SimaPro® Guide

Produced by:
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Worcester
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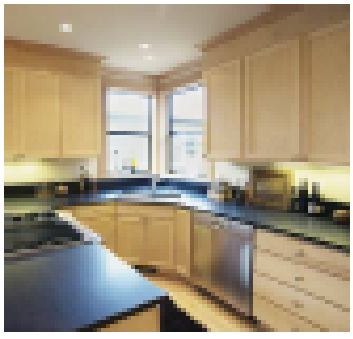
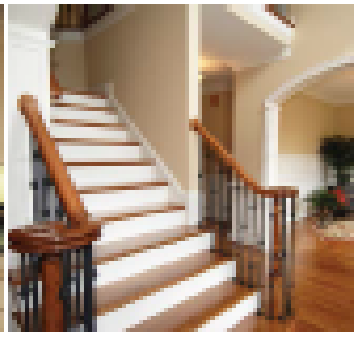
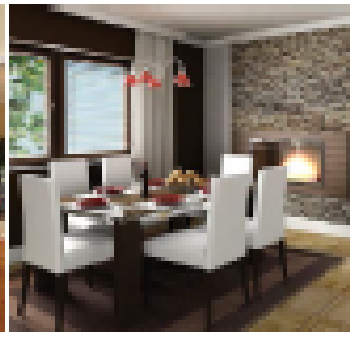


Used as reference to the Worcester Polytechnic Institute Interactive Qualifying Project; A Solar Decathlon Materials Selection Study. Preformed at the Luzern University of Applied Sciences and Arts.

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In order to combat the steep learning curve that SimaPro® is notorious for we have created a guide to learn basic commands, input data, and produce calculations. This guide does not asses the methodology of LCA, those can be found in the literature review. The process that we based the guide off of is turning a felled tree into lumber planks used in creating a shed.

Starting a New Project:

Firstly you will need to create a new project. Upon start-up, SimaPro® will prompt you to open a new project or continue an older one. Select “new project” and name it what you please. In this case we will call it Felled Tree.

Before starting any new LCA project you need to understand the goal and scope of your project. This is important to keep in mind throughout the whole process because SimaPro® is extremely granular and it will be easy to get caught up inputting data that is unnecessary to the project.

Selecting a Library:

In this section, you can define which libraries you want to use for each of your projects. They are intended to be used as resources that you can use in all your projects and that are not intended to be edited. If a certain item or material from a library needs to be customized for your project, copy that item and edit it accordingly.

Process 1: Entering a Felled Tree:

The scope of this guide has been defined to include the woods life cycle starting from a fallen tree, to the end of its life.

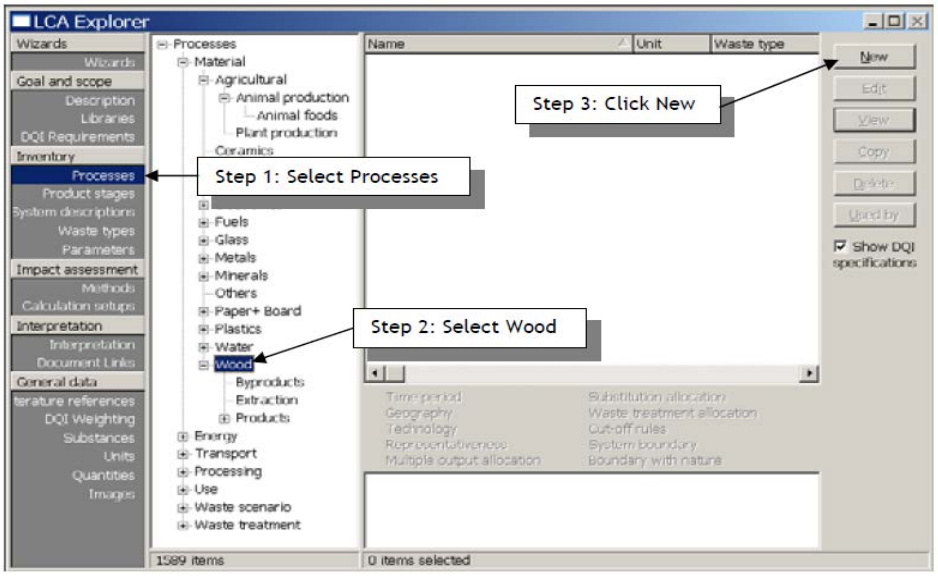
We will take 1.25 tons of wood from a felled tree. We will assume that only the truck of the trees will be used and any branches or leaves will be left in the forest from which this is being gathered. As part of the scope we will take into account any machines (i.e. chainsaws) needed to gather this given amount of wood.

Now follow the three steps, which are also shown in the figure below:

1. Click on Processes in the LCA Explorer window.

2. Click on the category Wood.

3. Click new and a new and empty process record will appear.

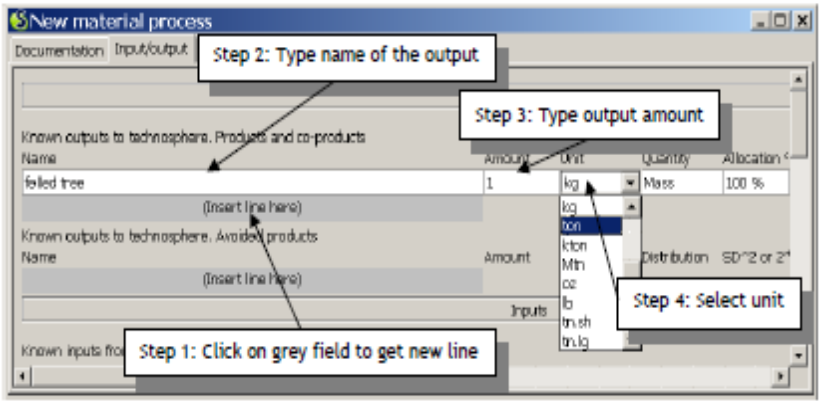


Process Outputs:

The new material process window will have four tabs, for this click the Input/Output tab second in from the left.

Follow the four steps shown in this figure:

1. Double click on the white field under the “known outputs to techno sphere. products and co-products” section and a new line will appear.
2. Enter the text “Felled tree” in the section under “Name”.
3. Enter the number 1 under ‘Amount’.
4. Double click in the field under “unit” and choose ton by using the pull-down option. SimaPro® can convert units, so it understands that you now have just entered an output of 1 ton of felled trees.



Entering Inputs:

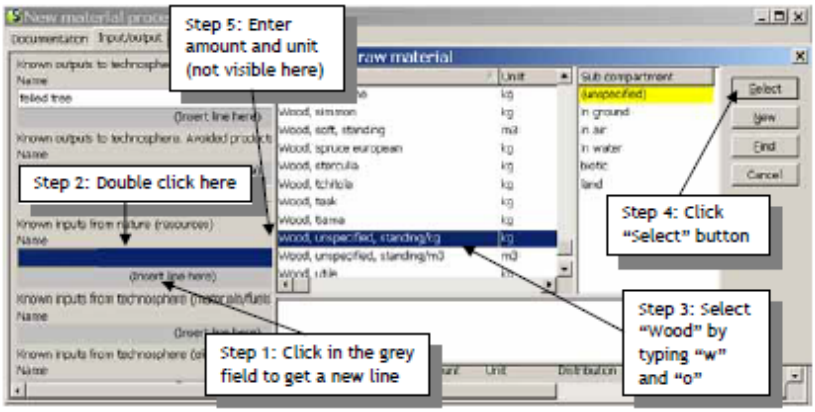
Entering inputs usually should come second, after entering the outputs, when starting a new process because knowing the desired quantities of the outputs will help to know the required amount of input. Note that under the Input option lines there are three pre-established types of inputs. These are Inputs from Nature Resources, Technosphere (materials and fuels), and Technosphere (Electricity and Heat). More detail on each of these is displayed below:

1. Known inputs from nature (resources). Here you can list the resources that are directly taken from the natural resources. In this case, the wood that is extracted from the forest. In a process that describes mining, the ore or metal input would be described here. All data you enter here will be included in the inventory result table.
2. Known inputs from technosphere (materials and fuels). Here you enter inputs that come from other industrial processes and not from nature.
3. Known inputs from technosphere (electricity and heat). This field has the same purpose.

Input from Nature Resources:

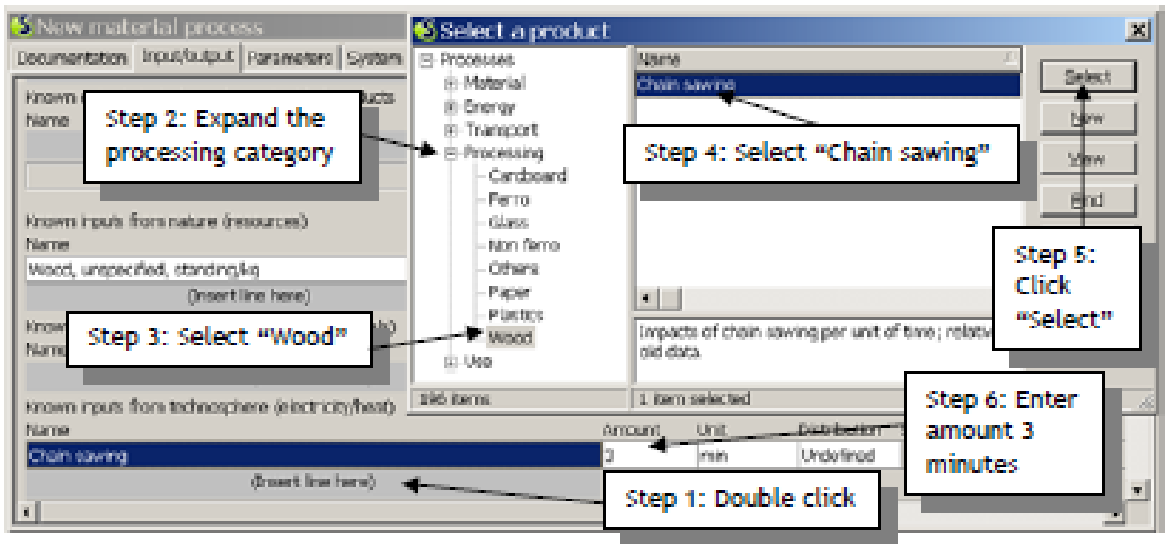
1. Click the grey box (insert line here) under ‘known inputs from nature (resources)
2. Double click in the blue field. A list of predefined resources is presented.
3. Select wood from the list. You can do this by scrolling, but also by typing “wood”: SimaPro® will immediately search for the closest match.
4. When you find “Wood, unspecified, standing/kg”, click ‘Select’ (or double click).
5. Enter the amount as 1.25 tons. The difference between input and output is entered as final waste flow “Wood waste”.

Displayed to the right are the steps:



Inputs from Technosphere (materials/fuels):

Given the scope of the project defined in the beginning of this guide we will take into account the input of materials and fuels need to run a chainsaw. This can be done by following the steps on the screen shot below.

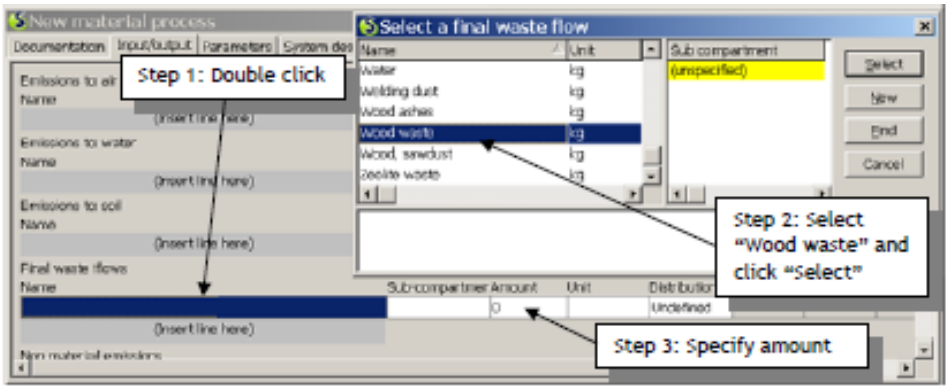


Based on quick research from local wood companies we came up with the estimate that it will take three minutes or 0.05 hours to fell a 1.25 ton tree.

Entering Emissions and other Outputs:

Below the inputs there are eight different sections to enter more outputs. They are: Emissions to air, Emissions to water, Emissions to soil (usually to express leaching), Final waste flows, or wastes in solid form, Non material emissions, like radiation, noise, etc., Social issues, Economic issues, and Waste and emissions to treatment. As mentioned above we will need to

enter “wood waste” as a known output. Further research will conclude that from a 1.25 ton felled tree, 250 kilograms or .25 tons of wood waste will be created. Image below displays this process.



Documenting the Process:

The figure below provides an example of how such documentation for this specific record could be entered. Please note the following characteristics:

- The name of the process is not the name that you will find in the list with processes. The name of the process is only there for your own reference.
- Under Data Quality Indicators there are 8 fields you can use to characterize the record. In the figure below, the appropriate settings have been entered.
- The comment field in the bottom will also be shown in the listing of the processes in the explorer. It is useful to add some characteristics that help you to understand the contents of the record.

The image to the right shows how the data should be entered for documentation:

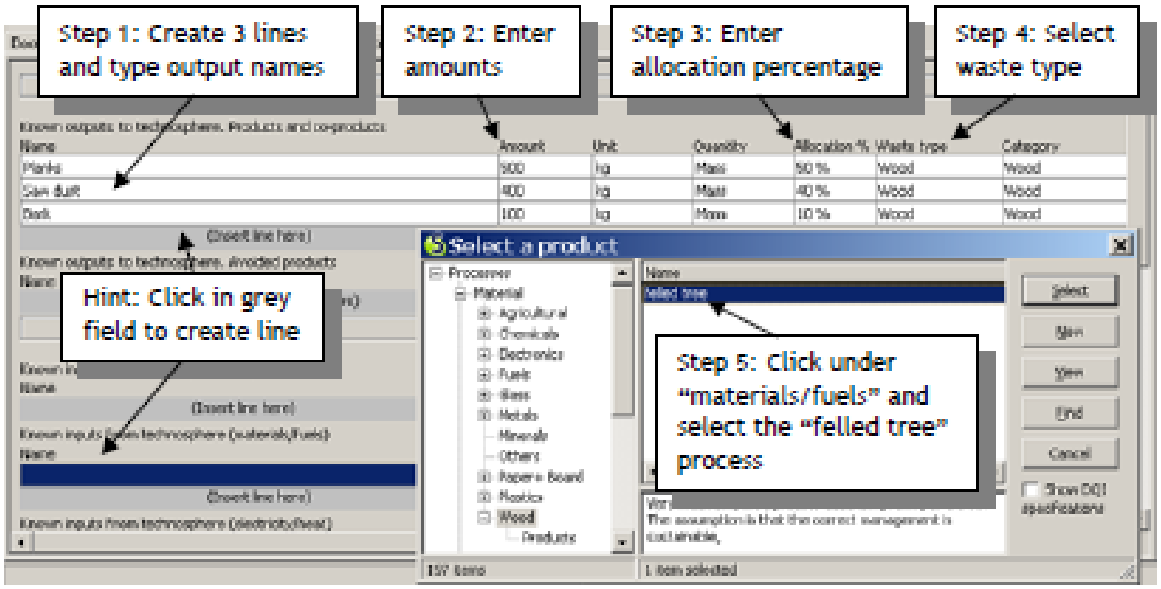
Process Two-Saw Mill (planks):

The next step in this LCA is to define the processes that occur at the saw mill after the tree is harvested. Here the mill will turn the felled tree into planks. As a result of this process we will take into account the amount of the tree that gets disposed of as either saw dust or bark. Start this process the same way as the felled tree; Materials, Wood, New process. In the command box that appears enter the three products that are produced at the mill and the percentages associated with each output;

1. Planks, 50% of the output, 500kg (half a ton)
2. Sawdust, 40% of the output, 400kg
3. Bark, 10% of the output, 100kg

Describing the Outputs:

The multiple outputs will create an allocation problem and this will need to be addressed. To tackle this problem and see the steps to enter the data for each output refer to the screenshot and steps displayed below:

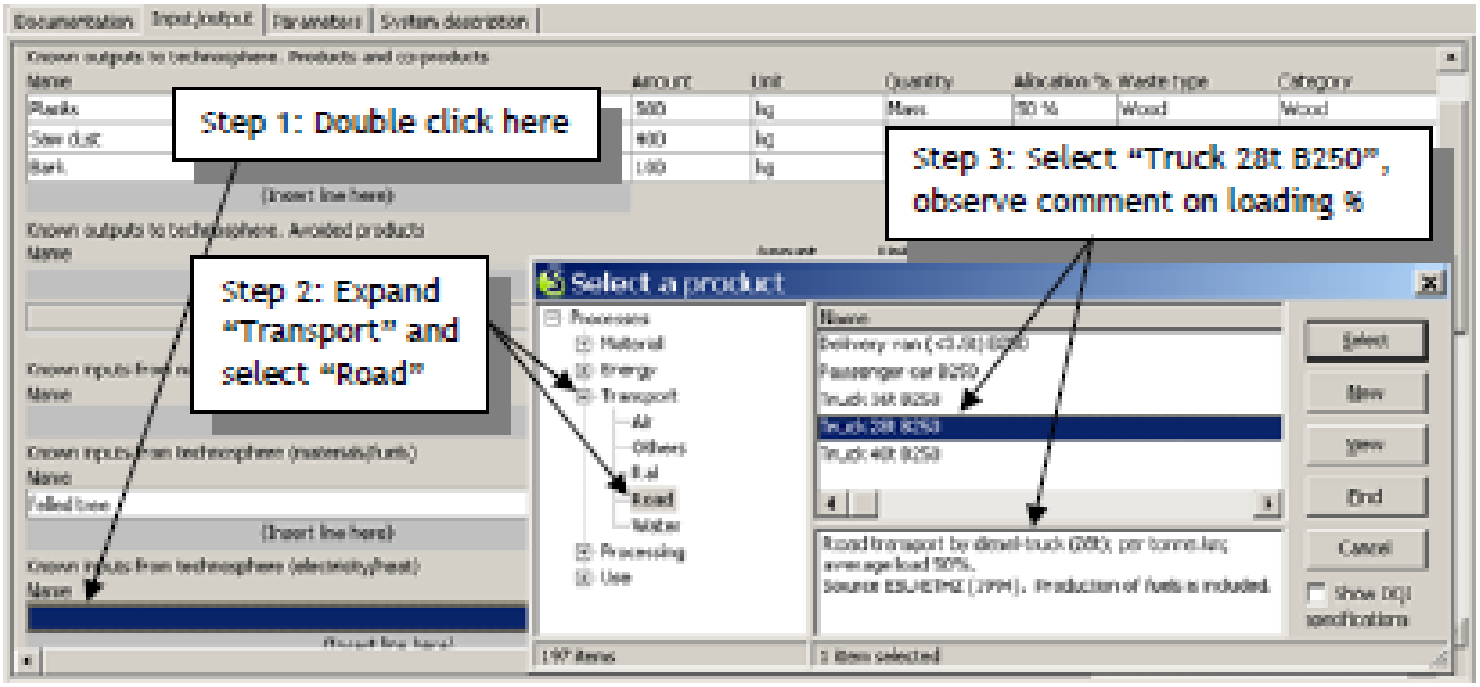


1. Create three lines under “known outputs”, by clicking two times on the “insert line here” field.
2. Type in the names of the three outputs.
3. Enter the allocation percentages, in the figure above this is done according to mass allocation.

4. Click under the waste type column and select wood. Below the purpose of this is explained.
5. Click under ‘Materials and fuels’. A selection box will appear, from which you can select the felled tree process. If you cannot see it there, use the “Find” button. To produce 1 ton of products (planks, sawdust and bark) and to have enough wood to burn wood for process energy (250 kg), we need an input of 1.25 tons of felled tree.

Adding Electricity, Transport and Emissions from the Mill:

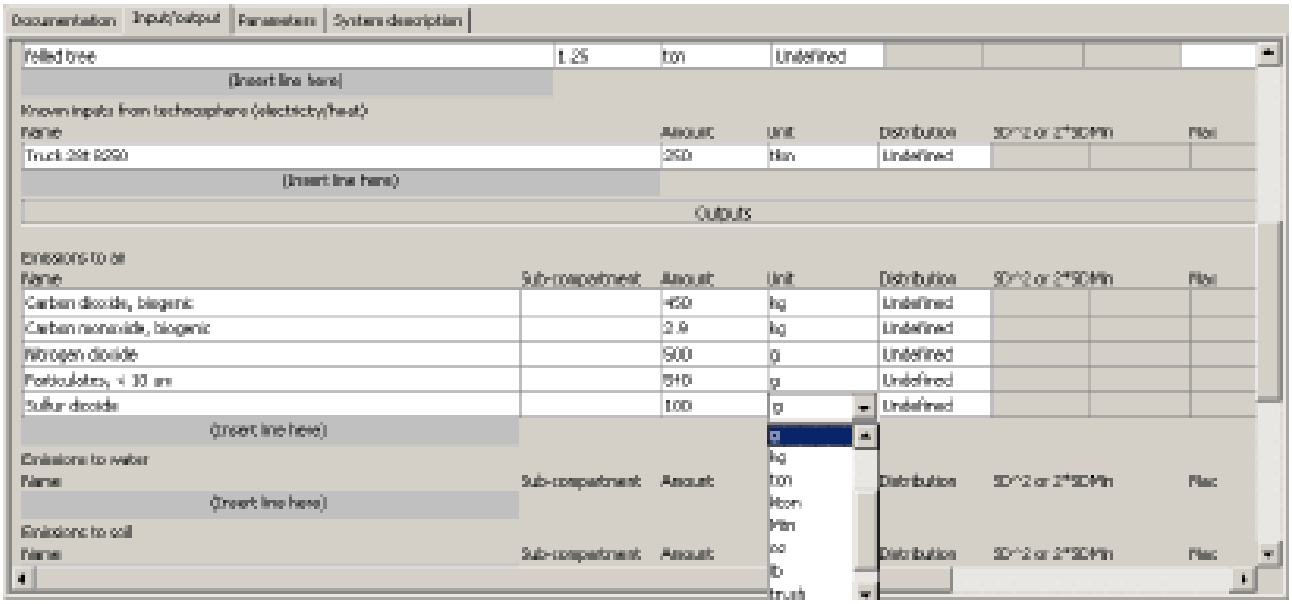
Energy and transport are added in the same way as the felled tree. We assume a transport distance of 200 km between the forest and the saw mill. For transport we assume that a 28 ton truck is used, with a load factor of 50% because the return trip will be empty.



When entering emissions from electricity it is important to use the standard from whichever country you will be preforming the LCA in. In our case we will use the Union for the Coordination for Production and Transmission of Electricity (UCPTE), this is the European standard when it comes to producing electricity, averaged off of European electrical grid data at medium voltage. Their estimation of sawing energy is 150 kWh (kilowatt hours). To take into account of emission from the wood burning we place the following values into the “emissions to air”:

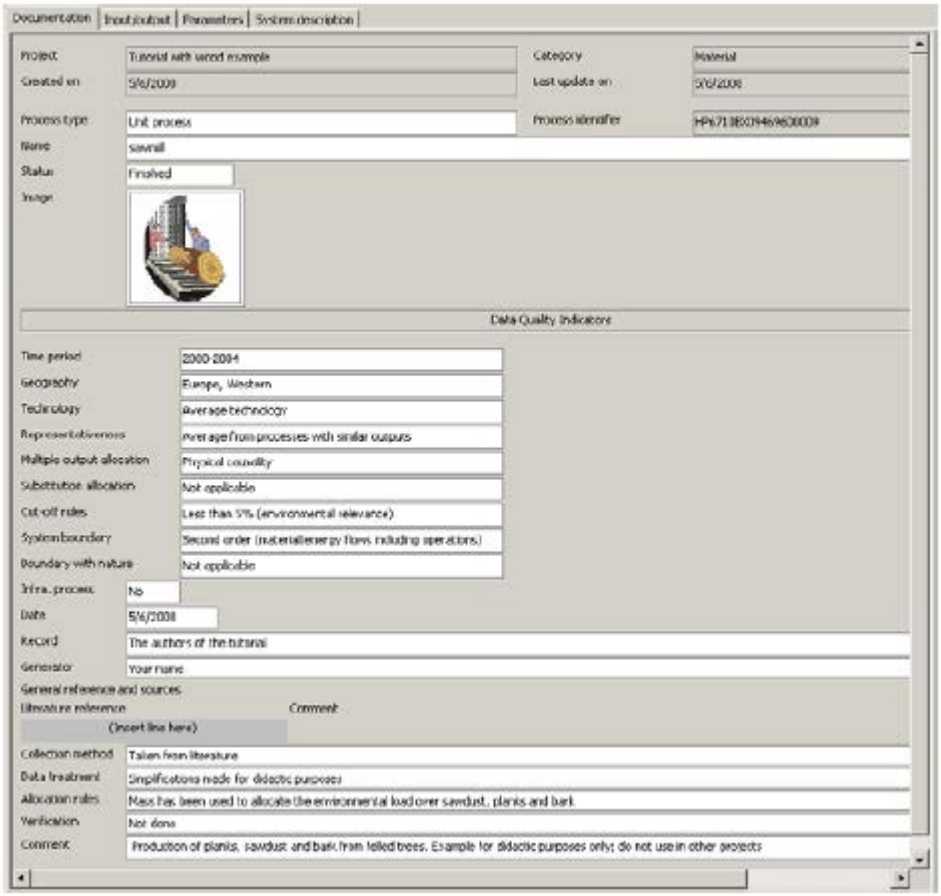
- 450 kg Carbon dioxide
- 2,9 kg Carbon monoxide
- 500 g Nitrogen dioxide
- 540 g Particulates, <10 µm
- 100 g Sulphur dioxide

Emissions to Air displayed below:



Documenting Process 2:

In order to finish up the Saw Mill Process you do the same type of documentation as the felled tree. The information is displayed by the screen shot below:



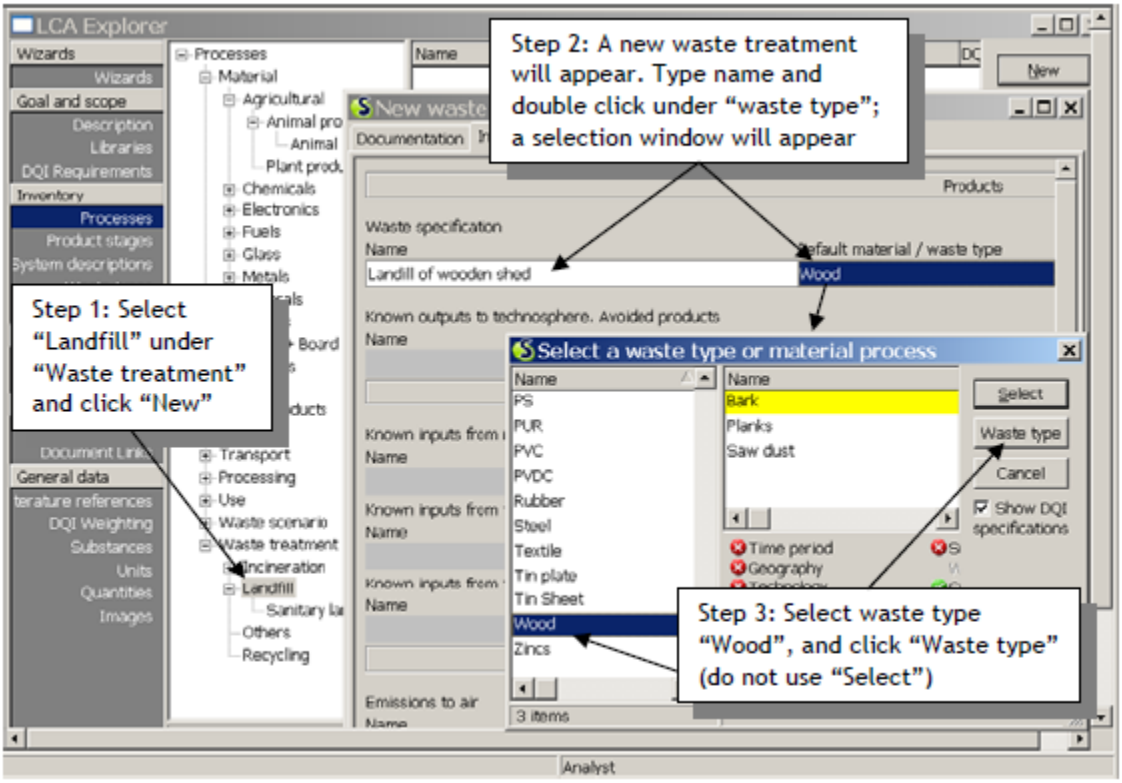
Waste Disposal and End of Life Scenarios

Now that the modeling for wood plank production is complete. In this section we will define and create a post-consumer waste scenario. The two materials that will make up the shed are the wooden planks as defined before, and steel parts used to conjoin the planks. For example nails and screws.

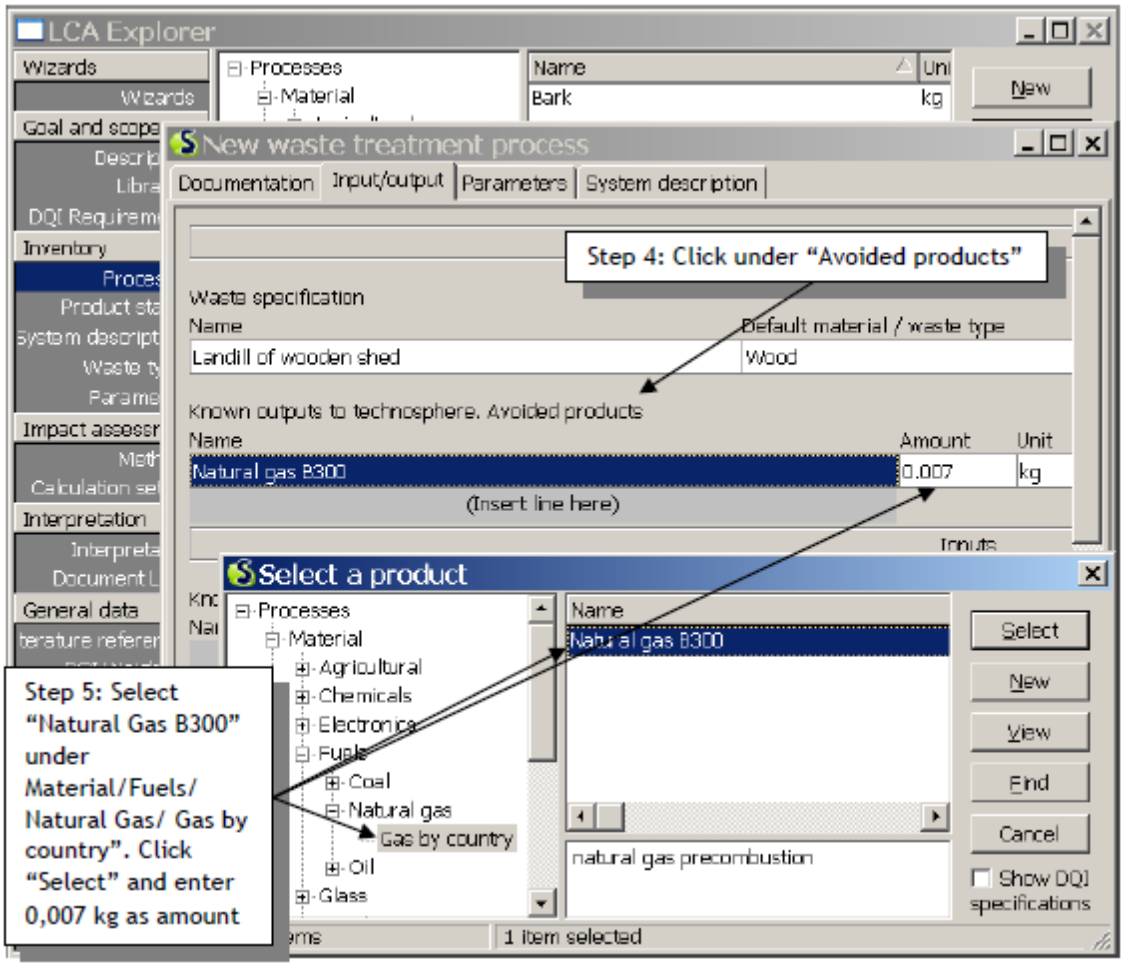
Standard with waste processes in Europe 40% of reused wood is burned in homes and 60% of wood is dumped in modern landfills. Using the full methodology of LCA we can conclude that the burned wood will provide no contribution to room heating, due to lack of proper ventilation in chimneys, and about a third of the methane produced by landfill due to the wood will be used as fuel. This information can be taken into account later in the analysis.

Waste Treatment for Landfill:

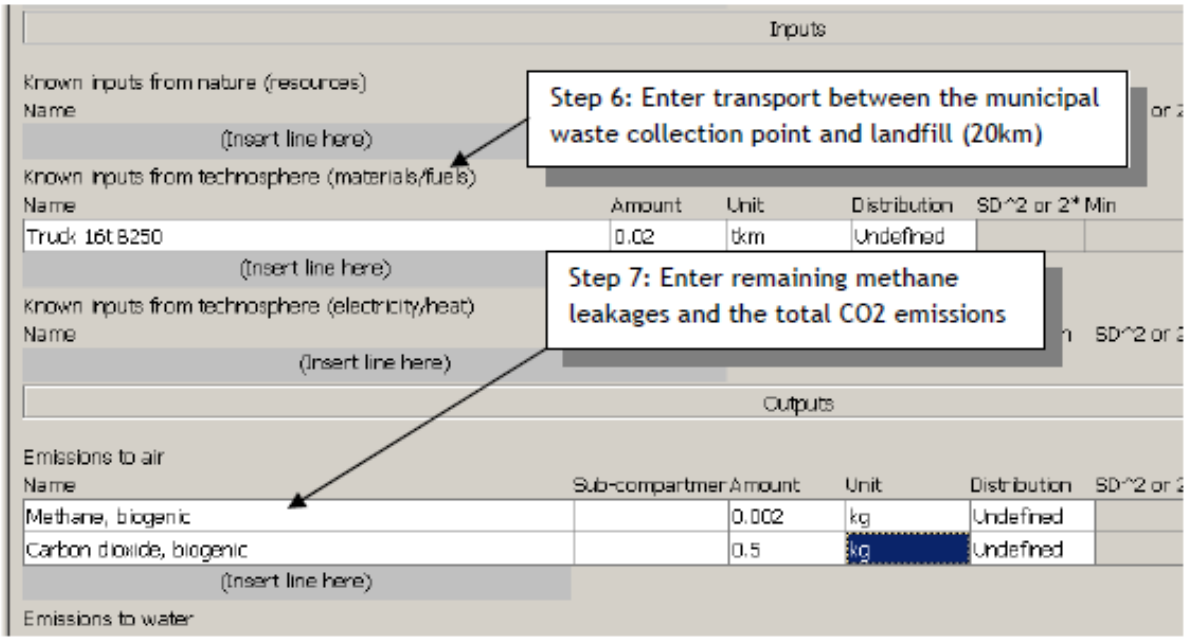
First end of life scenario that we walk through will be relocating the wood waste to a landfill. Data and steps to complete this process are displayed below.



1. Go to waste treatment under Processes, select the Landfill category. Click on the 'New' button on the right hand side to create a new and empty waste process.
2. Enter the name of the waste treatment ‘Landfill of wooden shed’. In a waste treatment the input determines the use of the process. Enter 1 kg as amount.
3. Now double click under “Default material/waste type”, to get another selection box. Here you define for which waste types this process is valid. Select wood from the list of already defined waste types. Click ‘Waste Type’ to select the waste type of the wood.
4. Click under Known outputs to technosphere, avoided products. A selection box will appear.
5. Select Natural Gas B300 from Materials/Fuels/Natural Gas/Gas by country. 0,007 kg methane is used for energy production.

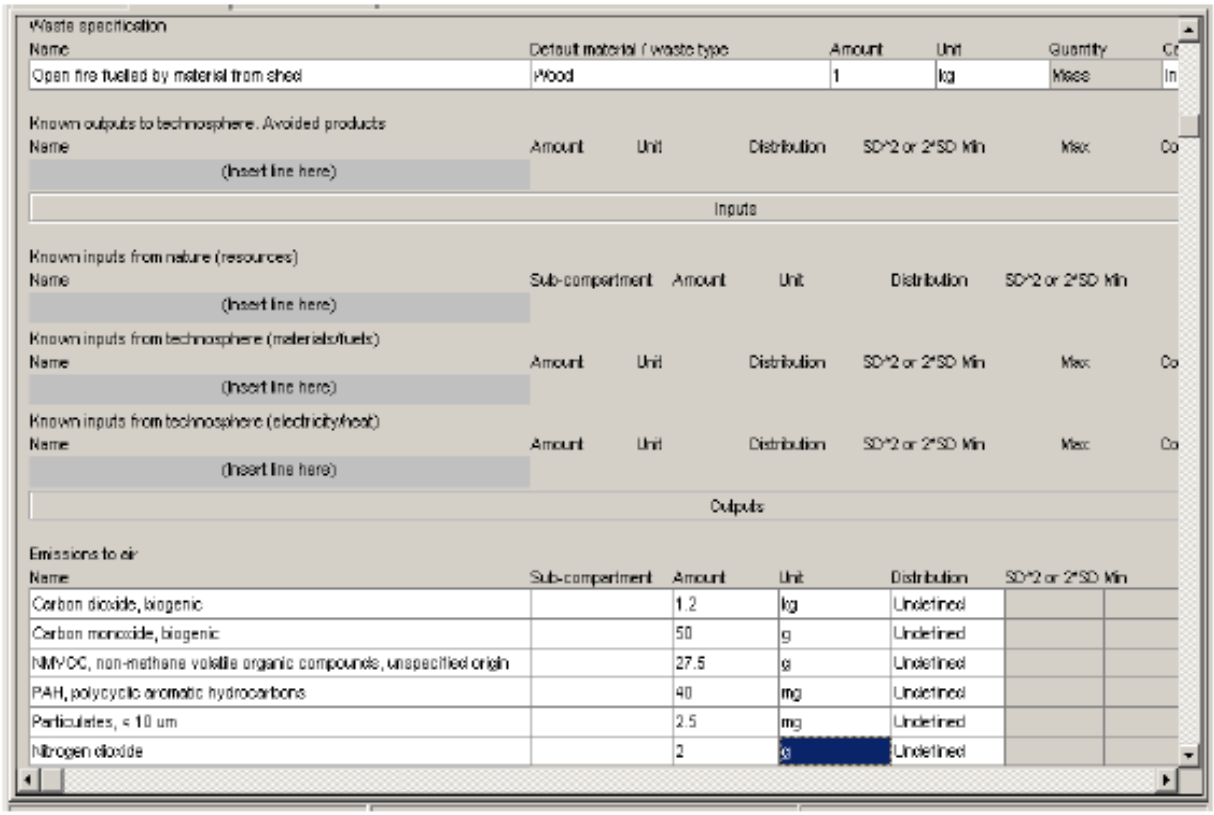


6. Enter under Known inputs from technosphere, Materials/Fuels the transport for the distance between the municipal waste collection centre and the landfill (Truck 16T BUWAL250 under Transport, Road). To transport 1 kg over 20 kilometres we need a transport amount of 0,001 ton x 20 km = 0,02 ton-kilometres.
7. Now enter the emission of the methane that is not collected (0,002 kg) and the total Carbon dioxide emissions (0,5 kg).
8. Finally document this process the same way as before.



Modelling the Impacts of the Open Fire:

When modeling the impacts of this open incineration we assume that there is no useful by-products. Below is the new process box for open incineration.



Waste Scenarios:

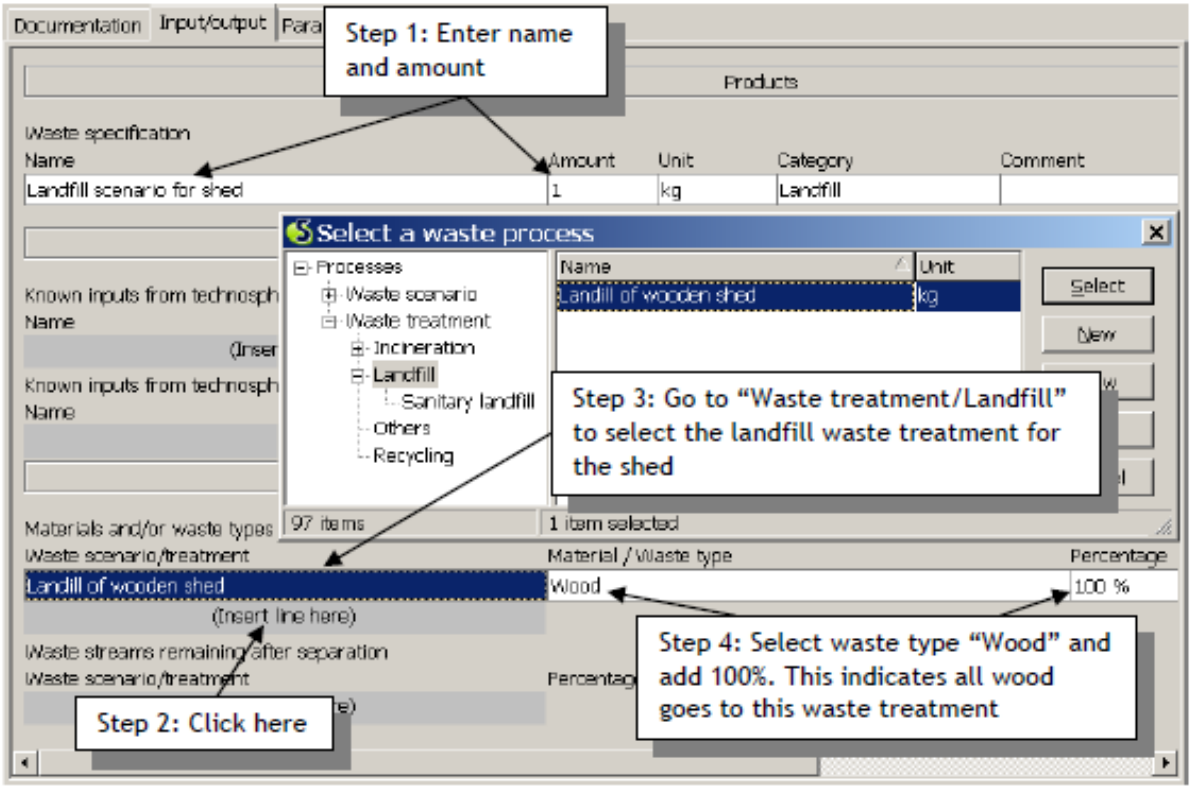
With the waste treatments created we continue on to the waste scenarios. They are:

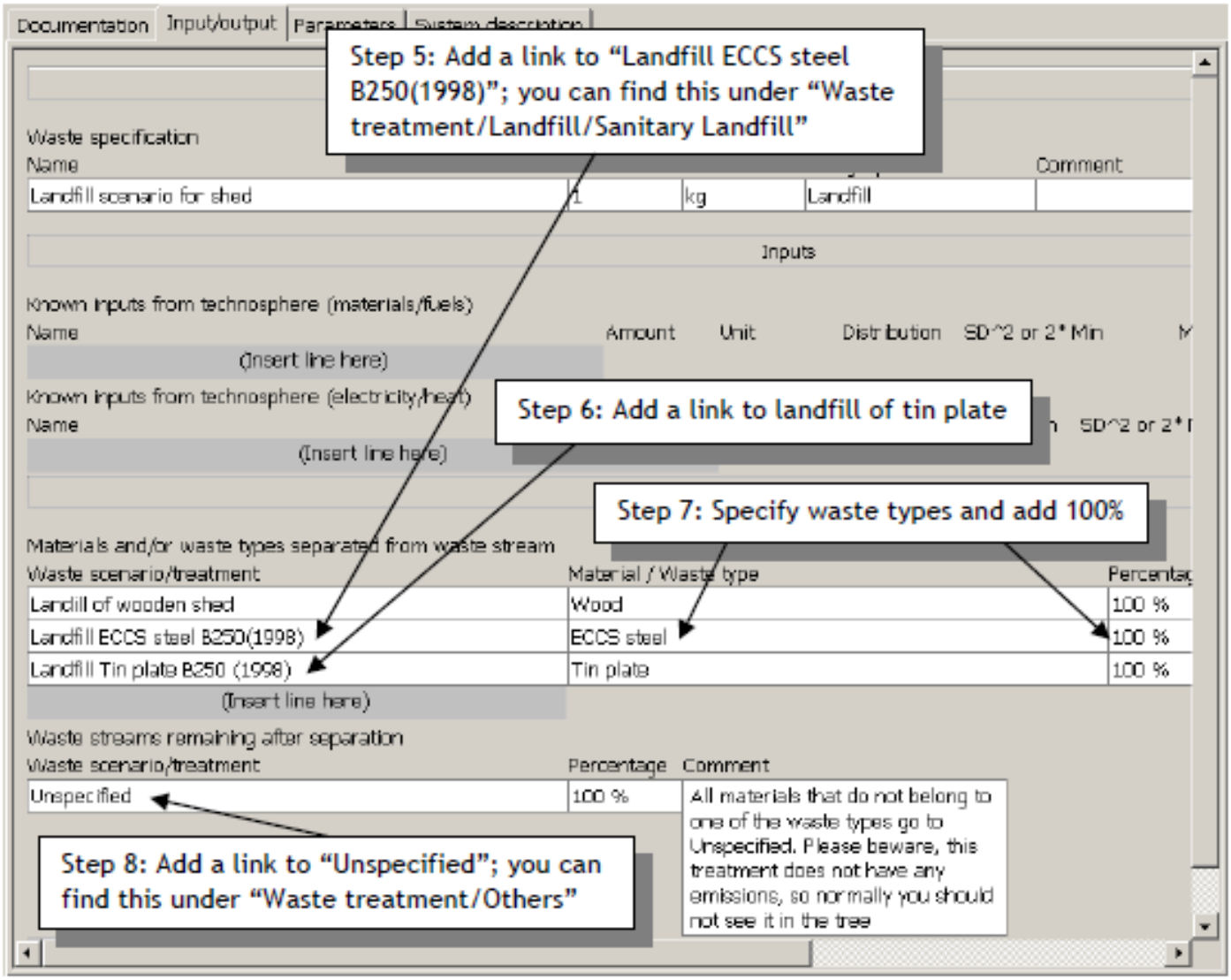
1. One for landfill
2. One for the open fire
3. One that splits up the waste between open fire and landfill

LandFill:

We will ensure that the wood is sent to the waste treatment landfill for wood and nails and other metal parts will be sent to a predefined treatment facility for steel. Steps below show how to input information for Landfill.

1. Enter the name of this scenario and the amount
2. Click under Materials and/or Waste Types separated from waste stream, indicated in the figure below
3. Select the landfill waste treatment we just created
4. Select the waste type “Wood” as we have done before and enter 100%

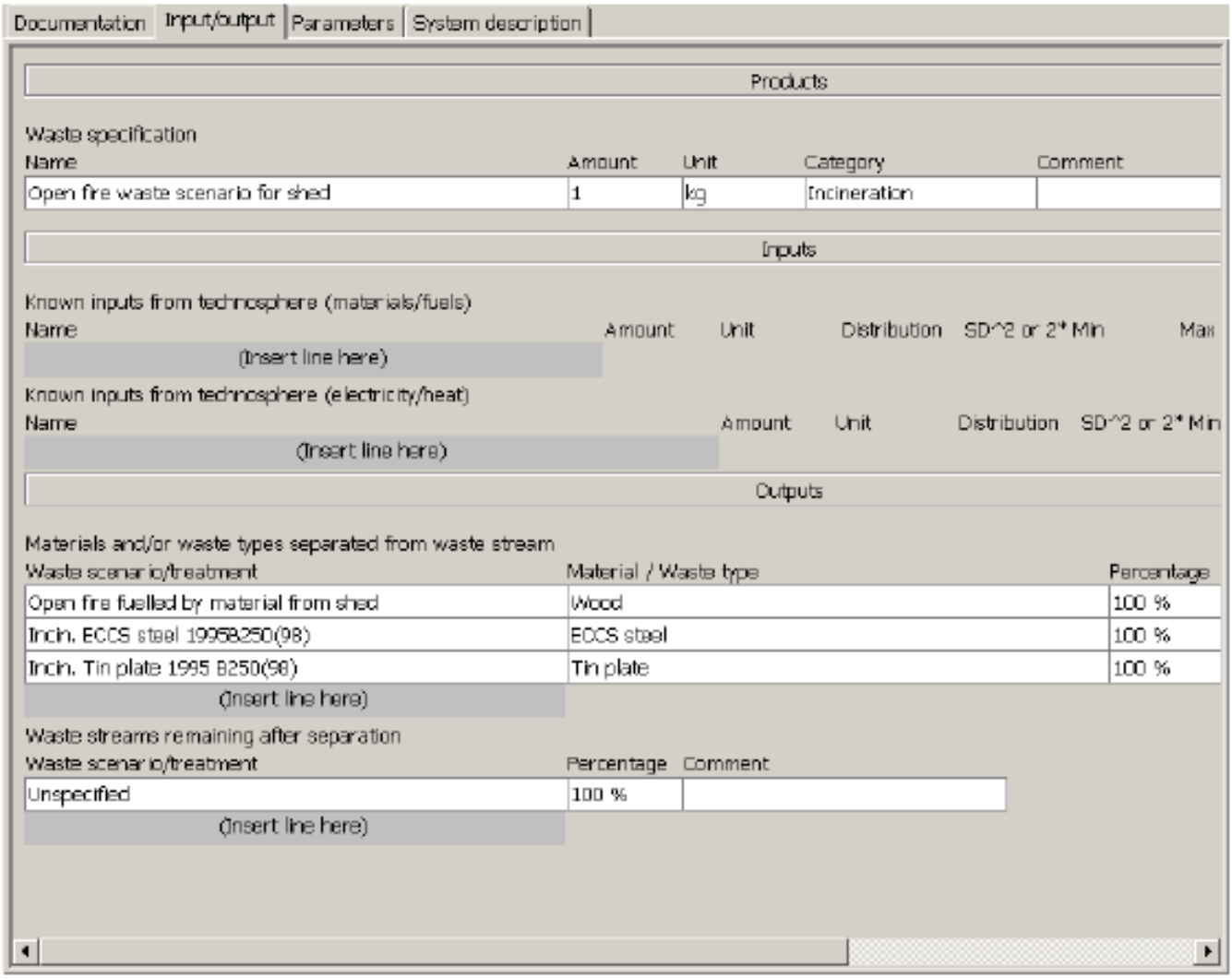




All materials with waste type wood that enter this record are sent to the waste treatment landfill of wooden shed. All metals with waste types ECCS steel are sent to the landfill of ECCS steel waste treatment and all metals with the waste type tin plate are sent to the landfill for tinned steel. All other materials are sent to the waste treatment "Unspecified".

Waste Scenario for Open Fire:

Go to Waste scenario, select category Incineration and create a record as below. For the steel, we use already predefined records.



Documentation | Input/output | Parameters | System description

Products

Waste specification

Name	Amount	Unit	Category	Comment
Open fire waste scenario for shed	1	kg	Incineration	

Inputs

Known inputs from technosphere (materials/fuels)

Name	Amount	Unit	Distribution	SD^2 or 2*Min	Max
(Insert line here)					

Known inputs from technosphere (electricity/heat)

Name	Amount	Unit	Distribution	SD^2 or 2*Min
(Insert line here)				

Outputs

Materials and/or waste types separated from waste stream

Waste scenario/treatment	Material / Waste type	Percentage
Open fire fuelled by material from shed	Wood	100 %
Incin. ECCS steel 19958250(98)	ECCS steel	100 %
Incin. Tin plate 1995 B250(98)	Tin plate	100 %
(Insert line here)		

Waste streams remaining after separation

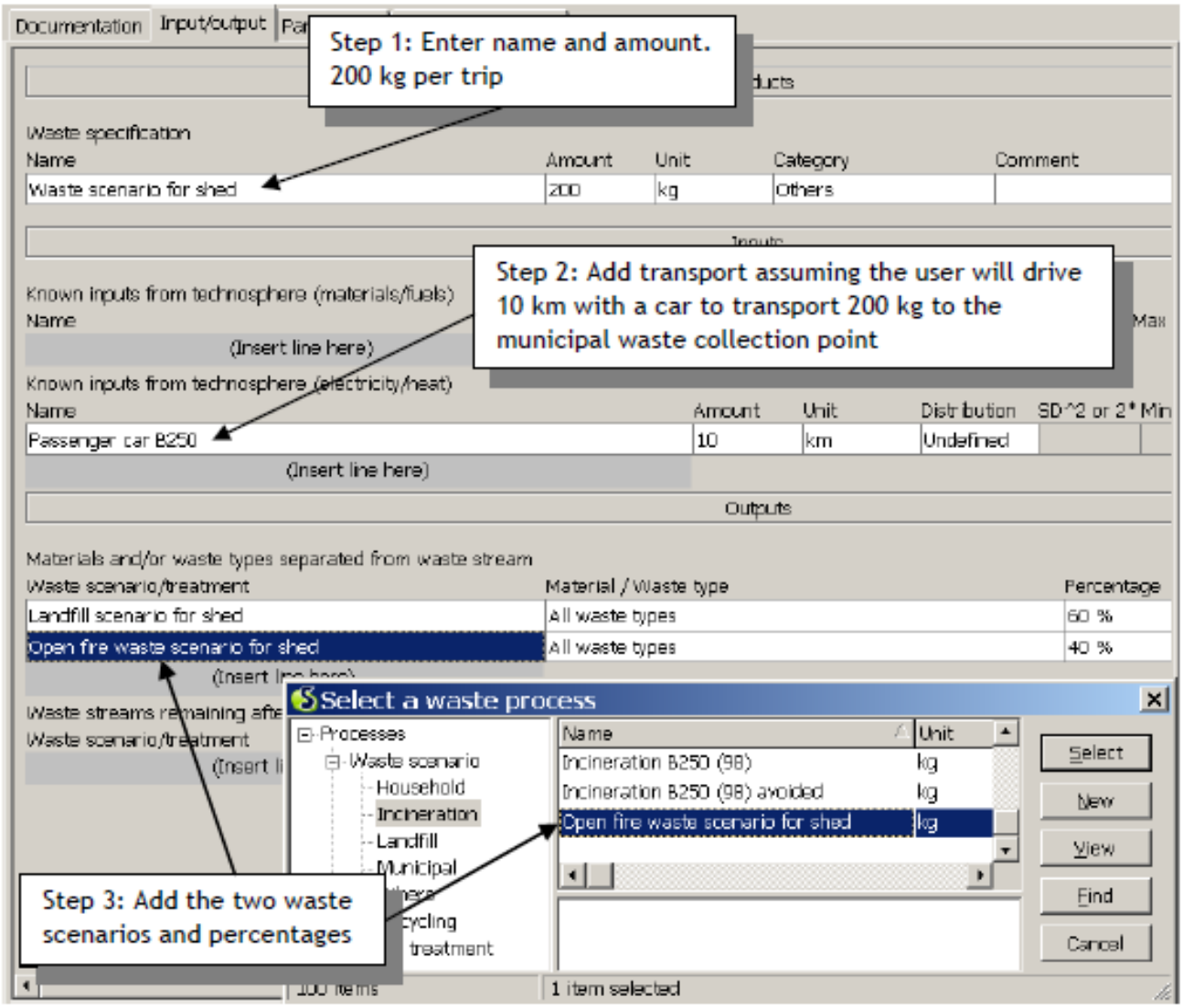
Waste scenario/treatment	Percentage	Comment
Unspecified	100 %	
(Insert line here)		

Finally, we develop a waste scenario that splits the waste stream into two:

1. 40% is used in open fires

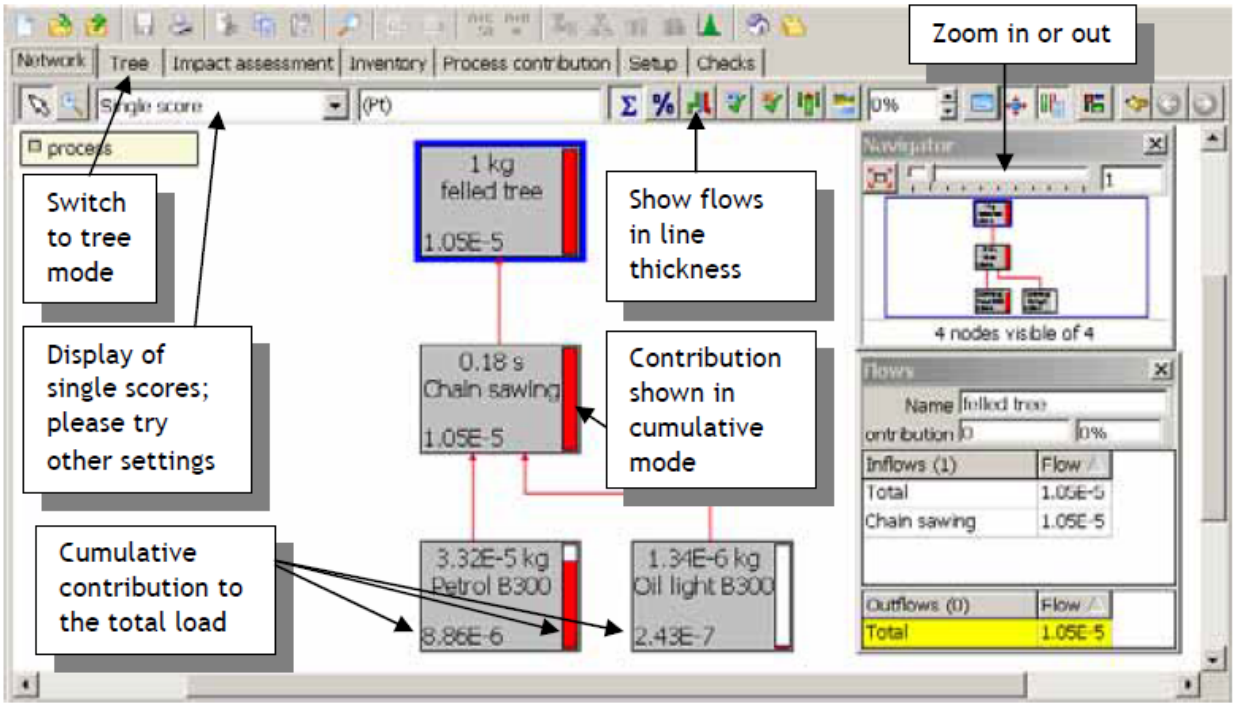
2. 60% is sent to the landfill

Please note that in this stage we take into account the transport by car as well, because it has an impact substantial to that of the landfill.

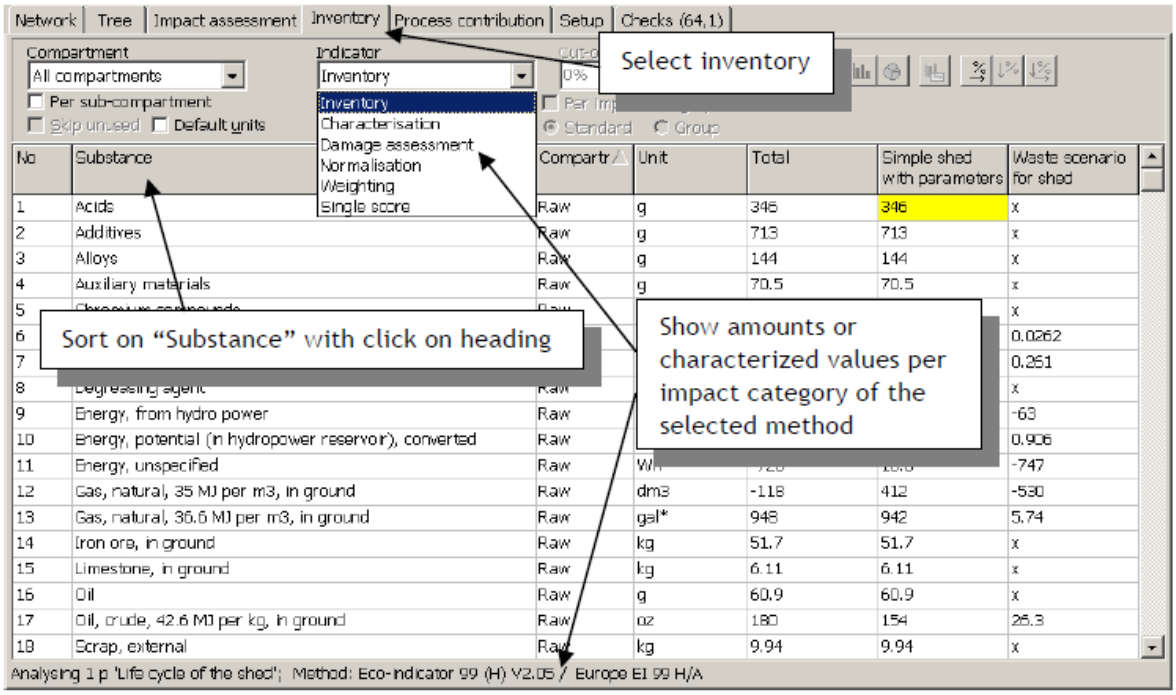


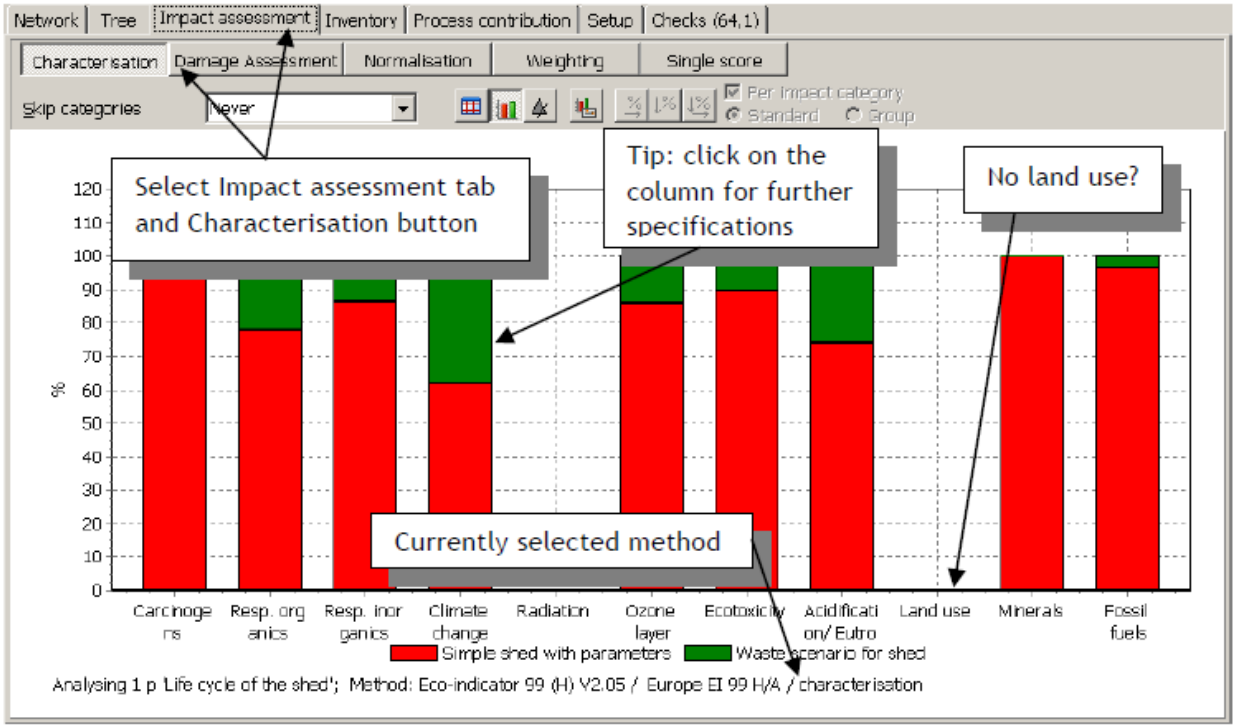
Impact Assessment and Comparisons:

At any point during the evaluation phase you can click on the Tree or Network functions. First by clicking on the  button or  and then navigating through the tabs you can look at the tree or network for any of the processes that have been created.



The two captured screen images below shows how to view an individual materials impact assessment.





Final Tree Display:

Finally when everything is entered under the Simple Shed project you can inspect all elements and play around with the zoom fuctions. The zoom will allow the granularity to be set for viewing pleasure. The final product should look similar to what we have displayed below.