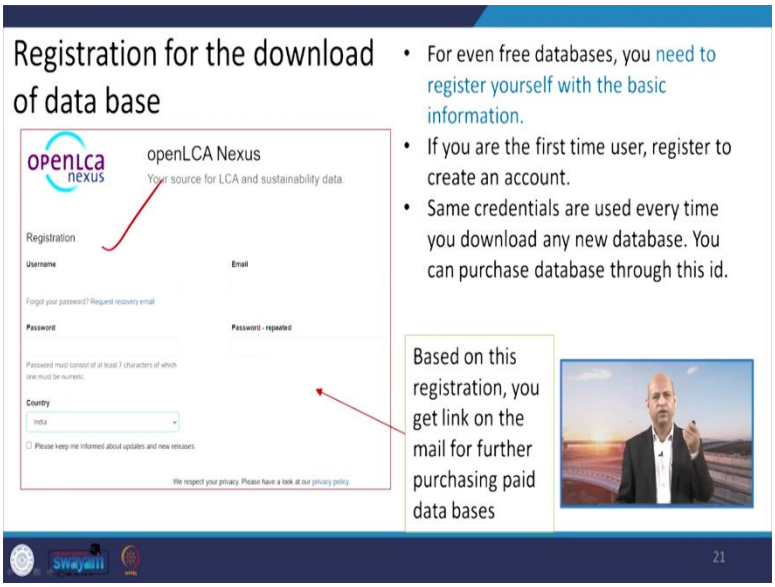

So, that these are the different steps then you have to do registration for the download of the database basically before that. So, even if you are having free database, you have to register basically. So, for that user name, password, email, etc., all those basic things you have to do so that whenever you access those basic things are helpful for you to enter into the website.

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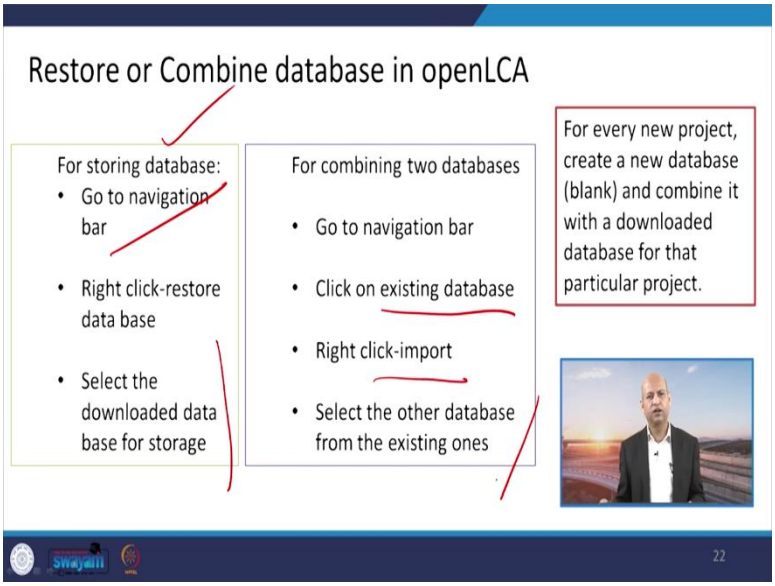

Then you have to do like restoring or combining database in the openLCA you have to combine them. So, what you do? Basically, you store this database after going to the navigation bar, then right click restore database and select the download database for the storage and then combining two databases you can also do again go to the navigation bar, click on existing database and right click and import and those kind of button is there so you can click on the import and select the other database from the existing ones so that you can combine those database.

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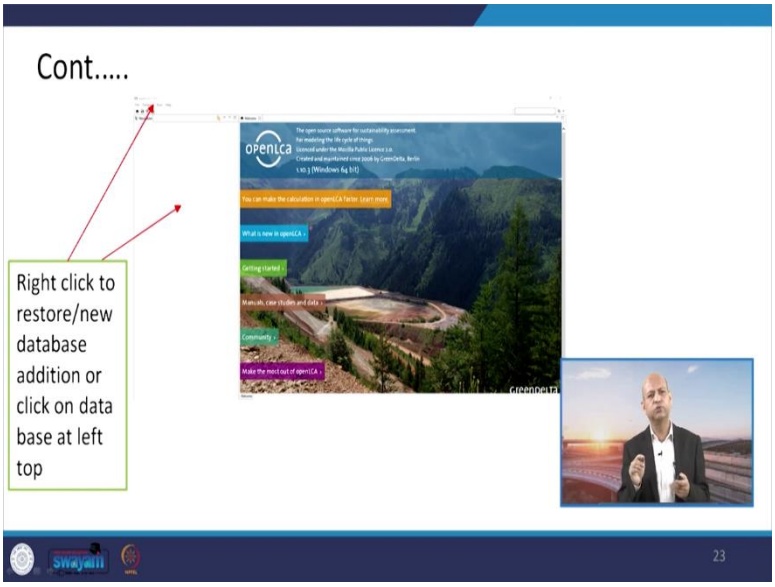

Well, then you can see like here right click to restore or new database so this kind of window is available. So, from there, the requisite button you have to click.

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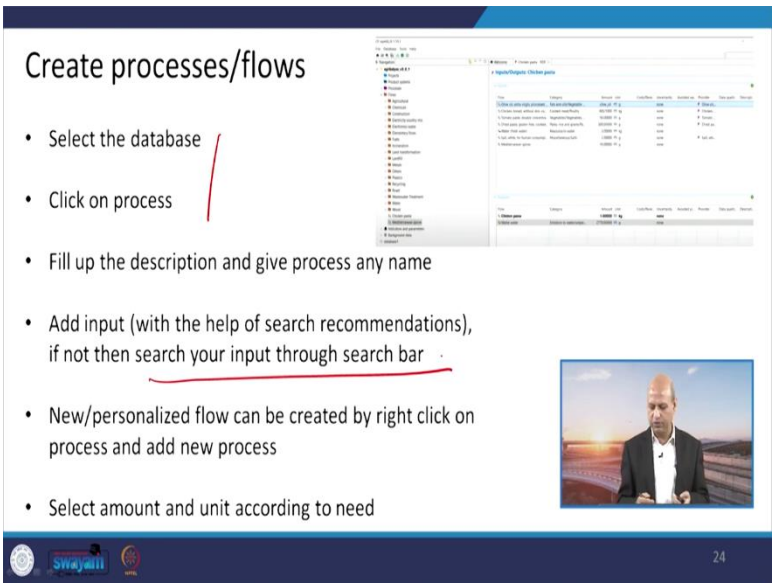

Well, when you are creating processes or flows, basic things you have to do. So, select the database and the click the process. So, this will process the database and bring to that level where you can do the impact analysis. So, before impact analysis this is the important process. You select the database and click the process so that you can see this kind of window and fill up the descriptions and give the process a name so that you can further search it later on.

This input with the help of search recommendations, you can do this search bar through search bar, then new personalized flow can be created and you can give it name and select the amount and units according to your needs. So, because different input parameters will be there.

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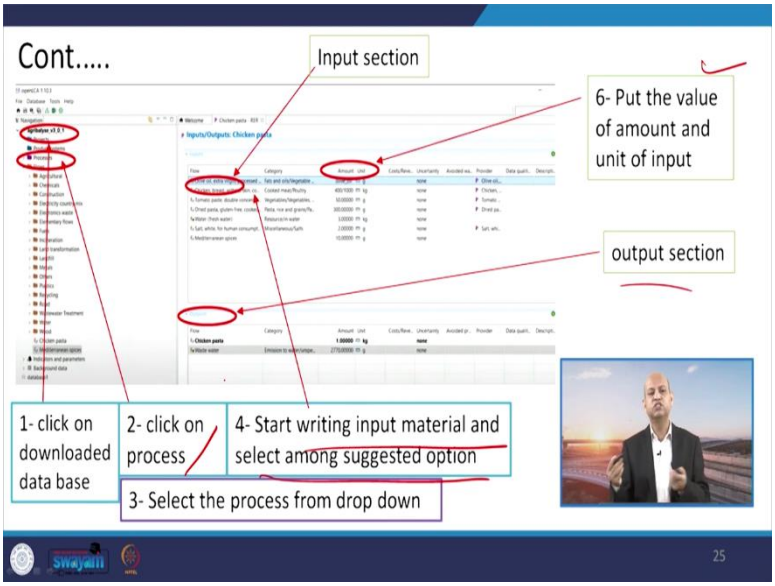

So, you have to select like these are the input parameters. So, download a database you see and you can see this button of the process then process from the drop down. You see the start writing input materials and among these you can see different units, different values. So, those values you can put from these available values and then the output section also you can choose in which nature you want to have the output.

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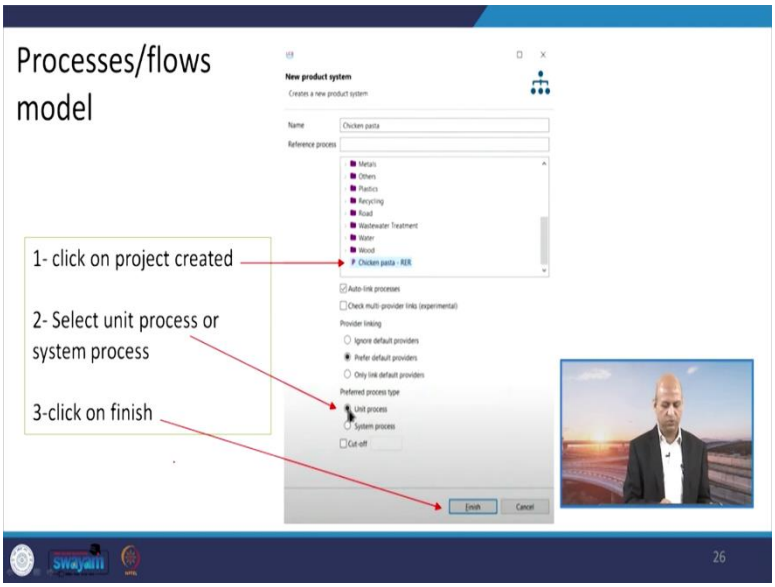

Then this project is created you have given some name and then you click the Finish. So, that it can process the process flow can be carried out by the model.

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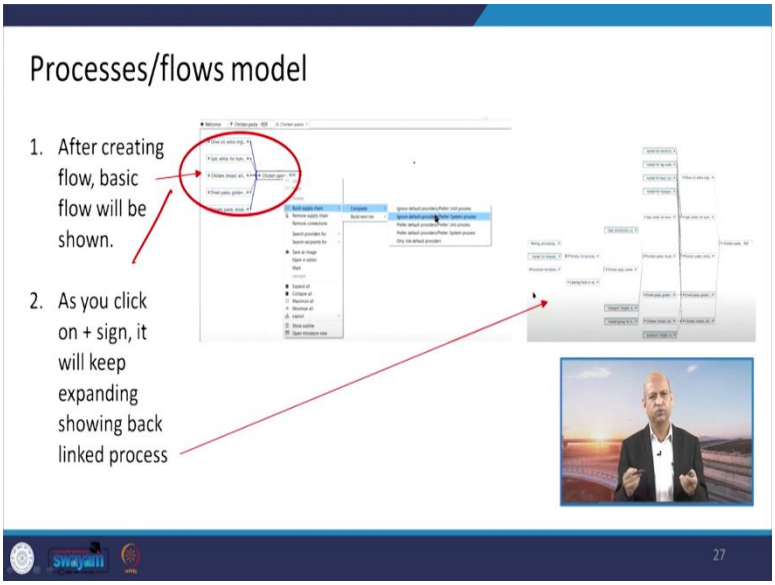

So, after creating this flow basic flow will be shown in this particular window. And you will see these kinds of options. So, those particular options which are related to your, activity. You can select those particular things.

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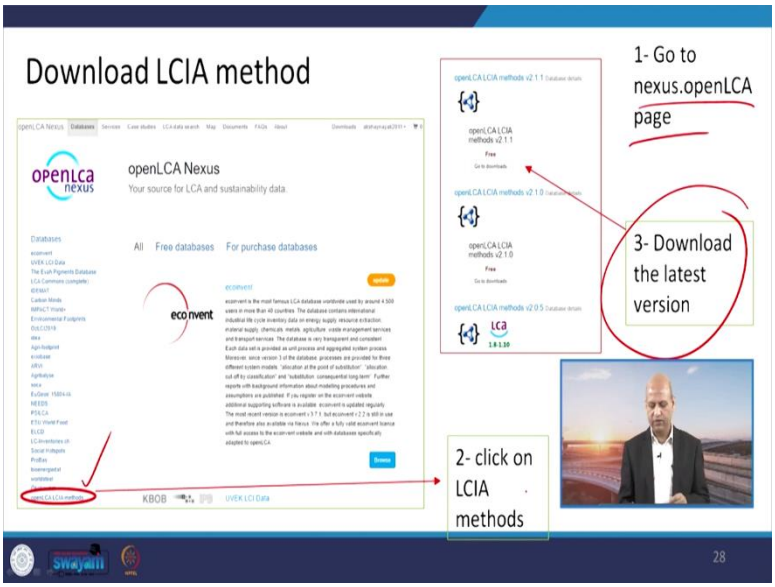

And then we do the impact analysis basically, LCIA. So, before means, we have done already the process we have certain values. So, now, this particular module, this LCIA, that is lifecycle impact analysis method, this module has to be selected basically. So, you can go to Nexus openLCA page, and you go to this download the latest version of LCIA like you have done for openLCA. So, basically, this is another module of the openLCIA, LCA and then you click the LCIA methods.

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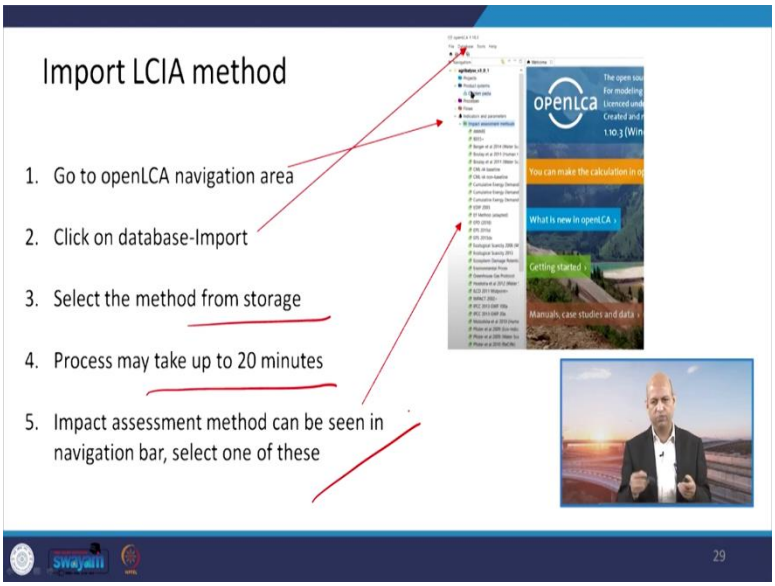

You see this navigation area again here. So, the database import is there, which you have already processed then the method from the storage and the process may take around 20 minutes when you choose this. The impact assessment method can be seen in navigation bar. So, according to your requirements, you select the one from these available options.

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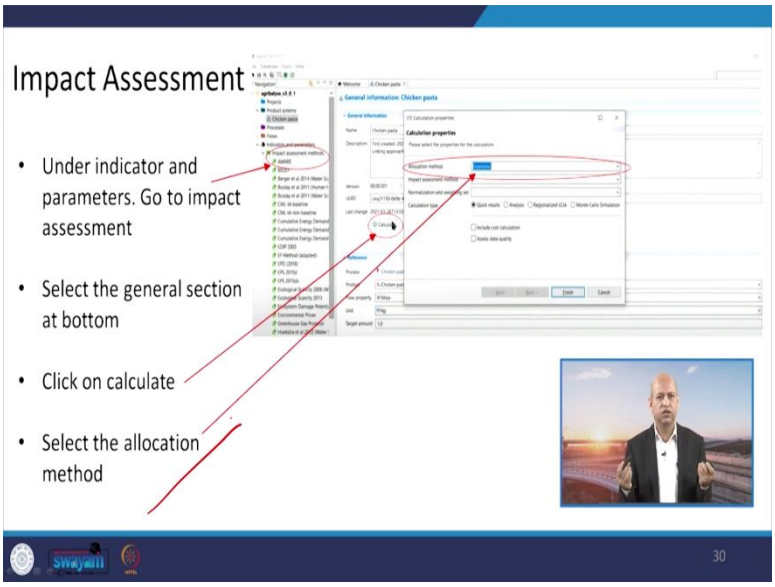

Then this impact assessment is carried out by different kind of names like this indicator is there, impact assessment related options are there. Then general sections are there also and then calculate button is there so, that you can calculate the values and allocation select the allocation method which is related to your case which is related to particular activity.

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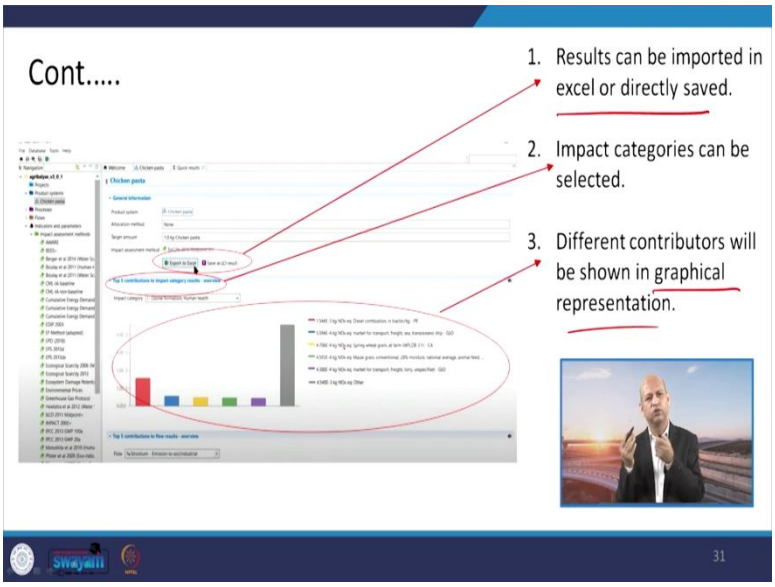

Then this window is there. So, results can be imported into Excel or directly you can save it after running and then you can process it in the different kinds of charts etc. So, different contributors are shown in terms of graphical representation, so, that you can see like different values are there and different kinds of activities are there and like effluent or particular pollutant, how much it is discharged or emitted?

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So, you can see here also like greenhouse gases, how much it is emitted? Those kinds of things. So, various impact flows are, output is there an impact category can be selected from there. So, whether it is greenhouse gas related or toxics related or smog related or effluent related whatever environmental aspects you are considering those things can be selected from here.

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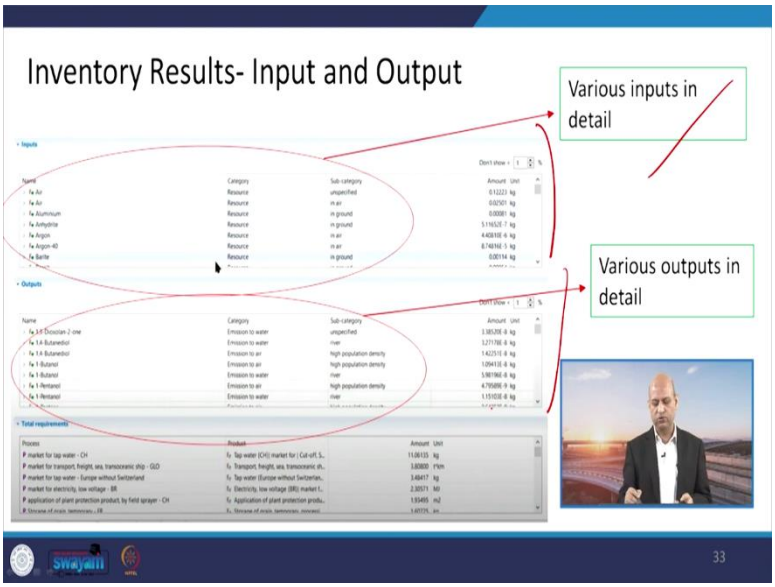

So, these are the inventory results input and output from this model basically. So, various inputs in detail you can see in the single window and output also you can see. So, you know these are the inputs values which we have already selected and processed and these are the outputs based on those input values. So, in a single window, you can also look at it.

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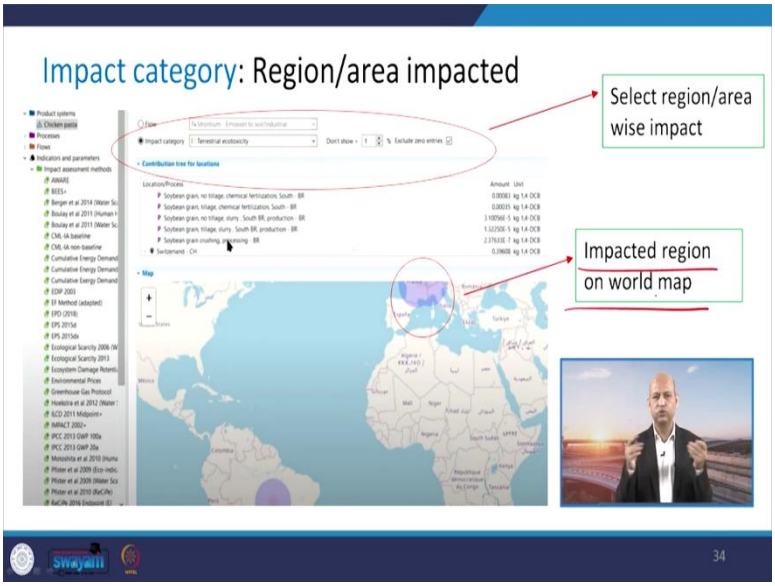

Then impact category like region wise or area wise. So, that is also available in this map. So, the region and their range etc., can be seen in this impacted region on the world map. You can zoom in, zoom out and accordingly you can see its impact.

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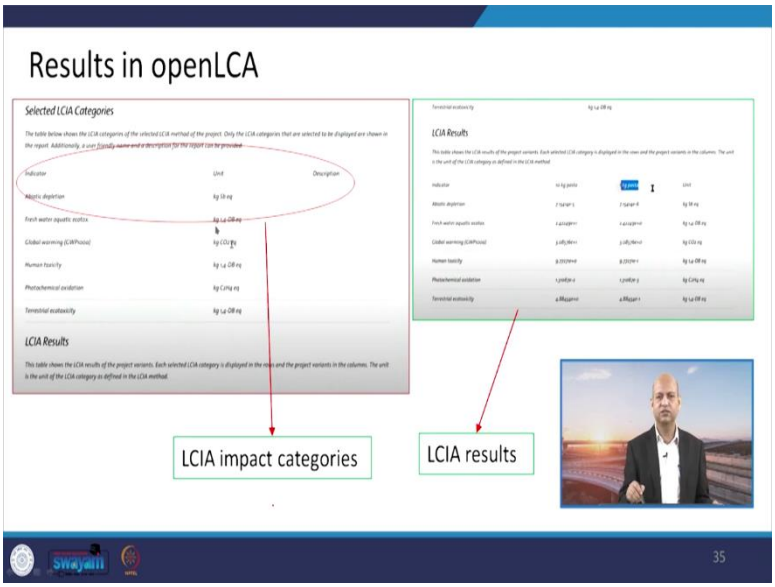

Well, these are the values in terms of categories, in terms of certain attributes like pollutant levels or their impact like acidity, like acidic kind of things or acid rain related impact or ozone related impact those kind of things you can see. So, these are the charts or values you can compare with each other.

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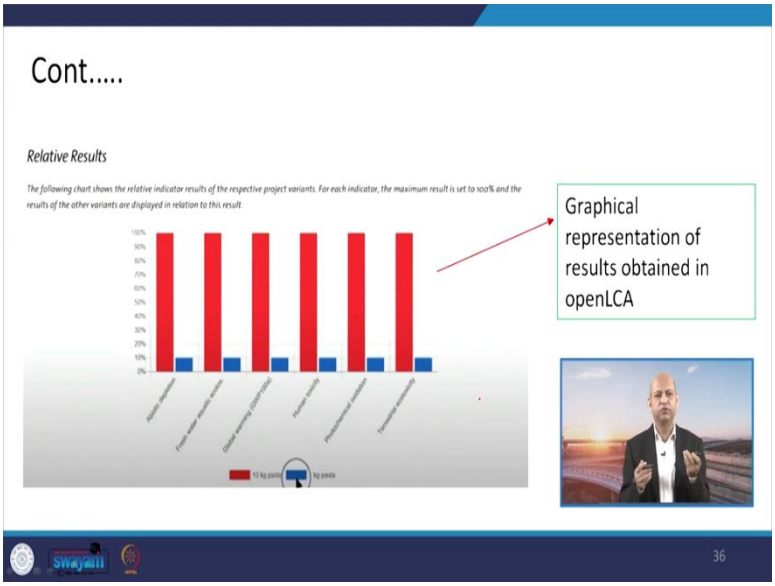

So, this is one basic example, which have been taken screenshot after running this particular. So, these kinds of variables are there and graphical representation can really help to see and visualization you in a proper way.

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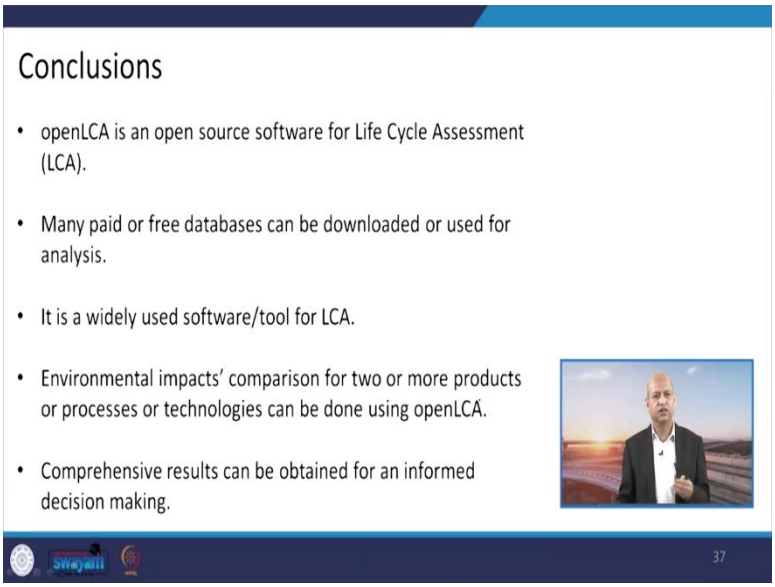

So, theoretically today we can say that this openLCA is an open-source tool which is freely available and you can play with it in different ways according to your requirements and there are other many paid versions also of paid software rather which you can use if you go for more detailed one more requirements are there in a kind of micro level kind of things and so, then paid software you can go otherwise freely available software for research purposes you can go.

Then it is widely used. So, that is why we have taken the case study for this, but case study we will take means next lecture, application, this is only the theoretical framework today we have discussed. And the environmental impacts comparison for two or more products is possible even two or more processes or technologies, you if you want to compare that this particular technology, how it will affect the environment? So, this particular tool can give you that insight, and then the comprehensive results are obtained by this LCA and that also helps you to have objective analysis and the informed decision-making process. So, this is all for today.

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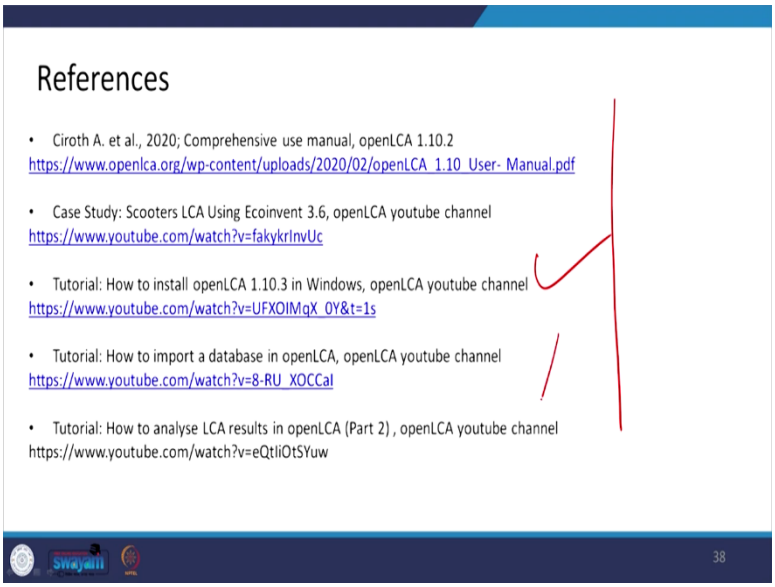

And these are the references, you can see the manual and the case study is also there. Then tutorials are there, you can go through these tutorials which can really help to learn this particular tool. So, I would, encourage you to go through this tool conceptually as well as after listening to or watching our next lecture, you can just practice it, it is very important because then you will learn about this particular software.

So, this will be a kind of skill you will earn and you can write in your bio data that this openLCA how to use it. So that is added advantage for you. So, this is all for today. Thank you for your attention, and see you in the next lecture. Thanks.