



Environment and
Climate Change Canada

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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](https://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:

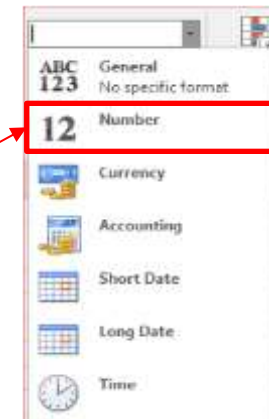
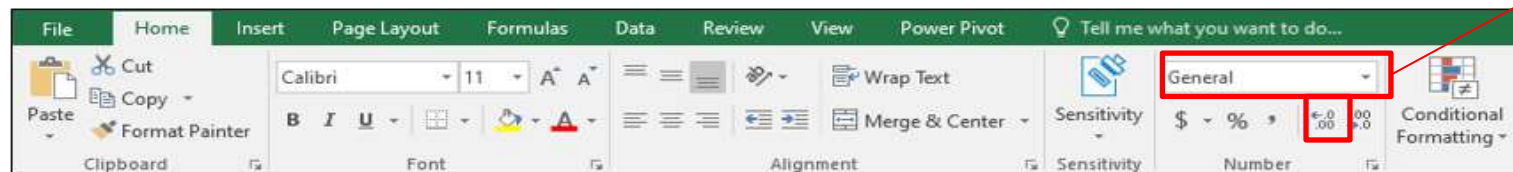


- Click on the cell with the original value, then copy the value displayed in the formula bar and paste it into openLCA.

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!

KEY CONCEPTS IN THIS EXAMPLE

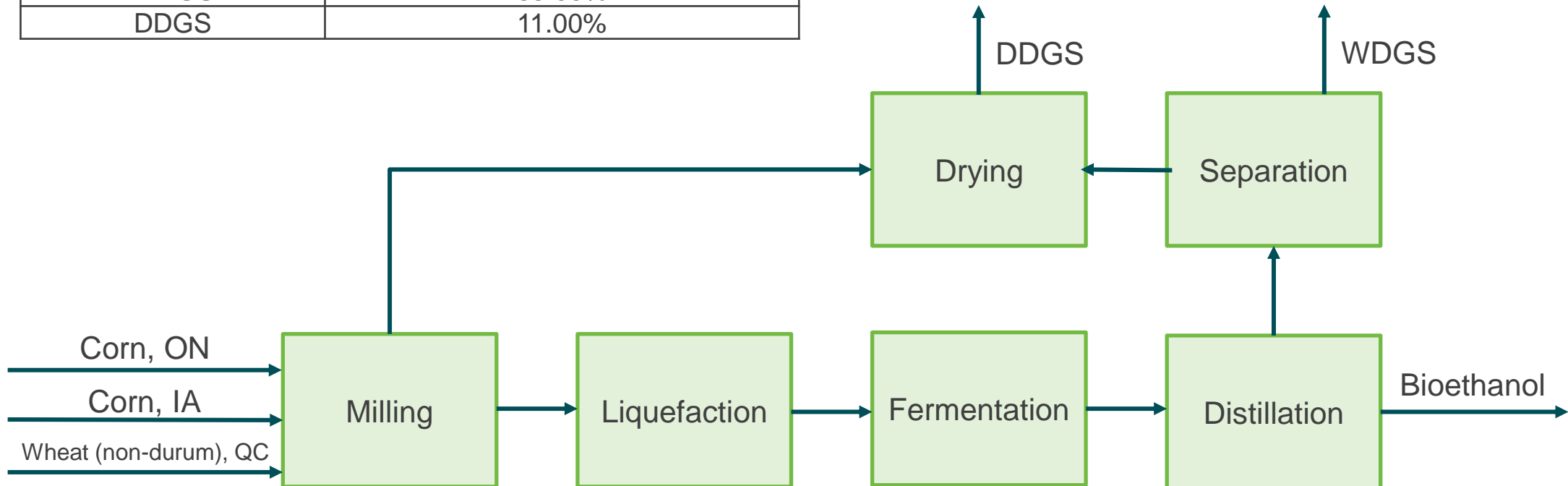
This example presents the following key concepts:

- ✓ **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
<div>General – LCIF Producer</div>	
<div>Feedstock (mass)</div>	<div>Corn (Global)</div> <div>Wheat (non-durum) (Global)</div> <div>  </div> <div> <p><i>Before filling in the worksheet, make a copy of it (one worksheet for each distinct feedstock)</i></p> </div>
<div>Fuel</div> <div>Fuel Portions</div>	<div>Bioethanol</div> <div>Bioethanol Portions</div>
<div>Co-Product</div> <div>Co-Product Portions</div>	<div>Animal Feeds (DDGS)</div> <div>Animal Feeds (DDGS) Portions</div> <div>Animal Feeds (WDGS)</div> <div>Animal Feeds (WDGS) Portions</div> <div>  </div> <div> <p><i>Before filling in the worksheet, make a copy of it (one worksheet for each co-product and co-product portions)</i></p> </div>



WORKSHEETS THAT MUST BE COMPLETED

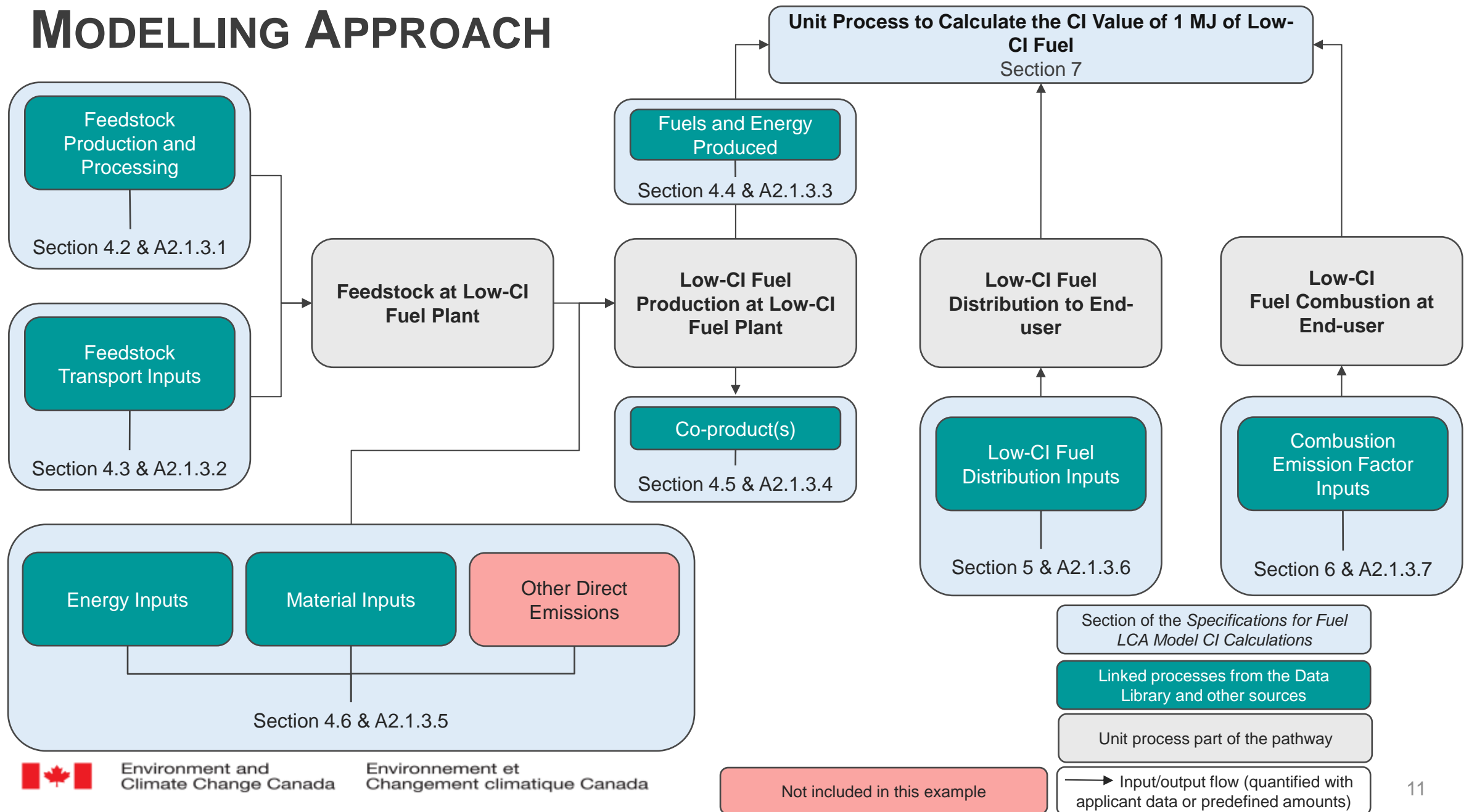
Relevant Worksheet Original Name	Rename Worksheet To
Fuel Input	Natural Gas
Electricity Input	<div>Grid electricity (ON,CA)</div> <div>On-site Electricity (Solar)</div>
Material Input	Pre-set Chemical Mix
Allocation	
LCIF distribution	Bioethanol distribution



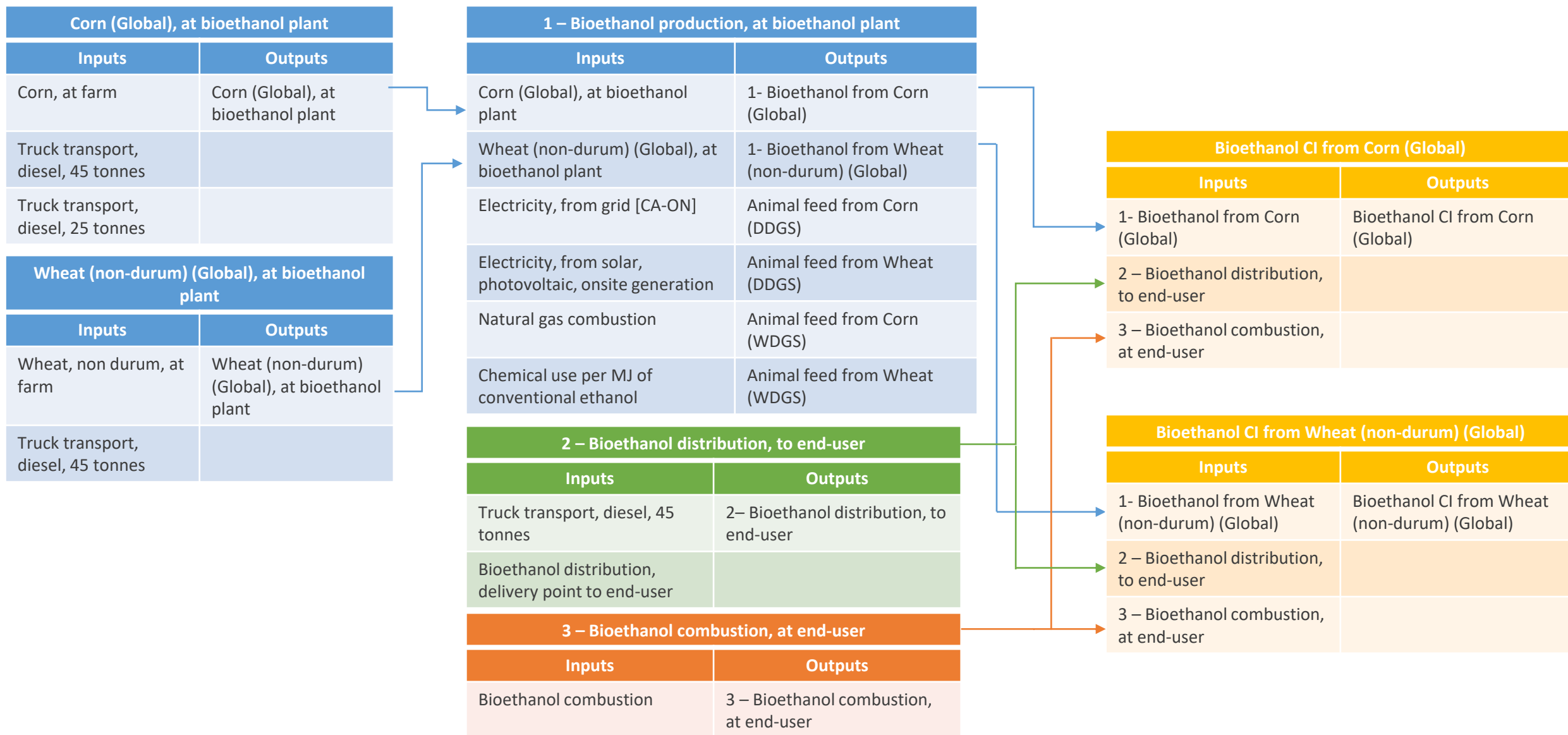
Before filling in the worksheet, make a copy of it (one worksheet for each distinct feedstock)



MODELLING APPROACH



PROCESSES AND FLOWS USED IN OPENLCA



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

4

Identification of fuel production facility

5

6

Name of the fuel production facility

Conventional Bioethanol Plant Example

7

Location of the fuel production facility (province, US state or other country)

Ontario, Canada

8

Civic address or GPS coordinates of the facility

123 Wellington Avenue, Toronto, ON, A1B 2C3

9

Additional notes (optional)

10

11

Description of fuel pathway

12

Enter description of production technology

Conventional bioethanol produced from corn and wheat (non durum)

13

Type of fuel pathway used

Existing fuel pathway

14

If "existing pathway" used, name of fuel pathway used

Bioethanol

15

16

17

18

List of fuel(s) produced at the facility

19

20

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.

21

Bioethanol

Yes

22

Select fuel type

Select answer

23

Select fuel type

Select answer

24

Select fuel type

Select answer

25

Add rows as needed

26

27

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Reporting period

45

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

46

47

48

Beginning

Month

Year

June

2022

49

End

May

2024

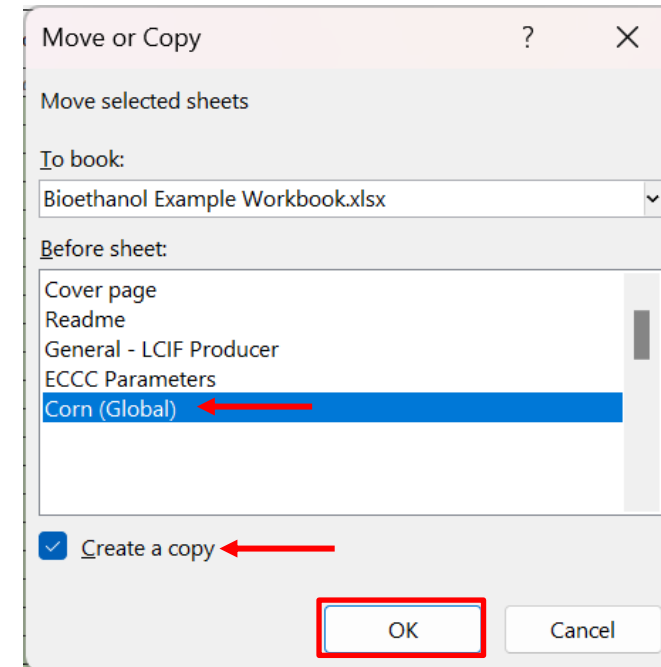
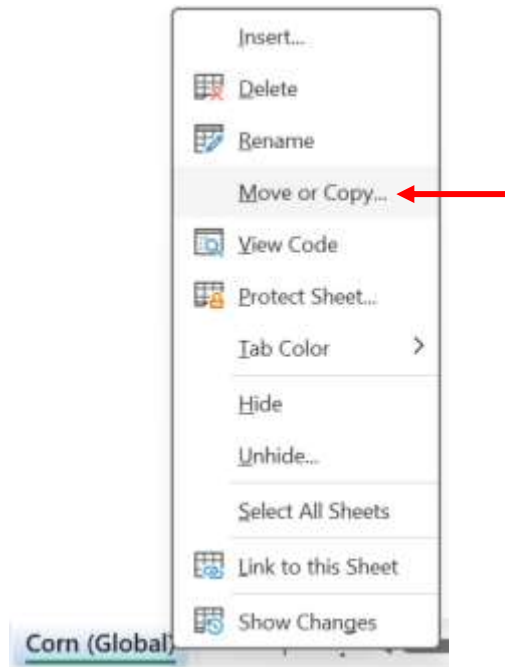
 **Always make sure the reporting period is within 30 months of the date of submission**

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)



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



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)



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-\$C\$32)) =249.440594719347000		=((SUMPRODUCT(B39:B42,D39:D42))/B43) *(1/(1-\$C\$32)) =287.116625986177000	

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

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

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)



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	Units (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).			
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	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



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

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
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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.

94	Conversion of feedstock quantities			
95	Mass-based unit (dry basis) or energy-based (transferred CI)	Mass unit		
96	Mandatory unit for feedstock quantities in the Fuel LCA Model:	t	(Dry basis)	
97	Conversion factor from wet-basis to dry-basis	0.86	kg (dry-basis)/kg (wet-basis)	<i>If the alternative is used</i>
98	Conversion factor from tonnes to Mass unit	=ECCC Parameters!D7	t/tonnes	<i>Use as feedstock</i>
99				
100	Information to copy in the Allocation matrix			
101	Feedstock name	Total feedstock quantity	Unit (dry-basis)	
102	Corn (Global)	496999.94899	t	<i>Copy to</i>
103	Allocation Sheet			
104				
105				
106				
107				
108				
109				



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

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.



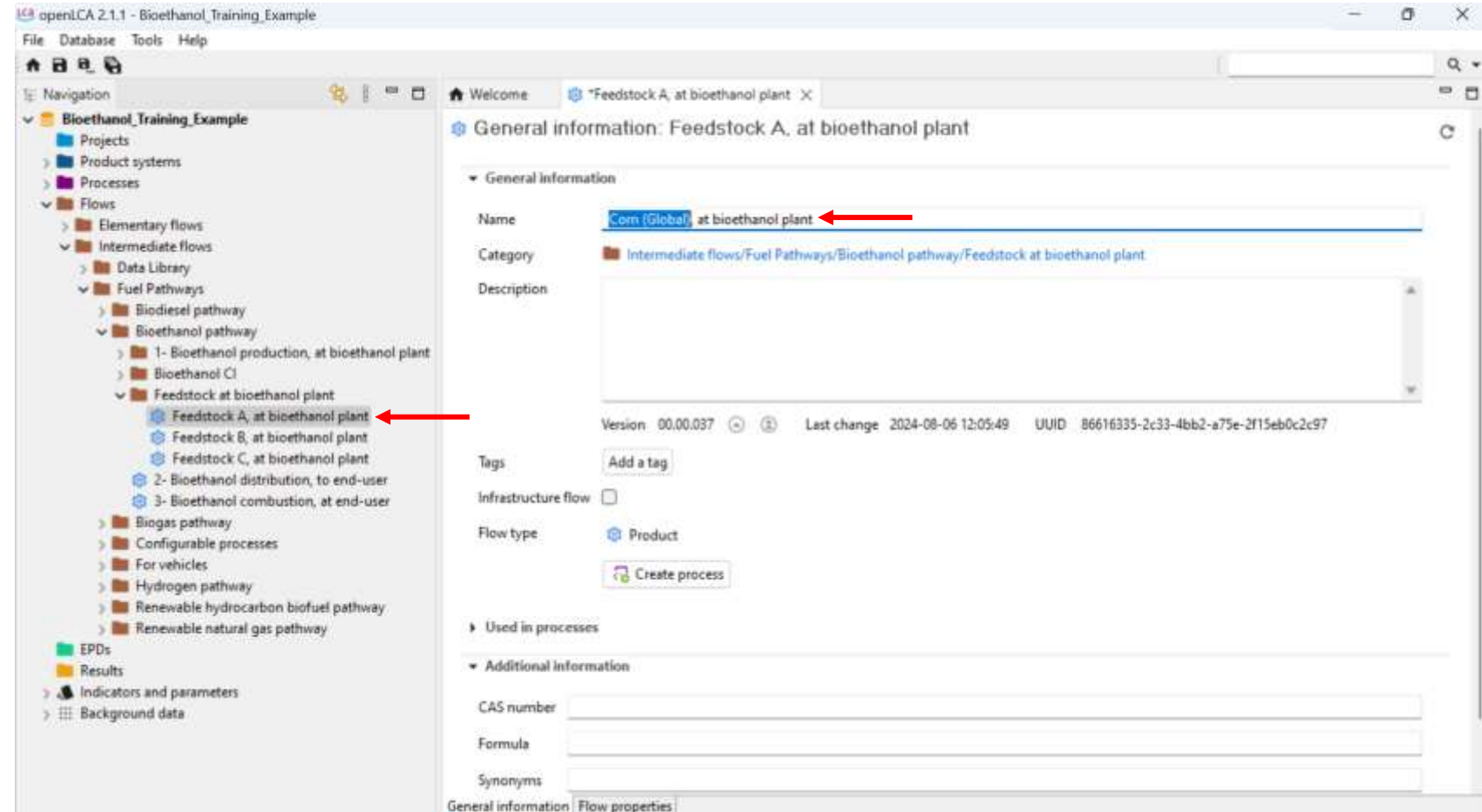
When copying values within the CFR Data Workbook make sure to insert a reference to the cell with the original value

[illegible]

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".



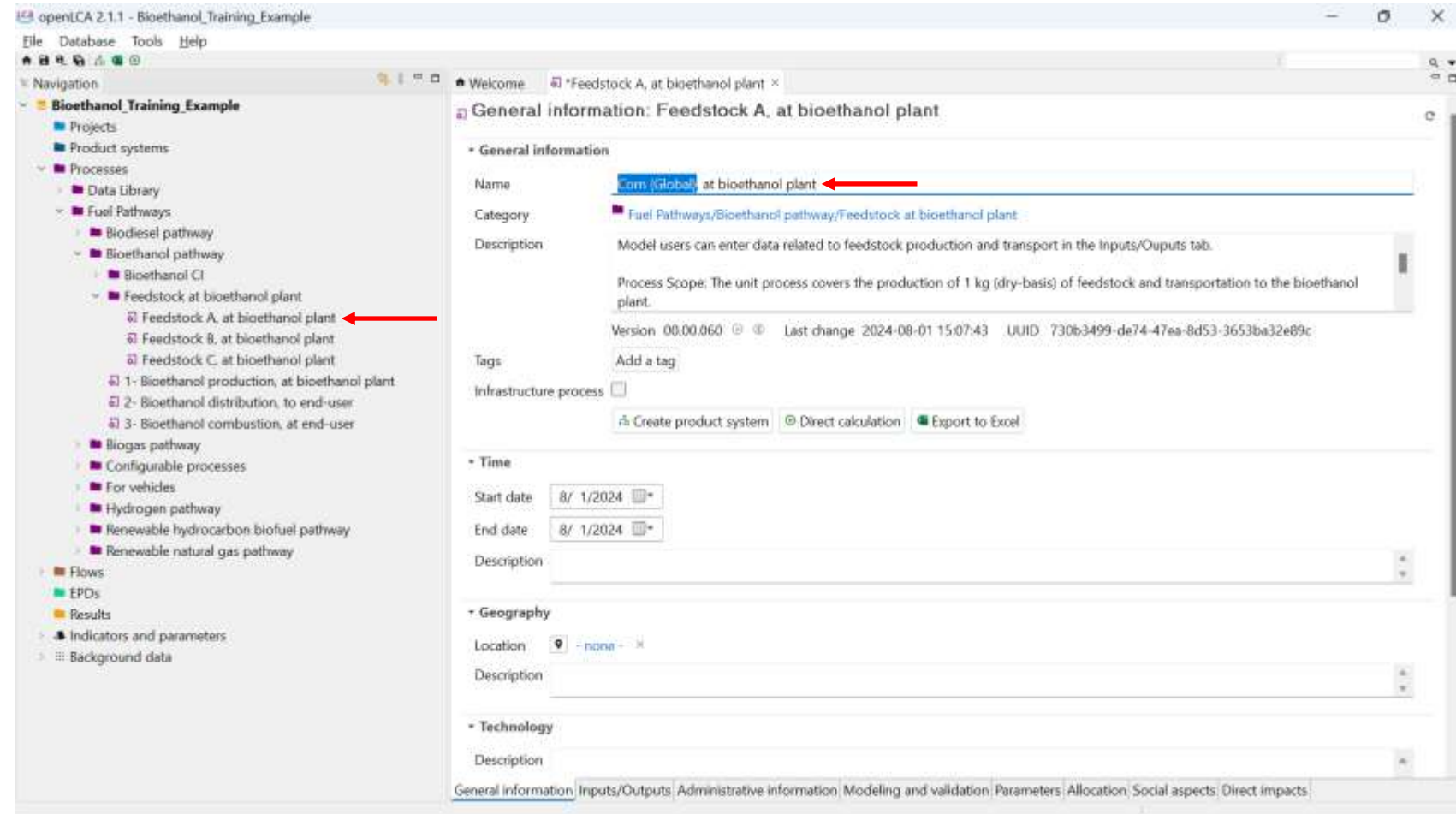
For more information, consult section 4.2, Annex A2.1.3.1 of the Specifications



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

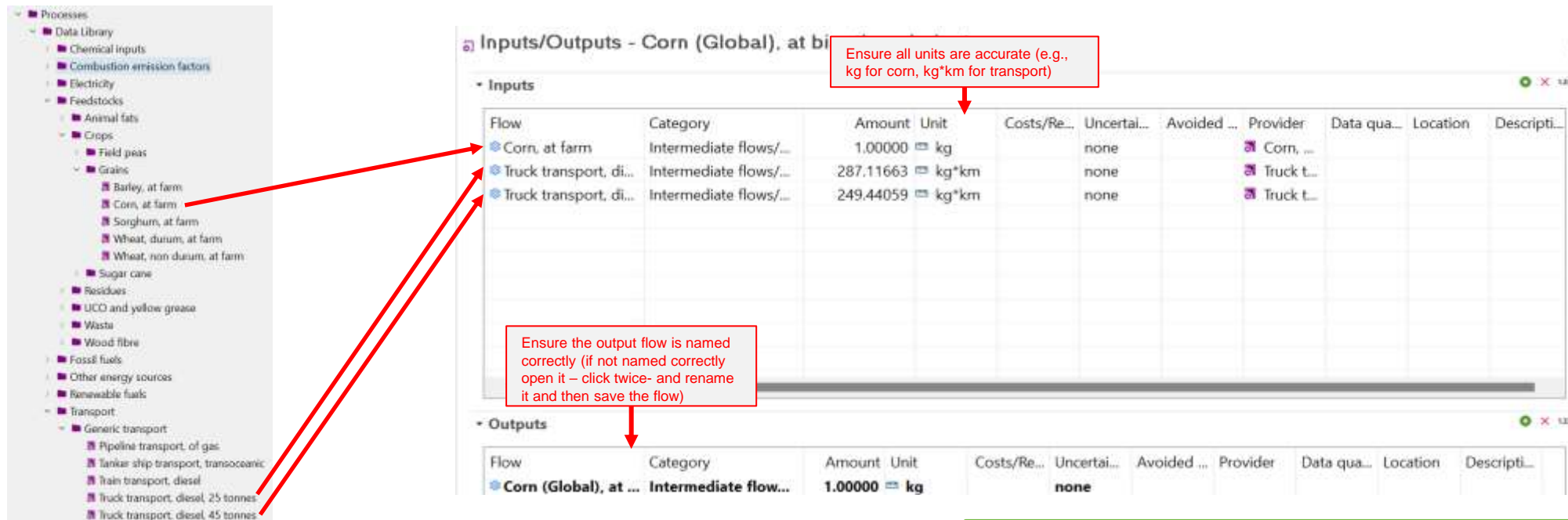


MODELLING THE FEEDSTOCK PRODUCTION PROCESS + TRANSPORTATION

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*



Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided ...	Provider	Data qua...	Location	Descripti...
Corn, at farm	Intermediate flows/...	1.00000	kg		none		Corn, ...			
Truck transport, di...	Intermediate flows/...	287.11663	kg*km		none		Truck t...			
Truck transport, di...	Intermediate flows/...	249.44059	kg*km		none		Truck t...			

Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided ...	Provider	Data qua...	Location	Descripti...
Corn (Global), at ...	Intermediate flow...	1.00000	kg		none					

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.

Ensure all units are accurate (e.g., t for corn and wheat)

Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided ...	Provider	Data qua...	Location	Descripti...
Corn (Global), at bioethanol plant	Bioethanol pathway...	4.97000E5	t							
Wheat (non-durum), at bioethanol plant	Bioethanol pathway...	9.09038E4	t							

Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided ...	Provider	Data qua...	Location	Descripti...
1- Bioethanol from...	1- Bioethanol pro...	1.00000	MJ		none					
1- Bioethanol from...	1- Bioethanol produ...	0.00000	MJ		none					
1- Bioethanol from...	1- Bioethanol produ...	0.00000	MJ		none					



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



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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

General information

Description of the fuel

Select fuel type	Bioethanol
Fuel name	Bioethanol
Additional notes (optional)	

If fuel type "New fuel" selected, fill out these additional cells

Name of the new fuel	
Alphanumeric identifier of the approved new pathway	

Fuel properties

HHV of fuel	=ECCC Parameters!B65
Density of fuel	=ECCC Parameters!F65
Methane content (%)	

Enter a value if the select

General - LCIF Producer | ECCC Parameters | Corn (Global) | Wheat (non-durum) (Global) | Bioethanol

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



FUEL AND FUEL PORTIONS

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).

Fuel quantities						
Select unit in which fuel quantities are entered. Unit must correspond to the unit in which fuel quantities are produced.						
Reporting Month (YYYY/MM)	Fuel, beginning inventory*	Fuel sales*	Fuel, end inventory*	Fuel recovered at the plant*	Fuel produced	Unit
*Applicant data must be entered in all columns. Do not leave any green cells blank (enter "0" where necessary).						
2022/06	0.00	8,854,195.00	0.00	0.00	8,854,195.00	g
2022/07	0.00	9,375,030.00	0.00	0.00	9,375,030.00	g
2022/08	0.00	10,104,190.00	0.00	0.00	10,104,190.00	g
2022/09	0.00	10,312,533.00	0.00	0.00	10,312,533.00	g
2022/10	0.00	9,062,529.00	0.00	0.00	9,062,529.00	g
2022/11	0.00	8,958,362.00	0.00	0.00	8,958,362.00	g
2022/12	0.00	9,687,531.00	0.00	0.00	9,687,531.00	g
2023/01	0.00	9,895,865.00	0.00	0.00	9,895,865.00	g
2023/02	0.00	9,476,197.00	0.00	0.00	9,476,197.00	g
2023/03	0.00	9,270,863.00	0.00	0.00	9,270,863.00	g
2023/04	0.00	10,208,566.00	0.00	0.00	10,208,566.00	g
2023/05	0.00	9,583,864.00	0.00	0.00	9,583,864.00	g
2023/06	0.00	11,879,205.00	0.00	0.00	11,879,205.00	g
2023/07	0.00	11,458,370.00	0.00	0.00	11,458,370.00	g
2023/08	0.00	10,729,203.00	0.00	0.00	10,729,203.00	g
2023/09	0.00	10,520,867.00	0.00	0.00	10,520,867.00	g
2023/10	0.00	11,230,873.00	0.00	0.00	11,230,873.00	g
2023/11	0.00	11,895,038.00	0.00	0.00	11,895,038.00	g
2023/12	0.00	11,345,889.00	0.00	0.00	11,345,889.00	g
2024/01	0.00	10,937,535.00	0.00	0.00	10,937,535.00	g
2024/02	0.00	11,354,203.00	0.00	0.00	11,354,203.00	g
2024/03	0.00	11,362,537.00	0.00	0.00	11,362,537.00	g
2024/04	0.00	10,625,034.00	0.00	0.00	10,625,034.00	g
2024/05	0.00	11,250,034.00	0.00	0.00	11,250,034.00	g
Total fuel quantities					299,090,800	g

Conversion of fuel quantities		
Mandatory unit for fuel amount in the Fuel LCA Model: MJ	MJ	
Conversion factor from L to MJ	=ECCC Parameters/G2	(Use only values from "ECCC Parameters" worksheet for existing fuel types or approved values for new fuel from a new pathway submission. This parameter is not calculated from general parameters.)

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



FUEL AND FUEL PORTIONS

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.

301 Information to copy in the Allocation matrix

302

303

304

Feedstock name	Total feedstock quantity	Unit (dry-basis)
Corn (Global)	406099.94899	t

301 Information to copy in the Allocation matrix

302

303

304

Feedstock name	Total feedstock quantity	Unit (dry-basis)
Wheat (non-durum) (Global)	90903.70666	t

60 Information to copy in the Allocation Matrix

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Fuel name	Bioethanol
Total fuel quantity	5855018736
Unit	l

If only one distinct feedstock is used for the production of this fuel, copy these orange cells in the Allocation matrix (see Allocation worksheet). Otherwise, fill the "Fuel Portions" worksheet and do not copy these cells in the Allocation matrix.

7 Calculating portions of fuels

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Fuel name	Bioethanol	Provide fuel name (same name as in corresponding "Fuel" worksheet).
Additional notes (optional)		

Provide quantities only for feedstocks related to the fuel of interest. Ensure that the units are the same between each column.

Replace feedstock A,B,C with feedstock name that appears in the corresponding Feedstock worksheet. Copy in the green cells the "Total feedstock quantity" (orange cell) of the corresponding Feedstock (mass or energy) worksheet.

Copy in the green cells the unit of "Total feedstock quantity" (orange cell) of the corresponding Feedstock (mass or energy) worksheet. If mass-based, the unit should be on dry basis.

Feedstock	Feedstock C	Total feedstock quantity
=TRANSPOSE('Corn (Global)'!B104:D104)	=TRANSPOSE('Wheat (non-durum) (Global)'!B104:D104)	0
=TRANSPOSE('Corn (Global)'!B104:D104)	=TRANSPOSE('Wheat (non-durum) (Global)'!B104:D104)	t
=TRANSPOSE('Corn (Global)'!B104:D104)	=TRANSPOSE('Wheat (non-durum) (Global)'!B104:D104)	

Copy here the total amount of fuel produced from the corresponding "Fuel" worksheet:

Total quantity of fuel produced =Bioethanol!G6 MI

Calculated facility's average fuel yield:

Average yield at LCIF production facility MI/t

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



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
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- 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.



Tips and Tricks

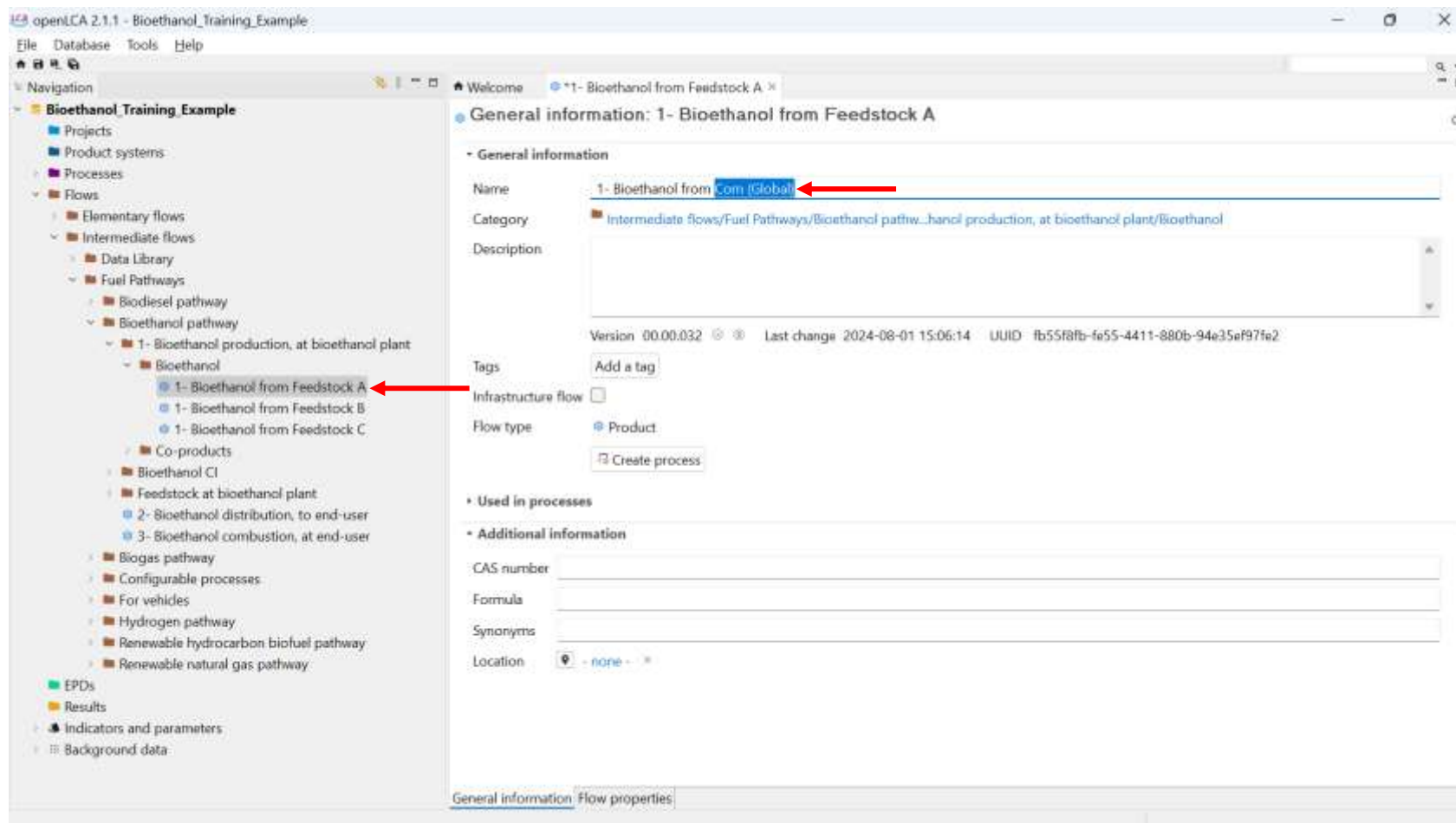
[illegible]

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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.

openLCA 2.1.1 - Bioethanol_Training_Example

File Database Tools Help

Navigation

- Bioethanol_Training_Example
 - Projects
 - Product systems
 - Processes
 - Data Library
 - Fuel Pathways
 - Biodiesel pathway
 - Bioethanol pathway
 - Bioethanol CI
 - 1- Bioethanol production, at bioethanol plant
 - 2- Bioethanol distribution, to end-user
 - 3- Bioethanol combustion, at end-user
 - Biogas pathway
 - Configurable processes
 - For vehicles
 - Hydrogen pathway
 - Renewable hydrocarbon biofuel pathway
 - Renewable natural gas pathway
- Flows
- EPDs
- Results
- Indicators and parameters
- Background data

Inputs/Outputs: 1- Bioethanol production, at bioethanol plant

Inputs

Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided...	Provider	Dat...
Corn (Global), at bioethanol plant	Bioethanol pathwa...	4.97000E5	t		none		Corn (...)	
Wheat (non-durum) (Global), at bioethanol plant	Bioethanol pathwa...	9.09038E4	t		none		Whea...	

Outputs

Flow	Category	Amount	Unit	Costs/Re...	Uncertai...	Avoided...	Provider	Dat...
1- Bioethanol from Corn (Global)	1- Bioethanol pro...	4.94969E9	MJ		none			
1- Bioethanol from Feedstock C	1- Bioethanol prod...	1.00000	MJ		none			
1- Bioethanol from Wheat (non-durum) (Global)	1- Bioethanol prod...	9.05324E8	MJ		none			

General information Inputs/Outputs Administrative information Modeling and validation Parameters Allocation Social aspects Direct impacts

Ensure all units are in MJ

Ensure the output flow is named correctly (if not named correctly open it – click twice- and rename and then save the flow)

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

This screenshot shows the 'General Information' worksheet. Red arrows point to the 'Animal feeds' cell in the 'Select co-product type' row, the 'Animal feeds' cell in the 'Co-product name' row, and the 'WDGS' cell in the 'Additional notes (optional)' row. A context menu is open over the 'WDGS' cell, with the 'Rename' option highlighted. The 'Co-product properties' section shows 'HHV of co-product' as '=ECCC Parameters!C82' and 'Density of co-product (kg/m3)' as 'N/A'.

This screenshot shows the 'General Information' worksheet. Red arrows point to the 'Animal feeds' cell in the 'Select co-product type' row, the 'Animal feeds' cell in the 'Co-product name' row, and the 'DDGS' cell in the 'Additional notes (optional)' row. A context menu is open over the 'DDGS' cell, with the 'Rename' option highlighted. The 'Co-product properties' section shows 'HHV of co-product' as '=ECCC Parameters!C82' and 'Density of co-product (kg/m3)' as 'N/A'.

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
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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	Units 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 calculated 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-\$C529	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	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

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.

Calculating portions of co-products

Co-product name	Animal feeds (WDGS)	Provide co-product (same name as in "Co-product" worksheet)
Additional notes (optional)		

Provide quantities only for feedstocks related to the coproduct of interest. Ensure that the units are the same between each column.

Replace feedstock A, B, C with feedstock name that appears in the corresponding feedstock worksheet.	Feedstock	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))	Feedstock C	Add columns as required for additional distinct feedstock inputs.	Total feedstock quantity
Copy here the "Total feedstock quantity" (orange cell) of the corresponding feedstock (mass or energy) worksheet.	Quantity	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))			0
Copy here the unit of "Total feedstock quantity" (orange cell) of the corresponding feedstock (mass or energy) worksheet. If mass-based, the unit should be on dry basis.	Unit	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))		Leave this cell blank; do not use, add columns to the left of this cell.	1

Copy here the total amount of co-product produced from the "Co-product" worksheet:

Total quantity of co-product produced	=Animal feeds (WDGS) (C108)	MJ
---------------------------------------	-----------------------------	----

Calculated facility's average co-product yield:

Average co-product yield at LCP plant	MJ/t
---------------------------------------	------

Calculating portions of co-products

Co-product name	Animal feeds (DDGS)	Provide co-product (same name as in "Co-product" worksheet)
Additional notes (optional)		

Provide quantities only for feedstocks related to the coproduct of interest. Ensure that the units are the same between each column.

Replace feedstock A, B, C with feedstock name that appears in the corresponding feedstock worksheet.	Feedstock	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))	Feedstock C	Add columns as required for additional distinct feedstock inputs.	Total feedstock quantity
Copy here the "Total feedstock quantity" (orange cell) of the corresponding feedstock (mass or energy) worksheet.	Quantity	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))			0
Copy here the unit of "Total feedstock quantity" (orange cell) of the corresponding feedstock (mass or energy) worksheet. If mass-based, the unit should be on dry basis.	Unit	=TRANSPOSE(Corn (Global) (B104:D104))	=TRANSPOSE(Wheat (non-durum) (Global) (B104:D104))		Leave this cell blank; do not use, add columns to the left of this cell.	1

Copy here the total amount of co-product produced from the "Co-product" worksheet:

Total quantity of co-product produced	=Animal feeds (DDGS) (C108)	MJ
---------------------------------------	-----------------------------	----

Calculated facility's average co-product yield:

Average co-product yield at LCP plant	MJ/t
---------------------------------------	------

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



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

- 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.

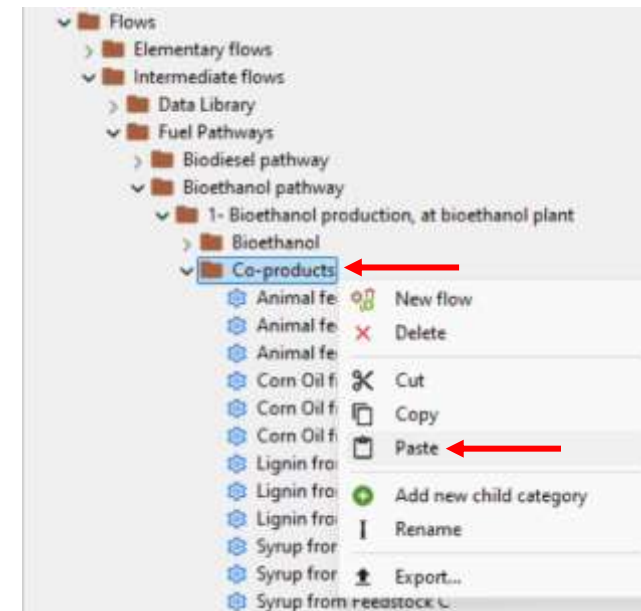
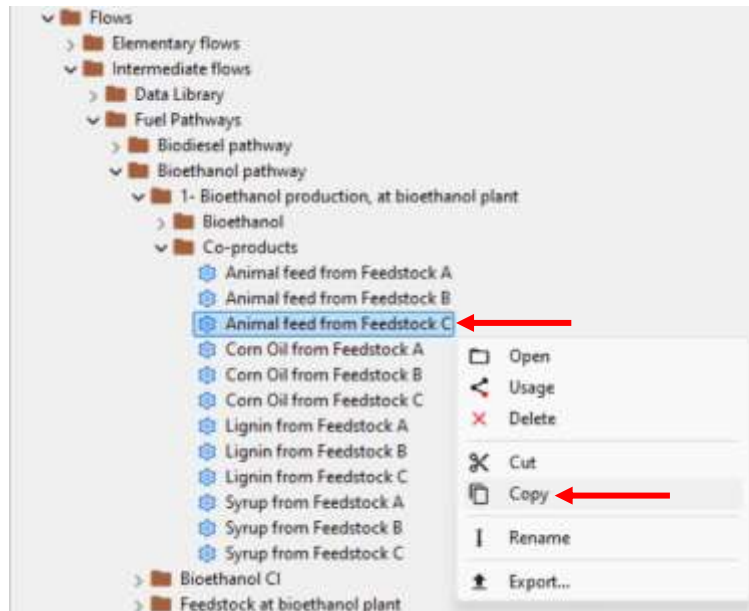
The screenshot displays the Allocation Matrix tool interface. At the top, there are two identical input tables for feedstock data. Each table has columns for 'Name of co-product portion', 'Co-product portion quantity', and 'Unit'. The first table contains data for 'Animal feeds (WDGS) from Corn (Global)' with a quantity of 548298846.908968 and unit 'MJ', and 'Animal feeds (WDGS) from Wheat (non-durum) (Global)' with a quantity of 100286593.963532 and unit 'MJ'. The second table contains data for 'Animal feeds (DDGS) from Corn (Global)' with a quantity of 2311818582.847830 and unit 'MJ', and 'Animal feeds (DDGS) from Wheat (non-durum) (Global)' with a quantity of 422846808.039669 and unit 'MJ'. Below these tables are instructions: 'Add columns to the end of this table, as required, for additional distinct feedstock inputs.' and 'Copy these orange cells in the Allocation matrix (see "Allocation" worksheet)'. The main part of the interface is the 'Allocation Matrix' grid. It has columns for 'Outputs' and 'Amount', and rows for 'Inputs' and 'Unit'. The 'Outputs' column lists various feedstock inputs like 'Corn (Global)', 'Wheat (non-durum) (Global)', 'Natural gas', 'Grid electricity (ON,CA)', 'On-site Electricity (Solar)', and 'Pre-set Chemical Mix'. The 'Amount' column contains numerical values for each input. The 'Unit' column contains units like 'MJ', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't'. The 'Inputs' column lists various feedstock inputs like 'Corn (Global)', 'Wheat (non-durum) (Global)', 'Natural gas', 'Grid electricity (ON,CA)', 'On-site Electricity (Solar)', and 'Pre-set Chemical Mix'. The 'Unit' column contains units like 'MJ', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't'. The 'Amount' column contains numerical values for each input. The 'Unit' column contains units like 'MJ', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't'. The 'Inputs' column lists various feedstock inputs like 'Corn (Global)', 'Wheat (non-durum) (Global)', 'Natural gas', 'Grid electricity (ON,CA)', 'On-site Electricity (Solar)', and 'Pre-set Chemical Mix'. The 'Unit' column contains units like 'MJ', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't'. The 'Amount' column contains numerical values for each input. The 'Unit' column contains units like 'MJ', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't', 'kg', 'GJ', 'MWh', 't'.

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”.



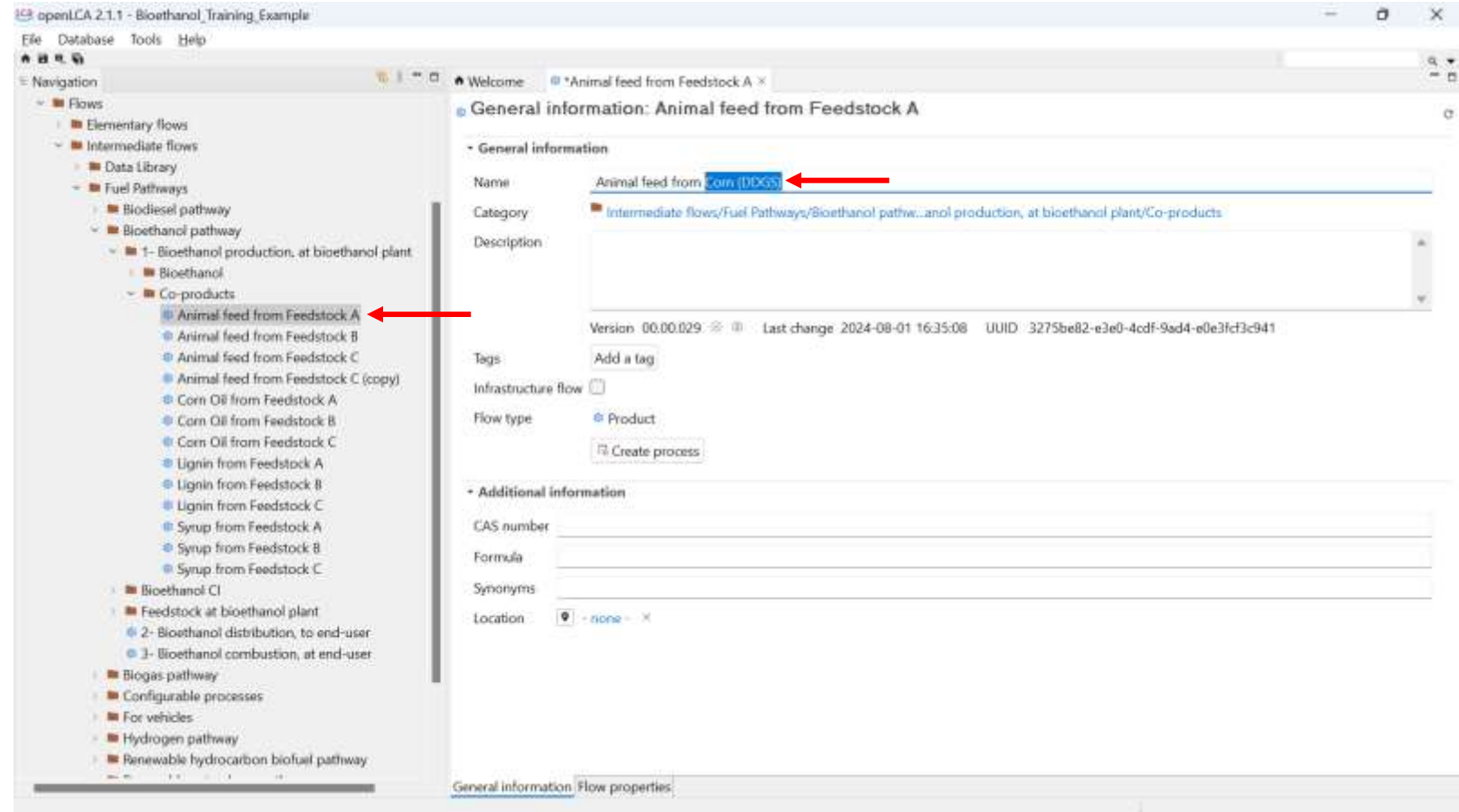
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications



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.



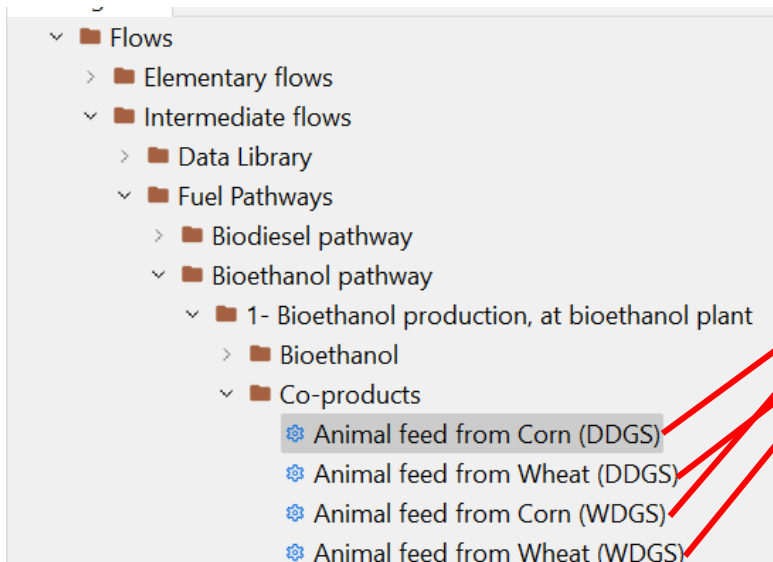
For more information, consult section 4.5, Annex A2.1.3.4 of the Specifications



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.

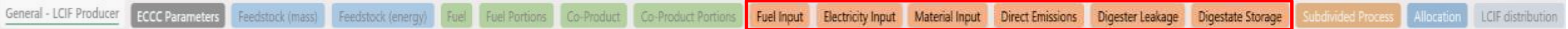
Ensure units are in MJ

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	<input type="checkbox"/>				
Animal feed from Corn (DDGS)	Intermediate flows/Fuel Pathw...	2.31184E9	MJ		none	<input type="checkbox"/>				
Animal feed from Corn (WDGS)	Intermediate flows/Fuel Pathw...	5.48299E8	MJ		none	<input type="checkbox"/>				
Animal feed from Wheat (DDGS)	Intermediate flows/Fuel Pathw...	4.22847E8	MJ		none	<input type="checkbox"/>				
Animal feed from Wheat (WDGS)	Intermediate flows/Fuel Pathw...	1.00287E8	MJ		none	<input type="checkbox"/>				

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



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ENERGY INPUTS, MATERIAL INPUTS AND DIRECT EMISSIONS



General information

Select type of fuel input	Natural gas, gaseous	
Fuel name	Natural gas, gaseous	Change the name of this worksheet for this name.
Methane content (%) (e.g. 0.91 or 91%)	0.00%	To be entered for biogas only
Additional notes (optional)		
Source of fuel CI	System process from Data library	If the fuel input is modeled using a CI calculated by the user, follow the instructions presented in the openLCIF, the two pathways are available.

If type of fuel input "New fuel input" selected, fill out these additional cells.

Name of new fuel input	
Alphanumeric identifier of the approved new pathway	

If "Transferred CI" is selected:

Alphanumeric identifier of the transferred CI	
Transferred CI, in g CO ₂ e/MJ	

Animal feeds (WDGS) Portions | Animal feeds (DDGS) Portions | **Natural gas**

General information

If the CFR Supplemental Specifications specify that a material input based on applicant data must be added to the fuel pathway:

Type of material input	Select material input	
Material input name		Change the name of this worksheet for this name.
Source of material input CI	Select source of CI	If the material input is modeled using a CI calculated by the user, follow the instructions presented in the openLCIF, the two pathways are available.
Additional notes (optional)		

If source of material input CI "New material input CI" selected, fill out these additional cells.

Name of new material input	
Alphanumeric identifier of the approved new pathway	

If a transferred CI value is used to model the material input:

Alphanumeric identifier of the transferred CI	
Transferred CI, in g CO ₂ e/MJ	

If the CFR Supplemental Specifications specify that a preset chemical mix must be added to the fuel pathway:

Select preset chemical mix	Chemical use per MJ of conventional ethanol	No quantities must be reported in this section below.
----------------------------	---	---

Grid electricity (ON,CA) | On-site Electricity (Solar) | **Pre-set Chemical Mix**



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 quantities (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.

Fuel quantities

Select unit in which data is entered: MJ

Unit to be used for the units in which fuel input quantities are measured

Reporting Month (YYYY/MM)	Fuel input, beginning inventory*	Fuel input, purchased*	Fuel input, end inventory*	Fuel input used	Unit
*Applicable data must be entered in all column quantities. Do not leave any green cells blank. Enter "0" where necessary.					
2022/06	0.00	3,383,177.00	30.00	2,240,177.00	m3
2022/07	0.00	3,375,129.00	30.00	2,875,129.00	m3
2022/08	0.00	2,500,881.50	30.00	2,500,881.50	m3
2022/09	0.00	2,812,842.18	0.00	2,812,842.18	m3
2022/10	0.00	3,295,958.28	30.00	2,295,958.28	m3
2022/11	0.00	2,269,367.00	30.00	2,269,367.00	m3
2022/12	0.00	2,454,895.24	30.00	2,454,895.24	m3
2023/01	0.00	2,507,080.48	30.00	2,507,080.48	m3
2023/02	0.00	2,801,515.50	30.00	2,801,515.50	m3
2023/03	0.00	2,340,738.50	30.00	2,340,738.50	m3
2023/04	0.00	2,580,251.85	30.00	2,580,251.85	m3
2023/05	0.00	2,427,908.00	30.00	2,427,908.00	m3
2023/06	0.00	3,044,887.38	30.00	3,044,887.38	m3
2023/07	0.00	2,902,895.70	30.00	2,902,895.70	m3
2023/08	0.00	2,718,203.48	30.00	2,718,203.48	m3
2023/09	0.00	2,065,422.83	30.00	2,065,422.83	m3
2023/10	0.00	2,982,106.73	30.00	2,982,106.73	m3
2023/11	0.00	2,006,497.05	30.00	2,006,497.05	m3
2023/12	0.00	2,824,794.79	30.00	2,824,794.79	m3
2024/01	0.00	2,712,884.12	30.00	2,712,884.12	m3
2024/02	0.00	2,876,545.43	30.00	2,876,545.43	m3
2024/03	0.00	2,929,326.06	30.00	2,929,326.06	m3
2024/04	0.00	2,691,811.15	30.00	2,691,811.15	m3
2024/05	0.00	2,850,155.10	30.00	2,850,155.10	m3
Total				49,336,780.00	m3

Conversion of fuel quantities

Mandatory unit to enter total fuel use in the Fuel LCA Model: energy-based unit

Unit

Select appropriate unit conversion factor(s) from "ECCC Parameters" worksheet

>"ECCC Parameters"Worksheet>"ECCC Parameters"Worksheet

For more information, visit the ECCC website

Conversion of fuel quantities	
Mandatory unit to enter total fuel use in the Fuel LCA Model: energy-based unit	MJ
Select appropriate unit conversion factor(s) from "ECCC Parameters" worksheet	=ECCC Parameters!B1317*ECCC Parameters!G14

Electricity quantities		
Select unit in which electricity quantities are entered: kWh		
Reporting Month (YYYY/MM)	Quantity*	Unit
*Applicable data must be entered in all column quantities. Do not leave any green cells blank. Enter "0" where necessary.		
2022/06	2,720,000.85	kWh
2022/07	2,880,000.90	kWh
2022/08	3,304,000.97	kWh
2022/09	3,168,000.99	kWh
2022/10	2,784,000.87	kWh
2022/11	2,752,000.86	kWh
2022/12	2,976,000.93	kWh
2023/01	3,040,000.95	kWh
2023/02	2,912,000.91	kWh
2023/03	2,848,000.89	kWh
2023/04	3,336,000.98	kWh
2023/05	2,944,000.92	kWh
2023/06	3,680,000.15	kWh
2023/07	3,520,000.10	kWh
2023/08	3,296,000.09	kWh
2023/09	3,232,000.08	kWh
2023/10	3,616,000.13	kWh
2023/11	3,848,000.14	kWh
2023/12	3,474,000.07	kWh
2024/01	3,360,000.05	kWh
2024/02	3,488,000.09	kWh
2024/03	3,512,000.11	kWh
2024/04	3,264,000.07	kWh
2024/05	3,456,000.08	kWh
Total	76809024.00	kWh

Conversion of electricity quantities	
Mandatory unit to enter total electricity quantities in the Fuel LCA Model: energy-based unit	kWh
Select appropriate unit conversion factor(s) from "ECCC Parameters" worksheet	=ECCC Parameters!G219

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

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 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.

Information to copy in the Allocation Matrix

Fuel input name	Amount	Unit
Natural gas, gaseous	2431374705.74	MJ

Information to copy in the Allocation Matrix

Electricity input name	Amount	Unit
Purchased electricity from grid (Canada/US)	75900024.00	kWh

Information to copy in the Allocation Matrix

Electricity input name	Amount	Unit
Low-C electricity (produced on-site at RBC-PVA) (Select grid)	8352.00	kWh

Preset chemical mix - name

Amount	Unit
Chemical use per MJ of conventional ethanol	5855018736.00
	MJ

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.

Inputs	Amount	Unit	Outputs	Amount	Unit
<ul style="list-style-type: none"> •Corn (Global) (B104-D104) •Grid electricity (ON,CA) (B69-D69) •Natural gas (B63-D63) •On-site Electricity (Solar) (B69-D69) •Pre-set Chemical Mix (B63-D63) 			<ul style="list-style-type: none"> •Bioethanol Portions (D26-E26) •Bioethanol Portions (E26-E26) •Animal feeds (WDGS) Portions (D27-E27) •Animal h 		



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



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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	<ul style="list-style-type: none"> • Select the process "Natural gas combustion" from the folder <i>Processes/Data library/Fossil Fuels/Combusted fossil fuels</i>. • 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	<ul style="list-style-type: none"> • Select the process "Electricity, from grid [CA-ON]" from the folder <i>Processes/Data library/Electricity/Grid electricity/Canadian grid electricity</i> (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	<ul style="list-style-type: none"> • Select the process "Electricity, from solar, photovoltaic, onsite generation" from the folder <i>Processes/Data library/Electricity/Technology specific electricity/Onsite generation</i>. • 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	<ul style="list-style-type: none"> • Select the process "Chemical use per MJ of conventional ethanol" from folder <i>Processes/Data library/Chemical inputs/Predefined chemical mixes</i>. • Enter the total amount of fuel produced (sum of the bioethanol portions) in units of MJ.



MODELLING ENERGY INPUTS, MATERIAL INPUTS AND DIRECT EMISSIONS

Processes

- Data Library
 - Chemical inputs
 - Agrochemicals
 - Chemicals
 - Predefined chemical mixes
 - Chemical use per MJ of biodiesel
 - Chemical use per MJ of cellulosic bioethanol
 - Chemical use per MJ of conventional bioethanol

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	<input type="checkbox"/>				
Animal feed from Corn (DDGS)	Intermediate flows/Fuel Pathw...	2.31184E9	MJ		none	<input type="checkbox"/>				
Animal feed from Corn (WD...	Intermediate flows/Fuel Pathw...	5.48299E8	MJ		none	<input type="checkbox"/>				
Animal feed from Wheat (DD...	Intermediate flows/Fuel Pathw...	4.22847E8	MJ		none	<input type="checkbox"/>				
Animal feed from Wheat (W...	Intermediate flows/Fuel Pathw...	1.00287E8	MJ		none	<input type="checkbox"/>				

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

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MODELLING ENERGY INPUTS, MATERIAL INPUTS AND DIRECT EMISSIONS

- Processes
 - Data Library
 - Chemical inputs
 - Combustion emission factors
 - Electricity
 - Excess electricity to grid
 - Grid electricity
 - Technology specific electricity
 - Offsite generation
 - Onsite generation
 - Electricity, from coal, bituminous, onsite generation
 - Electricity, from coal, lignite, onsite generation
 - Electricity, from coal, sub-bituminous, onsite generation
 - Electricity, from diesel, onsite generation
 - Electricity, from heavy fuel oil, onsite generation
 - Electricity, from hydro, reservoir, onsite generation
 - Electricity, from hydro, run-of-river, onsite generation
 - Electricity, from natural gas, cogeneration, onsite generation
 - Electricity, from natural gas, combined cycle, onsite generation
 - Electricity, from natural gas, converted boiler, onsite generation
 - Electricity, from natural gas, simple cycle, onsite generation
 - Electricity, from nuclear, CANDU, onsite generation
 - Electricity, from solar, concentrated solar power, onsite generation
 - Electricity, from solar, photovoltaic, onsite generation
 - Electricity, from wind, onshore, onsite generation
 - Electricity, from wood biomass, cogeneration, onsite generation
 - Electricity, from wood biomass, simple cycle, onsite generation

Welcome 1- Bioethanol production, at bioethanol plant x

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

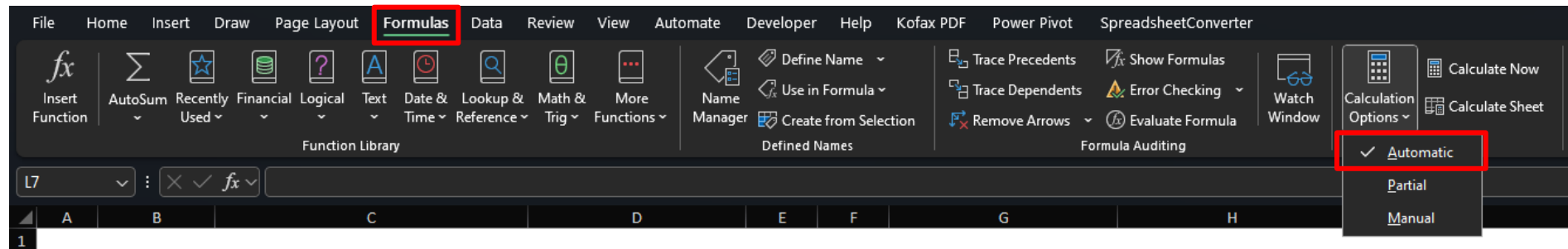


Link Input and Output Flows with the Allocation Matrix

- 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



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.



Flow	Direction	Category	Amount	1- Bioetha...	1- Bioetha...	Animal fee...	Animal fee...	Animal fee...	Animal fee...	Σ
Natural gas combustion	Input	Fossil fuels/Co...	2.43137E9 MJ	0.53578044...	0.09799691...	0.29024530...	0.05935068...	0.04577111...	0.01085553...	1.00000
Electricity, from grid [CA-QN]	Input	Grid electricity/...	7.68000E7 kWh	0.53578044...	0.09799691...	0.29024530...	0.05935068...	0.04577111...	0.01085553...	1.00000
Electricity, from solar, photovoltaic	Input	Technology spe...	8352.00000 kWh	0.53578044...	0.09799691...	0.29024530...	0.05935068...	0.04577111...	0.01085553...	1.00000
Corn (Global), at bioethanol plant	Input	Bioethanol pot...	4.97000E5 t	0.63377735...	0.0	0.29601641...	0.07020622...	0.0	0.0	1.00000
Chemical use per MJ of conventi...	Input	Chemical input...	5.85502E9 MJ	0.53578044...	0.09799691...	0.29024530...	0.05935068...	0.04577111...	0.01085553...	1.00000
Wheat (non durum) (Global), at b...	Input	Bioethanol pot...	9.09038E4 t	0.0	0.63377735...	0.0	0.0	0.29601641...	0.07020622...	1.00000

The bottom navigation bar shows the following tabs: General information | Inputs/Outputs | Administrative information | Modeling and validation | Parameters | Allocation | Social aspects | Direct impacts. The 'Allocation' tab is currently selected and highlighted with a red box.



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



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For more information, consult section 4.7 of the Specifications

LCIF DISTRIBUTION AND COMBUSTION

Complete the “LCIF Distribution” Worksheet

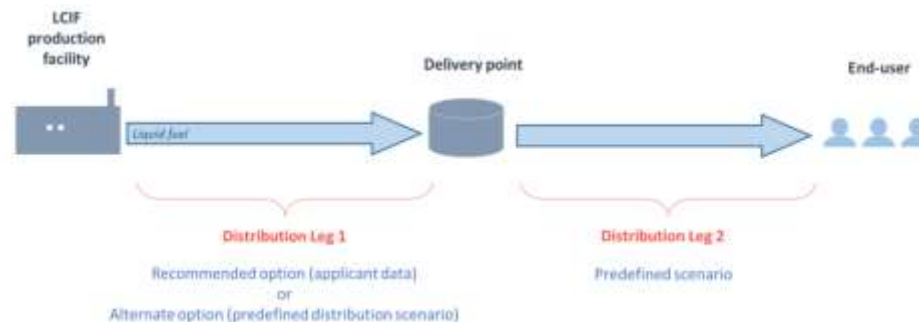
- Rename the worksheet “Bioethanol Distribution”.
- Fill out the relevant sections of the worksheet.
 - General information

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.



LCIF DISTRIBUTION

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

General information

Description of the fuel

Select fuel type: Bioethanol

HHV of fuel: 29.67

Copy values from "ECCC Parameters" worksheet for existing fuel types (or approved values for new fuel types in the case of a new pathway application).

Distribution Leg 1

Fuel distribution modelling option: Recommended option - Applicant data

State of fuel for Leg 1: Liquid

Density of fuel for Leg 1: 789.39

Enter a value if required for fuel quantity conversion. Use values from "ECCC Parameters" worksheet whenever available.

If "Recommended option - Applicant data" is selected:
Calculations must be provided in the "Side Calculations" worksheet.

Transport	Distance	Unit	Fraction of LCIF transported for each transport mode
	Enter weighted-average (or longest) distance for this transportation mode		If multiple transport modes are used, enter fraction of LCIF transported for each transport mode (between 0 and 1).
Truck transport, gaseous state	0 km	km	
Truck transport, liquid state	186 km	km	
Rail transport, gaseous state	0 km	km	
Rail transport, liquid state	0 km	km	
Ship transport, gaseous state	0 km	km	
Ship transport, liquid state	0 km	km	
Natural gas pipeline transport	0 km	km	
Dedicated pipeline transport	0 km	km	

Calculated transport amounts (Distribution of 1 MJ of fuel)

Transport	Unit
Truck transport, gaseous state	0.00 kg.km
Truck transport, liquid state	6.26895854398382 kg.km
Rail transport, gaseous state	0.00 kg.km
Rail transport, liquid state	0.00 kg.km
Ship transport, gaseous state	0.00 kg.km
Ship transport, liquid state	0.00 kg.km
Natural gas pipeline transport	0.00 kg.km
Dedicated pipeline transport	0.00 kg.km

These calculations use the HHV of fuel that is entered in the "General information" section. These values must be entered in the "2-[LCIF name] distribution, to end-user" unit processes of the Fuel Pathway for each transport input flow.

If "Alternate option - Predefined distribution scenario" is selected:

Select predefined scenario: Select answer only if Predefined scenario is selected

Amount of fuel distributed per MJ of fuel produced: MJ

This value must be entered in the "2-[LCIF name] distribution, to end-user" unit processes of the Fuel Pathway for the system process corresponding to the predefined distribution scenario in the Data Library.

Animal feeds (WDGS) Portions | Animal feeds (DDGS) Portions | Natural gas | Grid electricity (CA, ON) | On-site Electricity (Solar) | Pre-set Chemical Mix | Allocation | **Bioethanol distribution**



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

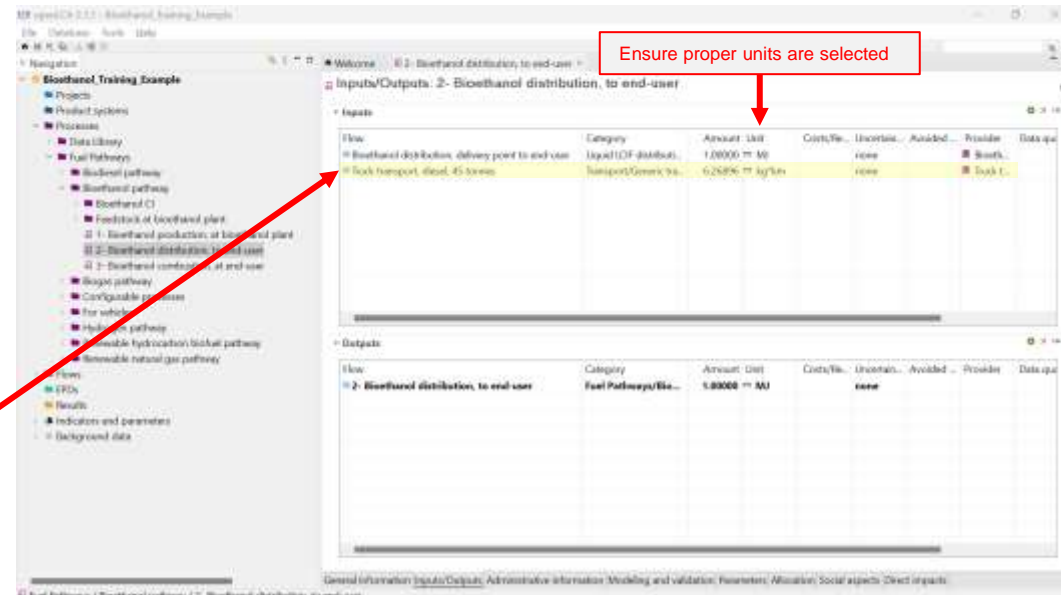
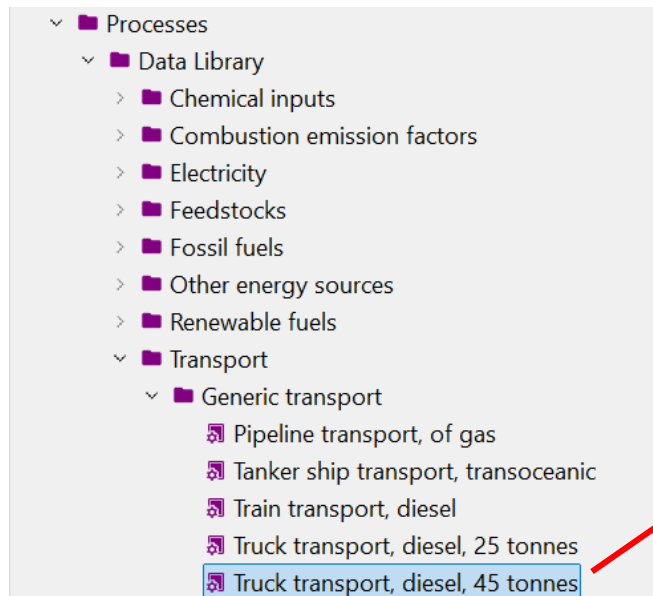
MODELLING LCIF DISTRIBUTION

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.



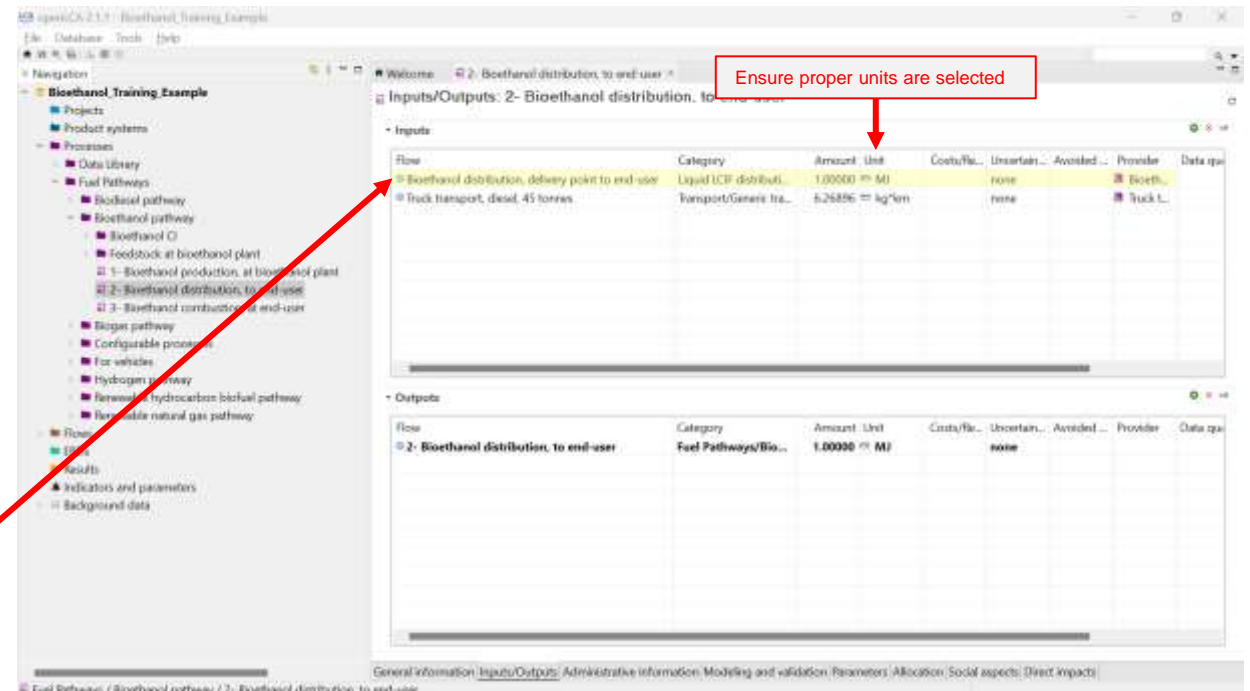
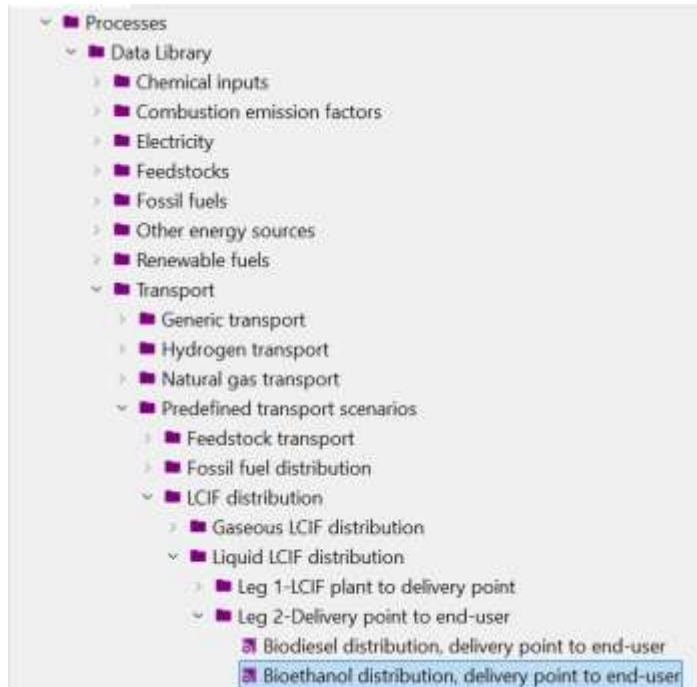
For more information, consult section 5 A2.1.3.6 of the Specifications



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.



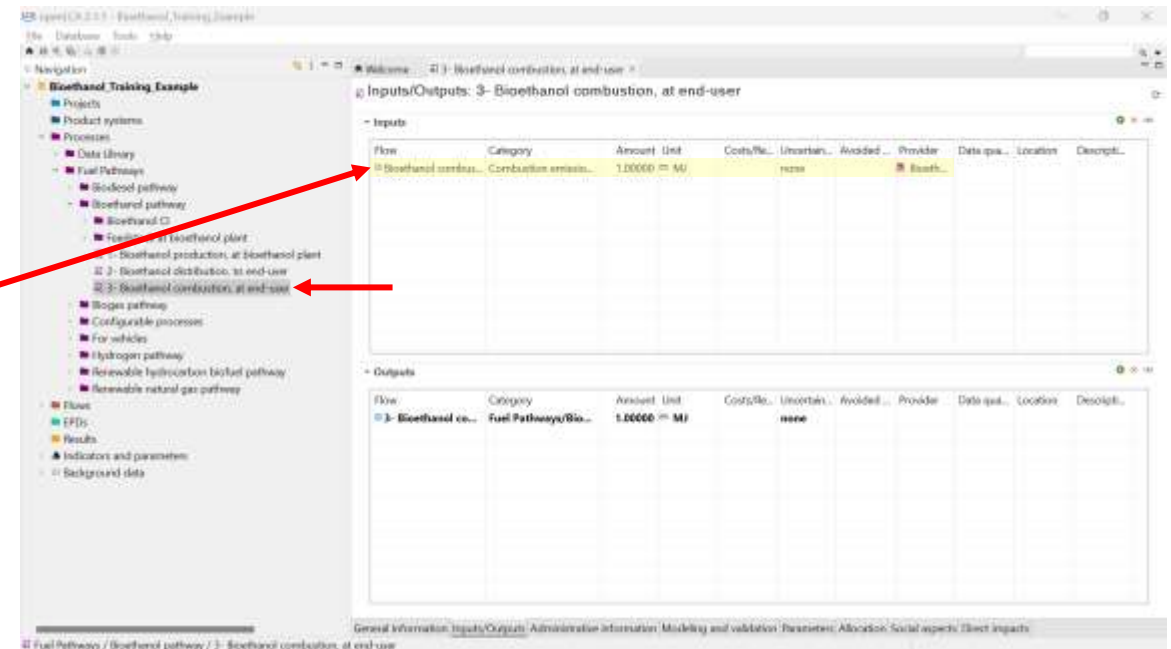
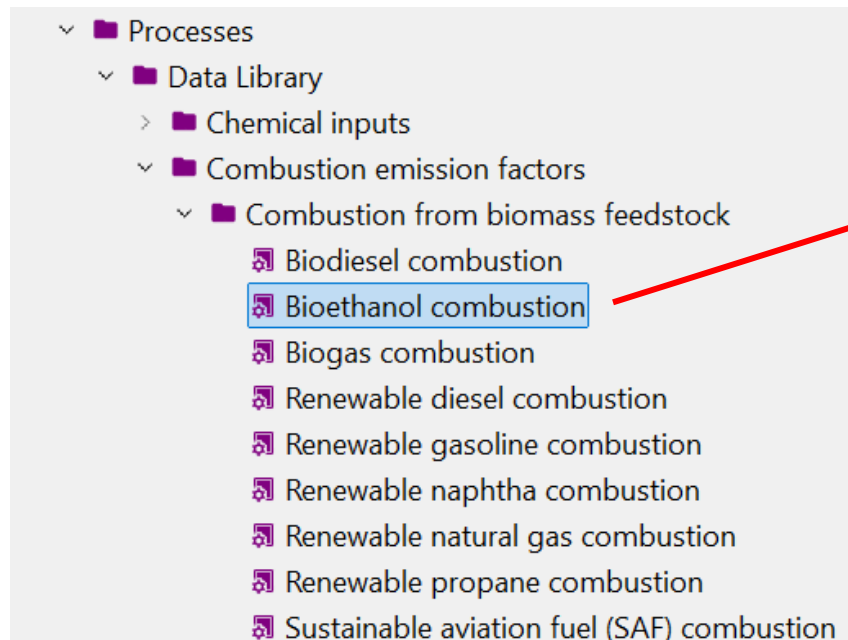
For more information, consult section 5 A2.1.3.6 of the Specifications



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.



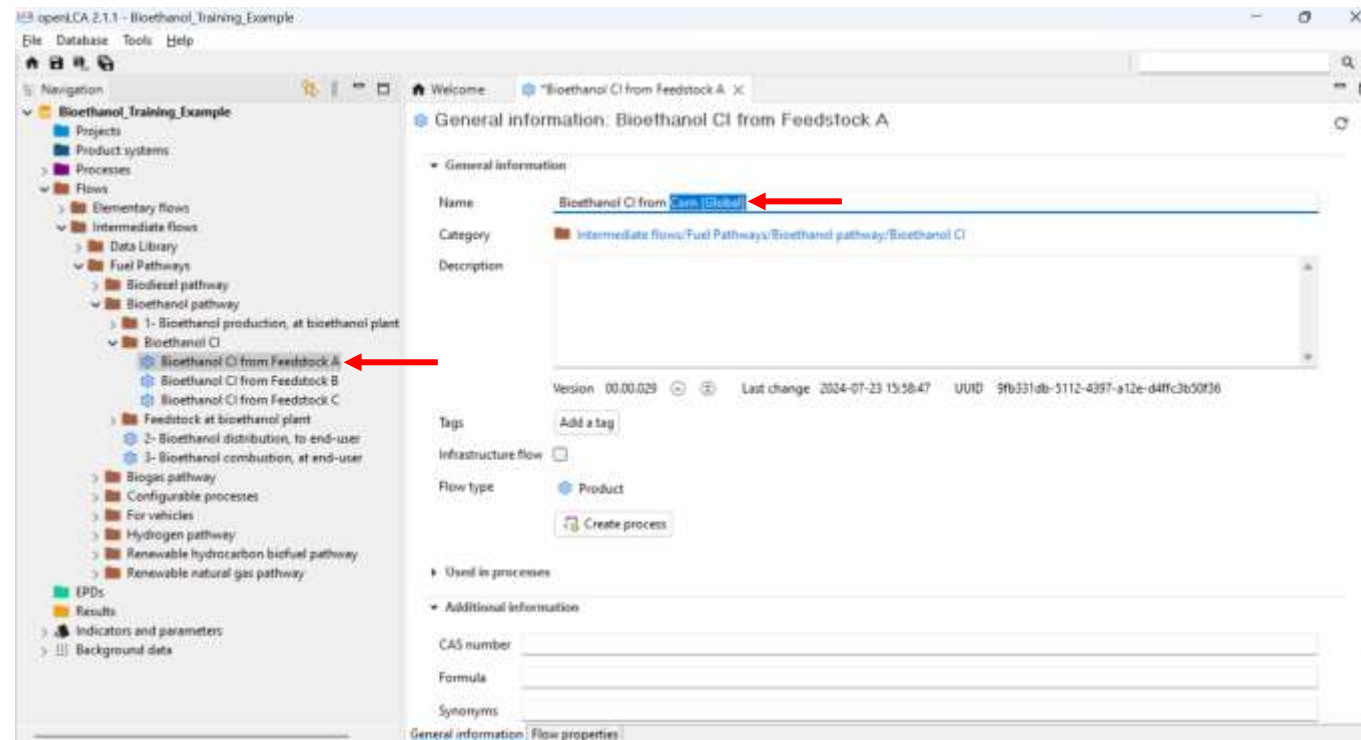
For more information, consult section 6 A2.1.3.7 of the Specifications



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”.



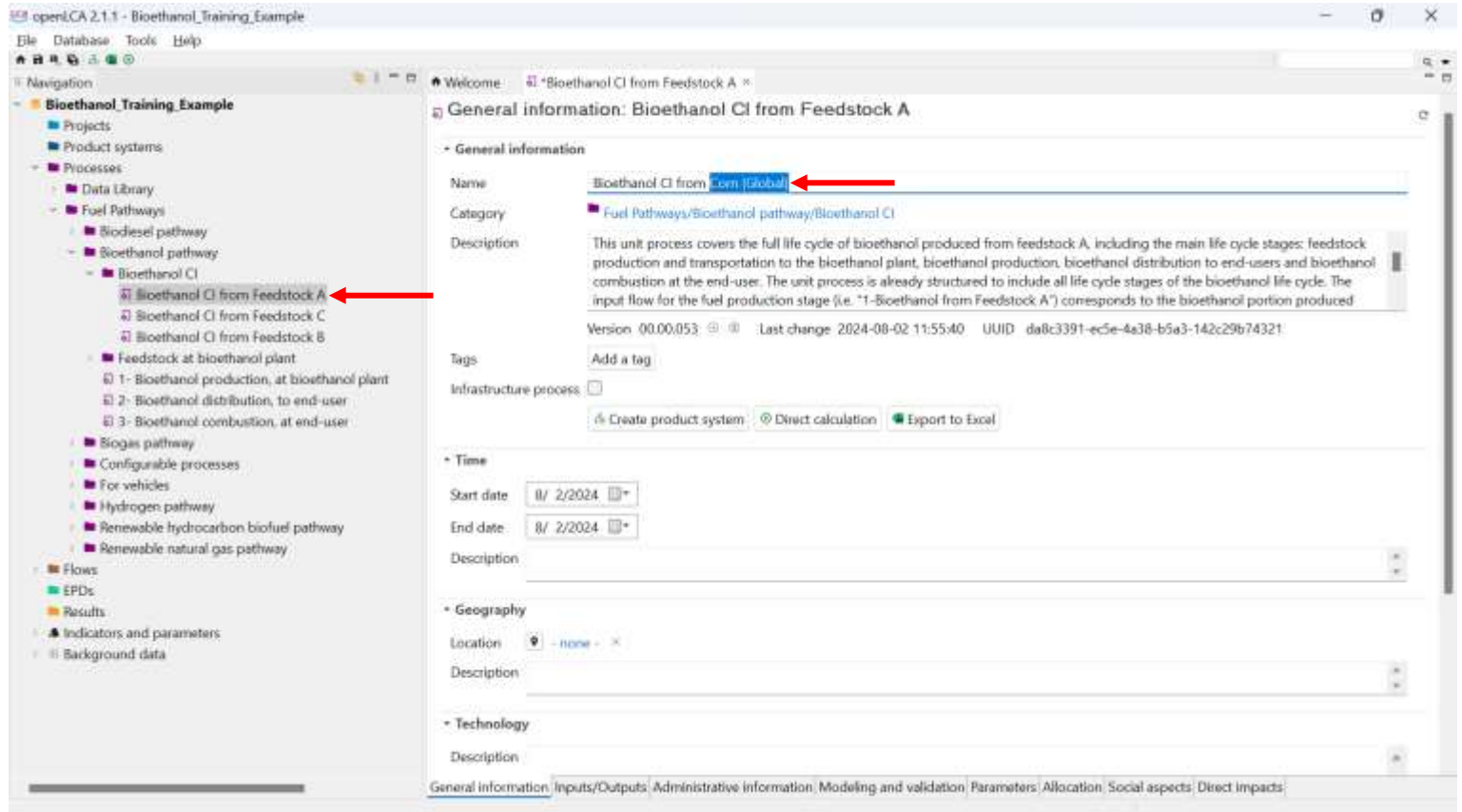
For more information, consult section 7 of the Specifications



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



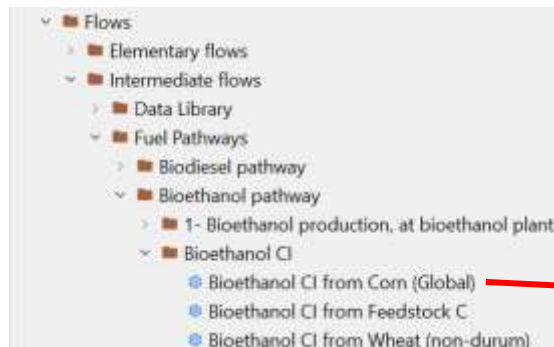
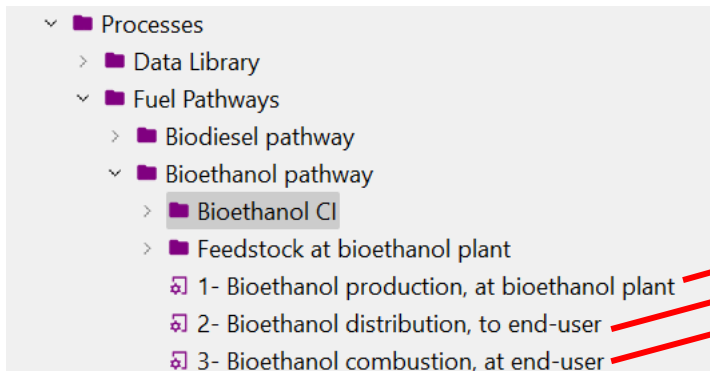
DETERMINING CARBON INTENSITY VALUES

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.



Each process in the folder corresponds to a distinct feedstock



Welcome Bioethanol CI from Corn (Global) ×

Inputs/Outputs: Bioethanol CI from Corn (Global)

Inputs

Flow	Category	Amount	Unit	Costs/Re...	Uncertain...	Avoided ...	Provider	Data qua...	Location
1- Bioethanol from Corn (Global)	1- Bioethanol produ...	1.00000	MJ		none		1- Bio...		
2- Bioethanol distribution, to end-user	Fuel Pathways/Bioet...	1.00000	MJ		none		2- Bio...		
3- Bioethanol combustion, at end-user	Fuel Pathways/Bioet...	1.00000	MJ		none		3- Bio...		

Outputs

Flow	Category	Amount	Unit	Costs/Re...	Uncertain...	Avoided ...	Provider	Data qua...	Location
Bioethanol CI from Corn (Global)	Bioethanol pathwa...	1.00000	MJ		none				

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”.

Welcome Bioethanol CI from Corn (Global) ×

General information: Bioethanol CI from Corn (Global)

General information

Name: Bioethanol CI from Corn (Global)

Category: Fuel Pathways/Bioethanol pathway/Bioethanol CI

Description: This unit process covers the full life cycle of bioethanol produced from feedstock A, including the main life cycle stages: feedstock production and transportation to the bioethanol plant, bioethanol production, bioethanol distribution to end-users and bioethanol combustion at the end-user. The unit process is already structured to include all life cycle stages of the bioethanol life cycle. The input flow for the fuel production stage (i.e. "1-Bioethanol from Feedstock A") corresponds to the bioethanol portion produced.

Version: 00.00.054 Last change: 2024-08-02 12:01:38 UUID: da8c3391-ec5e-4a38-b5a3-142c29b74321

Tags: Add a tag

Infrastructure process: ☐

☒ Create product system ☐ Direct calculation ☐ Export to Excel

Time

Start date: 8/2/2024

End date: 8/2/2024

Description:

Geography

Location: none

Description:

Technology

Description:

General information Inputs/Outputs Administrative information Modeling and validation Parameters Allocation Social aspects Direct impacts



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.

New product system

Name: Bioethanol CI from Corn (Global)

Reference process:

- Bioethanol CI from Corn (Global)
- Bioethanol CI from Feedstock C
- Bioethanol CI from Wheat (non-durum) (Global)
- Feedstock at bioethanol plant
- 1- Bioethanol production, at bioethanol plant
- 2- Bioethanol distribution, to end-user
- 3- Bioethanol combustion, at end-user

☒ Auto-link processes

☐ Check multi-provider links (experimental)

Provider linking

- ☐ Ignore default providers
- ☒ Prefer default providers
- ☐ Only link default providers

Preferred process type

- ☐ Unit process
- ☒ System process

☐ Cut-off


Finish Cancel

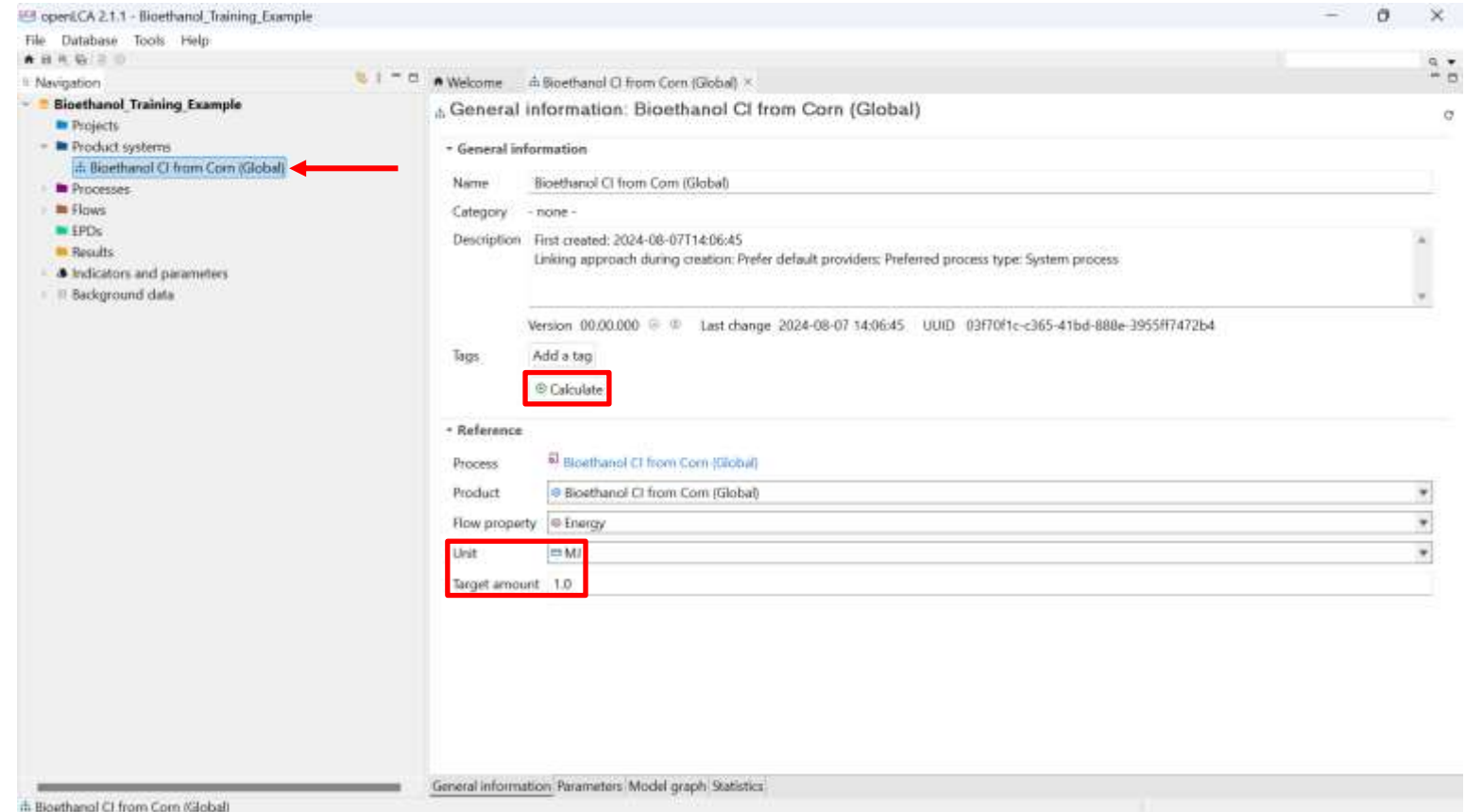
For more information, consult section 7 of the Specifications



DETERMINING CARBON INTENSITY VALUES

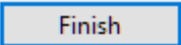
Calculate the CI Value

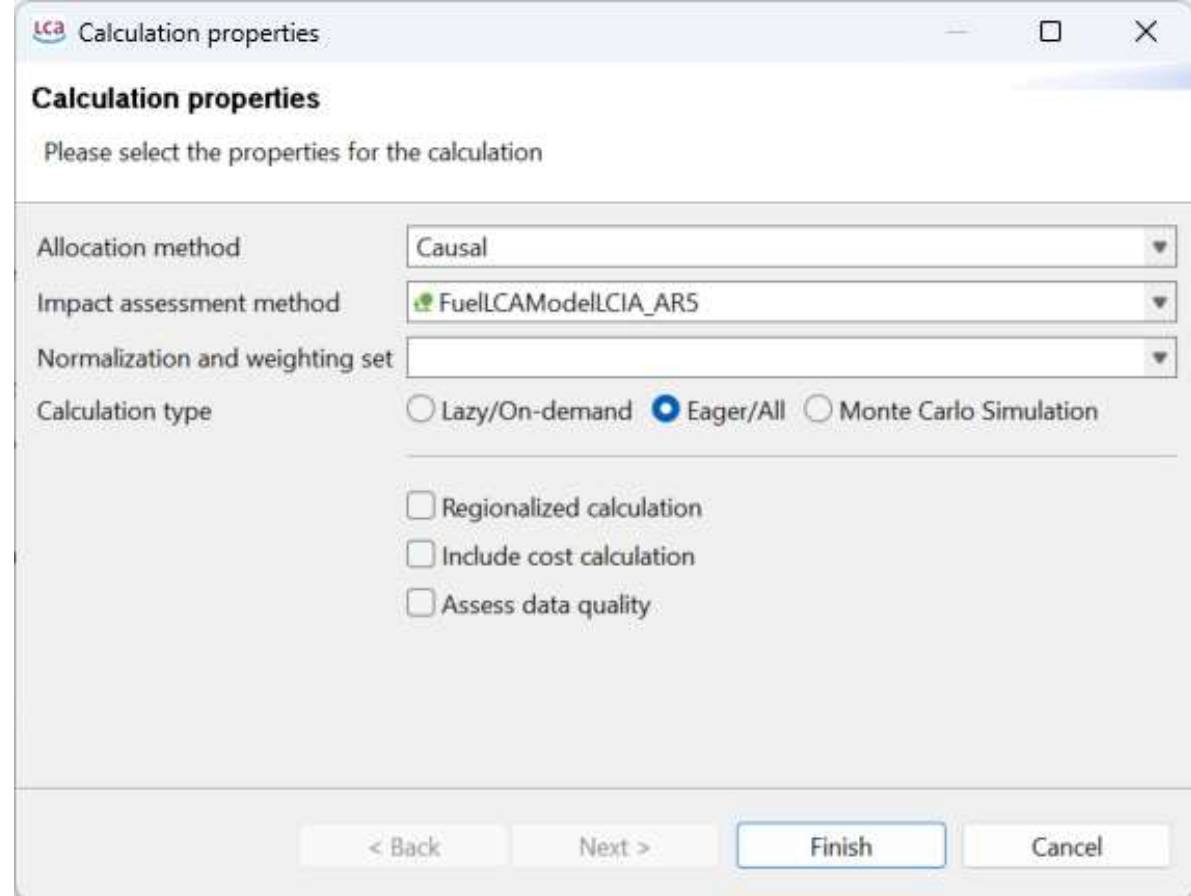
- Open the product system created and verify that the target amount and unit in the “Reference” section are set to "1.0" and "MJ", respectively.
- Click  Calculate



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 



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.

Bioethanol CI from Corn (Global)

General information

Product system: Bioethanol CI from Corn (Global)

Allocation method: Causal

Target amount: 1.0 MJ Bioethanol CI from Corn (Global)

Impact assessment method: FuelCAModelLCIA_AR5

[Export to Excel](#) [Save result as...](#)

Top 5 contributions to impact category results - overview

Impact category: Carbon intensity (AR5)



Bioethanol CI from Corn (Global)

Impact analysis - FuelCAModelLCIA_AR5

Sub-group by: ☐ Flows ☒ Processes %

Name	Category	Inventory result	Characterization fact...	Impact assessment r...
Carbon intensity (AR5)	FuelCAModelLCIA_AR5			42.85648 g CO2e
Corn, at farm	Data Library/Feedstocks/Crops/Grains			21.23512 g CO2e
Natural gas combustion	Data Library/Fossil fuels/Combusted...			15.88243 g CO2e
Bioethanol combustion	Data Library/Combustion emission f...			1.93719 g CO2e
Truck transport, diesel, 25 tonnes	Data Library/Transport/Generic trans...			1.59892 g CO2e
Truck transport, diesel, 45 tonnes	Data Library/Transport/Generic trans...			1.07650 g CO2e
Bioethanol distribution, delivery point	Data Library/Transport/Predefined tr...			0.47518 g CO2e
Electricity, from grid [CA-ON]	Data Library/Electricity/Grid electricity...			0.35148 g CO2e
Chemical use per MJ of conventional E	Data Library/Chemical inputs/Predefi...			0.29966 g CO2e
Electricity, from solar, photovoltaic, on	Data Library/Electricity/Technology s...			3.61189E-9 g CO2e

General information | Inventory results | **Impact analysis** | Process results | Contribution tree | Grouping | Locations | Sankey diagram | LCIA Checks

For more information, consult section 7 of the Specifications



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Climate Change Canada

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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.

Bioethanol CI from Wheat (non durum) (Global)

General information

Product system: Bioethanol CI from Wheat (non durum) (Global)

Allocation method: Causal

Target amount: 1.0 MJ Bioethanol CI from Wheat (non durum) (Global)

Impact assessment method: FuelCAMoDeLlCIA_AR5

Export to Excel Save result as...

Top 5 contributions to impact category results - overview



Bioethanol CI from Wheat (non durum) (Global)

Impact analysis - FuelCAMoDeLlCIA_AR5

Sub-group by: ☐ Flows ☒ Processes Don't show < 0 %

Name	Category	Inventory result	Characterization fact...	Impact assessment r...
Carbon intensity (AR5)	FuelCAMoDeLlCIA_AR5			27.88594 g CO2e
Natural gas combustion	Data Library/Fossil fuels/Combusted ...			15.88243 g CO2e
Wheat, non durum, at farm	Data Library/Feedstocks/Crops/Grains			6.17645 g CO2e
Truck transport, diesel, 45 tonnes	Data Library/Transport/Generic trans...			2.76354 g CO2e
Bioethanol combustion	Data Library/Combustion emission f...			1.93719 g CO2e
Bioethanol distribution, delivery point	Data Library/Transport/Predefined tr...			0.47518 g CO2e
Electricity, from grid [CA-ON]	Data Library/Electricity/Grid electricity...			0.35148 g CO2e
Chemical use per MJ of conventional l...	Data Library/Chemical inputs/Predefi...			0.29966 g CO2e
Electricity, from solar, photovoltaic, on	Data Library/Electricity/Technology s...			3.61189E-9 g CO2e

General information | Inventory results | Impact analysis | Process results | Contribution tree | Grouping | Locations | Sankey diagram | LCIA Checks

For more information, consult section 7 of the Specifications



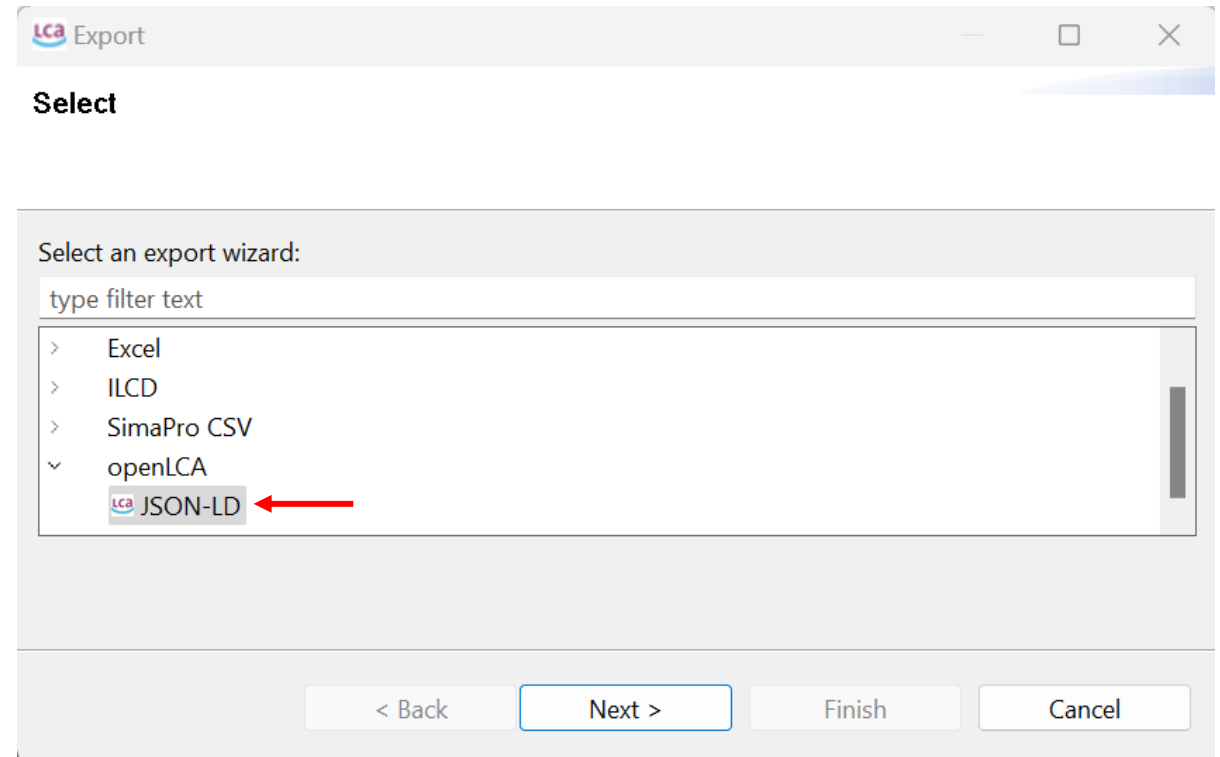
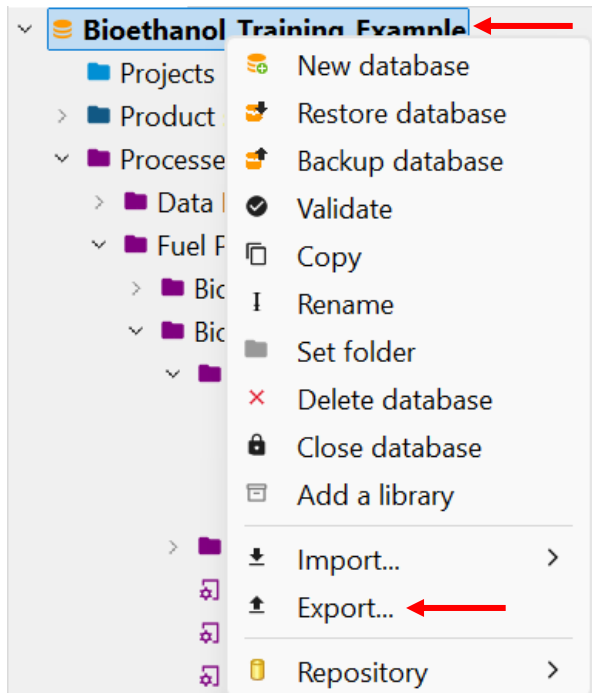
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Climate Change Canada

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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.

