Getting started with Ecochain Mobius

Mobius Exercise - Apple pie

Ecochain

Empowering for sustainable impact

Getting started with Ecochain Mobius

Introduction

Welcome to the ‘Getting started’ assignment. This assignment will guide you through the basic steps to use Ecochain Mobius. During this assignment, you will learn how to model a product and measure its environmental impact in Ecochain Mobius.

Measure the impact of an apple pie

We will use the example of baking an apple pie throughout this assignment. Imagine yourself to be a kitchen star. You like to bake, and you want to steal the show at an upcoming dinner party. However, all your friends are conscious of the environment, and you are too. You would like to know the environmental impact of the things you do and create.

During this assignment, you will measure the environmental impact of an apple pie, both in the production phase (i.e., raw materials supply) and the processing phase (i.e., baking) by using Life Cycle Assessment (LCA). You’ve found a nice recipe to bake, and now you would like to start with measuring the environmental impact, but where to start…?

Learning goals of the ‘Getting started’ assignment

For this training, we have established the following learning goals:

- **Understanding objects vs products**: objects are the building blocks for modeling any product in Mobius.
- **Understanding how to fill your inventory** - the inventory of your product is build with a hierarchical structure and consists of objects - such as ingredients (i.e. Bill-of-Material), processes, etc.
- **Understanding how to add impact to an object**: an impact can be added either by selecting a reference from an environmental database or by a creating a custom impact (e.g. an impact found in literature);
- **Understanding how to search references in the environmental databases**: finding references (datasets) for objects, such as materials, energy sources, etc. is key to making a complete LCA model.

Creating an apple pie in Ecochain Mobius

Steps to take during the assignment

Below the steps that you will take during the assignment are listed.

- Step 1 - Sign-up to Ecochain Mobius and create an account
- Step 2 - Create ‘Apple pie assignment’ workspace
- Step 3 - Workspace settings
- Step 4 - Create a product and add ingredients
- Step 5 - Add impact
- Step 6 - Add processes (baking your apple pie)
- Step 7 - Viewing Results
- Step 8 - Creating a scenario
- Step 9 - Start a product comparison
- Step 10 - Share your results

Good luck from here on!

Step 1 - Sign-up to Ecochain Mobius and create an account

If you haven’t done so already, sign-up to *Ecochain Mobius* first. Fill in your personal information and create an account. If you have already signed up, log in to your Mobius account.

Step 2 - Create ‘Apple pie assignment’ workspace

Go to “workspaces” in the top-left of Mobius. Click on the button to add a workspace.

A pop-up will appear. Create a new workspace. Give the workspace the name “Apple pie”.

This is an empty workspace that you can use to model the apple pie. See, figure 1.

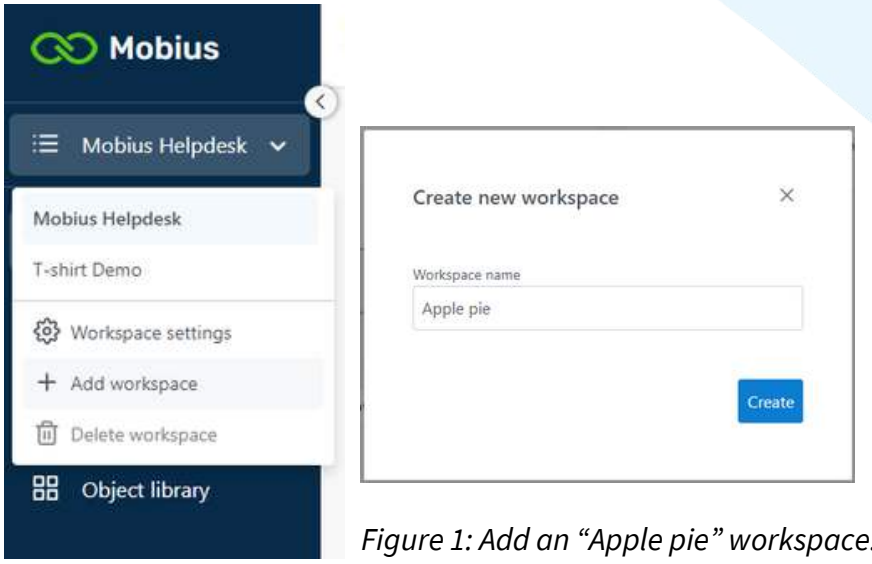

Figure 1: Add an “Apple pie” workspace.

Step 3 - Workspace settings

The workspace settings are by default on the OpenLCA LCIA methods v2.0.4. However, for this assignment, we would like to model an apple pie according to the Product Environmental Footprint Method (PEF). More information on the PEF can be found in this *article* on our website.

Workspace settings are explained in the tutorial "*How can you manage your workspace settings in Mobius?*", which can be found in our *Help Center*.

Figure 2 shows the correct workspace settings for this specific assignment.

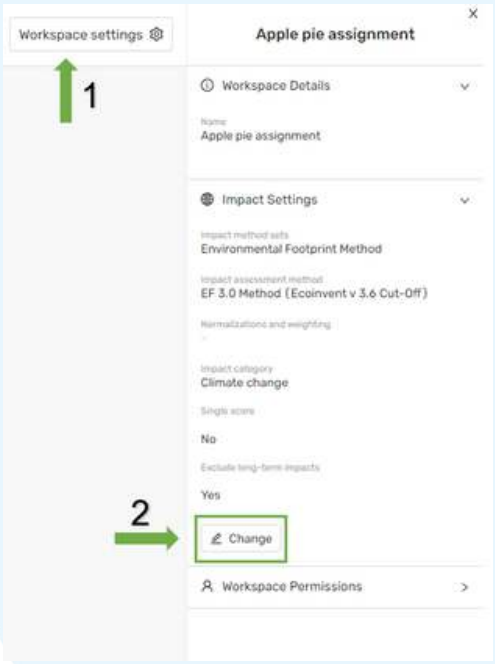

Figure 2: Workspace settings.

Step 4 - Creating a product and adding ingredients

Before you can start modeling the apple pie, it is important to understand the difference between objects and products. Below follow some Mobius terminology definitions:

Objects are the subitems you use while creating your Product Footprints and Life Cycle Assessments (LCAs) of end products. They are materials, intermediate products, energy sources, waste items, transport, etc. We often call them building blocks, as you can reuse and attach them to different products multiple times.

Products are your final results (the baked pie that comes out of the oven) and usually contain multiple objects. Products are items that are not reused in other products or recipes (inventories). Watch also our video tutorial "*What is the difference between Product & Objects?*"

Now that this is clear, go to the **(1) products page** and **(2) create a product** called "Apple pie". See Figure 3, below.

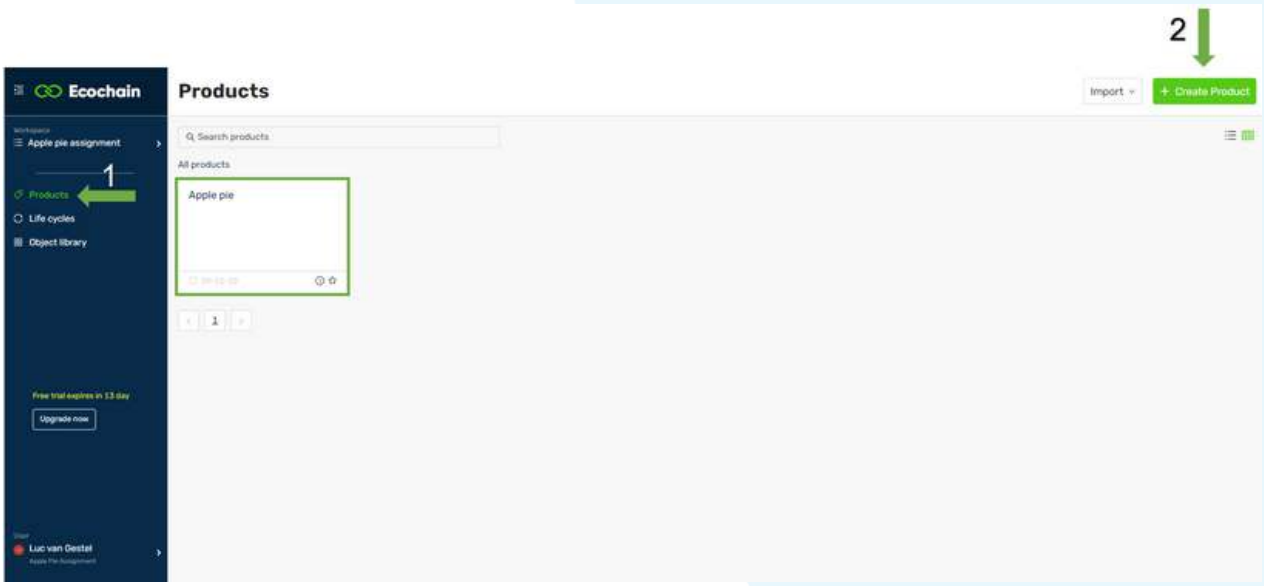

Figure 3: adding an "Apple pie" product.

Now that we have created our end product - the apple pie, it is time to start thinking about all the necessary elements we will need to add.

Structuring your inventory - adding a "list of ingredients"

The inventory in Mobius uses a hierarchical structure - you can create multiple layers. Each layer (i.e. level) can be used for a different group of objects (materials or ingredients, intermediate products, energy sources, waste items, transport). By doing this, you can bring structure to your inventory

Add "Ingrediënts" as the first sub-item on "level 2". Fill in "list" as an unit of Ingredients. It will be placed directly below "level 1", which is the apple pie. The ingredients of the apple pie can be added as sub-items on "level 3", directly below your "list of ingredients".

See the example in Figure 4, below.

Figure 4: Building your Inventory in Ecochain Mobius.

List of ingredients

Table 1 gives an overview of all ingredients (i.e. Bill-of-Materials) you need for baking an apple pie.

Table 1: Ingredients for baking an apple pie

Ingredients	Amount	Unit
Apple	1.5	Kg
Egg	0.057	Kg
Self-rising flour	0.4	Kg
Sugar	0.25	Kg
Unsalted butter	0.25	Kg

Add the ingredients shown in the green column of Table 1 to Ecochain Mobius. Watch also our video tutorial "*Using the inventory builder*". Afterwards, follow the instructions under step 5 to add an impact by choosing the right datasets to the ingredients you have just added.

Does the ingredient structure of your apple pie look similar to the example shown in figure 5, below?

Figure 5: List of ingredients in Ecochain Mobius.

Step 5 - Adding impact

Now that you have added all the necessary ingredients for an apple pie, it's time to add the impact in Ecochain Mobius! You can do this by adding references (datasets) from an environmental database.

How to add impact is explained in the tutorial "*How to add impact and find references from environmental databases?*" You could also have a look at the following Help Center article to find out more about the database we use: the *Ecoinvent database*.

Add the following references to Ecochain Mobius.

Table 2: Database reference for an apple

Ingredient	Database reference
Apple	market for apple | apple | Cutoff, U | Global - Ecoinvent v3.6 Cut-off
Egg	Add Custom Impact (see next paragraph)
Self-rising flour	market for wheat flour mix | wheat flour mix | Cutoff, U | Global - Ecoinvent v3.6 Cut-off
Sugar	market for sugar, from sugar beet | sugar, from sugar beet | Global - Ecoinvent v3.6 Cut-off
Unsalted butter	market for butter, from cow milk | butter, from cow milk | Global - Ecoinvent v3.6 Cut-off

An example of how to search for a dataset or reference in Ecochain Mobius is shown in Figure 6.

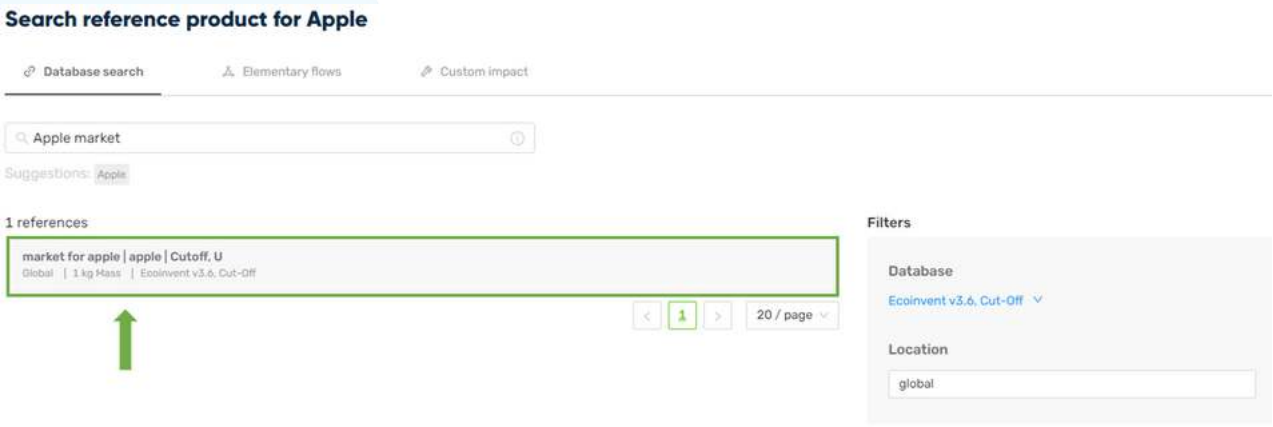

Figure 6: Searching for references in Ecochain Mobius.

References in the environmental database Ecoinvent can be found in **“market for”** or **“production”**. What does a “market for” reference mean? And what’s the difference with a “production” reference? Have a look at the following *article* to find out how Ecoinvent structures the names of their datasets.

Make sure to add mass as a property, for every item. By adding a property underneath the ‘Properties’. You can learn how to do this easily, see our video tutorials ‘*How to use properties in Mobius*’. Add the property mass for every ingredient. See also Figure 7, below.

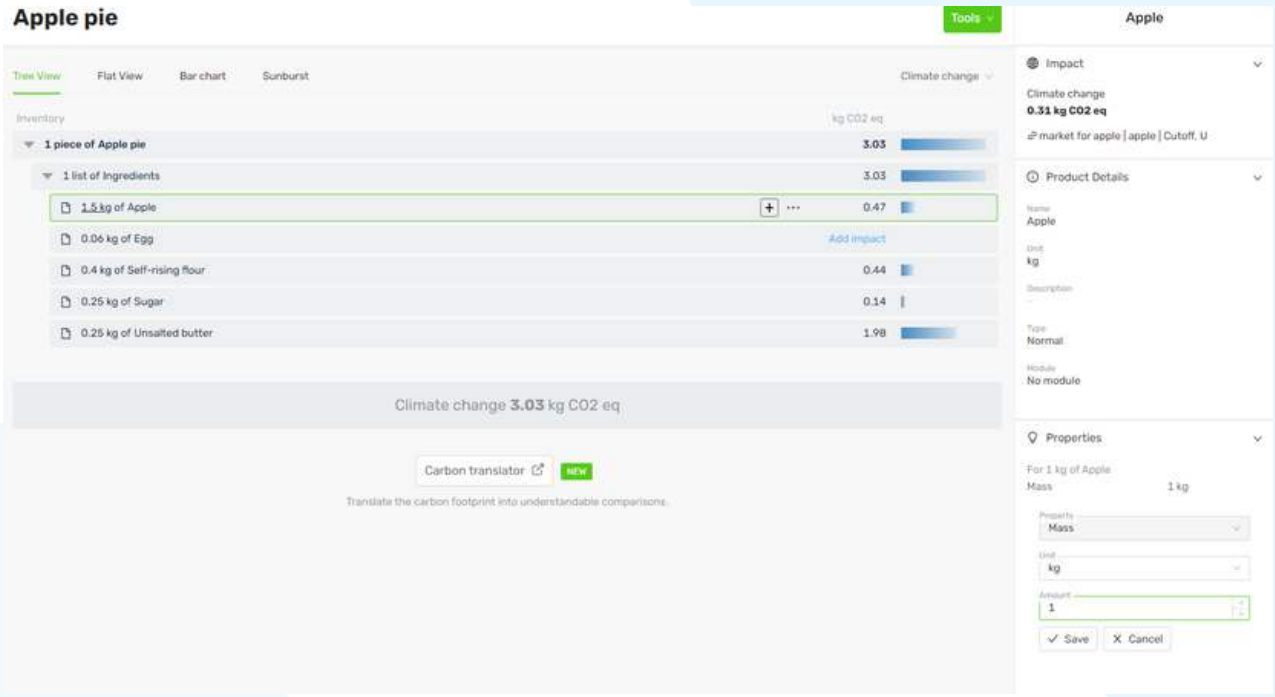

Figure 7: Adding properties in Ecochain Mobius

Unknown materials and unavailability of datasets

You might have noticed that there is no reference available for eggs in the Ecoinvent database v3.6. There are a couple of alternative options to dealing with missing references. For this assignment, we suggest adding a custom impact - an environmental value you may have found online, or in scientific literature.

Table 3 shows the carbon footprint of eggs, expressed **in kg CO2-eq per kg ingredient**.

Custom impacts should be entered by using the Object library. Enter the value of kg CO2-eq **per kg ingredient**. Mobius will automatically scale the custom impact proportionately to the weight of the used ingredient.

Add the **custom impacts** shown in Table 3 to the relevant ingredients in the Object library**.**

Table 3: Custom impact for egg (in CO2-eq per kg product)

Ingredients	Custom impact (kg CO2-eq per kg ingredient)
Egg	4.7 [1]

A quick way to open the **Object library** of a specific object is by using the "Open item" functionality. Simply hover over the three dots of the object and select "Open item".

See Figures 8-10, below.

Figure 8: Adding custom impact for an egg (1 out of 3).

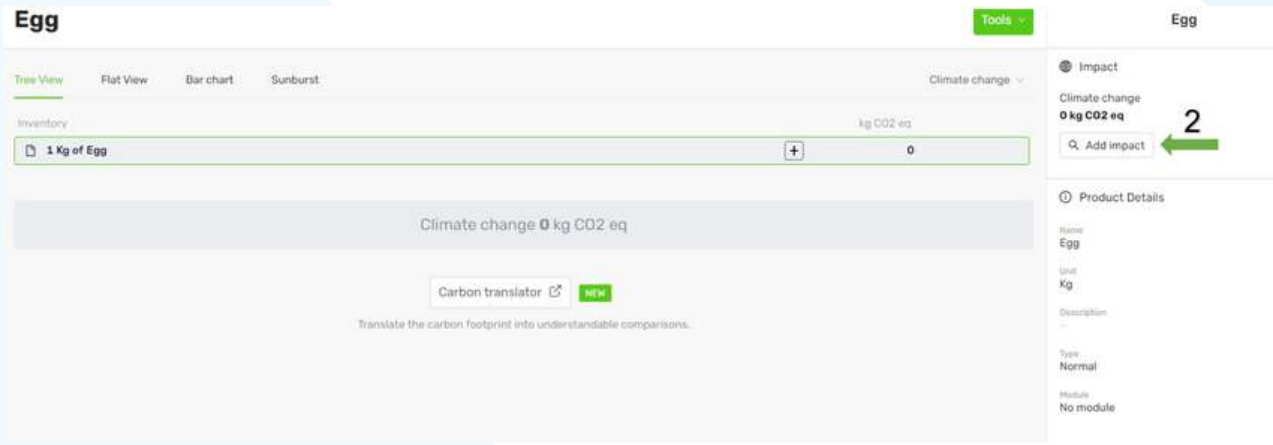

Figure 9: Adding custom impact for an egg (2 out of 3).

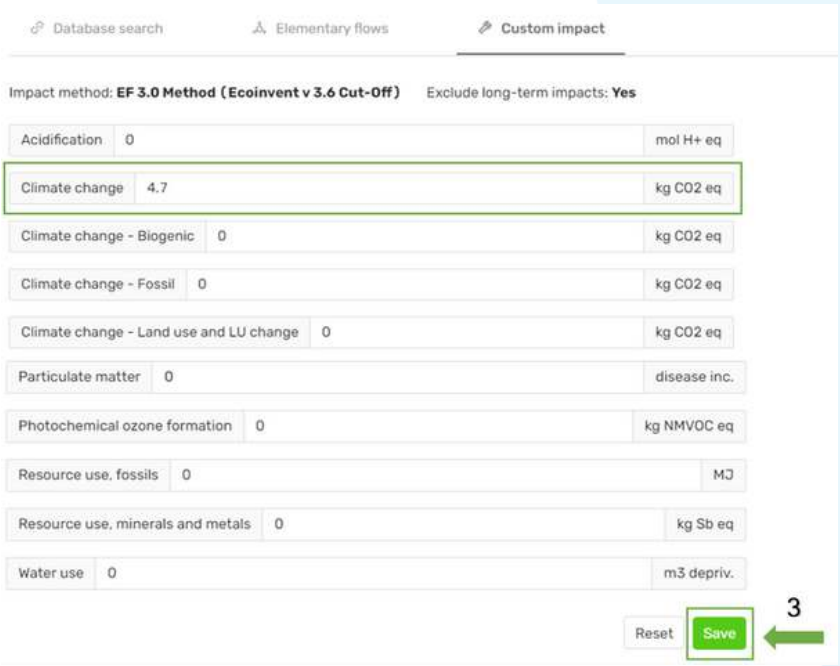

Figure 10: Adding custom impact for an egg (3 out of 3).

Step 6 - Adding processes (baking your apple pie)

Now that you have added all the ingredients, it's time to start the baking process by following these steps:

1. The bottom of the apple pie is made by mixing the flour, sugar and butter into a nice-looking dough ball. Flatten it, and refrigerate it for 1 hour. This is the *cooling* process of your dough.
2. In the meantime, peel the apples, cut them into quarters, and remove the core.
3. Put the apples on top of the bottom and bake the cake in the oven for about 1 hour, until it's golden brown and well-cooked. This represents the *baking* (or heating) process of the apple pie.

Structuring your inventory - adding a "list of processes"

Now that you have added all the ingredients of your apple pie to Ecochain Mobius, it's time to add the production steps. Add "Processes" as a second sub-item on "level 2". This can be done by adding a sub-item directly below "Apple pie". Fill in "list" as a unit of "Processes". The "Processes" will be placed directly below the "Ingredients".

See the example in Figure 11, below.

Figure 11: Adding a "List of Processes" in Ecochain Mobius.

Translating the steps from the recipe to usages

The electricity usage of your refrigerator and oven can be calculated by multiplying the power (in kW) by the time (in hours) needed for the process.

Table 4 shows the power of your refrigerator and oven.

Table 4: Power of refrigerator and oven

Ingredients	Amount	Unit
Cooling; refrigerating 7°C	0.019	kW
Heating; oven 175°C	1.50	kW

The electricity usage can be calculated using the following formula: E = P x T

E = Electricity usage (in kWh)
P = Power (in kW)
T = Time (in hour)

Now, in your product's inventory, **add the necessary processes** as separate objects. Add the 'cooling' and 'heating' processes in Mobius. Use the *market group for electricity, low voltage* and select Europe as the location. Make sure to add "kWh" or "3.6 MJ" as a **property** of electricity.

Step 7 - viewing results

You have now generated the first crucial part of an LCA model for your apple pie! In fact, you have just completed your first product LCA from cradle-to-gate. You are slowly turning into a footprint master.

You're now able to generate a result and some insights. You can find the carbon footprint of the apple pie below the inventory of the product. Your result should be somewhere between 3.7 – 4.2 kg CO2-eq. And what did you find out? Which ingredient (or object) contributes the most to the carbon footprint of your apple pie? Did you already view the sunburst overview?

Figure 12: Tree view of the apple pie (in kg CO2-eq)

Step 8 - Creating a scenario

Are you ready to reduce the environmental impact of your apple pie? In Ecochain Mobius, you are able to develop different product scenarios. This is explained in the tutorial "*How do I use the scenario feature in Ecochain Mobius?*".

With the insights you have gathered during this assignment, you know where to focus when reducing the impact of your apple pie. You decided to create an eco-design of your apple pie by changing unsalted cow butter to unsalted vegan butter.

A vegan apple pie

On the internet, you found that the impact of unsalted vegan butter is 2.26 kg CO2-eq per kg product (see Table 5).

Table 5: Custom impact for unsalted vegan butter (in CO2-eq per kg product)

Ingredients	Custom impact (kg CO2-eq per kg ingredient)
Unsalted vegan butter	2.26 [3]

Now, follow the steps from the tutorial: "*How do I use the scenario feature in Ecochain Mobius?*" and create a new object for unsalted vegan butter. Assume that you need the same amount of unsalted vegan butter as you would need for the apple pie with unsalted cow butter. Afterwards, you can remove the unsalted cow butter from your eco-design apple pie.

Add a custom impact to the unsalted vegan butter.

Figure 13: Scenario unsalted vegan butter vs unsalted cow butter (in kg CO2-eq)

Step 9 - Start a product comparison

Now that you have created a new eco-design, you would like to compare the difference in impact between an apple pie with unsalted cow butter and an apple pie with unsalted vegan butter. This can be easily done in Ecochain Mobius by the “Comparison” feature. This is explained in the tutorial “*How do you compare products in Mobius?*”.

As the result in Figure 14 shows, by replacing cow butter with vegan butter, you can reduce the impact (in kg CO2-eq) of your apple pie by 1.41 kg CO2-eq - a reduction of 36%!

Figure 14: Comparison Sunburst of unsalted vegan butter vs unsalted cow butter (in kg CO2-eq)

Step 10 - Share your results

Share your first LCA model in Mobius with your friends and colleagues. Bear in mind that these are examples and not the final results ;-)

Greetings from the Ecochain Team!

Congratulations!

You are turning into a footprint master ;-)

You have now generated the first crucial part of an LCA model for an apple pie.
In fact, you have just completed your first product LCA from cradle-to-gate.

You're now able to generate a result. You can find the carbon footprint of the apple pie below the inventory of the product.

Your results of the apple pie should be in the range of 3.7 – 4.2 kg CO2-eq. And what did you find out? Which material contributes the most to the carbon footprint of the apple pie?

Did you expect that the impact would be so significant? Well, this is a great insight that you've created.

We are Ecochain

Founded in 2011, Ecochain has one mission: Empowering companies to make an ongoing sustainable impact on our planet. Our Amsterdam based company consists of +32 passionate team members who calculated over 300.000 footprints in more than 20 countries.

We're looking forward to empower you to make sustainable impact!

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