Environment and Climate Change Canada | Environnement et Changement climatique Canada

CONVENTIONAL BIOETHANOL EXAMPLE

Fuel LCA Model CI Calculation Training

November 2024

Canada

DISCLAIMER

- **This presentation provides guidance only and the data that is used in the example is not a real-life scenario, as it is intended for illustrative and educational purposes only.**

- **This presentation does not in any way supersede or modify the *Canadian Environmental Protection Act*, 1999 (the Act), the *Clean Fuel Regulations* (CFR), the *CFR Specifications for Fuel LCA Model CI Calculations* (the Specifications) or the *CFR Supplemental Specifications.***

- **In the event of an inconsistency between this presentation and the Act, the CFR, the *CFR Specifications* or the *CFR Supplemental Specifications*, the Act, the CFR, the *CFR Specifications* and the *CFR Supplemental Specifications* prevail.**

Links to Relevant Materials

Fuel Life Cycle Assessment Model

- Fuel LCA Model – August 2024 (or most recent)
- Fuel LCA Model User Manual – June 2024
- Fuel LCA Model Methodology – June 2024

Carbon Intensity Calculations for the Clean Fuel Regulations

- CFR Data Workbook – Version 3.0 June 2024
- CFR Specifications for Fuel LCA Model CI Calculations – Version 3.0 June 2024
- Changes-to-Version-2.0-of-the-CFR-Supporting-Documents – Version 3.0 June 2024
- Supplemental CFR Data Workbook Landfill Methane Tool – Version 2.0 June 2024

Download | openLCA.org

- openLCA software – Version 2.0 or higher
- The language can be chosen in the software.
  - select File > Preferences > Configuration

Compliance with the Clean Fuel Regulations - Canada.ca

- Quantification Methods

COPYING DATA WITHIN THE WORKBOOK AND TO OPENLCA

For calculations in the CFR Data Workbook, the use of cell references in formulas, as opposed to copying cell values, is recommended to ensure that no significant digits are lost and to allow traceability of work.

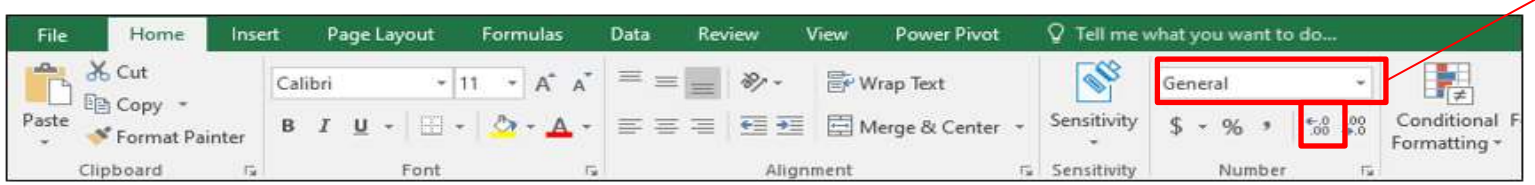
- To do this, insert a reference to the cell with the original value into the cell to which the value is to be copied. For example, if the value in cell **E74** must be copied to cell **G4**, type "**=E74**" into the formula for cell **G4**.

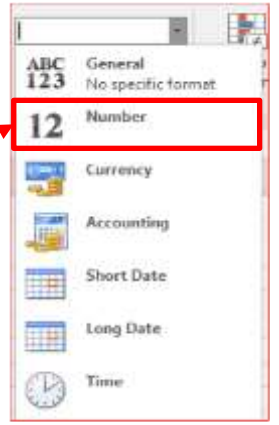
The following procedures are recommended for copying values from the CFR Data Workbook to openLCA, to ensure that all significant digits provided by Excel are kept.

1. **For cells where the formula bar displays a numerical value:** 

   - Click on the cell with the original value, then copy the value displayed in the formula bar and paste it into openLCA.
2. **For cells where the formula bar displays a mathematical formula:** 

   - Change the format of the cell to "Number" (see below), then click the "show more decimal places" button () until the decimal places become repeated zeros. Copy that value into openLCA.





Example Scenario – Bioethanol Production Facility

- The conventional bioethanol production facility is located in Ontario.
- Two distinct feedstocks, corn and wheat (non-durum), are used at this facility.
  - Corn is supplied from multiple locations in both Iowa and Ontario via different modes of truck transportation.
  - Wheat is supplied from one location in Quebec and is transported by truck.
- Input is supplied to the system through natural gas, grid electricity, on-site electricity from solar energy, and a predefined chemical mix.
- The bioethanol is distributed by truck from the facility to the delivery point, and applicant data pertaining to this distribution is available (leg 1).

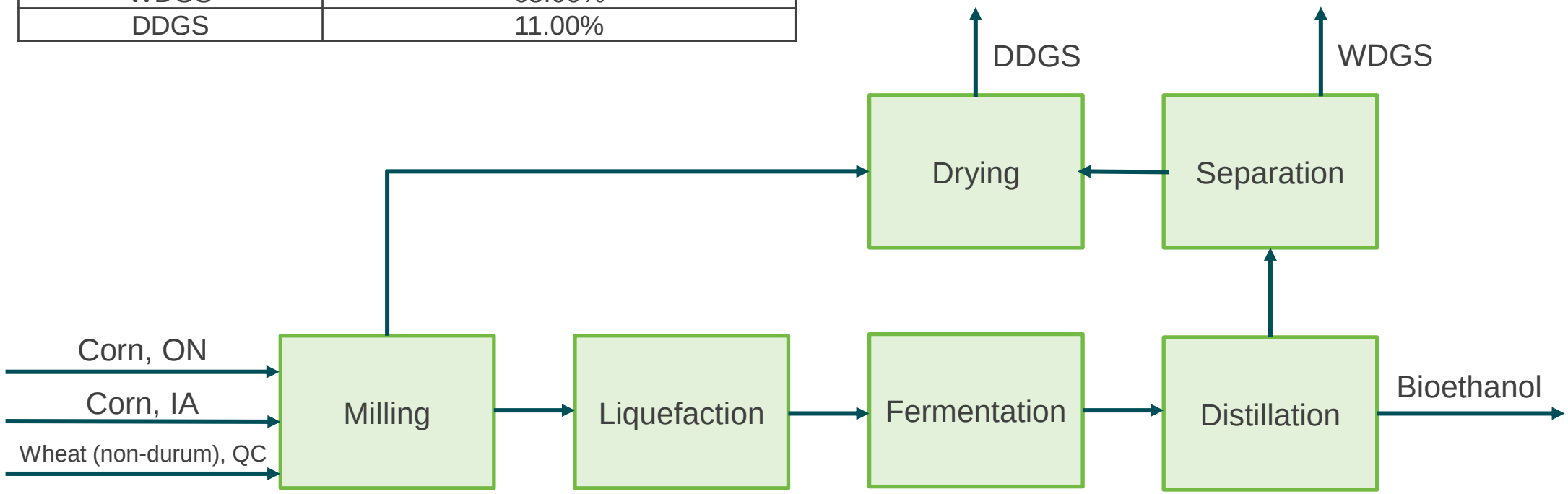
KEY CONCEPTS IN THIS EXAMPLE

This example presents the following key concepts:

- ✓ Multiple distinct feedstock
- ✓ Weighted average transportation modes calculations
- ✓ Weighted average moisture content calculations
- ✓ Feedstock transportation using different types of trucks (45 and 25 tonnes)
- ✓ Fuel and co-product portions
- ✓ Onsite Electricity production (solar)
- ✓ Fuel transport modelled using applicant data for leg 1

Example Scenario – Bioethanol Production Steps

Feedstock/Co-Product	Weighted Average Moisture Content
Corn	14.43%
Wheat (non-durum)	14.06%
WDGS	65.00%
DDGS	11.00%



Example Scenario – Feedstock, Fuel, Co-product and Energy Input Quantities

Description	Flow Type	Quantity	Units
Corn, ON	Feedstock	478,103	wet tonnes
Corn, IA	Feedstock	102,700	wet tonnes
Wheat (non-durum), QC	Feedstock	105,775	wet tonnes
Bioethanol	Fuel	250,000,800	litres
Wet Distillers Grains with Solubles (WDGS)	Co-product	85,196	wet tonnes
Dried Distillers Grains with Solubles (DDGS)	Co-product	141,270	wet tonnes
Electricity from Grid (ON)	Electricity input	76,800,024	kWh
Electricity from Solar Panel	Electricity input	8,352	kWh
Natural Gas	Energy input	63,336,780	m^3

WORKSHEETS THAT MUST BE COMPLETED

Relevant Worksheet Original Name	Rename Worksheet To
General – LCIF Producer	
Feedstock (mass)	Corn (Global) Wheat (non-durum) (Global)
Fuel Fuel Portions	Bioethanol Bioethanol Portions
Co-Product Co-Product Portions	Animal Feeds (DDGS) Animal Feeds (DDGS) Portions Animal Feeds (WDGS) Animal Feeds (WDGS) Portions

Before filling in the worksheet, make a copy of it (one worksheet for each distinct feedstock)

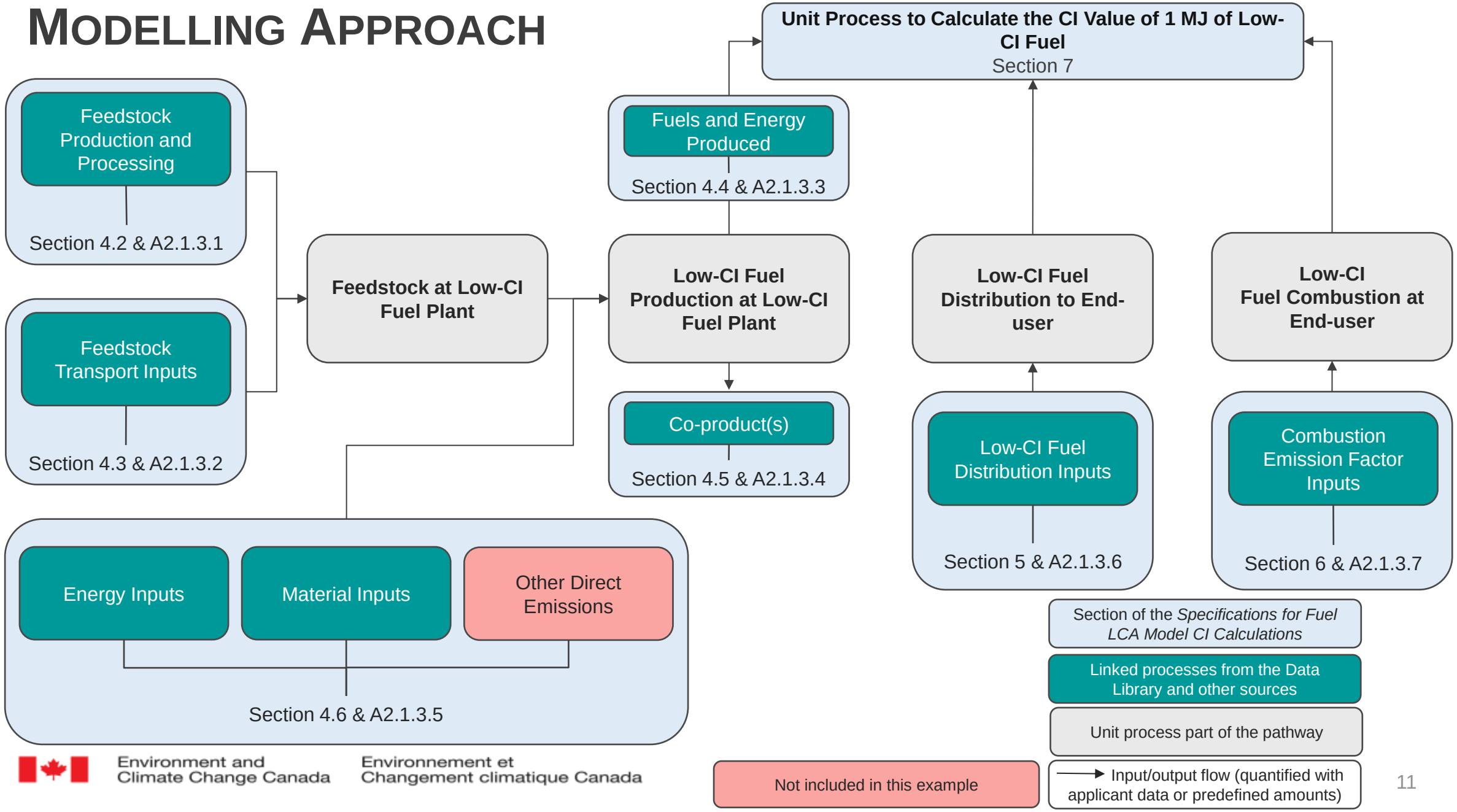
Before filling in the worksheet, make a copy of it (one worksheet for each co-product and co-product portions)

WORKSHEETS THAT MUST BE COMPLETED

Relevant Worksheet Original Name	Rename Worksheet To
Fuel Input	Natural Gas
Electricity Input	Grid electricity (ON,CA); On-site Electricity (Solar)
Material Input	Pre-set Chemical Mix
Allocation	
LCIF distribution	Bioethanol distribution

Before filling in the worksheet, make a copy of it (one worksheet for each distinct feedstock)

Modelling Approach



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PROCESSES AND FLOWS USED IN OPENLCA

Corn (Global), at bioethanol plant	
Inputs	**Outputs**
Corn, at farm	Corn (Global), at bioethanol plant
Truck transport, diesel, 45 tonnes	
Truck transport, diesel, 25 tonnes	

Wheat (non-durum) (Global), at bioethanol plant	
Inputs	**Outputs**
Wheat, non durum, at farm	Wheat (non-durum) (Global), at bioethanol plant
Truck transport, diesel, 45 tonnes	

1 – Bioethanol production, at bioethanol plant	
Inputs	**Outputs**
Corn (Global), at bioethanol plant	1- Bioethanol from Corn (Global)
Wheat (non-durum) (Global), at bioethanol plant	1- Bioethanol from Wheat (non-durum) (Global)
Electricity, from grid [CA-ON]	Animal feed from Corn (DDGS)
Electricity, from solar, photovoltaic, onsite generation	Animal feed from Wheat (DDGS)
Natural gas combustion	Animal feed from Corn (WDGS)
Chemical use per MJ of conventional ethanol	Animal feed from Wheat (WDGS)

2 – Bioethanol distribution, to end-user	
Inputs	**Outputs**
Truck transport, diesel, 45 tonnes	2– Bioethanol distribution, to end-user
Bioethanol distribution, delivery point to end-user	

3 – Bioethanol combustion, at end-user	
Inputs	**Outputs**
Bioethanol combustion	3 – Bioethanol combustion, at end-user

Bioethanol CI from Corn (Global)	
Inputs	**Outputs**
1- Bioethanol from Corn (Global)	Bioethanol CI from Corn (Global)
2 – Bioethanol distribution, to end-user	
3 – Bioethanol combustion, at end-user	

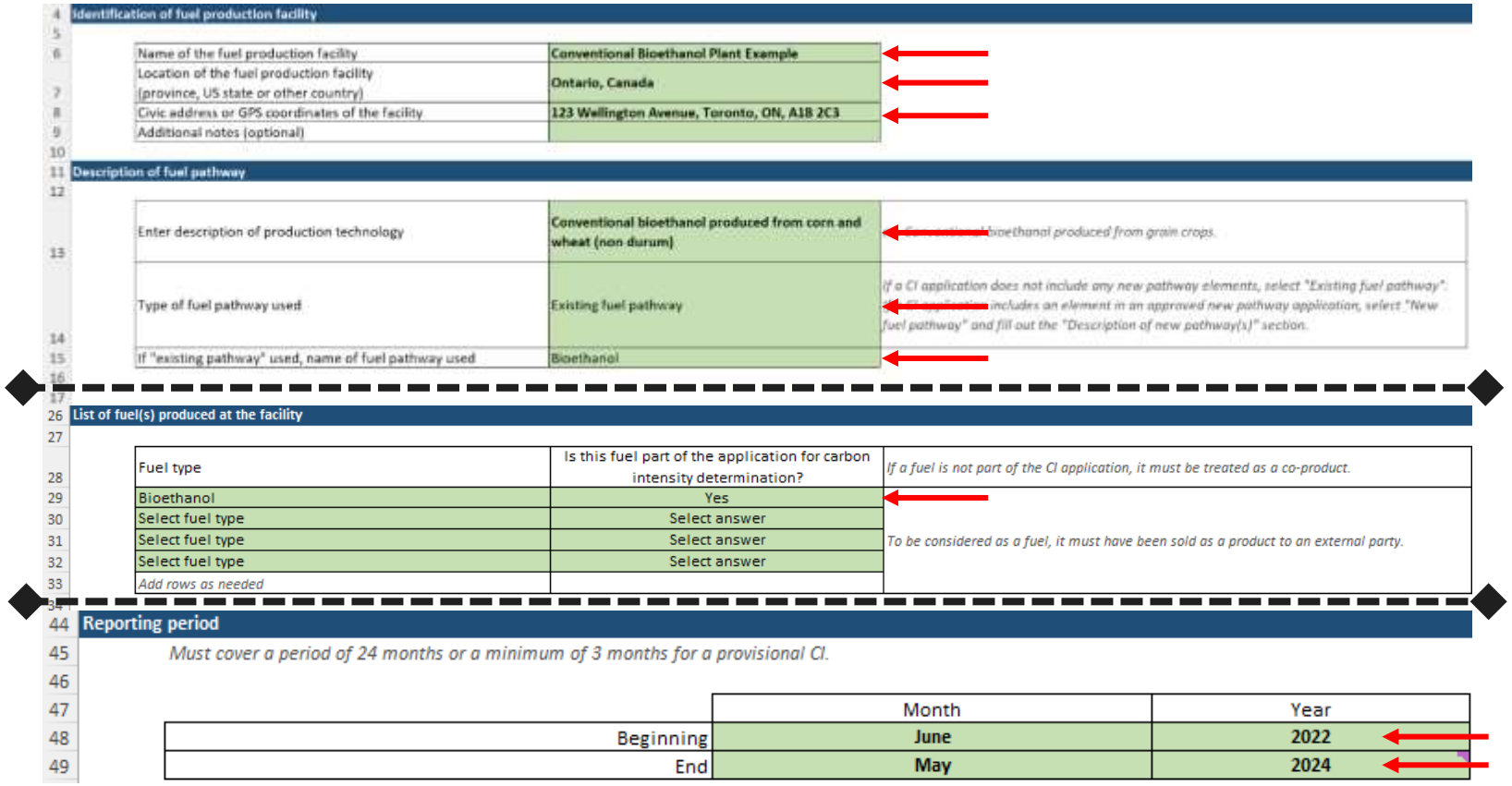
Bioethanol CI from Wheat (non-durum) (Global)	
Inputs	**Outputs**
1- Bioethanol from Wheat (non-durum) (Global)	Bioethanol CI from Wheat (non-durum) (Global)
2 – Bioethanol distribution, to end-user	
3 – Bioethanol combustion, at end-user	

General – LCIF Producer

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Complete the "General - LCIF Producer" worksheet

- Fill out the relevant sections:
  - Identification of fuel production facility
  - Description of fuel pathway
  - List of fuel(s) produced at the facility
  - Reporting period



Identification of fuel production facility

Name of the fuel production facility	Conventional Bioethanol Plant Example
Location of the fuel production facility (province, US state or other country)	Ontario, Canada
Civic address or GPS coordinates of the facility	123 Wellington Avenue, Toronto, ON, A1B 2C3
Additional notes (optional)	

Description of fuel pathway

Enter description of production technology	Conventional bioethanol produced from corn and wheat (non durum)	*Conventional bioethanol produced from grain crops.*
Type of fuel pathway used	Existing fuel pathway	*If a CI application does not include any new pathway elements, select "Existing fuel pathway". If the application includes an element in an approved new pathway application, select "New fuel pathway" and fill out the "Description of new pathway(s)" section.*
If "existing pathway" used, name of fuel pathway used	Bioethanol	

List of fuel(s) produced at the facility

Fuel type	Is this fuel part of the application for carbon intensity determination?	*If a fuel is not part of the CI application, it must be treated as a co-product.*
Bioethanol	Yes	*To be considered as a fuel, it must have been sold as a product to an external party.*
Select fuel type	Select answer	
Select fuel type	Select answer	
Select fuel type	Select answer	
Add rows as needed		

Reporting period

Must cover a period of 24 months or a minimum of 3 months for a provisional CI.

	Month	Year
Beginning	June	2022
End	May	2024

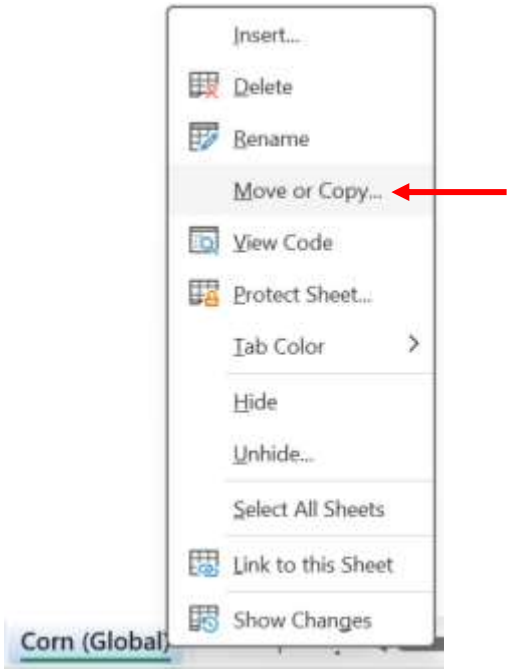
Key Concepts!

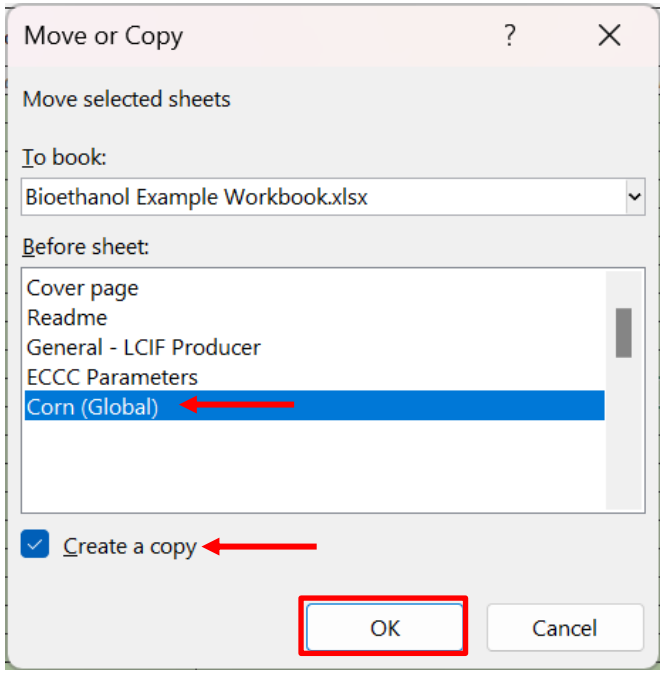
Always make sure the reporting period is within 30 months of the date of submission

FEEDSTOCK (MASS)

Complete the "Feedstock" Worksheets

- Duplicate the feedstock worksheet for each feedstock produced.
  - Right-click on the tab name and select "Move or Copy".
  - In the "Move or Copy" dialog box, select the worksheet that the duplicated worksheet will precede.
  - Check the "Create a copy" box.
  - Click "OK".





For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

FEEDSTOCK (MASS)

Tips and Tricks!

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

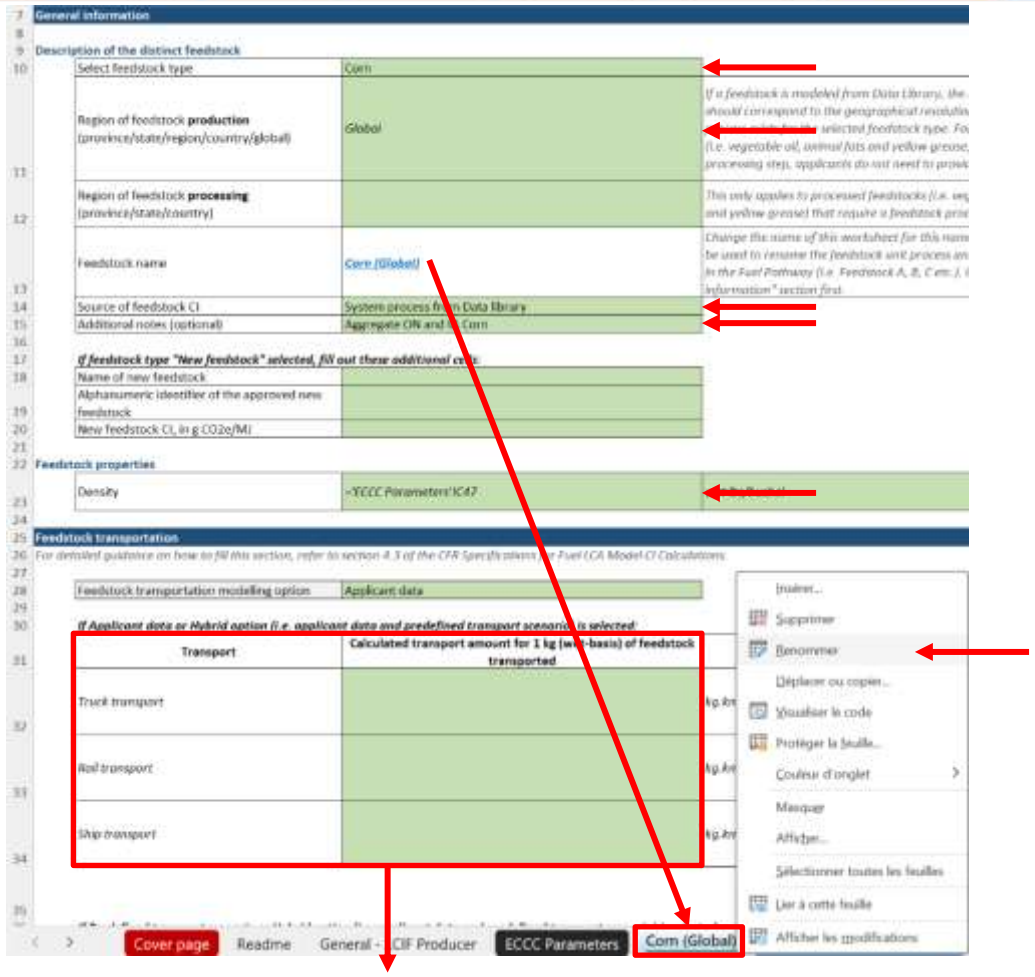
General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Complete the "Feedstock" Worksheets

- Rename one worksheet "Corn (Global)" and the other "Wheat (non-durum) (Global)".

Fill out relevant sections of the worksheets

- General information
  - Description of the distinct feedstock
    - Geographic resolution of these grains is global.
    - Note that the corn and wheat feedstocks are distinct and should be modelled as such.
  - Feedstock properties



Note: The feedstock transportation is not entered here because both 45 tonnes and 25 tonnes diesel trucks transported the feedstock, and it is not possible here to enter the transport amounts for both transport methods in this table. The transport amounts are calculated in the following slide.

For more information, consult section 4.3, Annex A2.1.3.2 of the Specifications

Side Calculations – Corn Transport (Weighted Average)

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | ... | Side Calculations

Fill out relevant sections of the worksheet

- Feedstock transportation
  - Use the "Side Calculations" worksheet to calculate the weighted average transportation distance for each mode of transport (one for truck 45 tonnes and one for truck 25 tonnes).
    - The appropriate documents were provided to support the choice of 45 tonnes truck.

Weighted Average Moisture content (%)	14.43

Producer	Wet Mass (tonnes)	Dry Mass (tonnes)	Transport Distance
A (ON by 45 tonnes truck)	200,803	171,829.90	235
B (ON by 45 tonnes truck)	152,993	130,917.89	250
C (ON by 45 tonnes truck)	124,306	106,370.51	310
1 (IA by 25 tonnes truck)	39,026	33,395.32	1,375
2 (IA by 25 tonnes truck)	21,568	18,455.61	1,380
3 (IA by 25 tonnes truck)	21,600	18,483.62	1,415
4 (IA by 25 tonnes truck)	20,506	17,547.10	1,400
Total	580,802	496,999.95	-

45 tonnes Truck Transport Amount for 1 kg (wet-basis) of feedstock (kg*km)	25 tonnes Truck Transport Amount for 1 kg (wet-basis) of feedstock (kg*km)
=((SUMPRODUCT(B36:B38,D36:D38))/B43) *(1/(1-C32)) **=249.440594719347000**	=((SUMPRODUCT(B39:B42,D39:D42))/B43) *(1/(1-C32)) **=287.116625986177000**

$$\text{Transport amount for mode A (kg.km)} = \text{distance for mode A (km)} \times \frac{1\ \text{kg}_{\text{dry-basis}}}{1 - \text{Moisture content}_{\text{feedstock}}}$$

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

Tips and Tricks!

For more information, consult section 4.3, Annex A2.1.3.2 of the Specifications

SIDE CALCULATIONS – WHEAT TRANSPORT

Fill out relevant sections of the worksheet

- Feedstock transportation
  - Use the “Side Calculations” worksheet to calculate the weighted average transportation distance for each mode of transport (one for truck 45 tonnes).
    - The appropriate documents were provided to support the choice of 45 tonnes truck.
  - Reference the cell containing the calculated transport amount in the “Side Calculations” worksheet in the “Feedstock transportation” section of the feedstock worksheet.

Average Weighted Moisture content (%)	14.06

Producer	Wet Mass (tonnes)	Dry Mass (tonnes)	Transport Distance	Truck Transport Amount, 45 tonnes, for 1 kg (wet-basis) of feedstock (kg*km)
Wheat producer	105,775.3424	90,903.77	683	=D36*(1/(1-C32)) =794.736663355221000

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

For more information, consult section 4.3, Annex A2.1.3.2 of the Specifications

FEEDSTOCK (MASS)

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Fill out relevant sections of the worksheets

- Feedstock quantities
  - Data must be entered in the units in which it was measured, in this case, in wet tonnes.
  - Enter the type of unit (dry or wet basis) and the calculated weighted average moisture content (if on a wet basis).
  - Do not leave any green cell in the “Feedstock quantities” section empty, instead enter 0.

Feedstock quantities

Select unit in which feedstock quantities are entered (mass or volume)	*tonnes*
Specify if unit is in dry or wet basis	Wet basis
Moisture content of transported feedstock, prior treatment at the LCIF plant (e.g. 0.12 or 12%)	='Side Calc. - Corn transport'!C32

Unit (mass or volume) must correspond to the unit in which feedstocks quantities are measured (e.g. if feedstock quantities from a feedstock supplier are measured in bushels, the feedstock quantities entered in the Data Workbook must be reported in bushels).

If the moisture content varies between batches of feedstock received at the LCIF facility, an applicant can use an alternate calculation procedure to ensure that total mass of feedstock on a dry basis calculated reflects the actual mass of feedstock used for the production of the fuel. Calculations must be included in the "Side Calculations" worksheet of the Data Workbook. For feedstocks that require a feedstock processing step (e.g. corn oil processed from corn), applicants must only provide the moisture content of the processed feedstock (i.e. corn oil).

Reporting Month (YYYY/MM)	Feedstock, beginning inventory*	Feedstock received*	Feedstock, end inventory*	Feedstock used	Unit
**Applicant data must be entered in all column quantities. Do not leave any green cells blank (enter "0" where necessary).*					
2022/06	0.00	20,570.09	0.00	20,570.09	tonnes
2022/07	0.00	21,780.09	0.00	21,780.09	tonnes
2022/08	0.00	23,474.10	0.00	23,474.10	tonnes
2022/09	0.00	23,958.10	0.00	23,958.10	tonnes
2022/10	0.00	21,054.09	0.00	21,054.09	tonnes
2022/11	0.00	20,812.09	0.00	20,812.09	tonnes
2022/12	0.00	22,506.10	0.00	22,506.10	tonnes
2023/01	0.00	22,990.10	0.00	22,990.10	tonnes
2023/02	0.00	22,022.09	0.00	22,022.09	tonnes
2023/03	0.00	21,538.09	0.00	21,538.09	tonnes
2023/04	0.00	23,716.10	0.00	23,716.10	tonnes
2023/05	0.00	22,264.10	0.00	22,264.10	tonnes
2023/06	0.00	27,830.12	0.00	27,830.12	tonnes
2023/07	0.00	26,620.11	0.00	26,620.11	tonnes
2023/08	0.00	24,926.11	0.00	24,926.11	tonnes
2023/09	0.00	24,442.10	0.00	24,442.10	tonnes
2023/10	0.00	27,346.12	0.00	27,346.12	tonnes
2023/11	0.00	27,588.12	0.00	27,588.12	tonnes
2023/12	0.00	25,894.11	0.00	25,894.11	tonnes
2024/01	0.00	25,410.11	0.00	25,410.11	tonnes
2024/02	0.00	26,378.11	0.00	26,378.11	tonnes
2024/03	0.00	26,862.12	0.00	26,862.12	tonnes
2024/04	0.00	24,684.11	0.00	24,684.11	tonnes
2024/05	0.00	26,136.11	0.00	26,136.11	tonnes
Total feedstock quantity				**580,802**	***tonnes***

Tips and Tricks!

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value.

For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

FEEDSTOCK (MASS) – CONVERSION

Fill out relevant sections of the worksheets

- Conversion of feedstock quantities
  - Using cell references, use factors from the “ECCC Parameters” worksheet to convert the total feedstock quantity consumed to units of dry mass (use the fewest number of conversion factors possible).
  - The total quantity of feedstock consumed in units of dry mass will appear in the “Information to copy in the Allocation Matrix” section of the worksheet.

Conversion of feedstock quantities

	Mass unit		
Mass-based unit (dry basis) or energy-based (transferred CI)			
Mandatory unit for feedstock quantities in the Fuel LCA Model:	t	(Dry basis)	
Conversion factor from wet-basis to dry-basis	0.86	kg (dry-basis)/kg (wet-basis)	*If the n… alterna… actua…*
Conversion factor from tonnes to Mass unit	='ECCC Parameters'!D7	t /tonnes	*Use va… feedst…*

Information to copy in the Allocation matrix

Feedstock name	Total feedstock quantity	Unit (dry-basis)	
Corn (Global)	496999.94899	t	*Copy t…*

Allocation Sheet

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

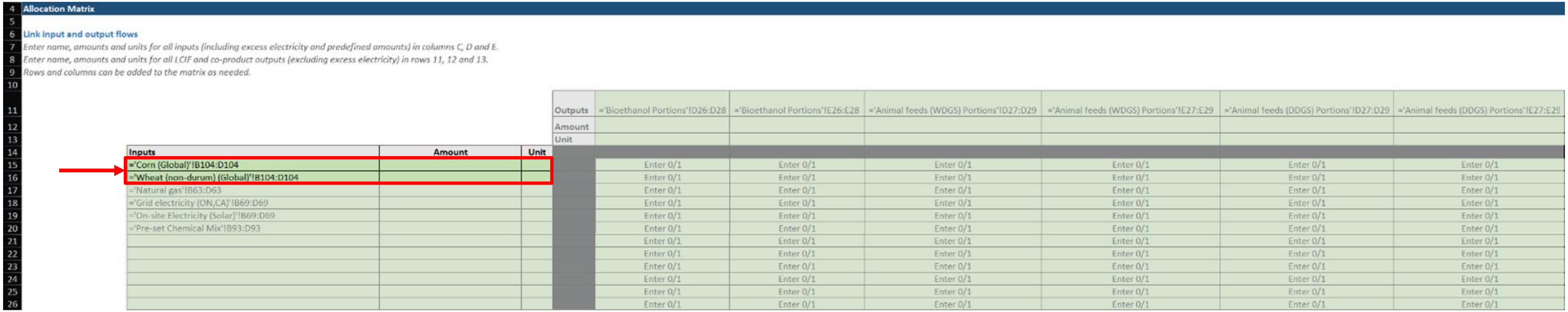
For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

FEEDSTOCK (MASS) – ALLOCATION MATRIX

Transfer the feedstock quantities to the Allocation Matrix

- Using cell references, transfer the information in the cells highlighted in orange in the feedstock worksheets to the Allocation Matrix.

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value



Allocation Matrix

Link input and output flows

Enter name, amounts and units for all inputs (including excess electricity and predefined amounts) in columns C, D and E.

Enter name, amounts and units for all LCIF and co-product outputs (excluding excess electricity) in rows 11, 12 and 13.

Rows and columns can be added to the matrix as needed.

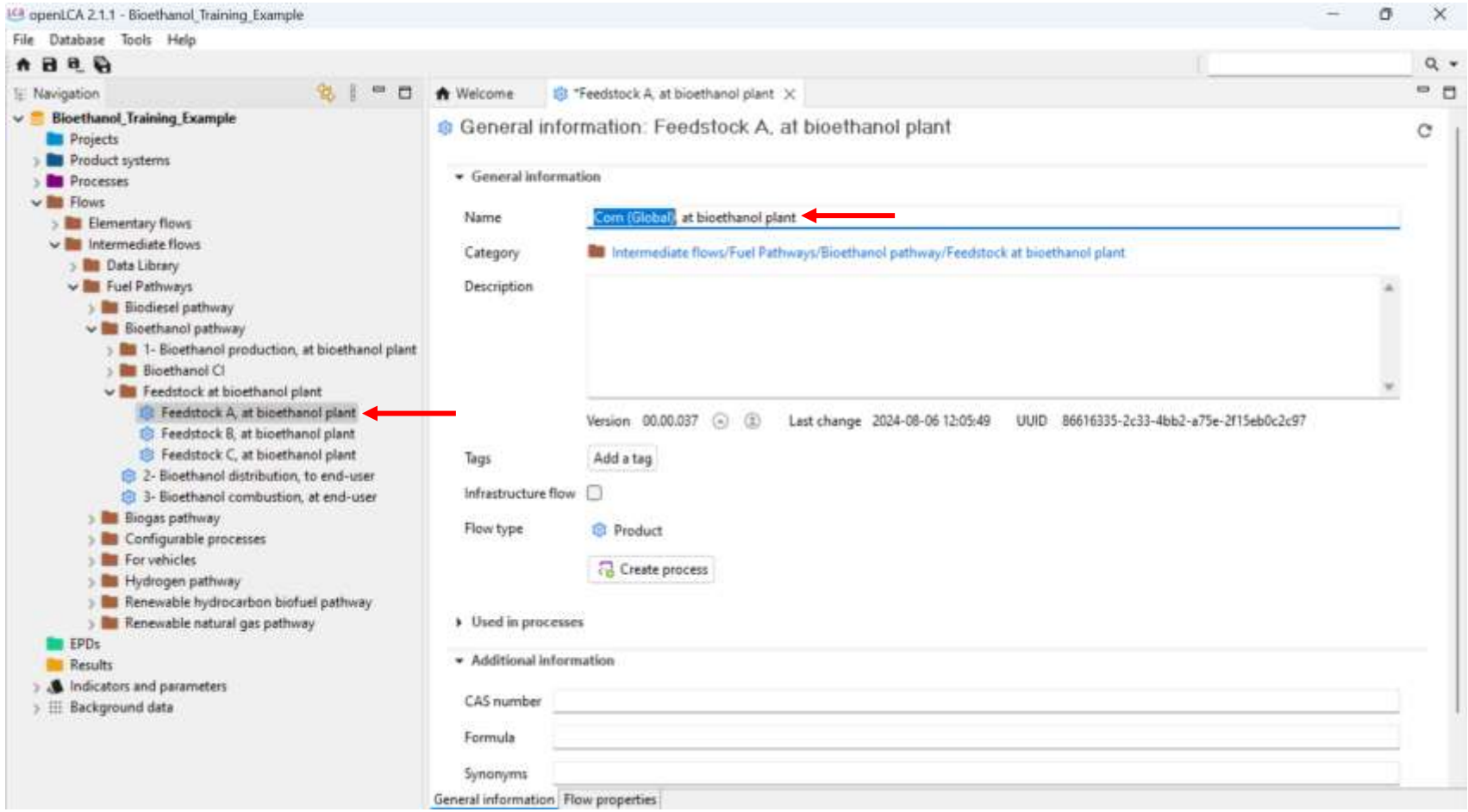
Row	Inputs	Amount	Unit							
11				Outputs	='Bioethanol Portions'!D26:D28	='Bioethanol Portions'!E26:E28	='Animal feeds (WDGS) Portions'!D27:D29	='Animal feeds (WDGS) Portions'!E27:E29	='Animal feeds (DDGS) Portions'!D27:D29	='Animal feeds (DDGS) Portions'!E27:E29
12				Amount						
13				Unit						
14	Inputs	Amount	Unit							
15	='Corn (Global)'!B104:D104				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
16	='Wheat (non-durum) (Global)'!B104:D104				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
17	='Natural gas'!B63:D63				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
18	='Grid electricity (ON,CA)'!B69:D69				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
19	='On-site Electricity (Solar)'!B69:D69				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
20	='Pre-set Chemical Mix'!B93:D93				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
21					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
22					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
23					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
24					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
25					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
26					Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1

For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

Modelling the Feedstock Production Process

Open and complete the feedstock processes

- In the folder *Flows/Intermediate flows/Fuel Pathways/Bioethanol pathway/Feedstock at bioethanol plant*, open the flow entitled "Feedstock A, at bioethanol plant".
- Rename the flow "Corn (Global), at bioethanol plant".
- Save and close the flow.
- Repeat the above steps for wheat using the flow entitled "Feedstock B, at bioethanol plant“.

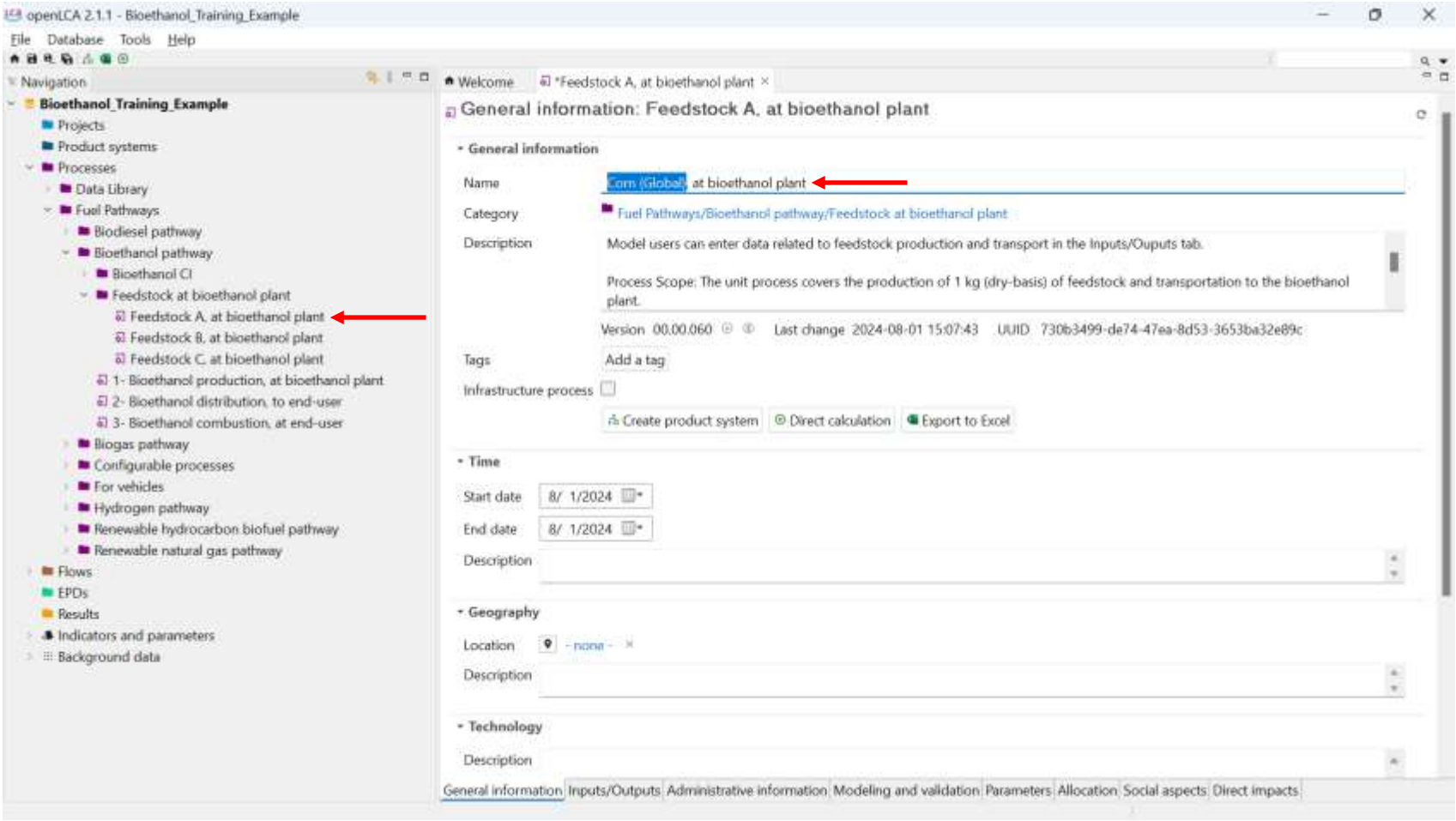


For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

Modelling the Feedstock Production Process

Open and complete the feedstock processes

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway/Feedstock at bioethanol plant*, open the process entitled "Feedstock A, at bioethanol plant".
- Rename the process "Corn (Global), at bioethanol plant".
- Repeat the above steps for wheat using the process entitled “Feedstock B, at bioethanol plant”.



For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

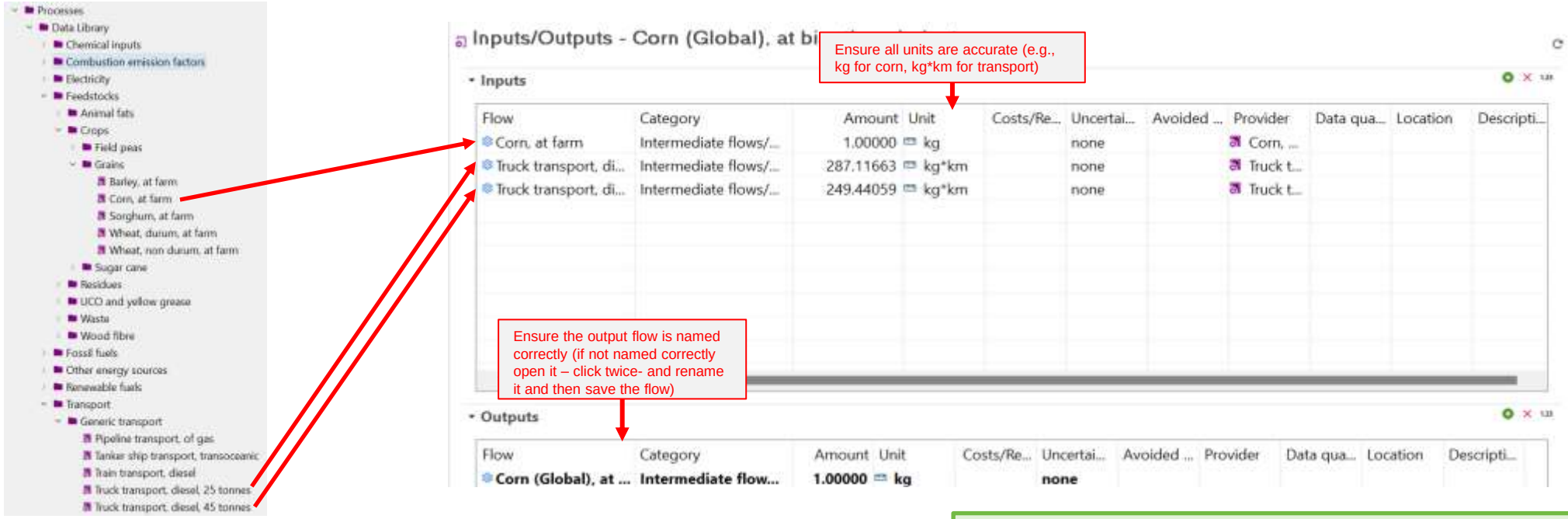
Modelling the Feedstock Production Process + Transportation

Open and complete the feedstock processes

- In the “Inputs/Outputs” tab of the process “Corn (Global), at bioethanol plant”:
  - Add the process entitled "Corn, at farm“ as an input, and specify the amount and unit as 1 kg, respectively.
  - Add the processes entitled "Truck transport, diesel, 45 tonnes", and "Truck transport, diesel, 25 tonnes" as inputs and specify the amounts and units using those entered in the CFR Data Workbook.
- Save and close the process.
- Repeat the above steps for wheat.
  - Wheat only uses "Truck transport, diesel, 45 tonnes“ for transport.

Key Concepts!

The weighted average transport method was used

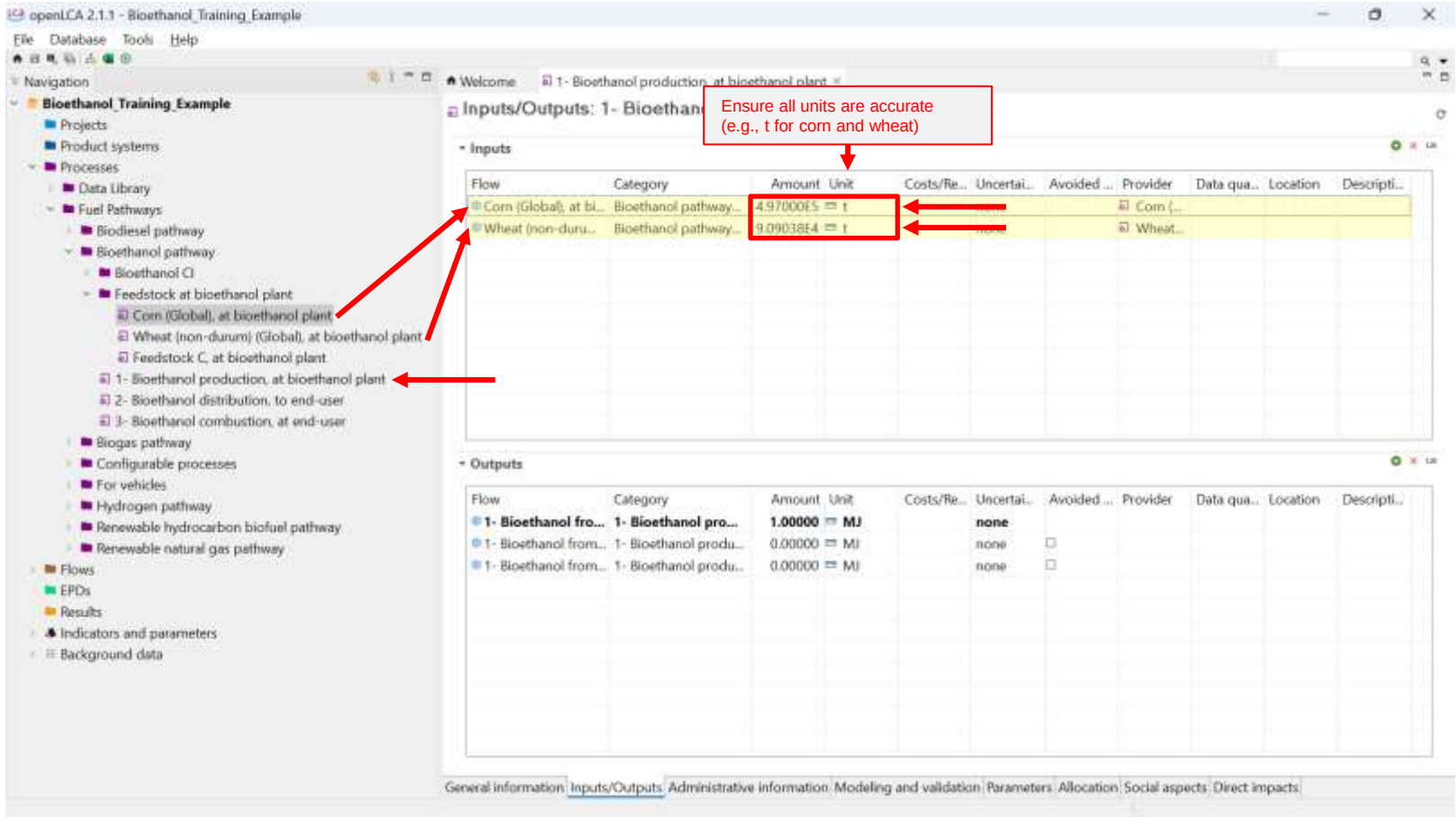


For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

Modelling the Feedstock Production Process and Transportation (cont'd)

Input the feedstock processes

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway*, open the process entitled "1 – Bioethanol production, at bioethanol plant".
- In the "Inputs/Outputs" tab, add the processes "Corn (Global), at bioethanol plant" and "Wheat (non-durum) (Global), at bioethanol plant" as inputs, then copy and paste the amounts and units that were entered in the Allocation Matrix of the CFR Data Workbook.
- Save and close the process.



Tips and Tricks!

When copying values from the CFR Data Workbook to openLCA ensure that you copy all the significant digits provided by Excel.

For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications

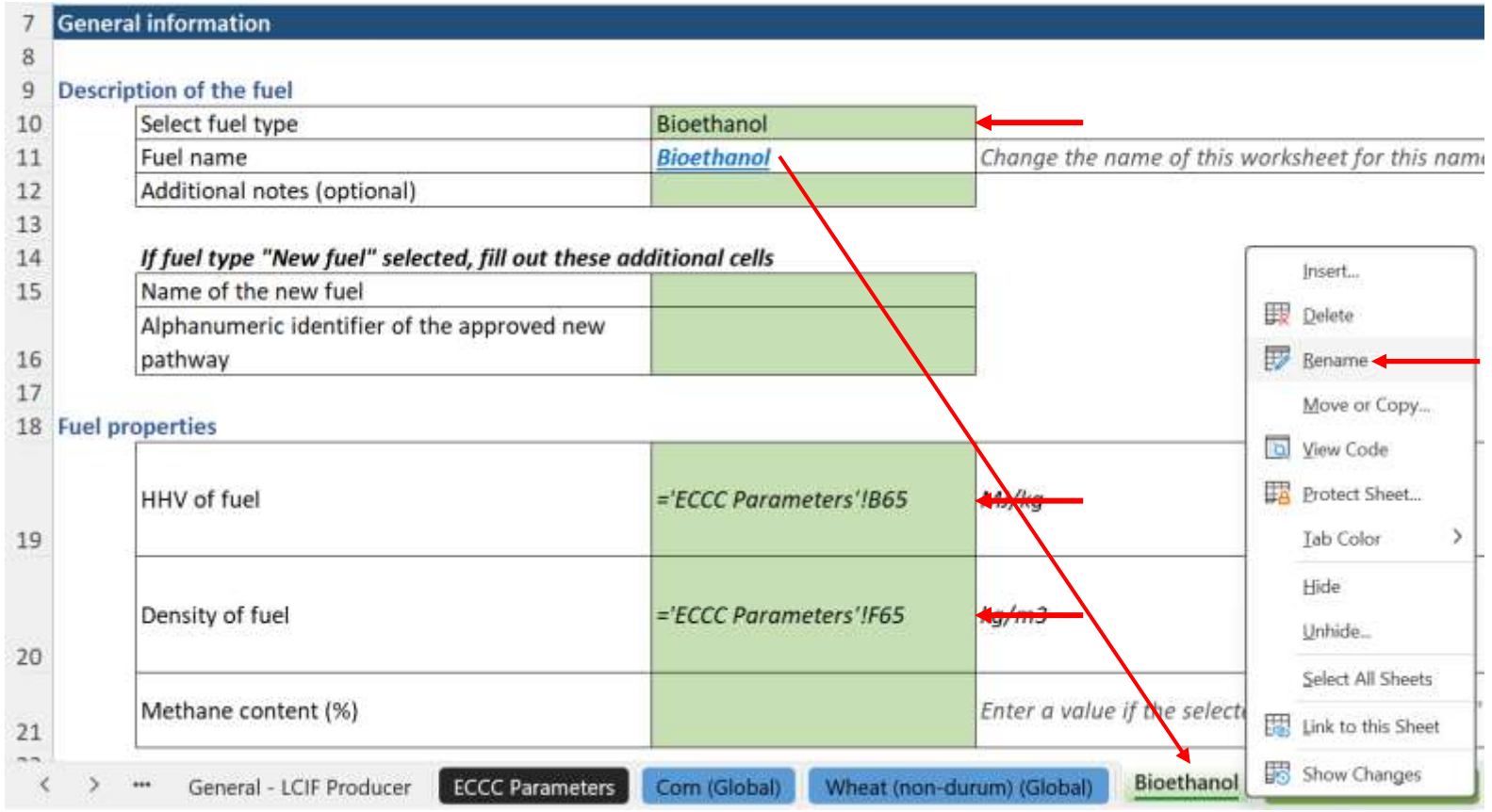
Fuel and Fuel Portions

Complete the "Fuel" Worksheet

- Rename the worksheet "Bioethanol".

Fill out the relevant sections of the worksheet

- General information
  - Description of the fuel
  - Fuel properties



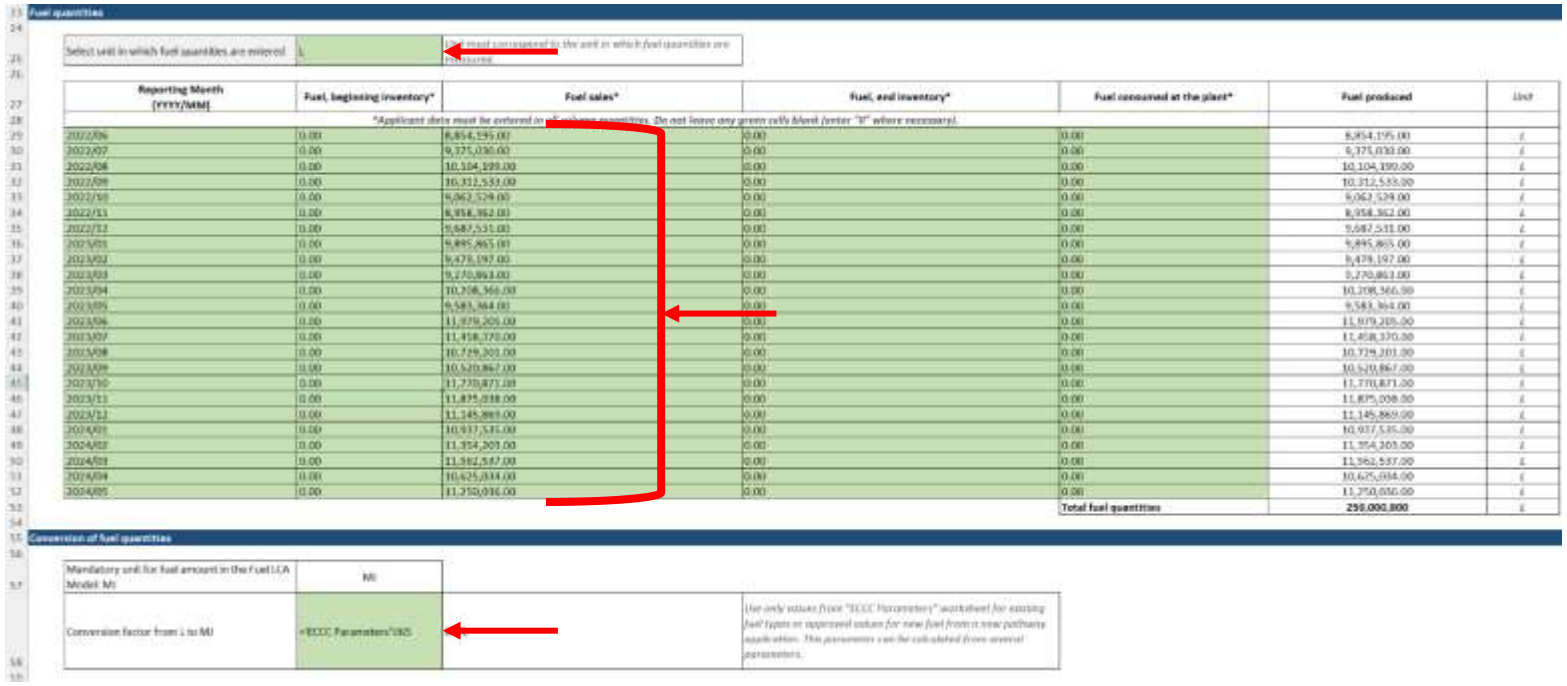
For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

Fuel and Fuel Portions

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Fill out the relevant sections of the worksheet

- Fuel quantities
  - Exclude denaturant quantities from fuel quantities.
  - Do not leave any green cell in the “Fuel quantities” section empty, instead enter 0.
- Conversion of fuel quantities
  - Using cell references, use factors from the “ECCC parameters” worksheet to convert the total quantity of fuel produced to units of MJ (use the fewest number of conversion factors possible).



For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

Fuel and Fuel Portions

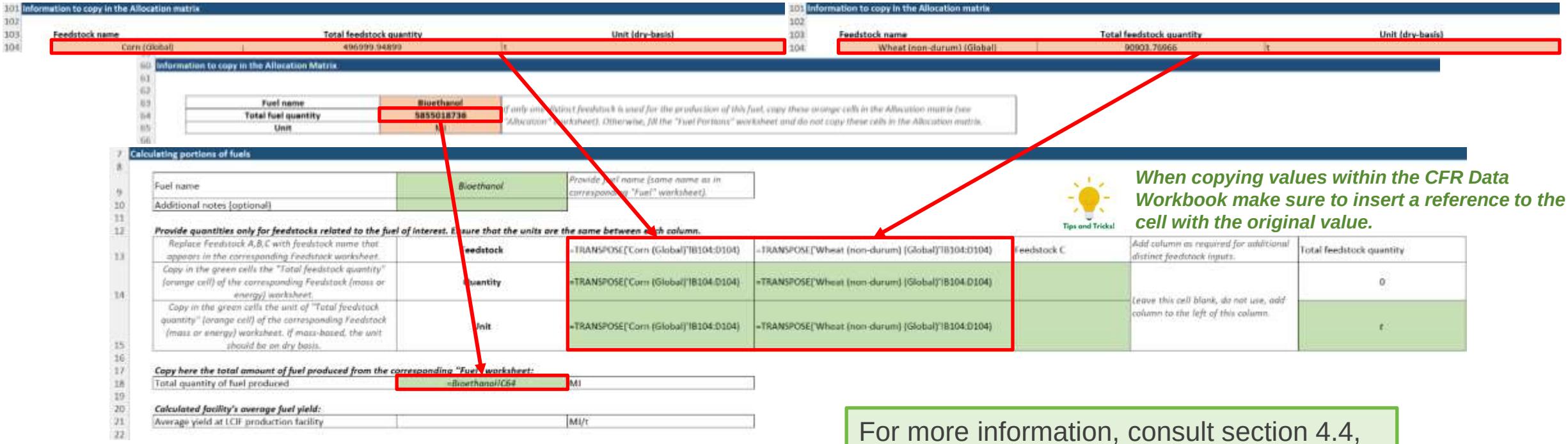
General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Complete the "Fuel Portions" Worksheet

- Since there are multiple distinct feedstocks, the “Fuel Portions” worksheet must be completed.
- Rename the worksheet “Bioethanol Portions”.

Fill out the "Calculating portions of fuels" section of the worksheet

- Using cell references, transfer the information in the cells highlighted in orange in the “Corn (Global)” and “Wheat (non-durum) (Global)” worksheets to the “Bioethanol Portions" worksheet.
- Using cell references, transfer the total quantity of bioethanol produced from the cells highlighted in orange in the “Bioethanol" worksheet to the “Bioethanol Portions” worksheet.



Tips and Tricks!

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value.

For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

FUEL PORTIONS – ALLOCATION MATRIX

General - LCIF Producer	ECCC Parameters	Feedstock (mass)	Feedstock (energy)	Fuel	Fuel Portions	Co-Product	Co-Product Portions	Fuel Input	Electricity Input	Material Input	Direct Emissions	Digester Leakage	Digestate Storage	Subdivided Process	Allocation	LCIF distribution

Copy Fuel Portions quantities to the Allocation Matrix

- The total quantity of each fuel portion converted to units of energy appears in the “Information to copy in the Allocation Matrix” section of the “Bioethanol Portions” worksheet.
- Using cell references, transfer the information in the cells highlighted in orange in the “Bioethanol Portions" worksheet to the Allocation Matrix.

Information to copy in the Allocation matrix

Add column as required for additional distinct feedstock inputs.

Copy orange cells in the Allocation matrix (see "Allocation" worksheet).	Name of fuel portion	Bioethanol from Corn (Global)	Bioethanol from Wheat (non-durum) (Global)	Bioethanol from Feedstock C
	Fuel portion quantity	4949694857.875000	905323878.125003	0
	Unit	MJ	MJ	MJ

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

Tips and Tricks!

Allocation Matrix

Link input and output flows

Enter name, amounts and units for all inputs (including excess electricity and predefined amounts) in columns C, D and E.
Enter name, amounts and units for all LCIF and co-product outputs (excluding excess electricity) in rows 11, 12 and 13.
Rows and columns can be added to the matrix as needed.

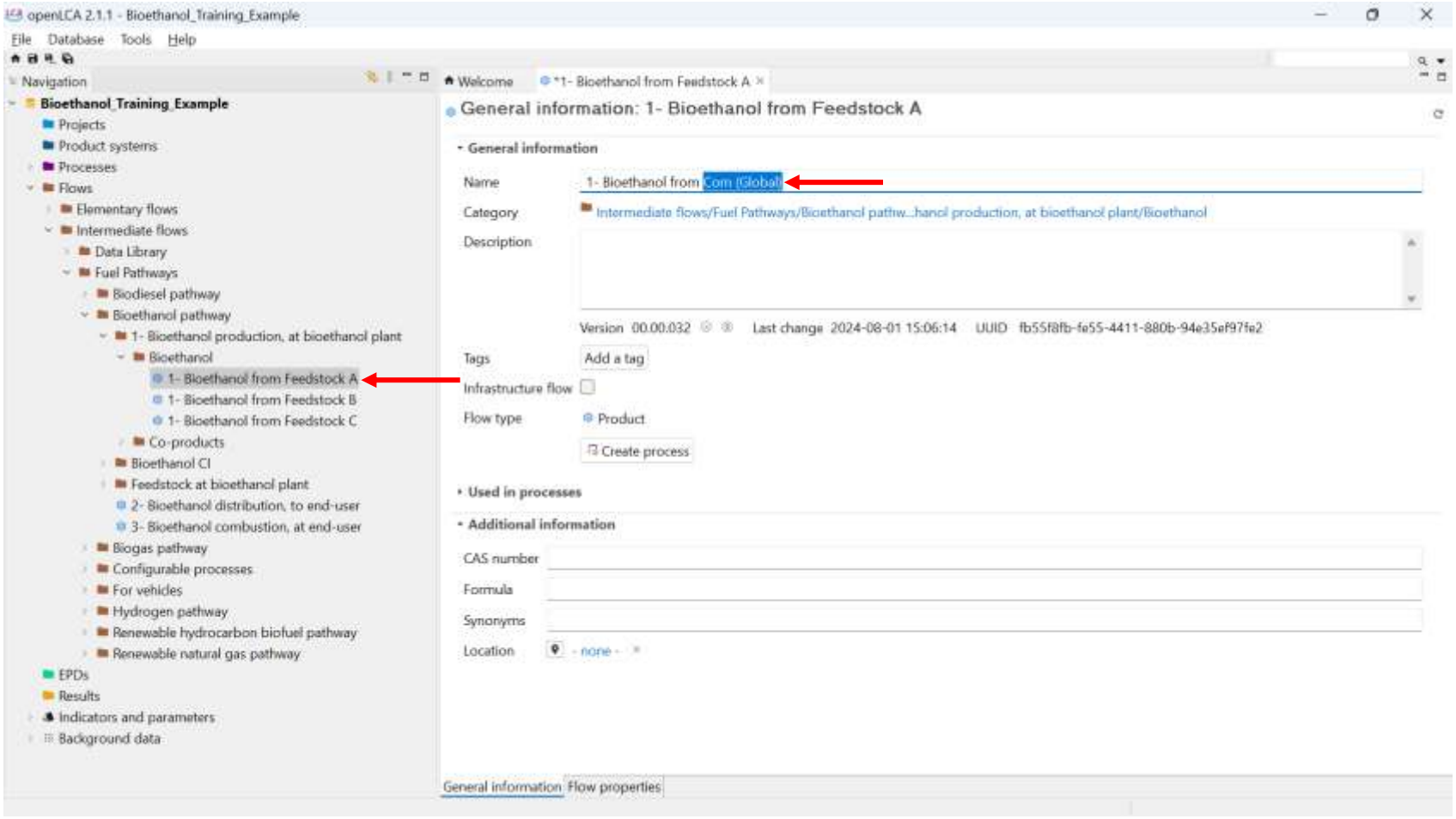
			Outputs	='Bioethanol Portions'!D26:D28	='Bioethanol Portions'!E26:E28	='Animal feeds (WDGS) Portions'!D27:D29	='Animal feeds (WDGS) Portions'!E27:E29	='Animal feeds (DDGS) Portions'!D27:D29	='Animal feeds (DDGS) Portions'!E27:E29
			Amount						
			Unit						
Inputs	Amount	Unit							
='Corn (Global)'!B104:D104				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
='Wheat (non-durum) (Global)'!B104:D104				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
='Natural gas'!B63:D63				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
='Grid electricity (ON,CA)'!B69:D69				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
='On-site Electricity (Solar)'!B69:D69				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
='Pre-set Chemical Mix'!B93:D93				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1

For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

Modelling fuel and Fuel Portions

Open and Rename Fuel Portion Flows

- In the folder *Flows/Intermediate flows/Fuel Pathways/Bioethanol Pathway/1- Bioethanol production, at bioethanol plant/Bioethanol*, open the flow entitled “1- Bioethanol from Feedstock A”.
- Rename the flow “1- Bioethanol from Corn (Global)”.
- Save and close the flow.
- Repeat the above steps for wheat using the flow entitled “1- Bioethanol from Feedstock B”.

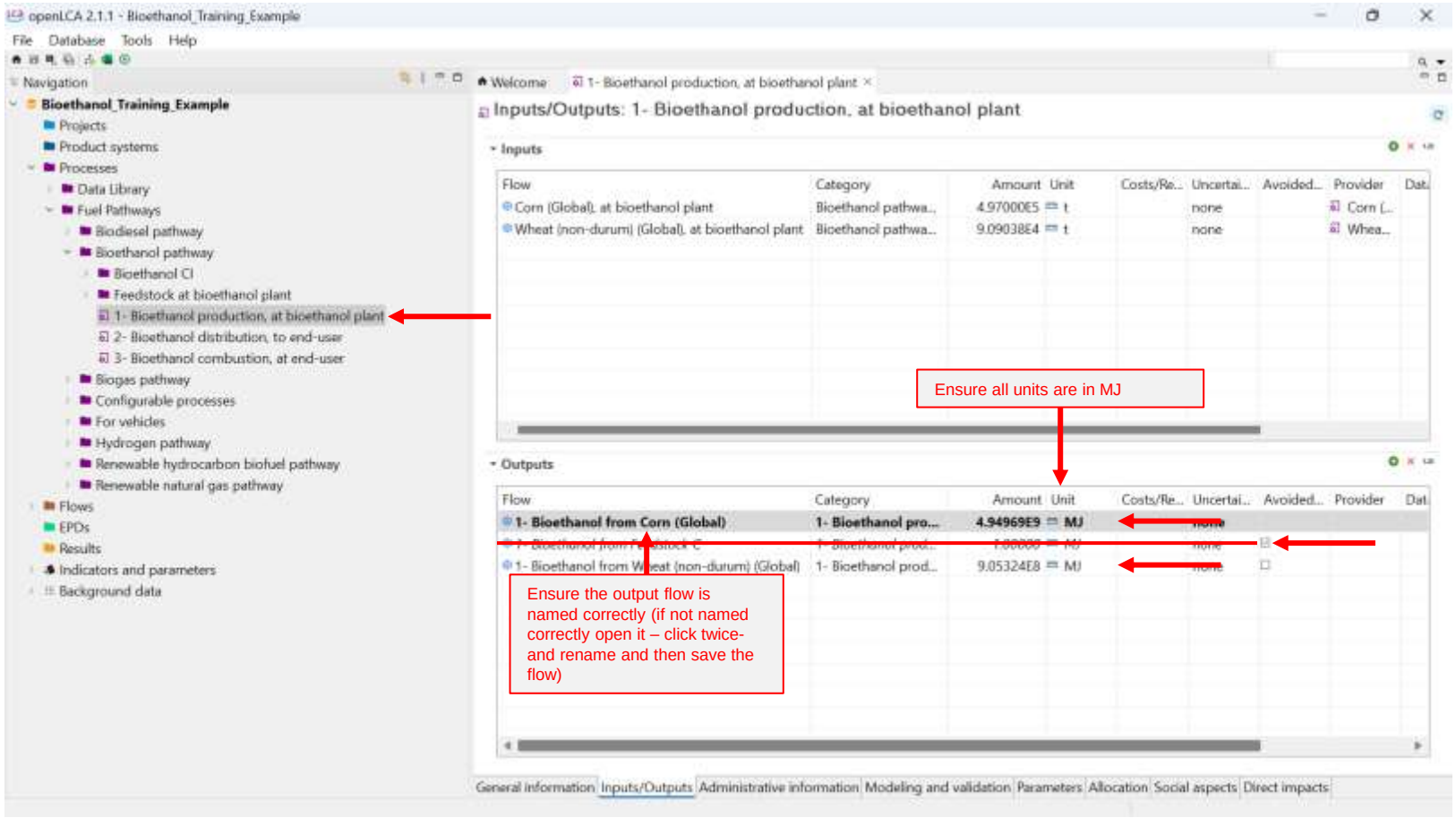


For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

Modelling fuel and Fuel Portions

Inputting Fuel Portion Flows in the Fuel Production Process

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway*, open the process entitled "1 –Bioethanol production, at bioethanol plant".
- For each fuel portion flow, enter the same amount that was entered in the Allocation Matrix in the CFR Data Workbook and select MJ units.
  - The process “1 – Bioethanol production, at bioethanol plant” already contains fuel portions as output flows. These were renamed as indicated in the previous slide.
  - Delete any fuel portion that is not used by checking the “Avoided product” box next to the output flow and deleting the flow.
- Save and close the process.



For more information, consult section 4.4, Annex A2.1.3.3 of the Specifications

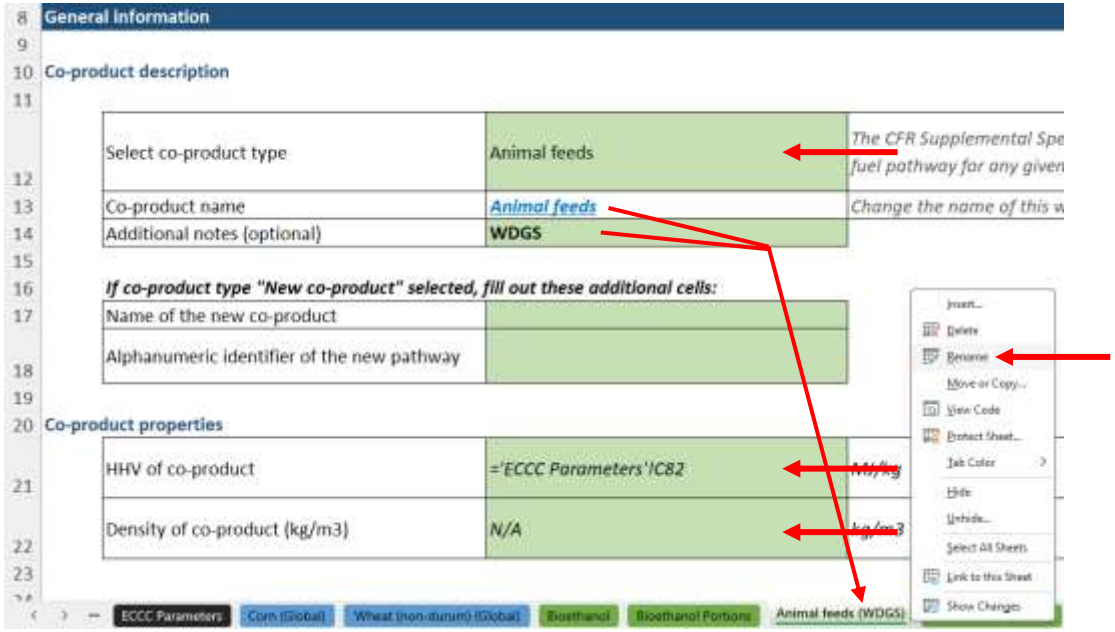
Co-Product and Co-Product Portions

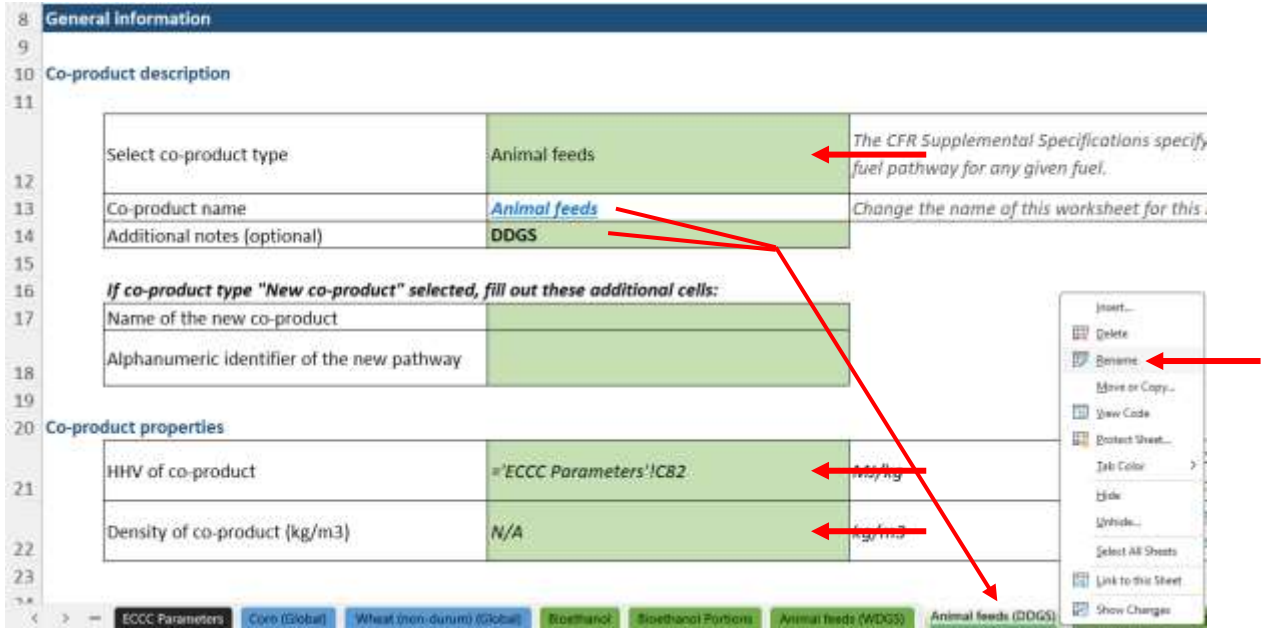
Complete the "Co-Product" Worksheet

- Duplicate the co-product worksheet for each co-product produced.
- Rename the worksheets "Animal Feeds (WDGS)" and "Animal Feeds (DDGS)".

Fill out the relevant sections of the worksheets

- General information
  - Co-product description
  - Co-product properties





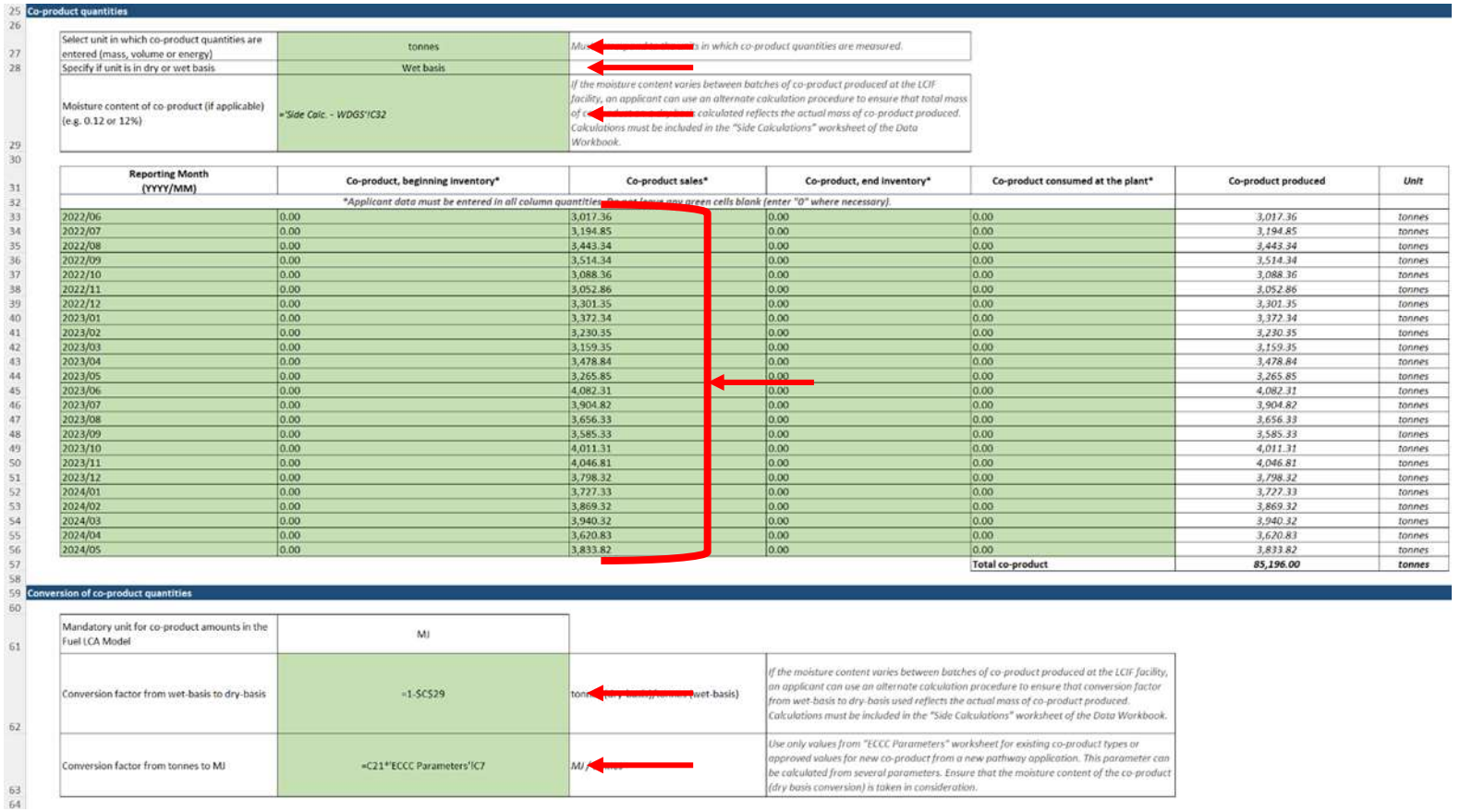
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

Co-Product and Co-Product Portions

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | **Co-Product** | **Co-Product Portions** | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Fill out the relevant sections of the worksheets

- Co-product quantities
  - Data must be entered in the units in which it was measured, in this case wet tonnes.
  - Enter the type of unit (dry or wet basis) and the calculated weighted average moisture content (if not on a dry basis).
  - Do not leave any green cell in the “Co-product quantities” section empty, instead enter 0.
- Conversion of co-product quantities
  - Using cell references, use factors from the “ECCC parameters” worksheet to convert the total co-product quantity produced to units MJ (use the fewest number of conversion factors possible).



Co-product quantities

Select unit in which co-product quantities are entered (mass, volume or energy)	tonnes	Must be the same as in which co-product quantities are measured.
Specify if unit is in dry or wet basis	Wet basis	
Moisture content of co-product (if applicable) (e.g. 0.12 or 12%)	='Side Calc. - WDGS'!C32	If the moisture content varies between batches of co-product produced at the LCIF facility, an applicant can use an alternate calculation procedure to ensure that total mass of co-product produced reflects the actual mass of co-product produced. Calculations must be included in the "Side Calculations" worksheet of the Data Workbook.

Reporting Month (YYYY/MM)	Co-product, beginning inventory*	Co-product sales*	Co-product, end inventory*	Co-product consumed at the plant*	Co-product produced	Unit
Applicant data must be entered in all column quantities. Do not leave any green cells blank (enter "0" where necessary).						
2022/06	0.00	3,017.36	0.00	0.00	3,017.36	tonnes
2022/07	0.00	3,194.85	0.00	0.00	3,194.85	tonnes
2022/08	0.00	3,443.34	0.00	0.00	3,443.34	tonnes
2022/09	0.00	3,514.34	0.00	0.00	3,514.34	tonnes
2022/10	0.00	3,088.36	0.00	0.00	3,088.36	tonnes
2022/11	0.00	3,052.86	0.00	0.00	3,052.86	tonnes
2022/12	0.00	3,301.35	0.00	0.00	3,301.35	tonnes
2023/01	0.00	3,372.34	0.00	0.00	3,372.34	tonnes
2023/02	0.00	3,230.35	0.00	0.00	3,230.35	tonnes
2023/03	0.00	3,159.35	0.00	0.00	3,159.35	tonnes
2023/04	0.00	3,478.84	0.00	0.00	3,478.84	tonnes
2023/05	0.00	3,265.85	0.00	0.00	3,265.85	tonnes
2023/06	0.00	4,082.31	0.00	0.00	4,082.31	tonnes
2023/07	0.00	3,904.82	0.00	0.00	3,904.82	tonnes
2023/08	0.00	3,656.33	0.00	0.00	3,656.33	tonnes
2023/09	0.00	3,585.33	0.00	0.00	3,585.33	tonnes
2023/10	0.00	4,011.31	0.00	0.00	4,011.31	tonnes
2023/11	0.00	4,046.81	0.00	0.00	4,046.81	tonnes
2023/12	0.00	3,798.32	0.00	0.00	3,798.32	tonnes
2024/01	0.00	3,727.33	0.00	0.00	3,727.33	tonnes
2024/02	0.00	3,869.32	0.00	0.00	3,869.32	tonnes
2024/03	0.00	3,940.32	0.00	0.00	3,940.32	tonnes
2024/04	0.00	3,620.83	0.00	0.00	3,620.83	tonnes
2024/05	0.00	3,833.82	0.00	0.00	3,833.82	tonnes
				Total co-product	85,196.00	tonnes

Conversion of co-product quantities

Mandatory unit for co-product amounts in the Fuel LCA Model	MJ		
Conversion factor from wet-basis to dry-basis	=1-C29	tonnes (dry basis)/tonnes (wet-basis)	If the moisture content varies between batches of co-product produced at the LCIF facility, an applicant can use an alternate calculation procedure to ensure that conversion factor from wet-basis to dry-basis used reflects the actual mass of co-product produced. Calculations must be included in the "Side Calculations" worksheet of the Data Workbook.
Conversion factor from tonnes to MJ	=C21*'ECCC Parameters'!C7	MJ/tonne	Use only values from "ECCC Parameters" worksheet for existing co-product types or approved values for new co-product from a new pathway application. This parameter can be calculated from several parameters. Ensure that the moisture content of the co-product (dry basis conversion) is taken in consideration.

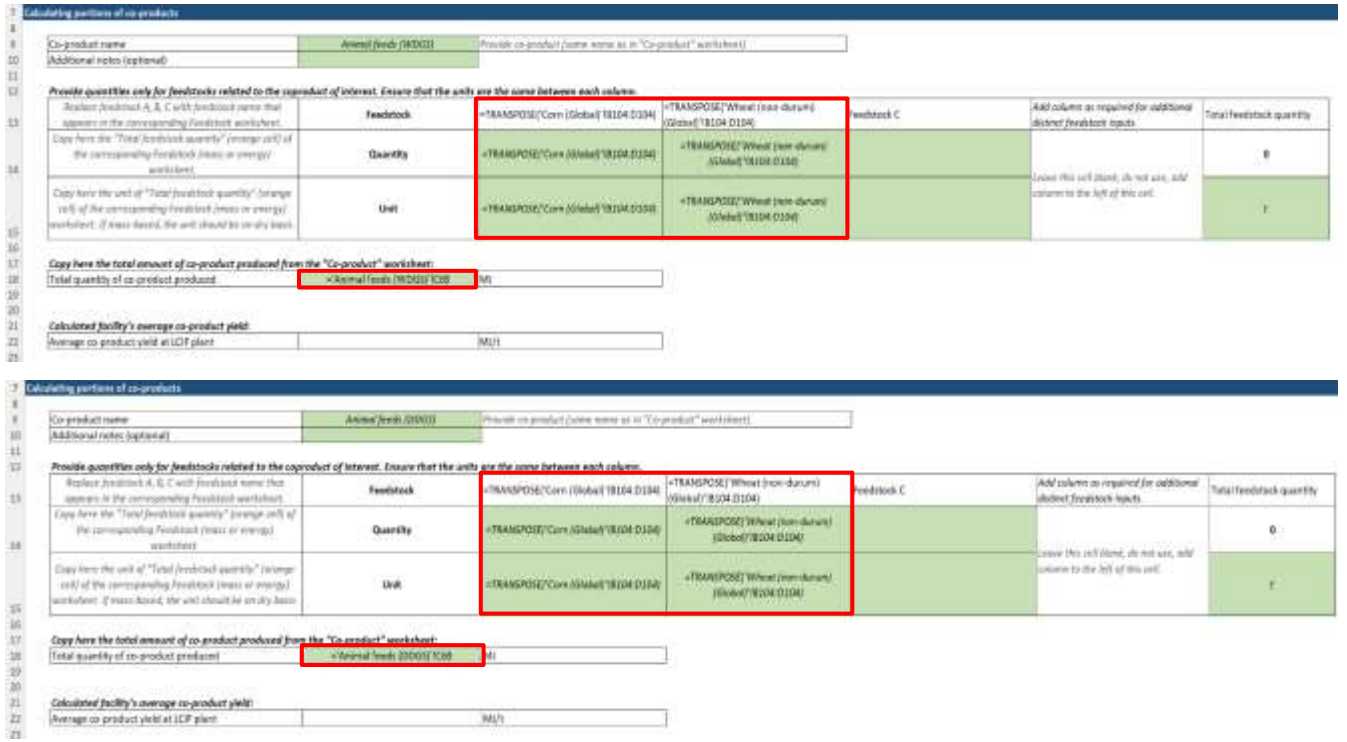
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

Co-Product and Co-Product Portions

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Complete the "Co-Product Portions" Worksheets

- Since there are multiple distinct feedstocks used and multiple co-products produced, two "Co-Product Portions" worksheets must be completed.
- Duplicate the worksheet for each co-product produced from multiple distinct feedstocks.
- Rename the worksheets "Animal feeds (WDGS) Portions" and "Animal feeds (DDGS) Portions".
- Using cell references, transfer the information in the cells highlighted in orange in the "Corn (global)" and "Wheat (non-durum) (global)" worksheets to the "Co-Product Portions" worksheets.
- Using cell references, transfer the total quantity of co-product produced converted to units of MJ from the cells highlighted in orange in the "Animal Feeds (WDGS)" worksheet to "Animal Feeds (WDGS) Portions" worksheet. Do the same for the Animal Feeds (DDGS) co-product.

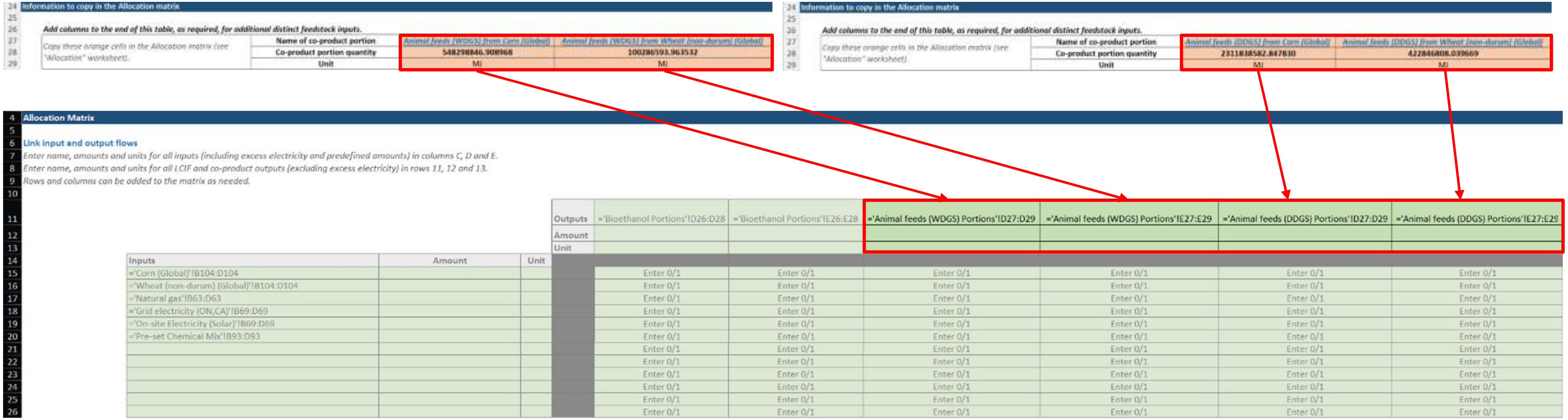


For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

CO-PRODUCT AND CO-PRODUCT PORTIONS – ALLOCATION MATRIX

Copy Co-Products Portions Quantities to the Allocation Matrix

- The total quantity of each co-product portion will appear in the “Information to copy in the Allocation Matrix” section of the “Animal Feeds (WDGS) Portions” and “Animal Feeds (DDGS) Portions” worksheets.
- Using cell references, transfer the information in the cells highlighted in orange in the “Animal Feeds (WDGS) Portions” and “Animal Feeds (DDGS) Portions" worksheets to the Allocation Matrix.

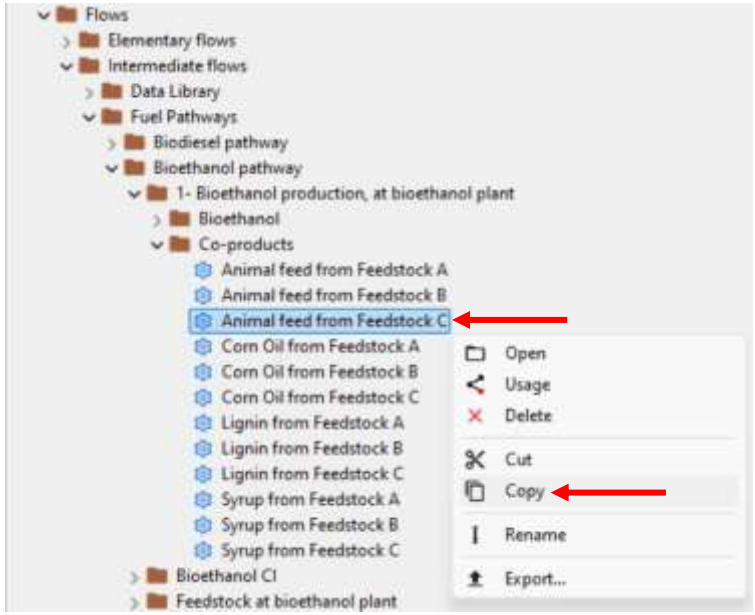


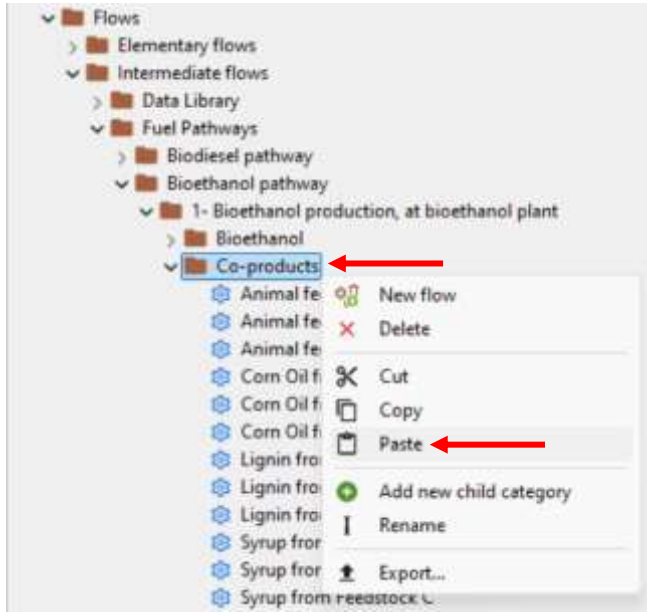
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

Modelling Co-Products & Co-Product Portions

Open and Rename Co-Product Portion Flows

- To represent all the co-product portions produced, a fourth animal feeds co-product flow needs to be created. This can be done by copying and pasting an existing animal feeds co-product flow.
  - Right-click on one of the existing animal feed co-product flows.
  - Select “Copy”.
  - Right-click on the folder entitled “Co-products”.
  - Select “Paste”.



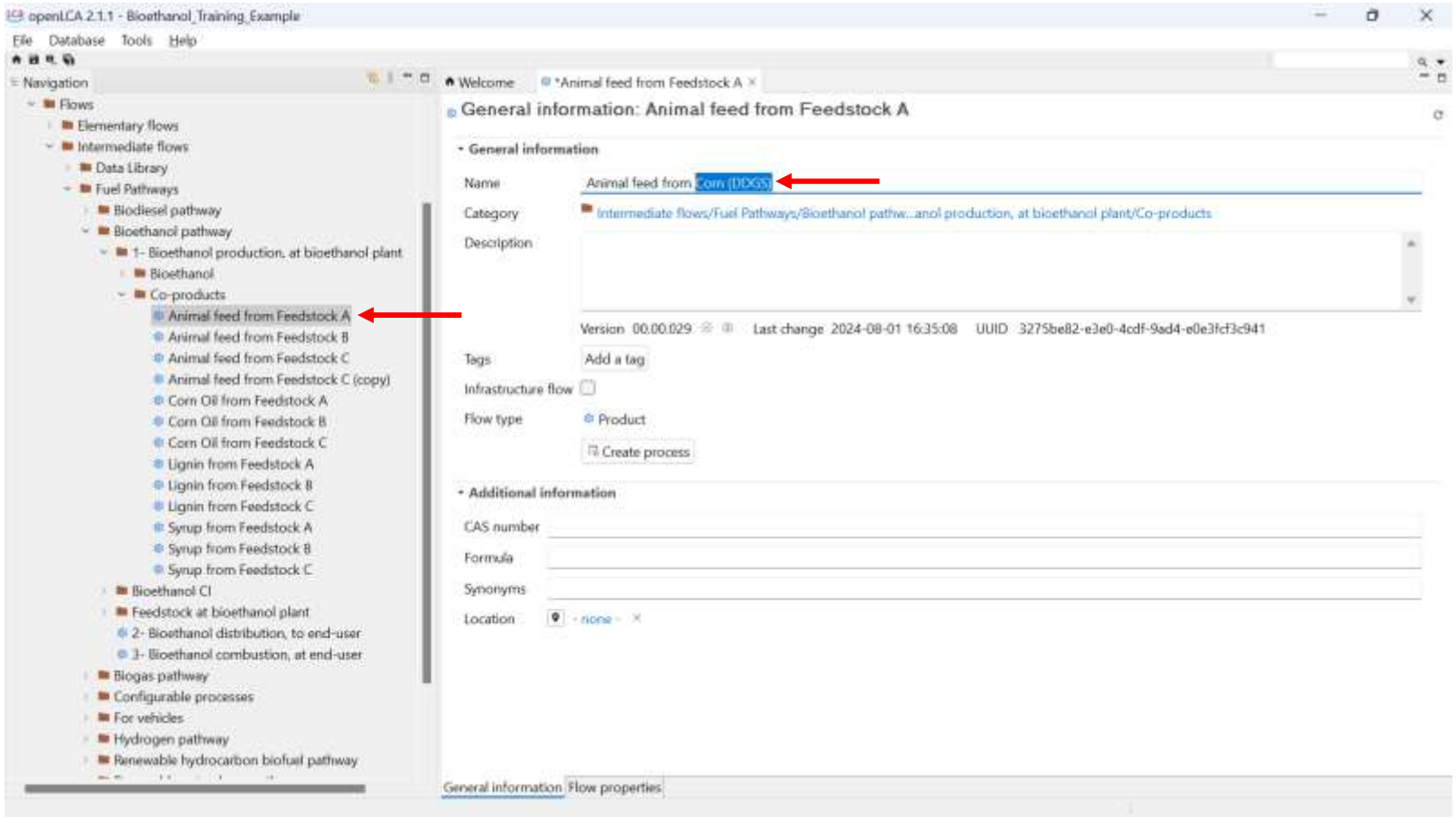


For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

Modelling Co-Products & Co-Product Portions

Open and Rename Co-Product Portion Flows

- In the folder *Flows/Intermediate flows/Fuel Pathways/Bioethanol Pathway/1- Bioethanol production, at bioethanol plant/Co-products*, open the flow entitled “Animal feed from Feedstock A”.
- Rename the flow “Animal feed from Corn (DDGS) ”.
- Save and close the flow.
- Repeat the above steps for "Animal feed from Corn (WDGS)", "Animal feed from Wheat (DDGS)", and "Animal feed from Wheat (WDGS)” using the other animal feeds coproduct flows.

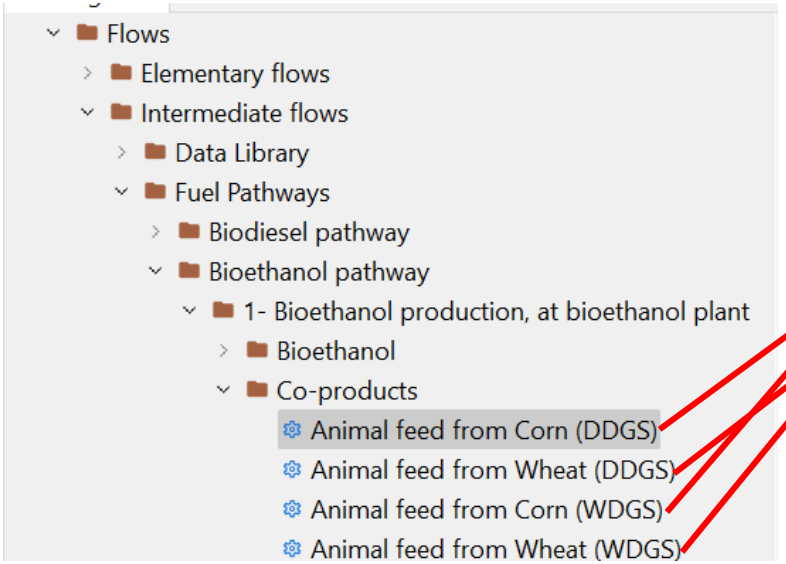


For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

Modelling Co-Products & Co-Product Portions

Input Co-product Portion Flows in the Fuel Production Process:

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway*, open the process entitled "1 – Bioethanol production, at bioethanol plant".
- In the “Inputs/Outputs” tab, ensure the co-product portion flows renamed previously are entered as outputs.
- For each co-product portion, enter the same amount that was entered in the Allocation Matrix in the CFR Data Workbook and select MJ units.
- Save and close the process.



When copying values from the CFR Data Workbook to openLCA to ensure that you copy all the significant digits provided by Excel.

Ensure units are in MJ

Outputs

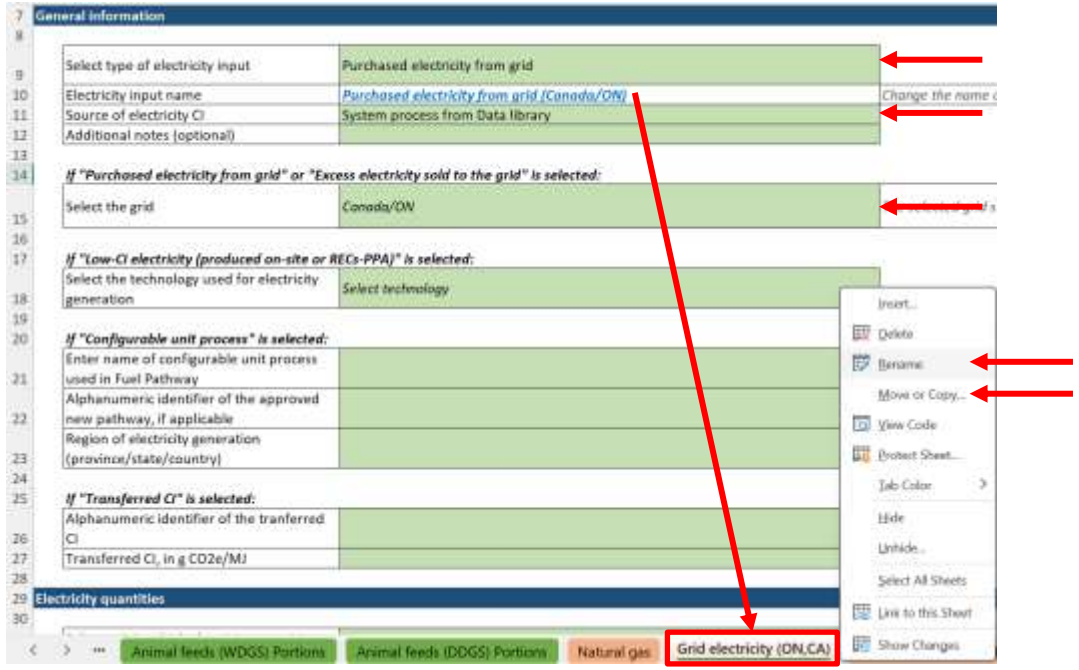
Flow	Category	Amount	Unit	Costs/Revenues	Uncertainty	Avoided prod...	Provider	Data quality e...	Location	De
1- Bioethanol from Corn (Global)	**Intermediate flows/Fuel Pat...**	**4.94969E9**	**MJ**		**none**					
1- Bioethanol from Wheat (non durum) (Global)	Intermediate flows/Fuel Pathw...	9.05324E8	MJ		none	☐				
Animal feed from Corn (DDGS)	Intermediate flows/Fuel Pathw...	2.31184E9	MJ		none	☐				
Animal feed from Corn (WDGS)	Intermediate flows/Fuel Pathw...	5.48299E8	MJ		none	☐				
Animal feed from Wheat (DDGS)	Intermediate flows/Fuel Pathw...	4.22847E8	MJ		none	☐				
Animal feed from Wheat (WDGS)	Intermediate flows/Fuel Pathw...	1.00287E8	MJ		none	☐				

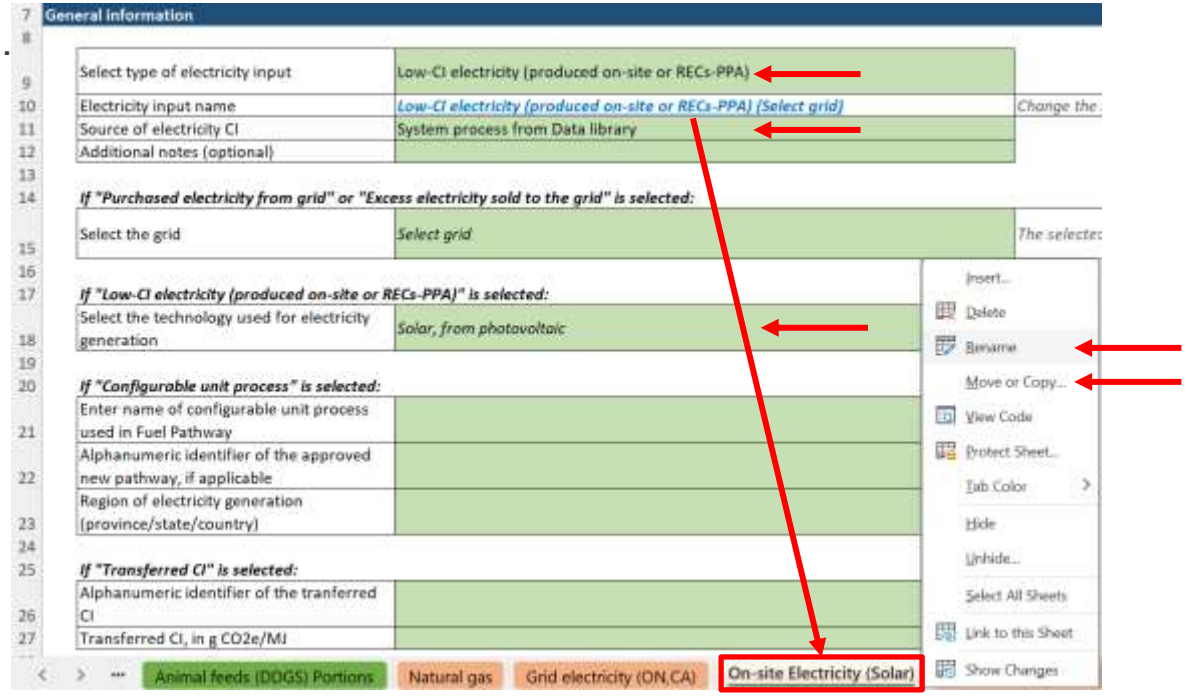
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications

ENERGY INPUTS, MATERIAL INPUTS AND DIRECT EMISSIONS

Rename the input worksheets

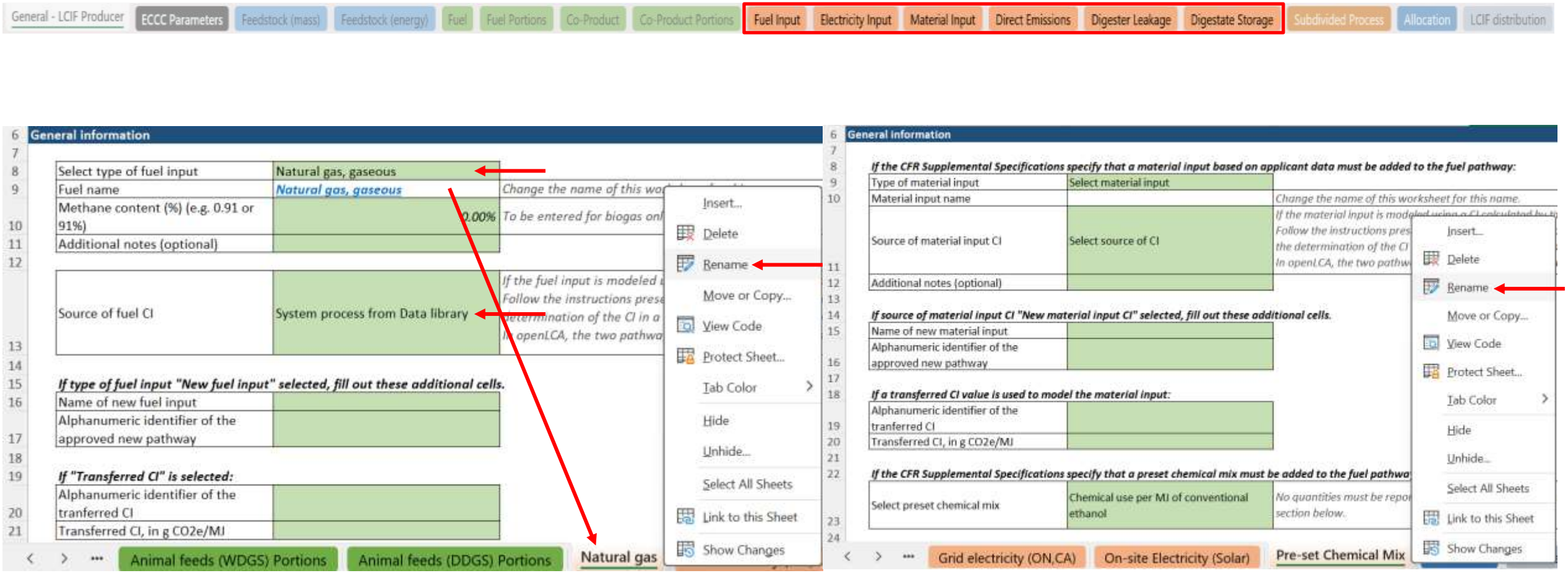
- Rename the “Energy Input” worksheet “Natural Gas”.
- Duplicate the “Electricity Input” worksheet and rename the first copy “Grid Electricity (ON,CA)” and the other one “On-site Electricity (Solar)”.
- Rename the “Material Input” worksheet “Pre-set Chemical Mix”.
- Fill out the “General information” sections of each of these worksheets.





For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

ENERGY INPUTS, MATERIAL INPUTS AND DIRECT EMISSIONS



For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

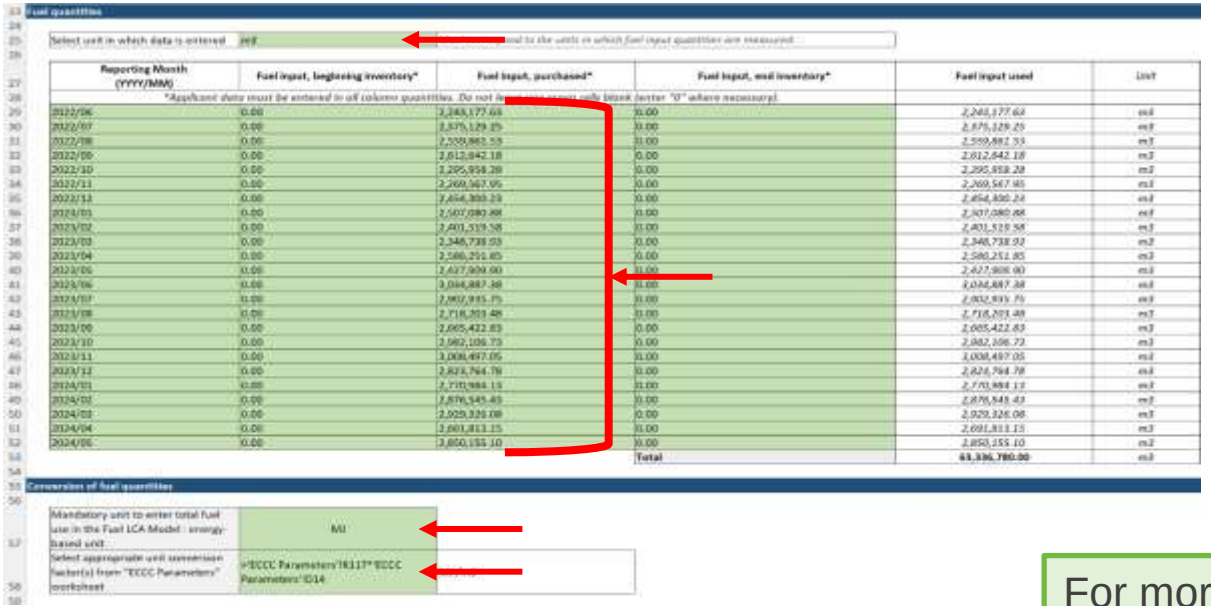
Energy Inputs, Material Inputs and Direct Emissions

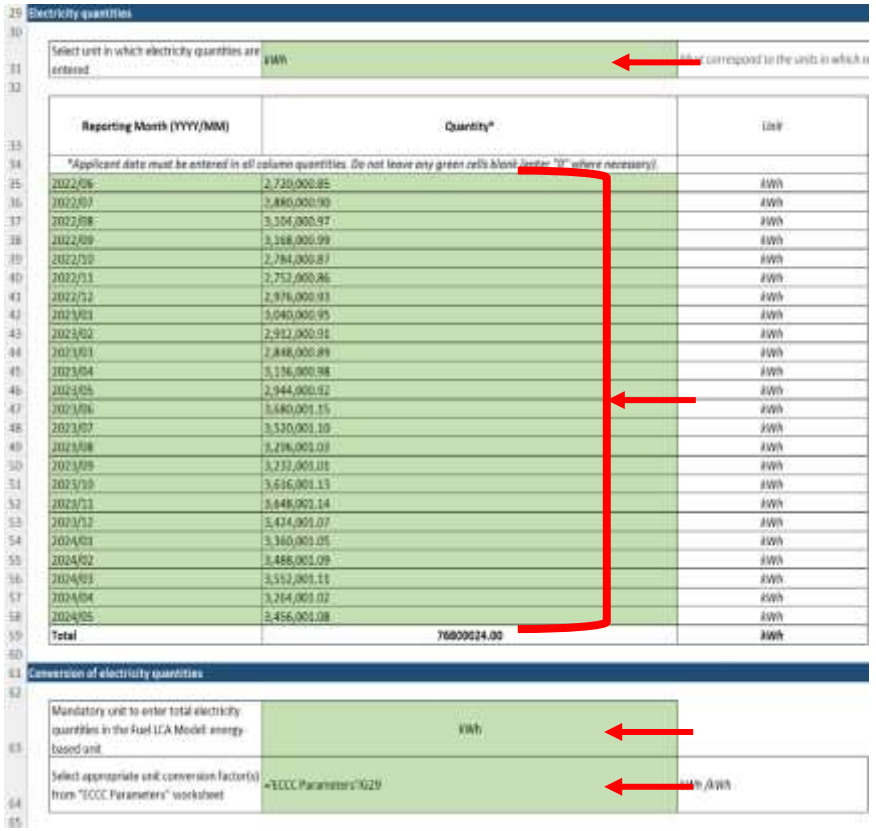
General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | **Fuel Input** | **Electricity Input** | **Material Input** | **Direct Emissions** | **Digester Leakage** | **Digestate Storage** | Subdivided Process | Allocation | LCIF distribution

Fill out the following sections of the "Fuel Input", "Electricity Input" and "Material Input" worksheets

- Fuel and Electricity quantities
- Using cell references, use factors from the "ECCC parameters" worksheet to convert the total fuel input and energy input quantities used to units of energy (use the fewest number of conversion factors possible).
- For the preset chemical mix, use a cell reference to enter the quantity of bioethanol produced (in MJ) from the "Bioethanol" worksheet in the "Information to copy in the Allocation Matrix" section of the "Material Input" worksheet.

When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value.

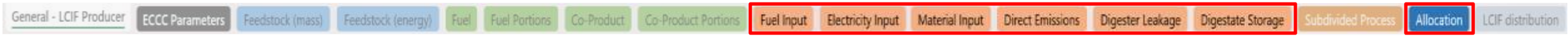




Preset chemical mix - name	Amount	Unit
Chemical use per MJ of conventional ethanol	*=Bioethanol!C64*	*MJ*

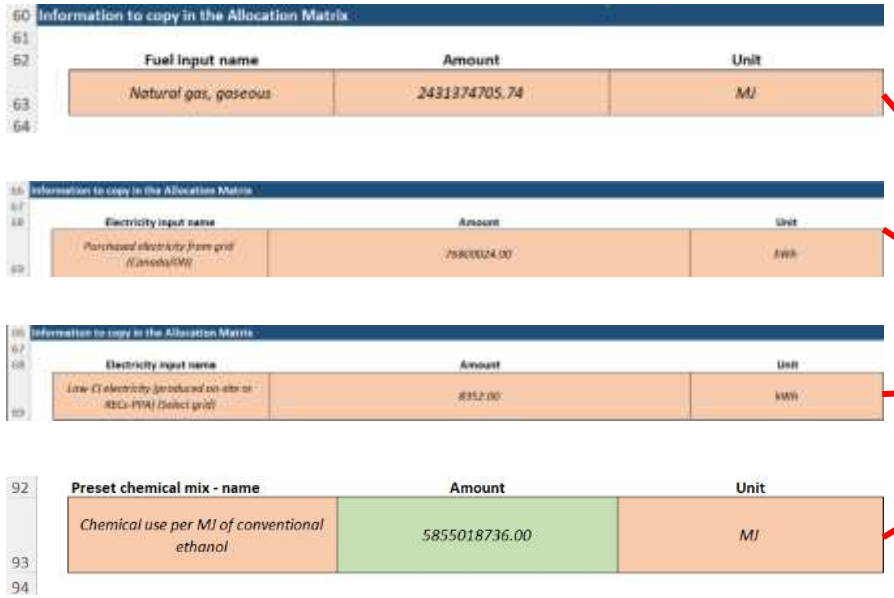
For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

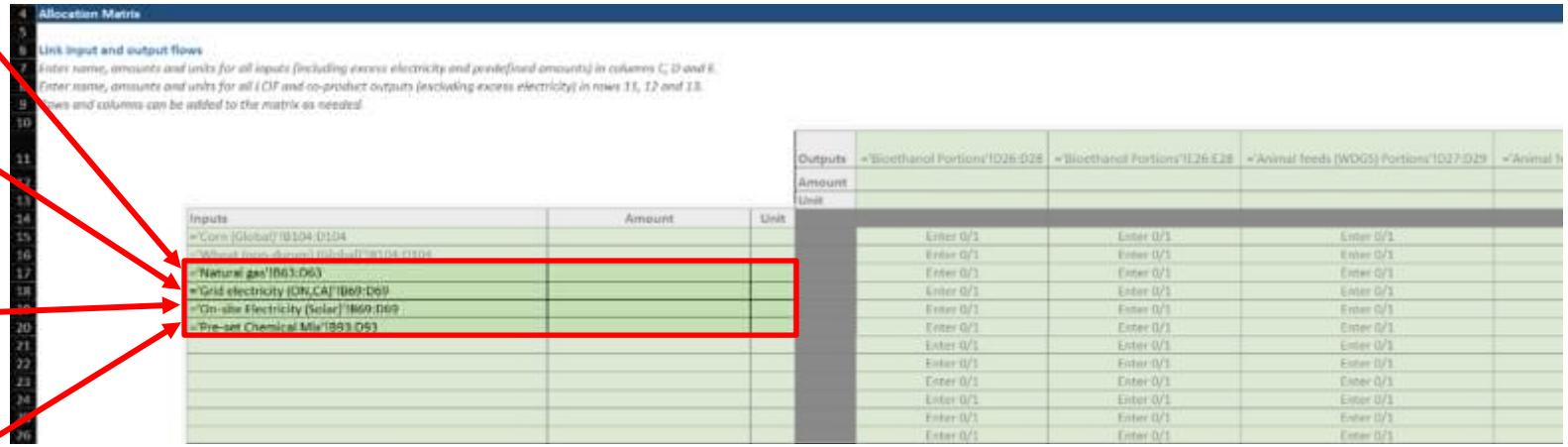
Energy Inputs, Material Inputs and Direct Emissions – Allocation Matrix



Copy Fuel Inputs, Electricity Inputs and Material Inputs in the Allocation Matrix

- Using cell references, transfer the information in the cells highlighted in orange in the “Natural gas”, “Grid Electricity (ON,CA)”, “On-site Electricity (Solar)”, and “Pre-set Chemical Mix” worksheets to the Allocation Matrix.





When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value.

For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

Modelling Energy Inputs, Material Inputs and Direct Emissions

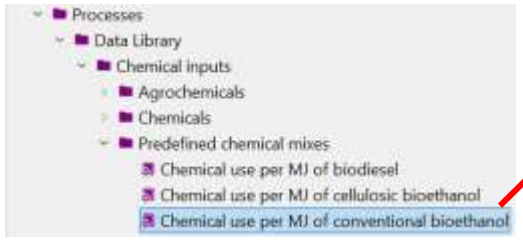
- In the folder *Processes/Fuel Pathways/Bioethanol Pathway*, open the process "1 – Bioethanol production, at bioethanol plant".
- In the "Inputs/Outputs" tab of the process "1 – Bioethanol production, at bioethanol plant", add the following as inputs:

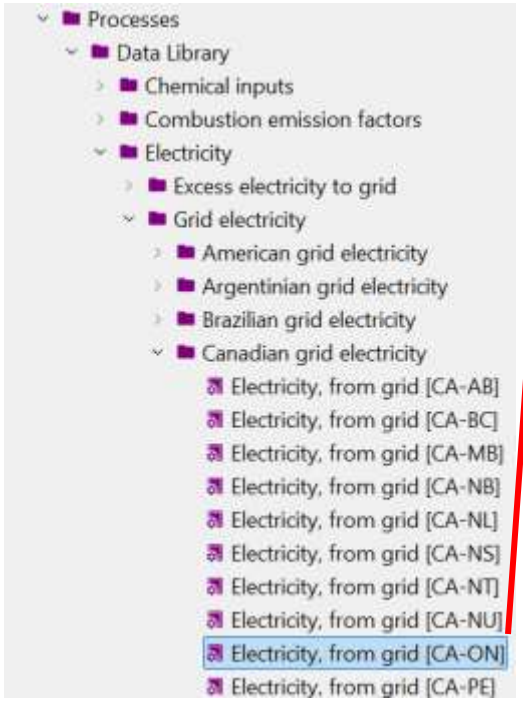
When copying values from the CFR Data Workbook to openLCA to ensure that you copy all the significant digits provided by Excel.

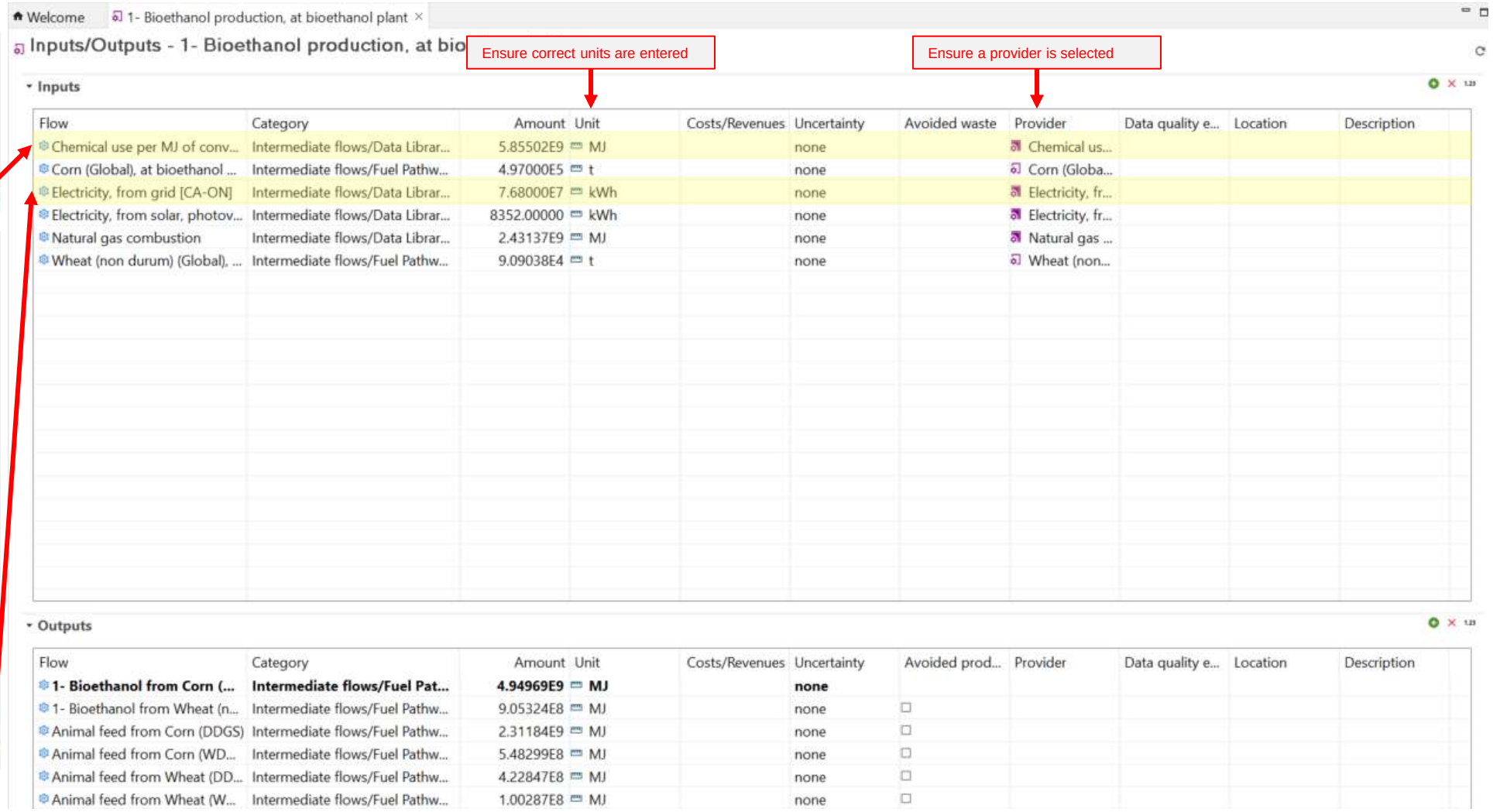
Inputs	Data Type	Process
Natural gas combustion	Applicant Data	• Select the process "Natural gas combustion" from the folder *Processes/Data library/Fossil Fuels/Combusted fossil fuels.* • Enter the same amount and corresponding unit that were entered in the Allocation Matrix in the CFR Data Workbook.
Electricity, from grid [CA-ON]	Applicant Data	• Select the process "Electricity, from grid [CA-ON]" from the folder *Processes/Data library/Electricity/Grid electricity/Canadian grid electricity* (region corresponds to where the electricity was purchased for the facility). • Enter the same amount and corresponding unit that was entered in the Allocation Matrix in the CFR Data Workbook.
Electricity, from solar, photovoltaic, onsite generation	Applicant Data	• Select the process "Electricity, from solar, photovoltaic, onsite generation" from the folder *Processes/Data library/Electricity/Technology specific electricity/Onsite generation.* • Enter the same amount and corresponding unit that was entered in the Allocation Matrix in the CFR Data Workbook.
Chemical use per MJ of conventional bioethanol	Pre-defined Data	• Select the process "Chemical use per MJ of conventional ethanol" from folder *Processes/Data library/Chemical inputs/Predefined chemical mixes.* • Enter the total amount of fuel produced (sum of the bioethanol portions) in units of MJ.

For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

Modelling Energy Inputs, Material Inputs and Direct Emissions







For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

Modelling Energy Inputs, Material Inputs and Direct Emissions

Welcome | 1- Bioethanol production, at bioethanol plant ×

Inputs/Outputs - 1- Bioethanol production, at bio

Ensure correct units are entered

Ensure a provider is selected

Inputs

Flow	Category	Amount	Unit	Costs/Revenues	Uncertainty	Avoided waste	Provider	Data quality e...	Location	Description
Chemical use per MJ of conv...	Intermediate flows/Data Librar...	5.85502E9	MJ		none		Chemical us...			
Corn (Global), at bioethanol ...	Intermediate flows/Fuel Pathw...	4.97000E5	t		none		Corn (Globa...			
Electricity, from grid [CA-ON]	Intermediate flows/Data Librar...	7.68000E7	kWh		none		Electricity, fr...			
Electricity, from solar, photov...	Intermediate flows/Data Librar...	8352.00000	kWh		none		Electricity, fr...			
Natural gas combustion	Intermediate flows/Data Librar...	2.43137E9	MJ		none		Natural gas ...			
Wheat (non durum) (Global), ...	Intermediate flows/Fuel Pathw...	9.09038E4	t		none		Wheat (non...			

Outputs

Flow	Category	Amount	Unit	Costs/Revenues	Uncertainty	Avoided prod...	Provider	Data quality e...	Location	Description
1- Bioethanol from Corn (...	**Intermediate flows/Fuel Pat...**	**4.94969E9**	**MJ**		**none**					
1- Bioethanol from Wheat (n...	Intermediate flows/Fuel Pathw...	9.05324E8	MJ		none	☐				
Animal feed from Corn (DDGS)	Intermediate flows/Fuel Pathw...	2.31184E9	MJ		none	☐				
Animal feed from Corn (WD...	Intermediate flows/Fuel Pathw...	5.48299E8	MJ		none	☐				
Animal feed from Wheat (DD...	Intermediate flows/Fuel Pathw...	4.22847E8	MJ		none	☐				
Animal feed from Wheat (W...	Intermediate flows/Fuel Pathw...	1.00287E8	MJ		none	☐				

For more information, consult section 4.6, Annex A2.1.3.5 of the Specifications

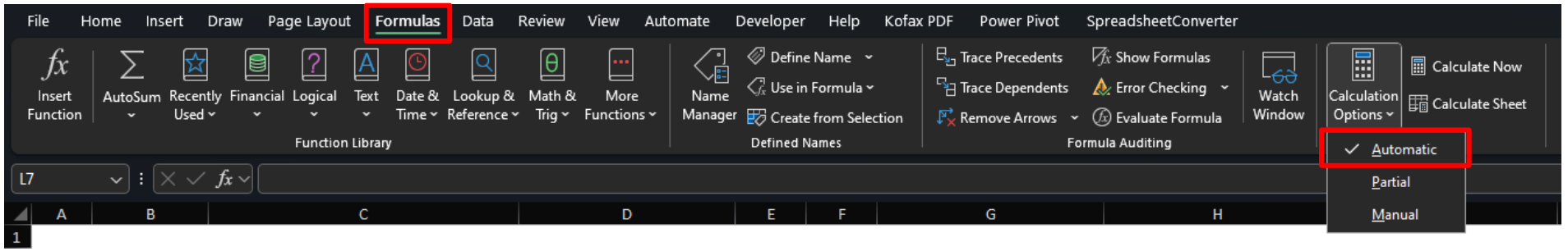
Calculation of Allocation Factors

Link Input and Output Flows with the Allocation Matrix

- Fuel and co-product portions can only be associated with one distinct feedstock.
  - In the row corresponding to "Corn (Global)", put a "1" in each cell pertaining to a fuel or co-product portion produced from corn. Put a "0" in all other cells.
  - In the row corresponding to "Wheat (non-durum) (Global)", put a "1" in each cell pertaining to a fuel or co-product portion produced from wheat. Put a "0" in all other cells.
- Input flows of energy and material inputs must be associated with all fuels and co-products.
  - In the rows corresponding to "Purchased electricity from grid (Canada/ON)", "Low-CI electricity (produced on-site or RECs-PPA), "Natural gas, gaseous", and "Chemical use per MJ of conventional ethanol", put a "1" in each cell pertaining to a fuel or co-product

Calculate Allocation Factors

- Once the "0" and "1" values have been entered into the Allocation Matrix, the CFR Data Workbook automatically calculates the allocation factors in the “Calculation of allocation factors" section of the worksheet.
- Make sure the workbook formulas are set to the automatic calculation option as shown below.



For more information, consult section 4.7 of the Specifications

CALCULATION OF ALLOCATION FACTORS

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | **Allocation** | LCIF distribution

Allocation Matrix

Link input and output flows

Enter name, amounts and units for all inputs (including excess electricity and predefined amounts) in columns C, D and E.
Enter name, amounts and units for all LCIF and co-product outputs (excluding excess electricity) in rows 11, 12 and 13.
Rows and columns can be added to the matrix as needed.

			Outputs	='Bioethanol Portions'!D26:D28	='Bioethanol Portions'!E26:E28	='Animal feeds (WDGS) Portions'!D27:D29	='Animal feeds (WDGS) Portions'!E27:E29	='Animal feeds (DDGS) Portions'!D27:D29	='Animal feeds (DDGS) Portions'!E27:E29
			Amount						
			Unit						
Inputs	**Amount**	**Unit**							
='Corn (Global)'!B104:D104				1	0	1	0	1	0
='Wheat (non-durum) (Global)'!B104:D104				0	1	0	1	0	1
='Natural gas'!B63:D63				1	1	1	1	1	1
='Grid electricity (ON,CA)'!B69:D69				1	1	1	1	1	1
='On-site Electricity (Solar)'!B69:D69				1	1	1	1	1	1
='Pre-set Chemical Mix'!B93:D93				1	1	1	1	1	1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1
				Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1	Enter 0/1

Calculation of allocation factors

Rows and columns can be added to the matrix as needed.
Allocation factors must be copied in the Allocation tab of the "1- [LCIF name] production, at [LCIF name] plant" unit process in openLCA.

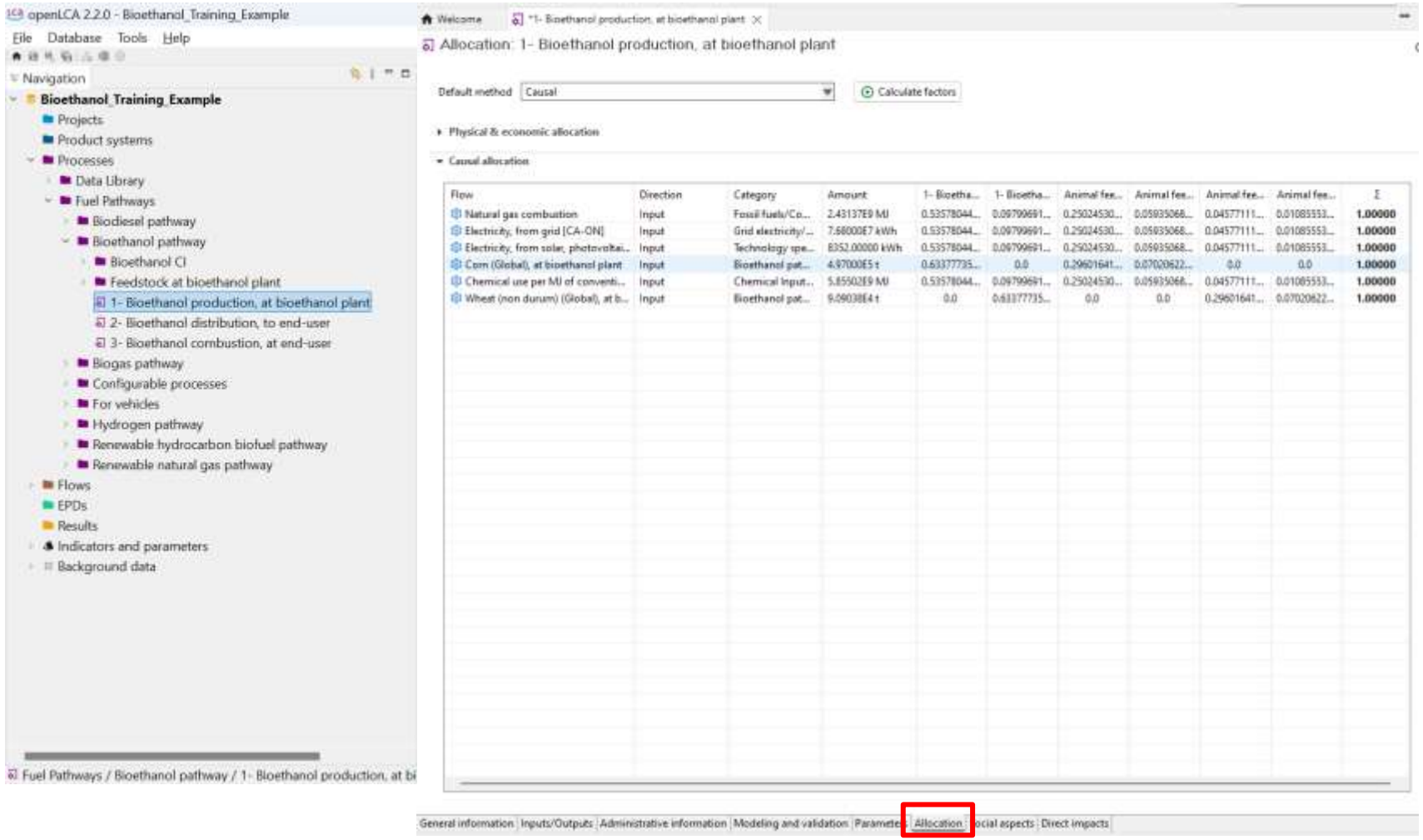
			Outputs	='Bioethanol Portions'!D26:D28	='Bioethanol Portions'!E26:E28	='Animal feeds (WDGS) Portions'!D27:D29	='Animal feeds (WDGS) Portions'!E27:E29	='Animal feeds (DDGS) Portions'!D27:D29	='Animal feeds (DDGS) Portions'!E27:E29
			Amount						
			Unit						
Inputs	**Amount**	**Unit**							
='Corn (Global)'!B104:D104				0.6337773559764770	0.0000000000000000	0.0702062255264166	0.0000000000000000	0.2960164184971070	0.0000000000000000
='Wheat (non-durum) (Global)'!B104:D104				0.0000000000000000	0.6337773559764770	0.0000000000000000	0.0702062255264166	0.0000000000000000	0.2960164184971070
='Natural gas'!B63:D63				0.5357804409106810	0.0979969150657956	0.0593506885541274	0.0108555369722892	0.2502453041649330	0.0457711143321736
='Grid electricity (ON,CA)'!B69:D69				0.5357804409106810	0.0979969150657956	0.0593506885541274	0.0108555369722892	0.2502453041649330	0.0457711143321736
='On-site Electricity (Solar)'!B69:D69				0.5357804409106810	0.0979969150657956	0.0593506885541274	0.0108555369722892	0.2502453041649330	0.0457711143321736
='Pre-set Chemical Mix'!B93:D93				0.5357804409106810	0.0979969150657956	0.0593506885541274	0.0108555369722892	0.2502453041649330	0.0457711143321736

For more information, consult section 4.7 of the Specifications

INPUTTING ALLOCATION FACTORS INTO OPENLCA

Open the Bioethanol Production Process and Enter the Allocation Factors

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway*, open the process entitled "1 – Bioethanol production, at bioethanol plant".
- Go to the "Allocation" tab and complete the “Causal allocation” table by entering the allocation factors calculated in the CFR Data Workbook.
- Default method : Causal
- Do not click the "Calculate factors" button because it will overwrite all the allocation factors that were entered.
- Save and close the process.



Make sure to double check that you are inputting the right allocation factors because the flows may be in a different order in the CFR Data Workbook

For more information, consult section 4.7 of the Specifications

LCIF Distribution and Combustion

General - LCIF Producer | ECCC Parameters | Feedstock (mass) | Feedstock (energy) | Fuel | Fuel Portions | Co-Product | Co-Product Portions | Fuel Input | Electricity Input | Material Input | Direct Emissions | Digester Leakage | Digestate Storage | Subdivided Process | Allocation | LCIF distribution

Complete the "LCIF Distribution" Worksheet

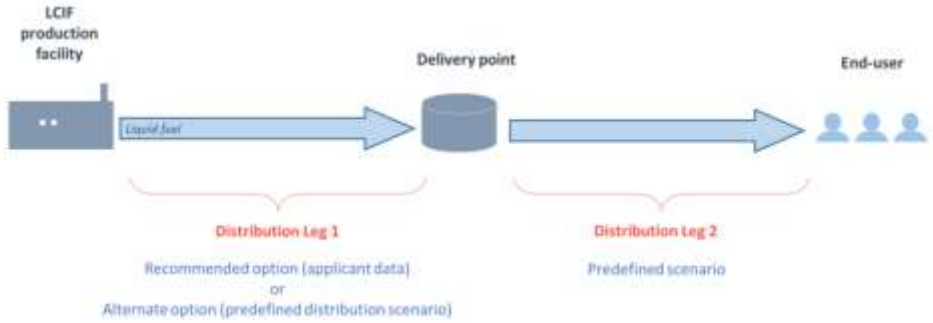
- Rename the worksheet "Bioethanol Distribution".
- Fill out the relevant sections of the worksheet.
  - General information

Distribution Leg 1

- For the "LCIF distribution modelling option" field, select "Recommended option - Applicant data".
- Enter the state of the fuel (liquid) and density using parameters from the "ECCC Parameters" worksheet.
- Enter the distance in km travelled for each mode of transport and the state of the low-CI fuel (truck, liquid state in this case), and the fraction of low-CI fuel transported via each transport mode (1 in this case).

Distribution Leg 2

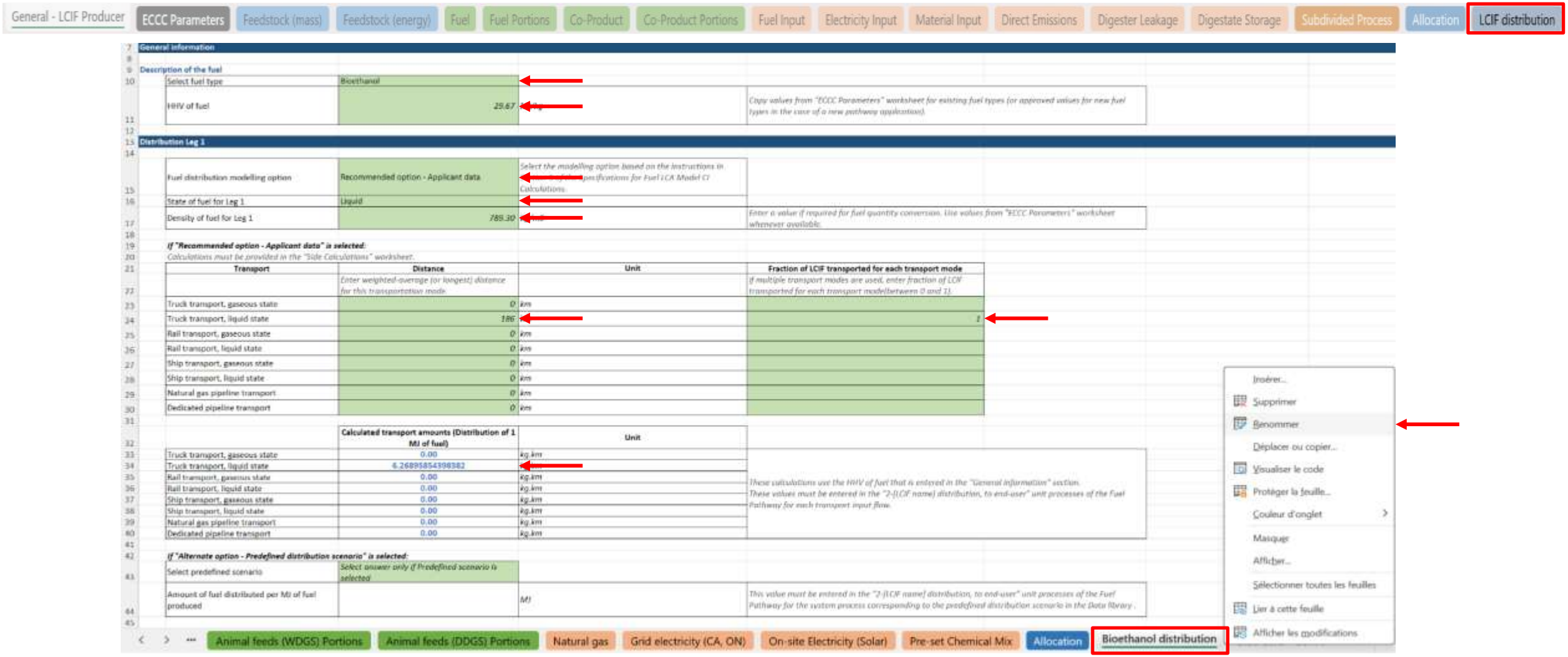
- Leave empty, all steps will be done in openLCA.



There is no tab for LCIF combustion because the user does not need to fill anything out in the CFR Data workbook for this phase in the process.

For more information, consult section 5 A2.1.3.6 of the Specifications

LCIF DISTRIBUTION



For more information, consult section 5 A2.1.3.6 of the Specifications

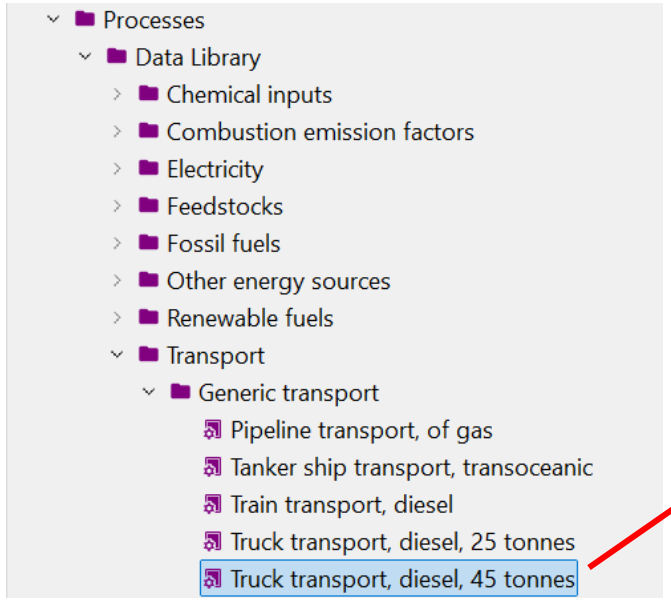
Modelling LCIF Distribution

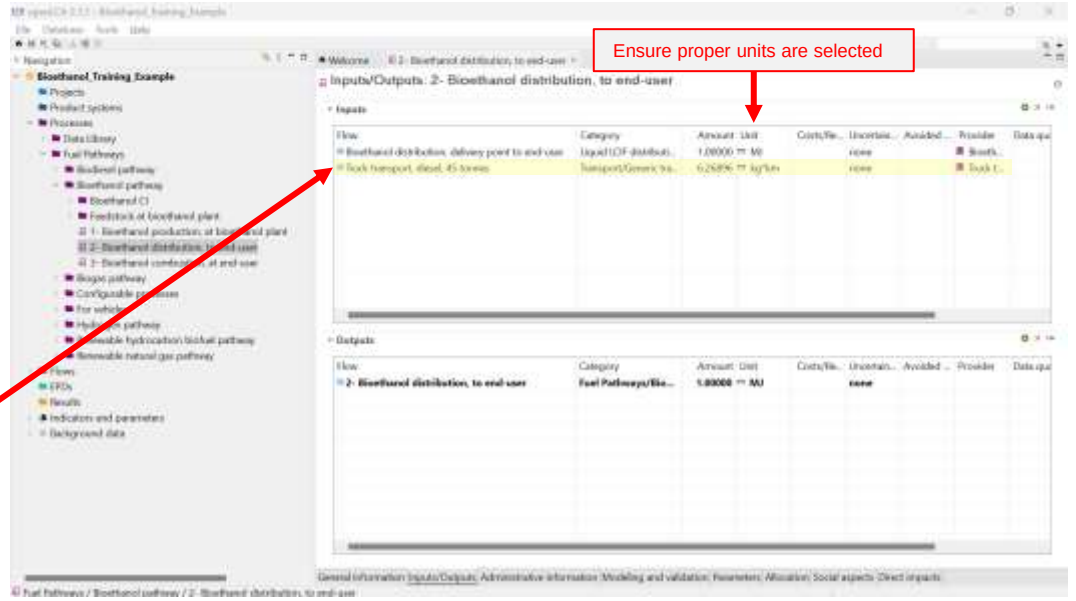
Open and Complete the Bioethanol Distribution Process

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway,* open the process entitled "2-Bioethanol distribution, to end-user".

In the “Inputs/Outputs” tab, for Leg 1

- Select the process entitled "Truck transport, diesel, 45 tonnes” from the folder *Processes/Data library/Transport/Generic transport* and enter it as an input.
- Enter the amount of kg*km calculated in the “Bioethanol distribution” worksheet of the CFR Data Workbook.



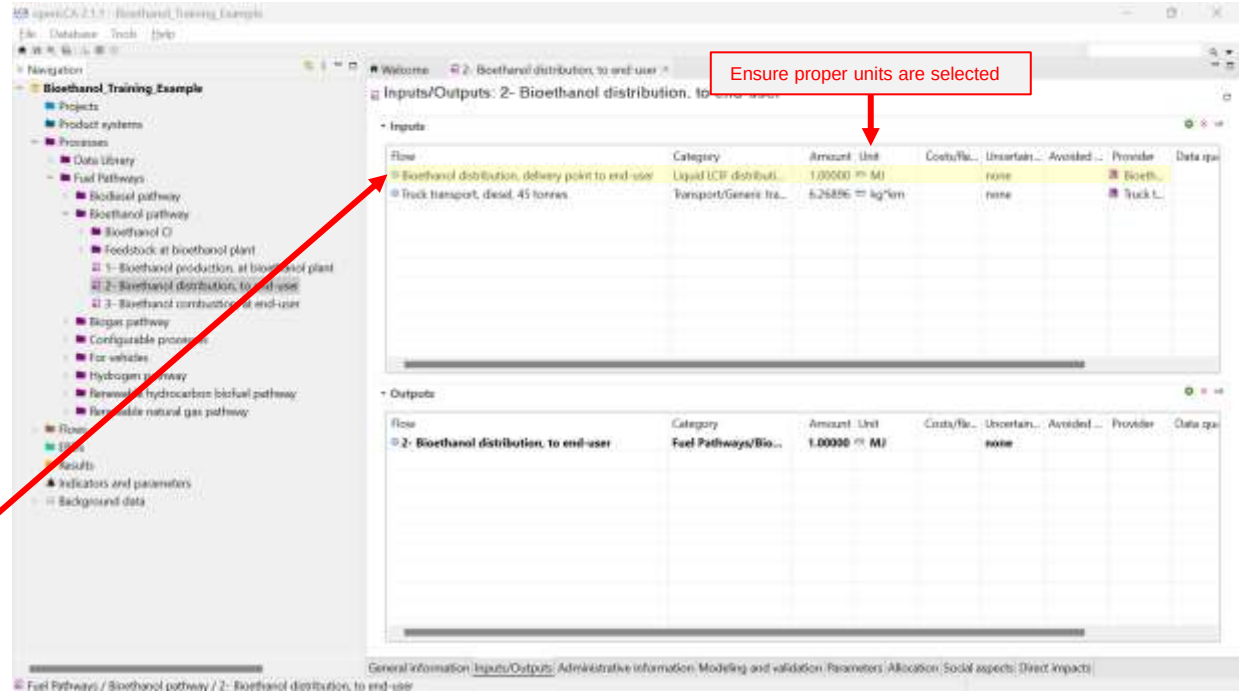


For more information, consult section 5 A2.1.3.6 of the Specifications

MODELLING LCIF DISTRIBUTION

In the “Inputs/Outputs” tab, for Leg 2

- Select the corresponding predefined transport scenario entitled "Bioethanol distribution, delivery point to end-user" from the folder *Processes/Data library/Transport/Predefined transport scenarios/LCIF distribution/Liquid LCIF distribution/Leg 2-Delivery point to end-user* and enter it as an input.
- Enter a value of 1 MJ for that input flow.
- Save and close the process.

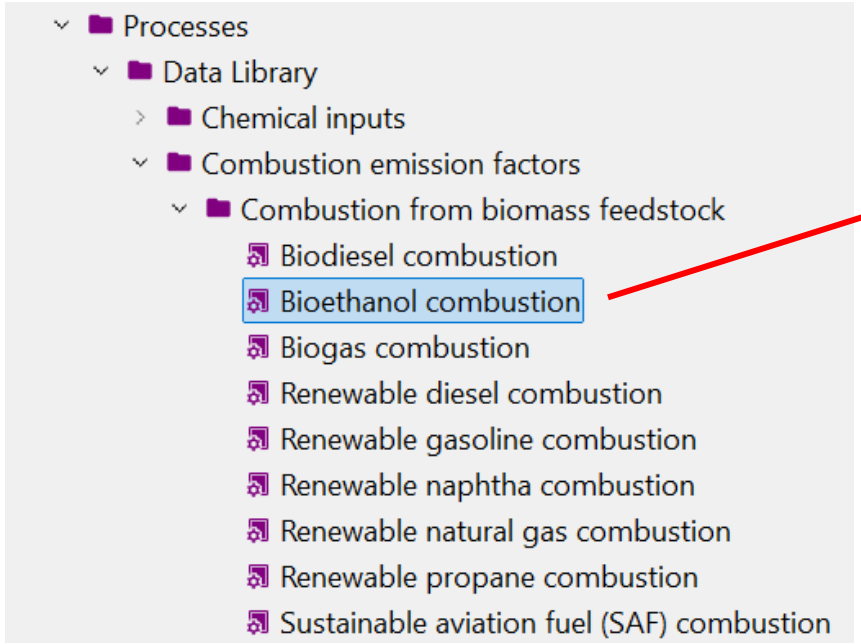


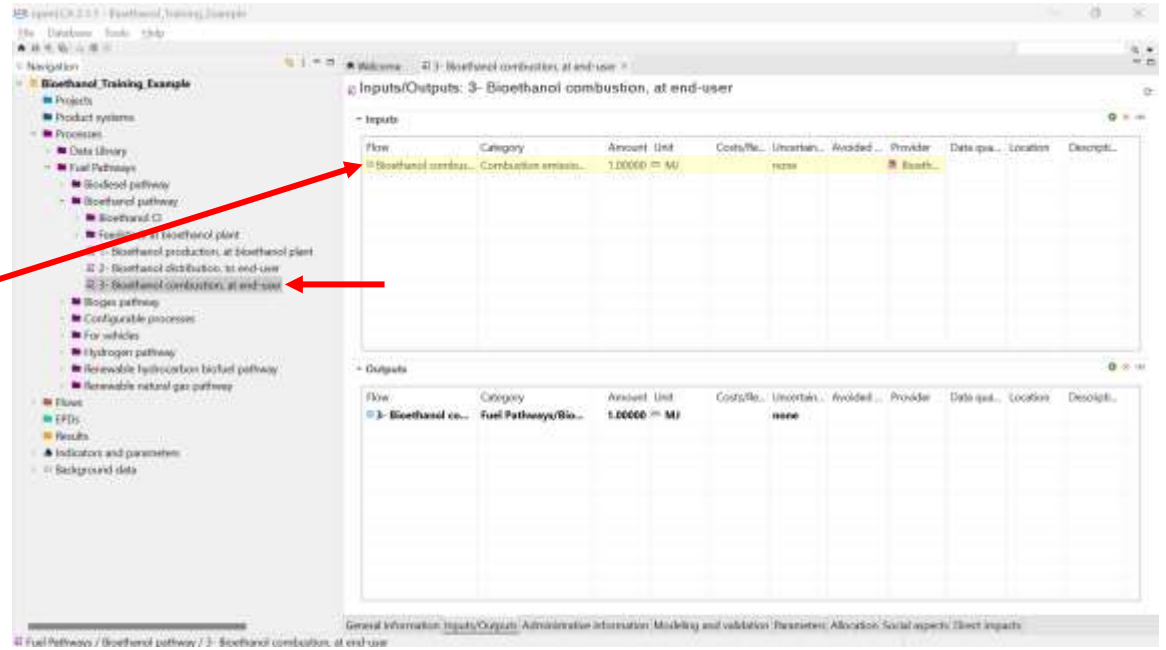
For more information, consult section 5 A2.1.3.6 of the Specifications

MODELLING LCIF COMBUSTION

Open and Complete the Bioethanol Combustion Process

- Open the folder *Processes/Fuel Pathways/Bioethanol Pathway* and open the process entitled "3- Bioethanol combustion, at end-user".
- In the “Inputs/Outputs” tab, enter as an input the process for bioethanol combustion from biomass feedstocks entitled "Bioethanol combustion", which can be found in the folder *Processes/Data Library/Combustion emission factors/Combustion from biomass feedstock*.
- Enter a value of 1 MJ for that input flow.
- Save and close the process.



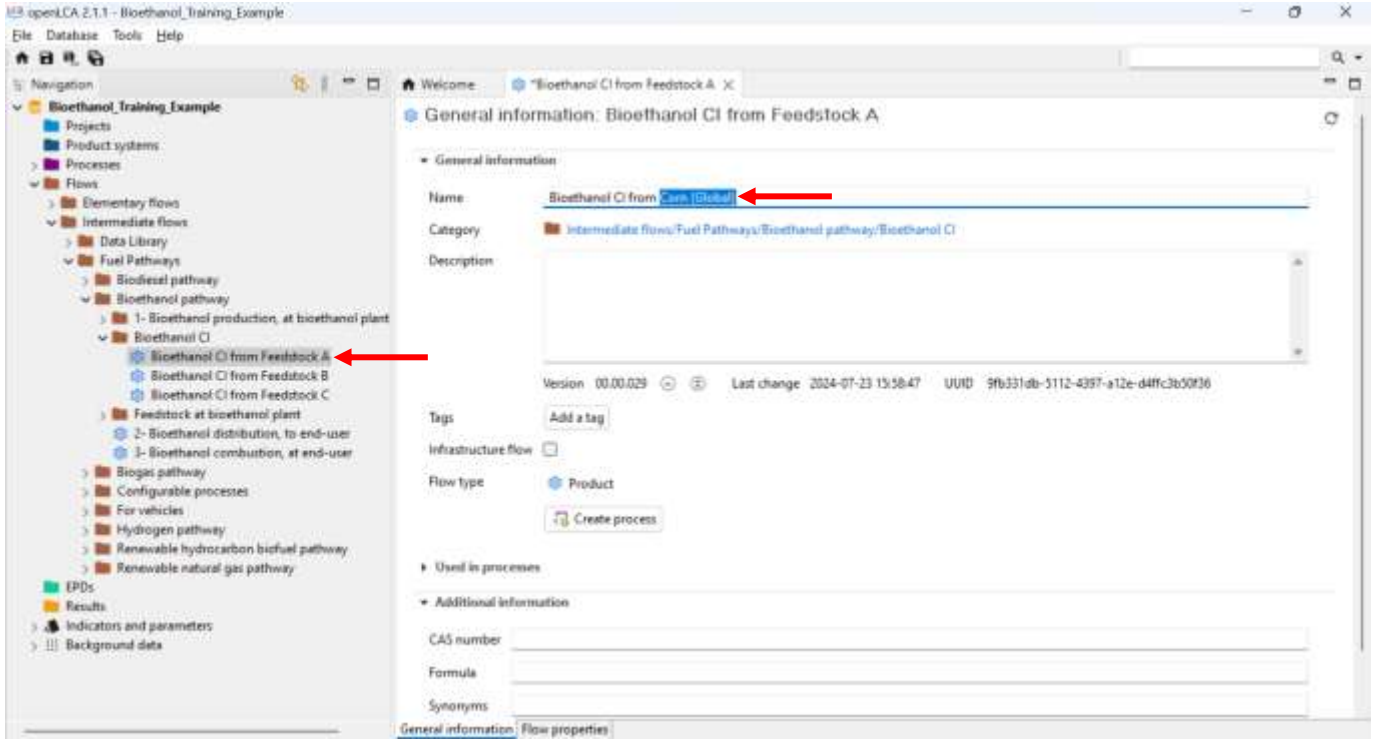


For more information, consult section 6 A2.1.3.7 of the Specifications

Determining Carbon Intensity Values

Open and Complete the Bioethanol CI Processes

- In the folder *Flows/Intermediate flows/Fuel Pathways/Bioethanol pathway/Bioethanol CI*, open the flow entitled “Bioethanol CI from Feedstock A”.
- Rename the flow “Bioethanol CI from Corn (Global)”.
- Repeat the above steps for wheat using the flow entitled “Bioethanol CI from Feedstock B”.

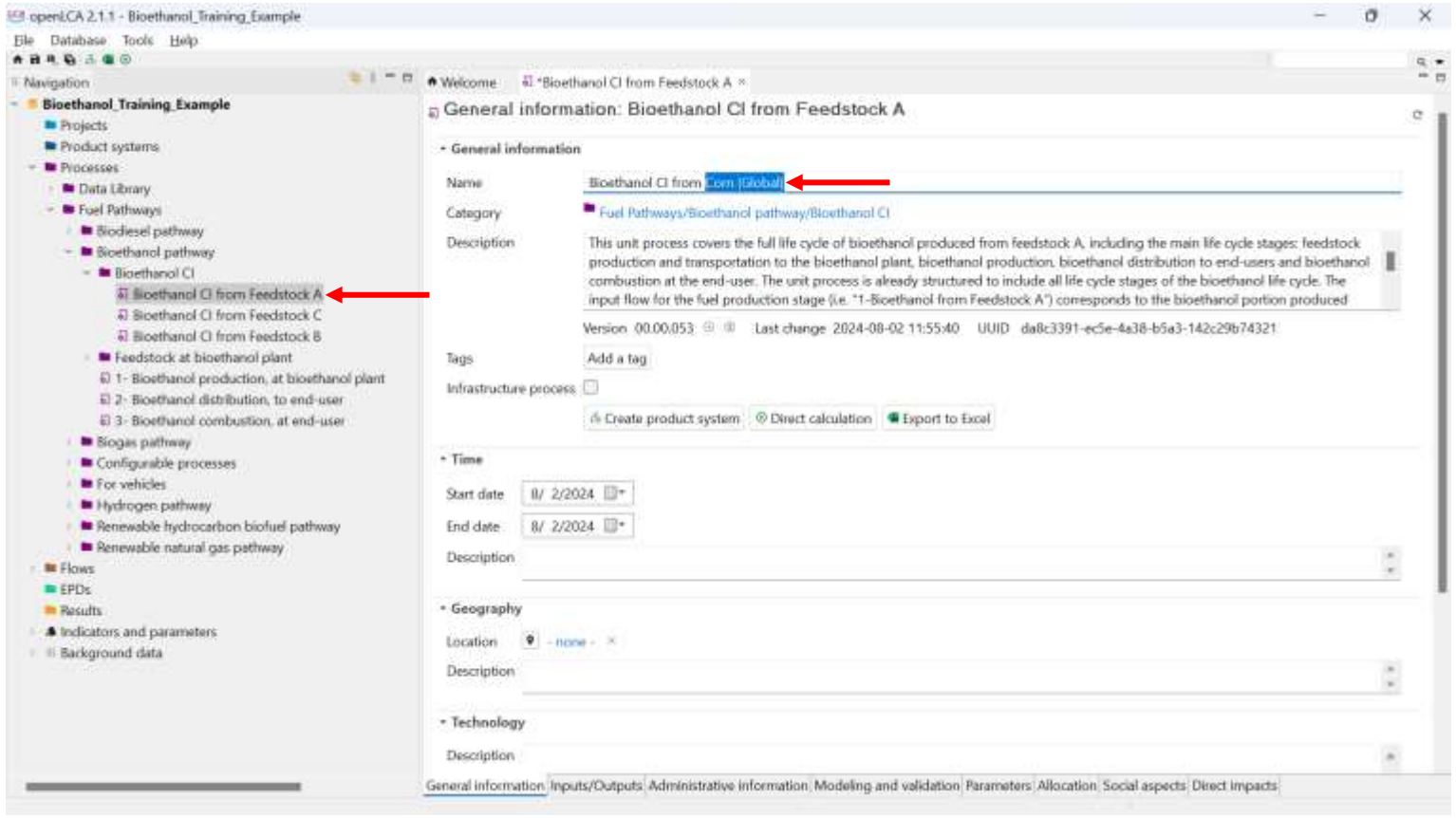


For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Open and Complete the Bioethanol CI Processes

- In the folder *Processes/Fuel Pathways/Bioethanol Pathway/Bioethanol CI,* open the process entitled “Bioethanol CI from Feedstock A”.
- Rename the process “Bioethanol CI from Corn (Global)”.
- Repeat the above steps for wheat using the process entitled “Bioethanol CI from Feedstock B”.



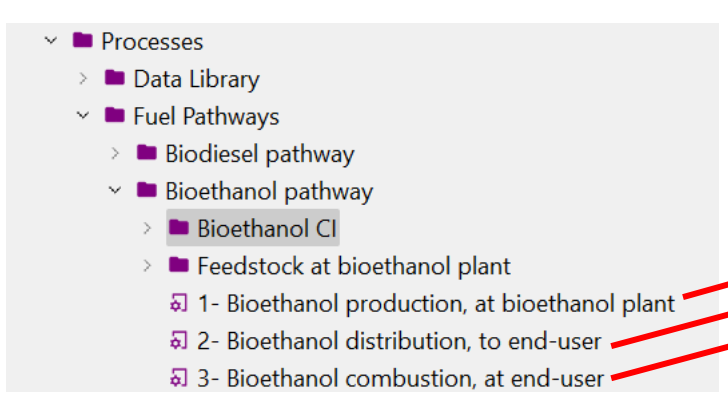
For more information, consult section 7 of the Specifications

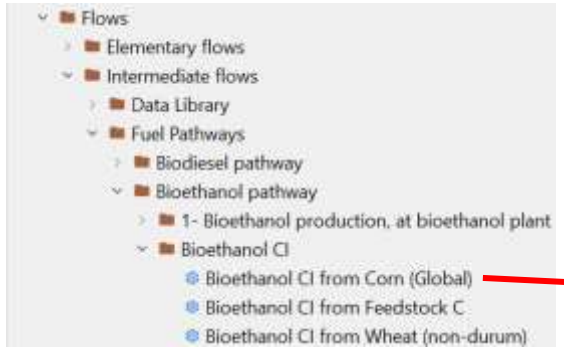
Determining Carbon Intensity Values

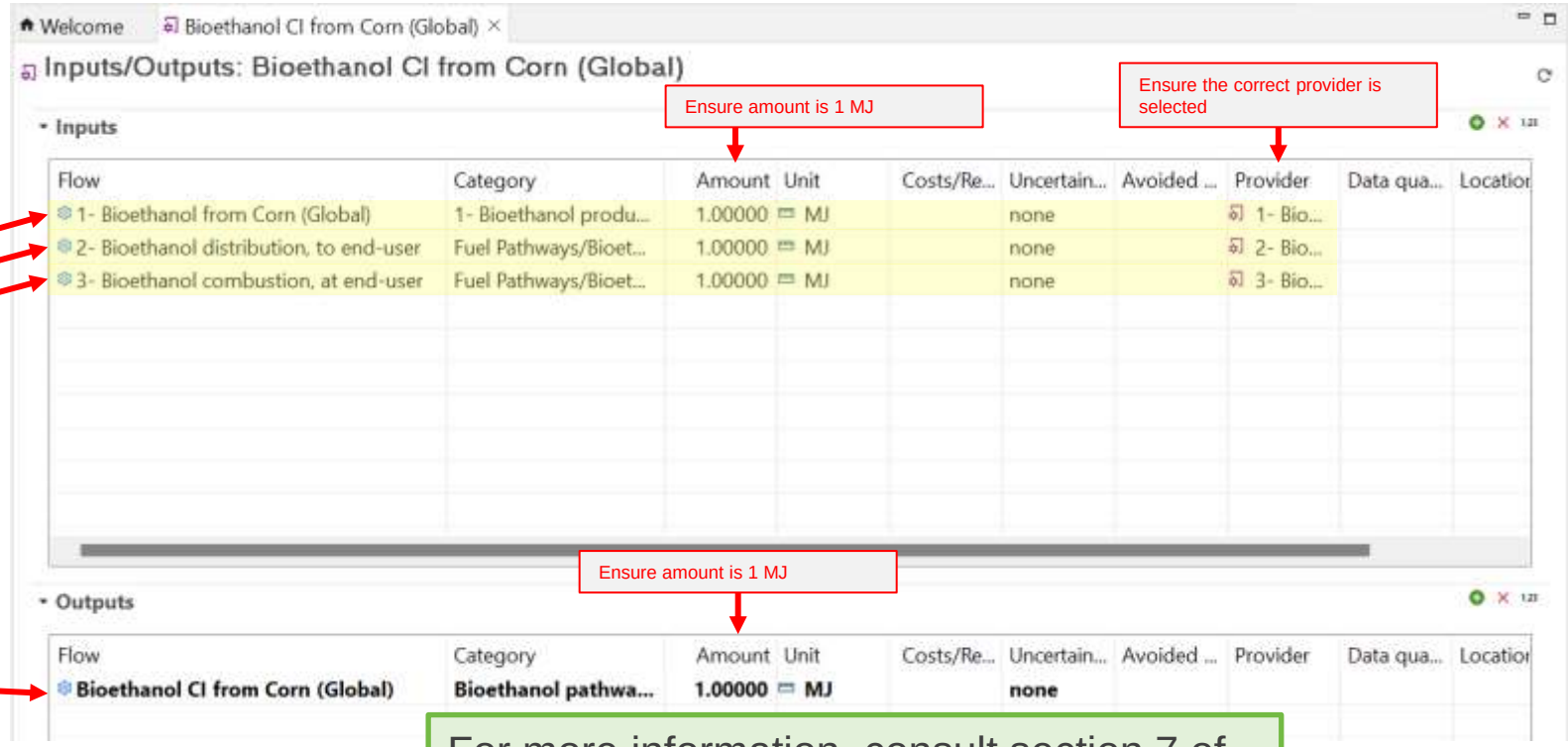
Open and Complete the Bioethanol CI Processes

- Verify that the following input and output flows are present in the “Inputs/Outputs” tab and that the “Providers” are correctly selected in the provider column.
- Save and close the process.
- Repeat the above steps for wheat.

Key Concepts! *Each process in the folder corresponds to a distinct feedstock*





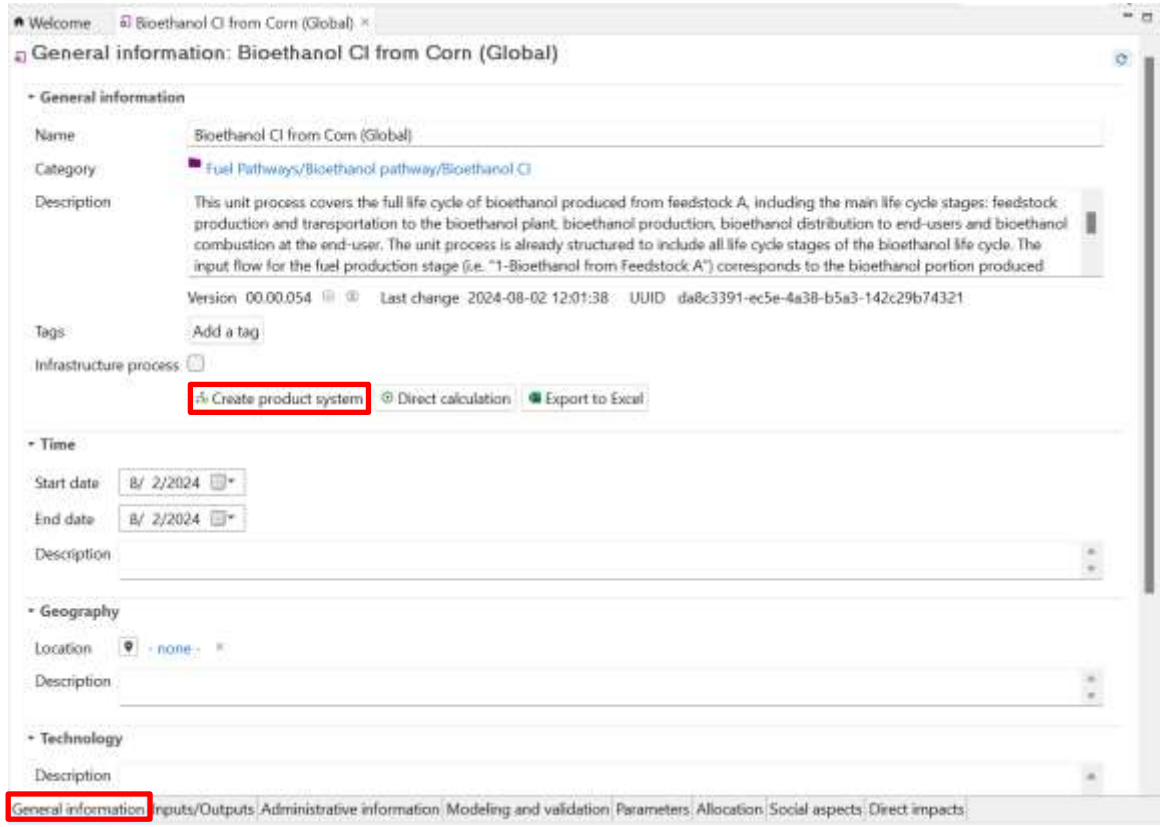


For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Create a Product System

- In the folder *Processes/Fuel Pathways/ Bioethanol Pathway/Bioethanol CI,* open the process entitled “Bioethanol CI from Corn (Global)”.
- In the “General Information” tab, click “Create product system”.

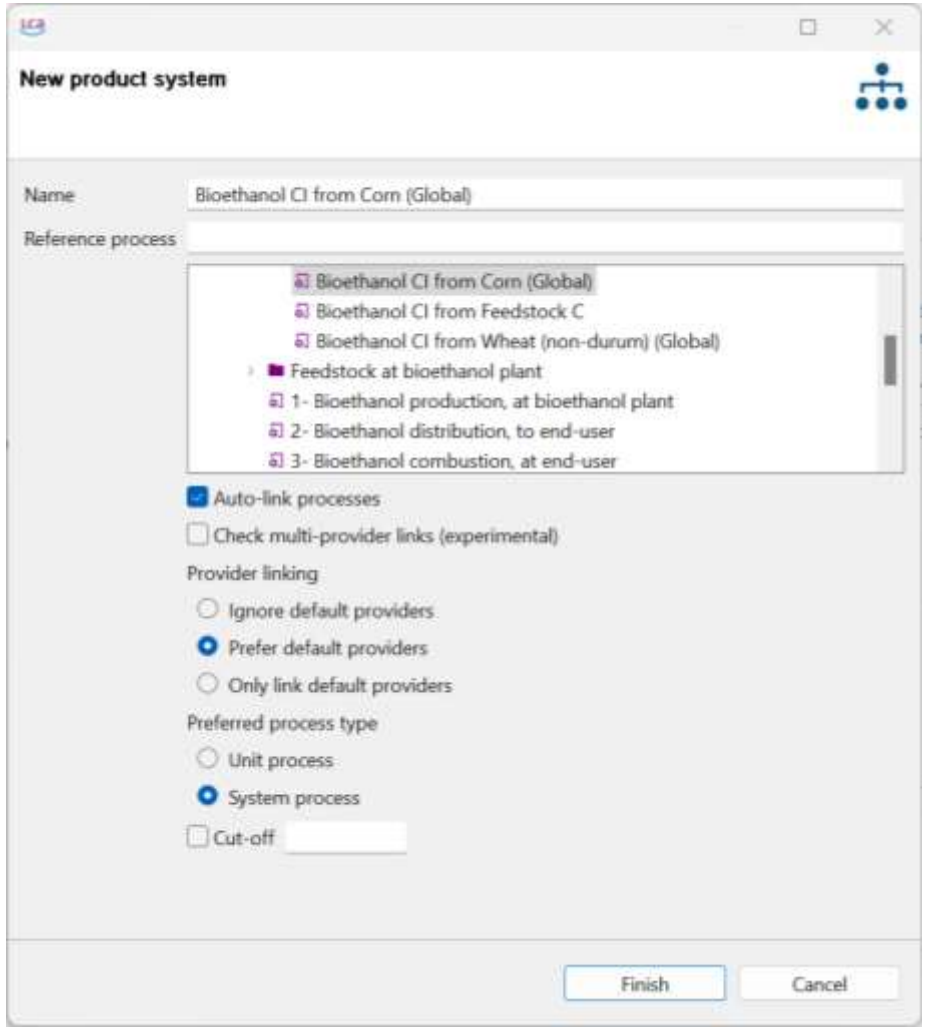


For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Create a Product System

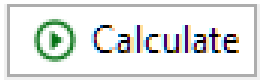
- A dialog box, as shown here, will show up.
- Ensure the following settings are selected and click Finish :
- Repeat the same steps for wheat.

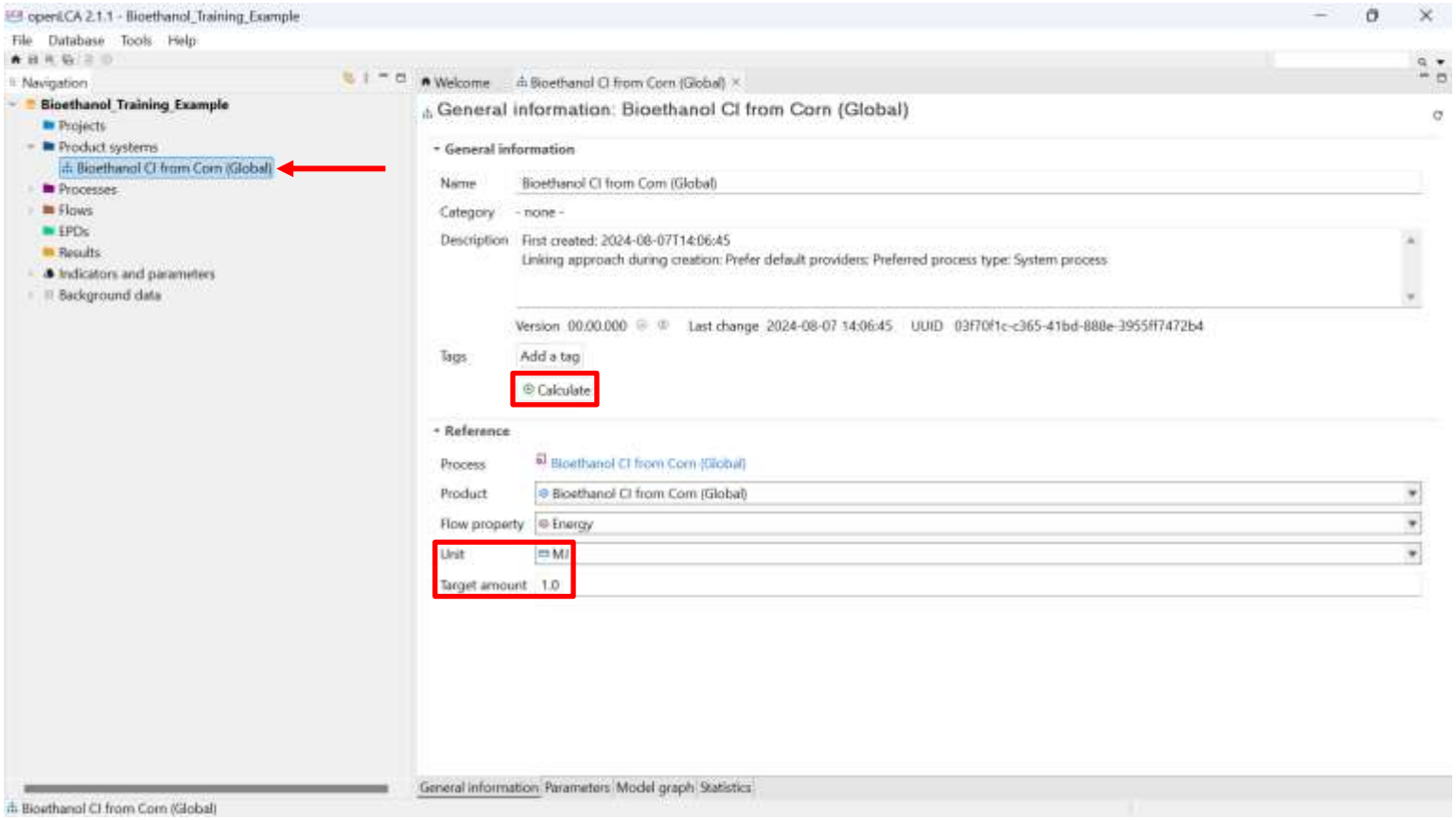


For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Calculate the CI Value

- Open the product system created and verify that the target amount and unit in the “Reference” section are set to "1.0" and "MJ", respectively.
- Click 

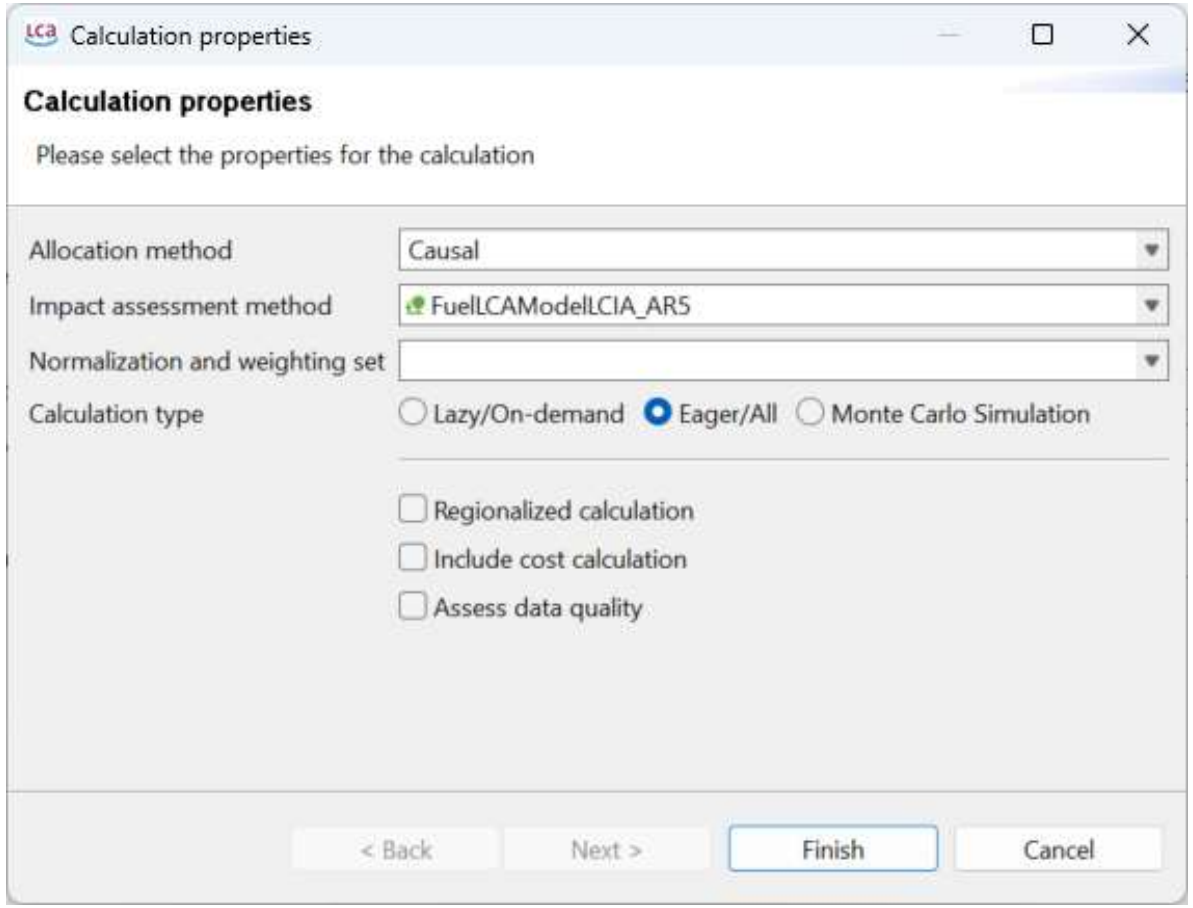


For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Calculate the CI Values

- A dialog box, as shown here, will appear.
- Ensure the following settings are selected:
  - Allocation method: "Causal“
  - Impact assessment method: "FuelLCAModelLCIA_AR5“
  - Normalization and weighting set: Empty
  - Calculation type: “Eager/All“
  - Regionalized calculation: not checked
  - Include cost calculation: not checked
  - Assess data quality: not checked
- Click Finish

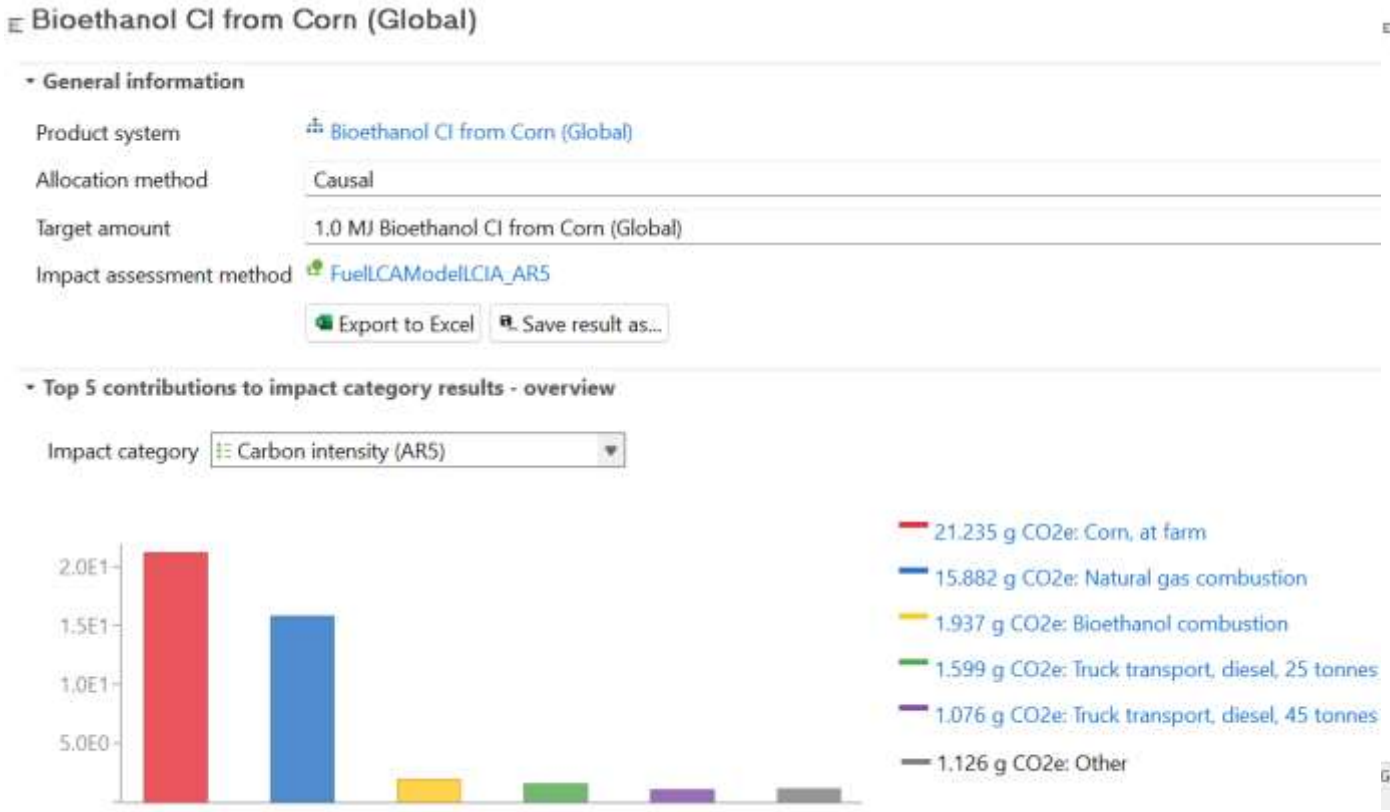


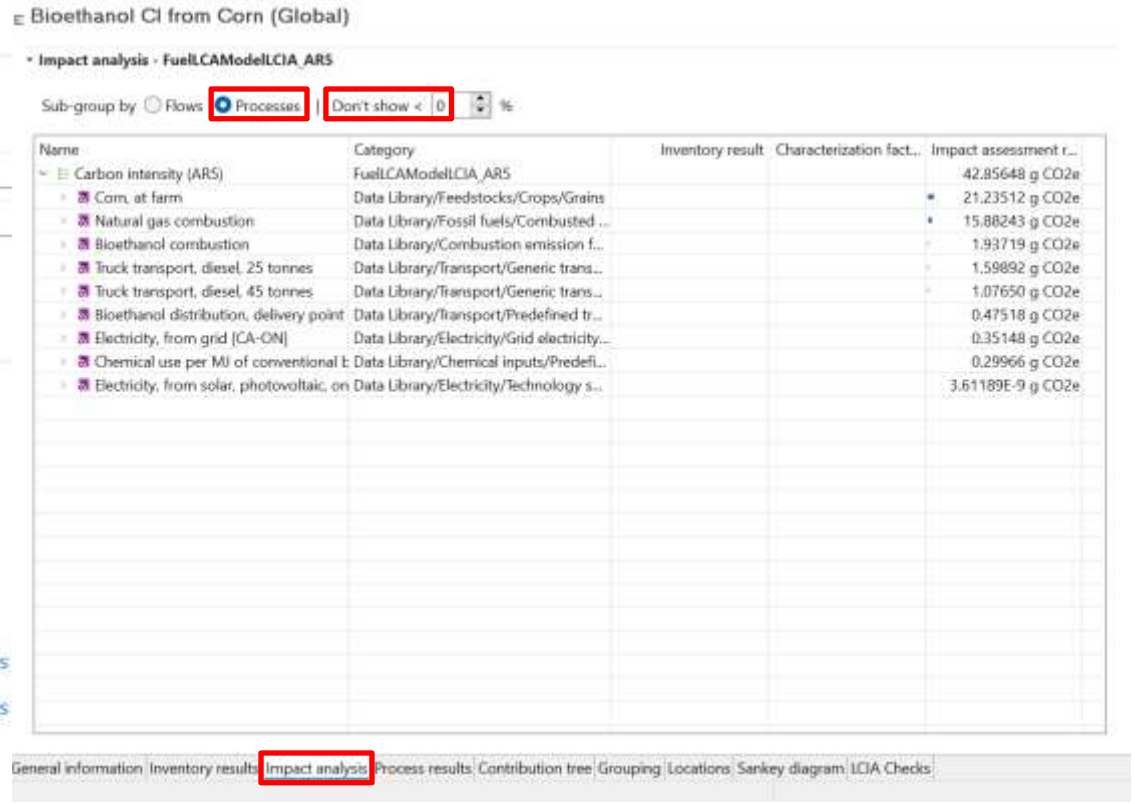
For more information, consult section 7 of the Specifications

Determining Carbon Intensity Values

Display analysis result of fuel CI

- The top contributions to the CI will appear in the bar graph in the "General information" tab.
- In the "Impact analysis" tab, check “Processes” and set “Don’t show <” to “0” to obtain a quantitative breakdown of the CI.



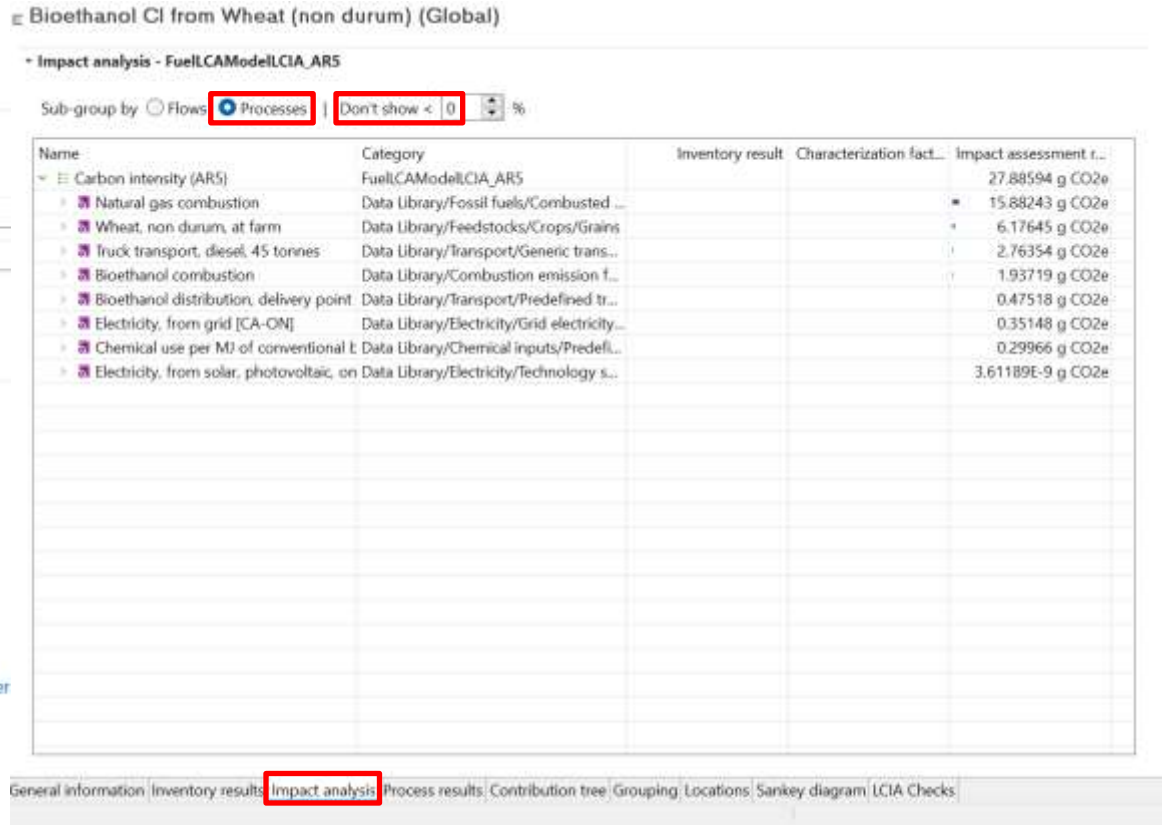


For more information, consult section 7 of the Specifications

DETERMINING CARBON INTENSITY VALUES

Display analysis result of fuel CI

- The top contributions to the CI will appear in the bar graph in the "General information" tab.
- The "Impact analysis" tab, check “Processes” and set “Don’t show <” to “0” to obtain a quantitative breakdown of the CI.

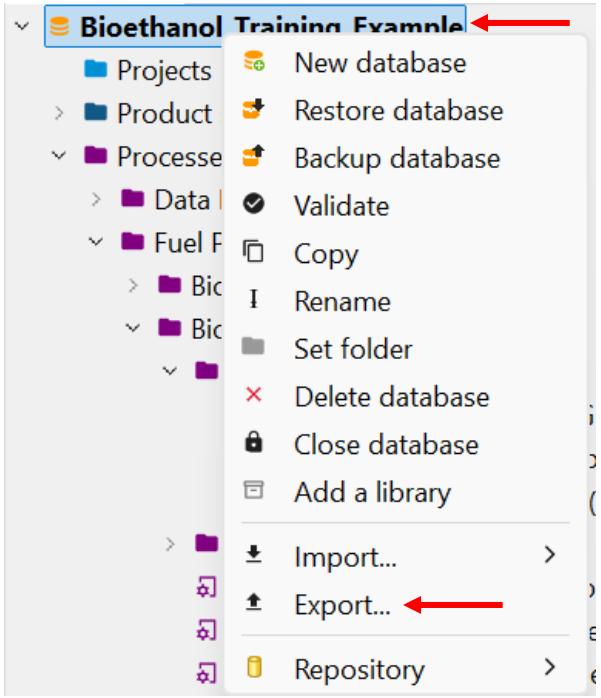


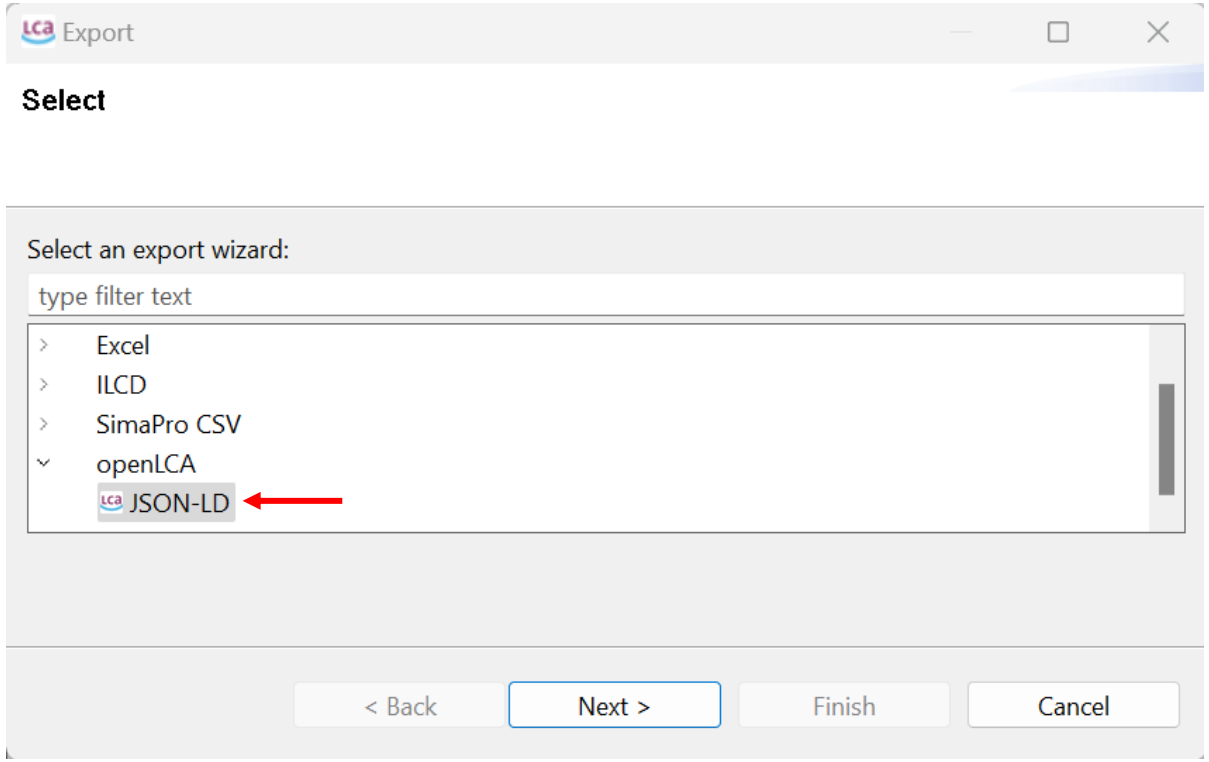
For more information, consult section 7 of the Specifications

Exporting Fuel Pathway

Export the Fuel Pathway

- Right-click the name of the database and then select “Export”.
- In the “Select” window, select the “JSON-LD” format (in the “openLCA” category) and click on “Next”.



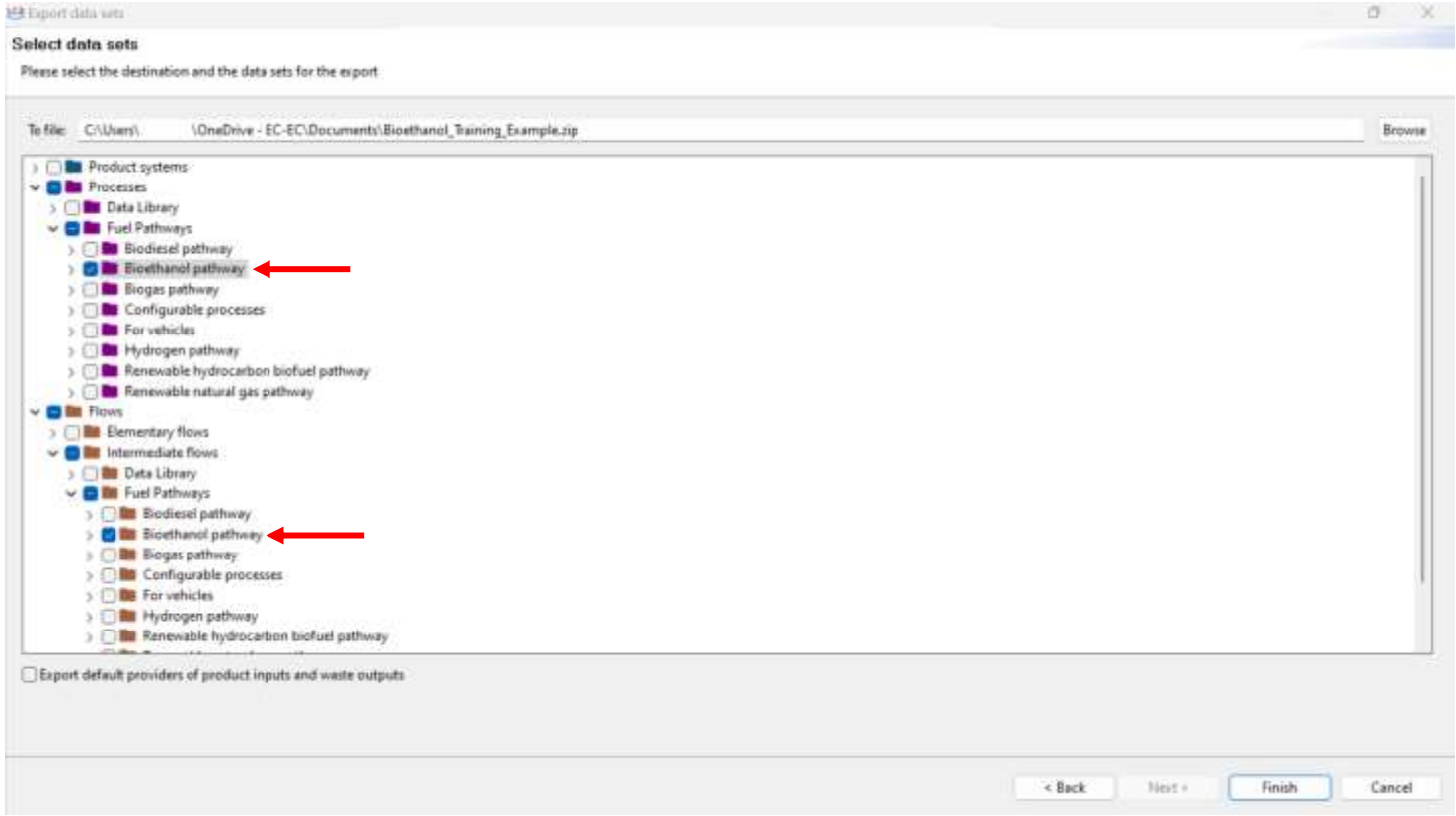


For more information, consult section 7 of the Specifications

EXPORTING FUEL PATHWAY

Export the Fuel Pathway

- In the “Select data sets” window:
  - Click on "Browse" and select a location and enter a file name. Click "Save".
  - In the section below the file name, select the fuel pathway folder that contains the modelling of the fuel. All relevant pathway processes (*Processes/Fuel Pathways/Bioethanol pathway*) and flows (*Flows/Intermediate flows/Fuel Pathways/Bioethanol pathway*) that have been created or modified during the modelling procedure must be included in this folder (and its sub-folders) as shown in the figure.
  - Click Finish .



For more information, consult section 7 of the Specifications