Co-funded by the European Union

ECOThink

Primerjalna analiza življenjskega cikla proizvodnje metanola iz zemeljskega plina in lesne biomase

PRIKAZ IZVEDBE S PROGRAMOM OpenLCA

Damjan Krajnc
MIITR

- Primerjalna analiza življenjskega cikla proizvodnje **METANOLA** dveh sinteznih poti:

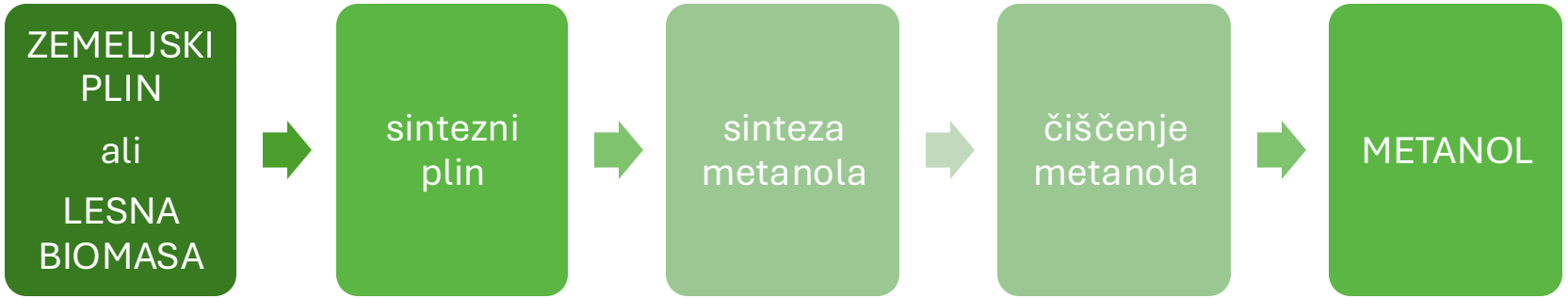
Metanol iz **zemeljskega plina**

Metanol iz **lesne biomase**

Funkcijska enota

Proizvodnja 1 kg metanola iz sinteznega plina

1. Parno reformiranje sinteznega plina preko uporabe zemeljskega plina
2. Parno reformiranje sinteznega plina preko uplinjanja biomase



Ogljikov monoksid in vodik reagirata ob prisotnosti katalizatorja, da nastane metanol. *Katalizator*: zmes bakrovih in cinkovih oksidov, podprtih na glinici

Programsko orodje OpenLCA

- **profesionalno orodje** za oceno življenjskega cikla
- razvija ga GreenDelta od leta 2006 (zadnja verzija 1.10.1, november 2019)
- funkcionalen in tehnično **posodabljan**

Prenos in namestitev

Namestitvene datoteke na voljo na https://www.openlca.org/download/

Downloads

openLCA

After 4 months of beta testing, here is finally version 1.9 (release date: June 30, 2019). We recommend to use this version. Our tests have not shown any issues, but should you run into any, please let us know. Thanks in advance! For the windows version, we are not providing the installer any more – just unzip the archive, and start openLCA.exe.

Windows	Mac	Linux	Sources	Latest build

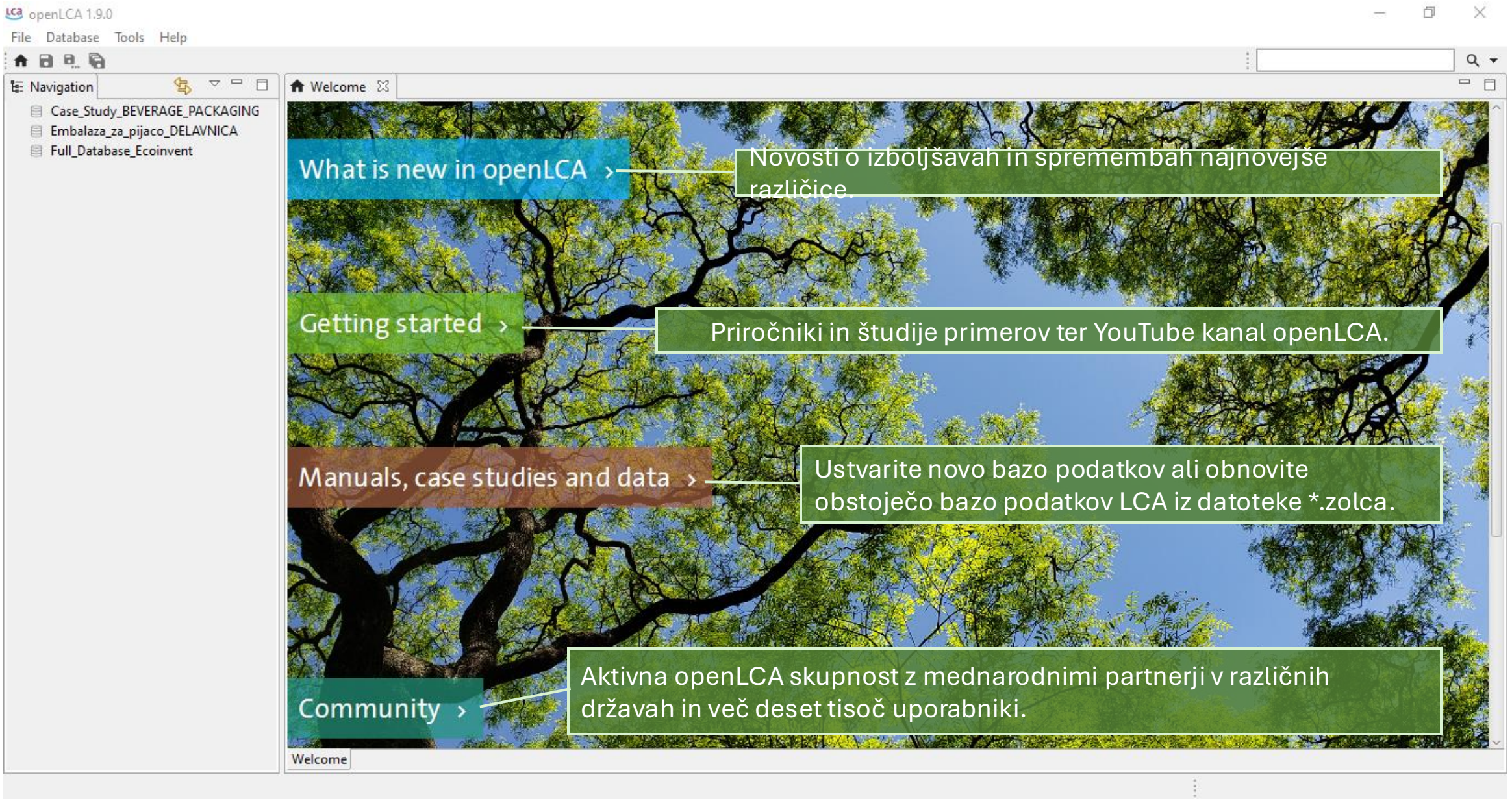
Just unzip the archive, and start openLCA.exe. To uninstall, just delete the created folder with subfolders. You can have several versions of openLCA in different folders on the same computer.

openLCA 1.9 Zip-Archive: 64 bit

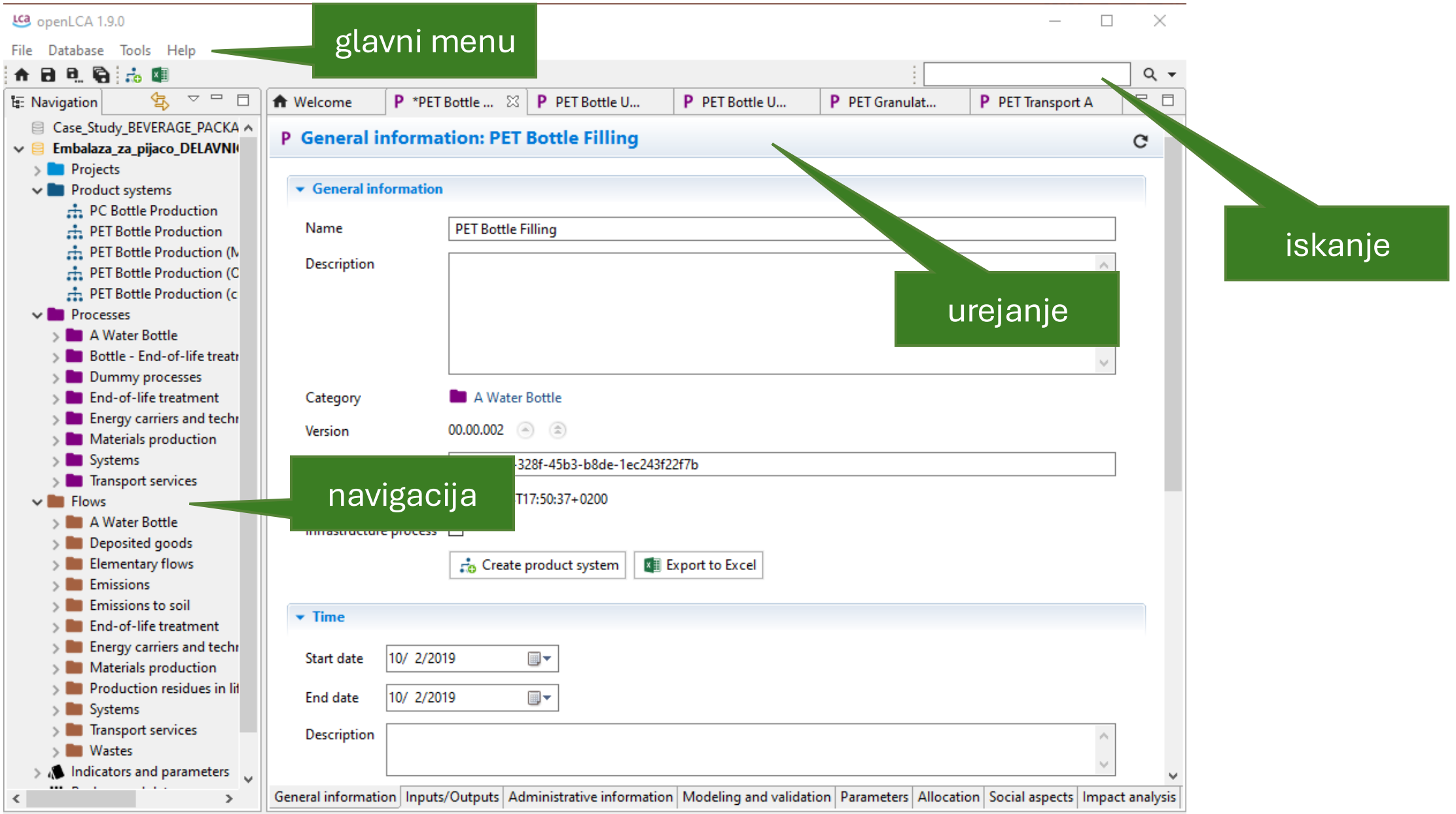
Downloads

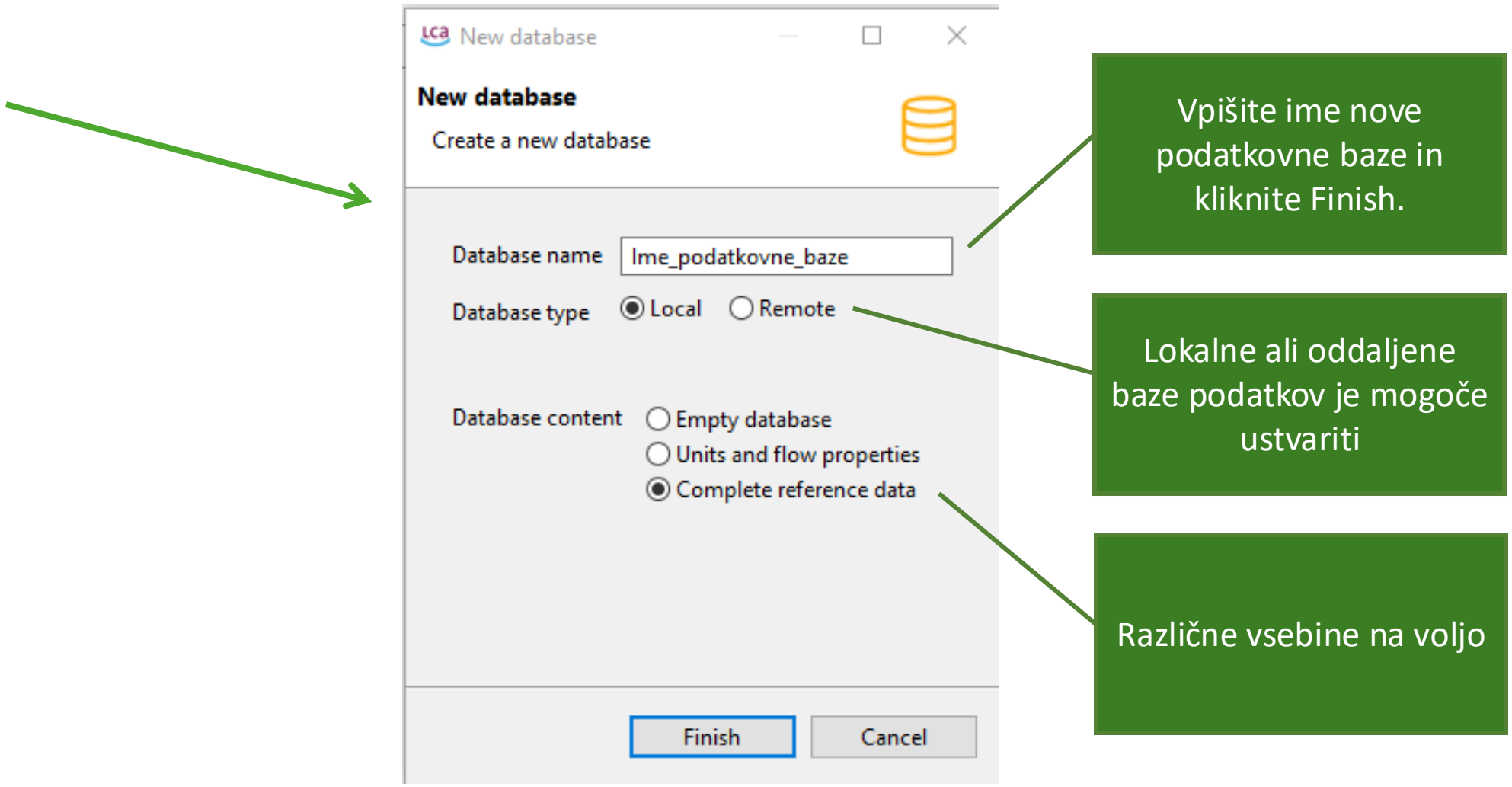
- openLCA
- LCA Collaboration Server
- Impact methods
- Data quality systems
- Format converter

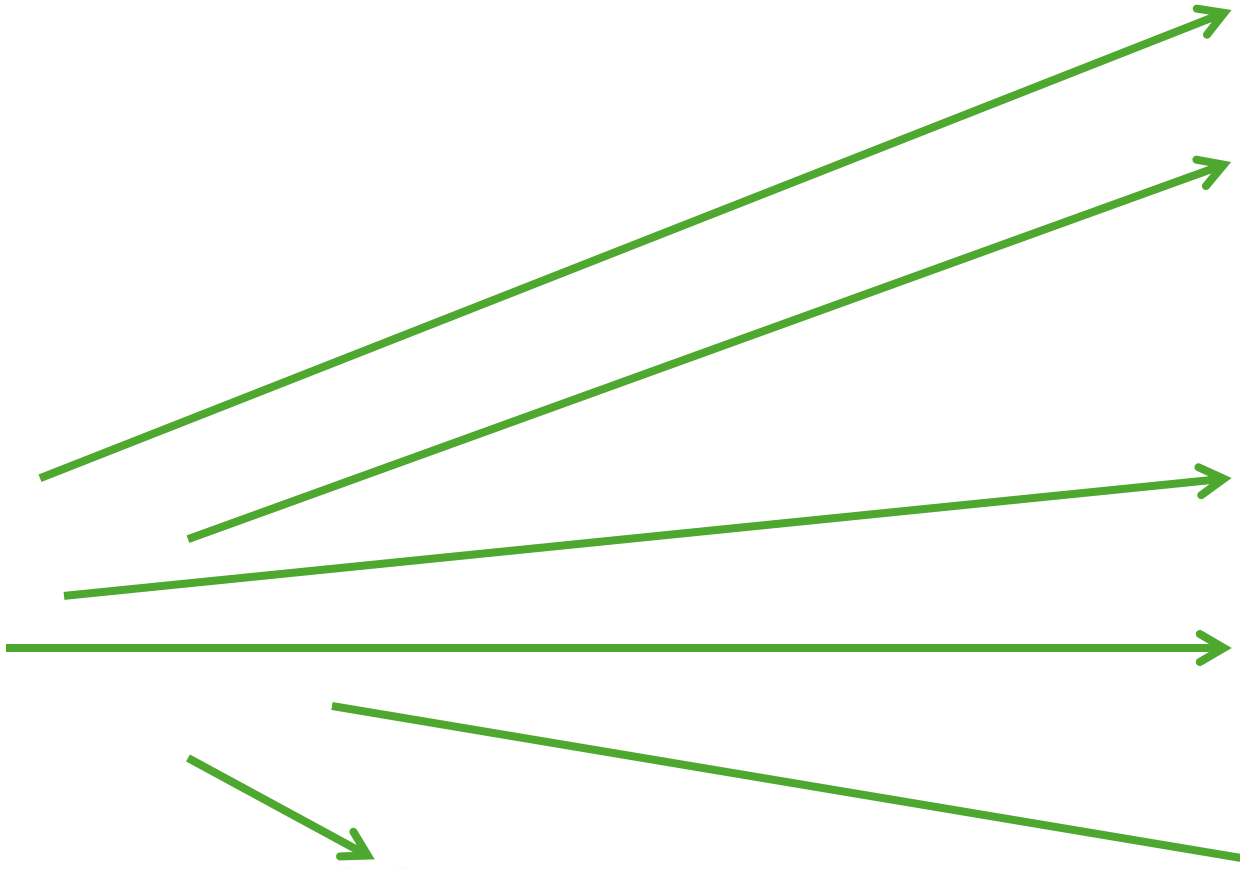
Uvodno okno OpenLCA



Uvodno okno OpenLCA




New database
New database
Create a new database
Database name
Ime_podatkovne_baze
Database type
Local
Remote
Database content
Empty database
Units and flow properties
Complete reference data
Finish
Cancel
Vpišite ime nove podatkovne baze in kliknite Finish.
Lokalne ali oddaljene baze podatkov je mogoče ustvariti
Različne vsebine na voljo



Projekti:
Primerjava proizvodnih sistemov

Proizvodni sistemi:
procesna omrežja
(potrebna za izračun rezultatov
inventarizacije in ocena vplivov)

Procesi:
Proizvodnja ali
modifikacija materialov / produktov

Tokovi:
Tokovi produktov in materialov

Osnovni podatki
Lastnosti toka (dolžina, masa itd.)
Skupine enot
Valute
Akterji (osebe, ki so posredovali podatke ali spremenile modele)
Viri (uporabljena literatura)
Lokacije

Indikatorji in parametri:
Metode ocene vplivov
Socialni kazalci
Globalni parametri
Sistem kakovosti podatkov

OpenLCA Nexus

https://nexus.openlca.org/

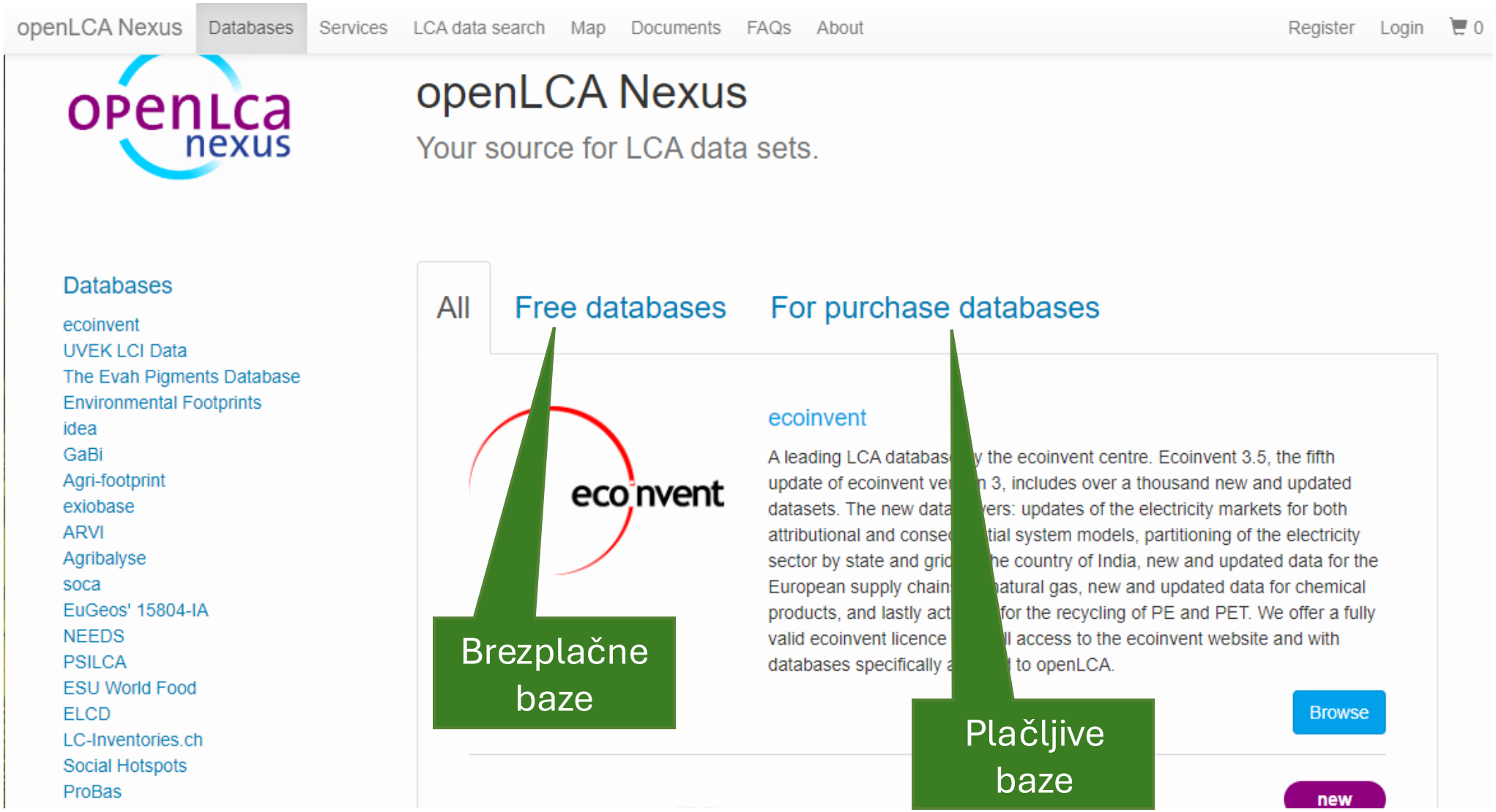
Ključni vir za zbirke podatkov LCA

OpenLCA ne vključuje podatkov o procesnih tokovih, proizvodnem sistemu, transportnih načinih ipd.

Možen neposreden nakup oz. prenos podatkov za uporabo v OpenLCA

OpenLCA Nexus

https://nexus.openlca.org/



OpenLCA Nexus

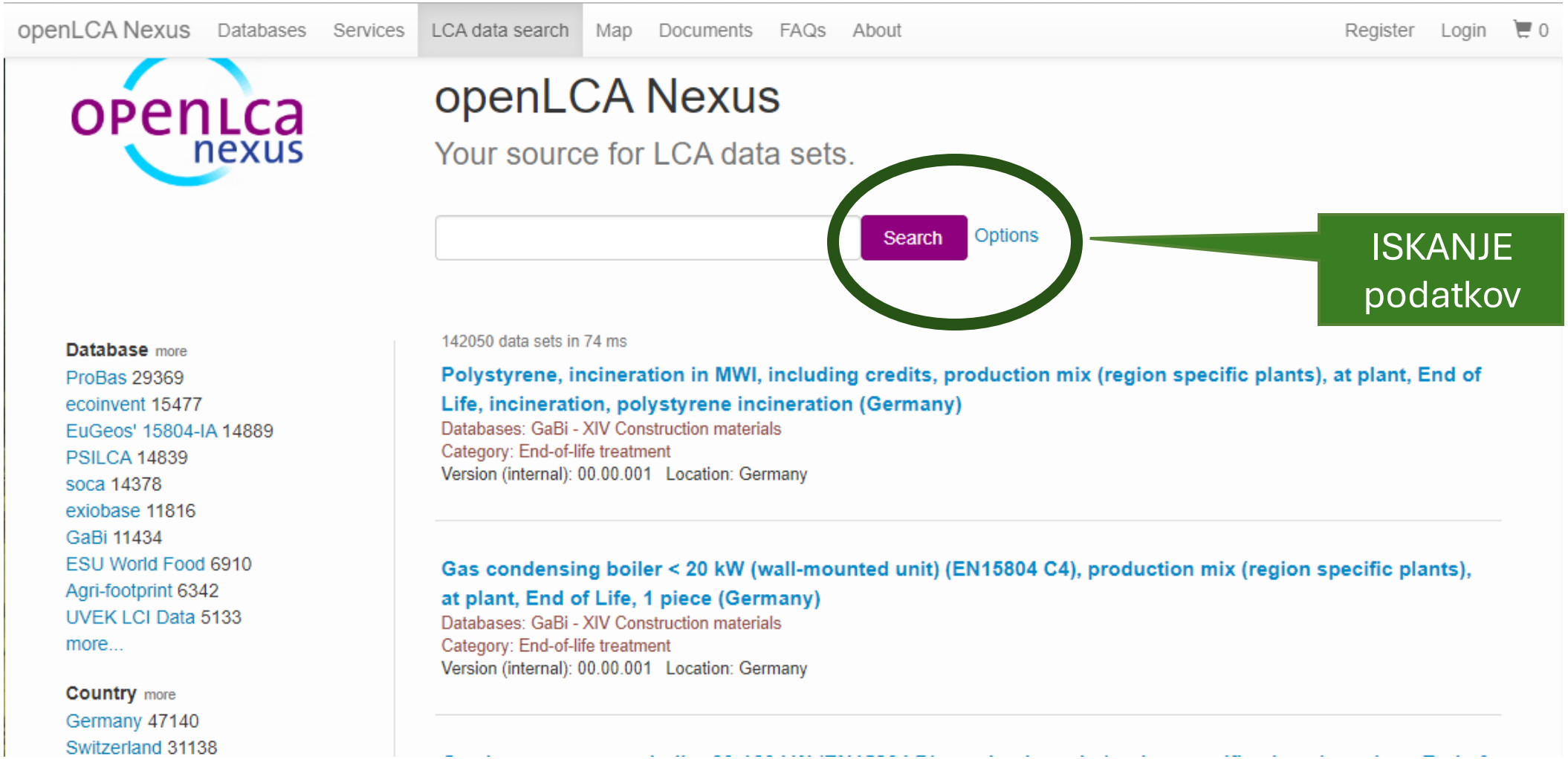
Skupno > 130.000 naborov podatkov

thinkstep

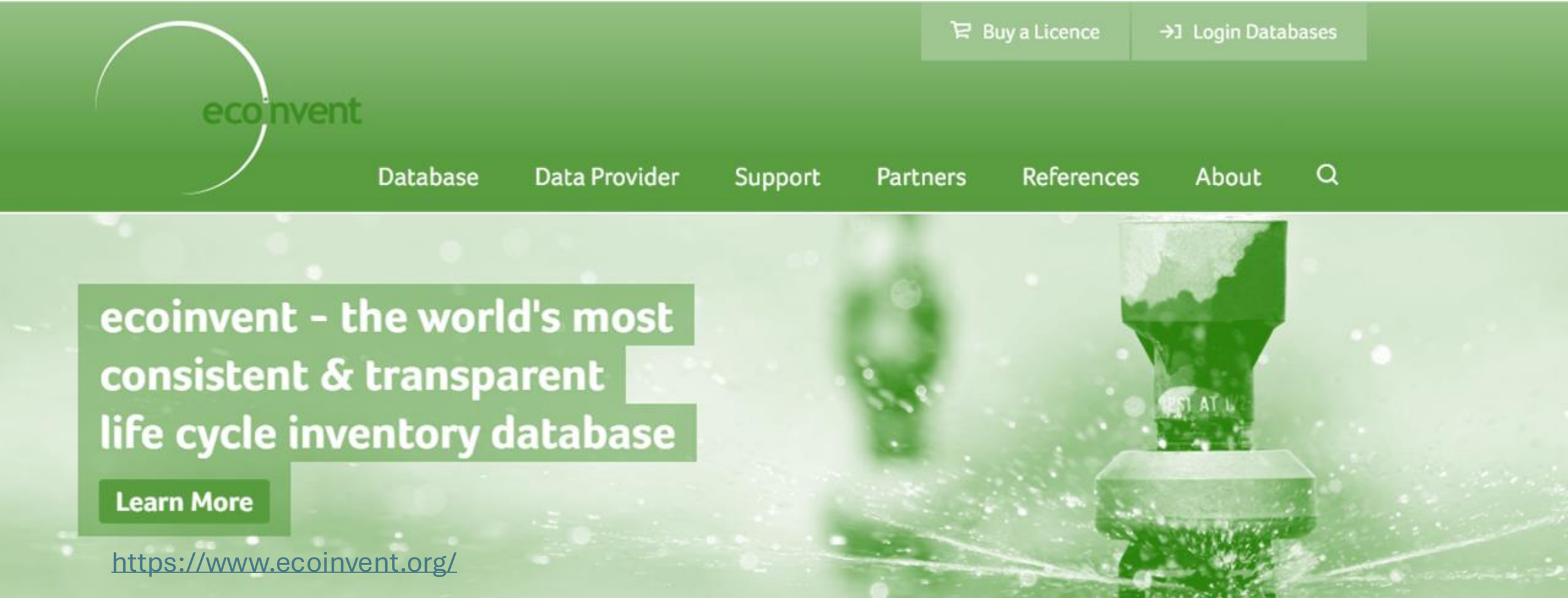
www.LC-Inventories.ch

BIOENERGIEDAT

OpenLCA Nexus



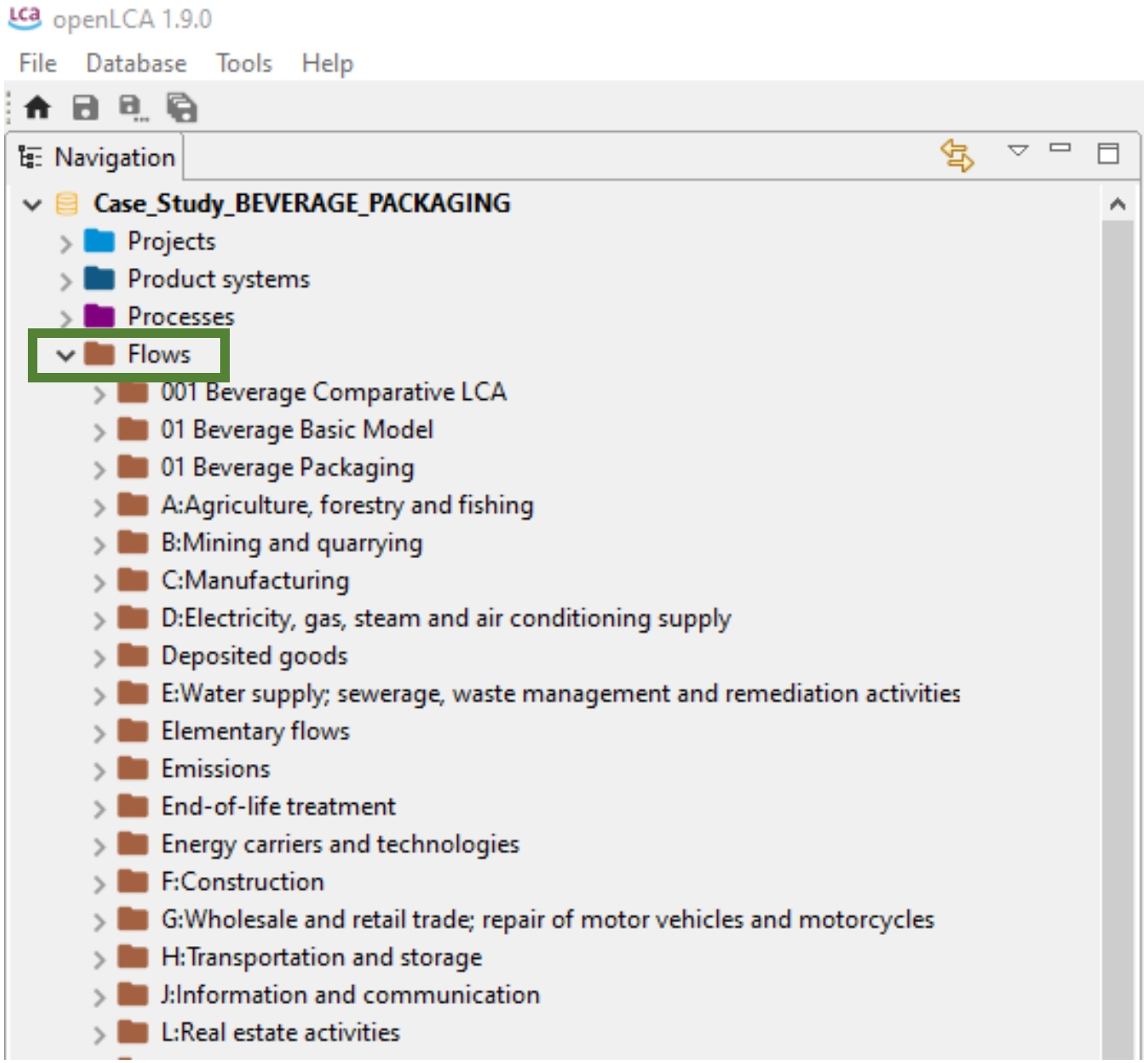
Ecoinvent 3.2

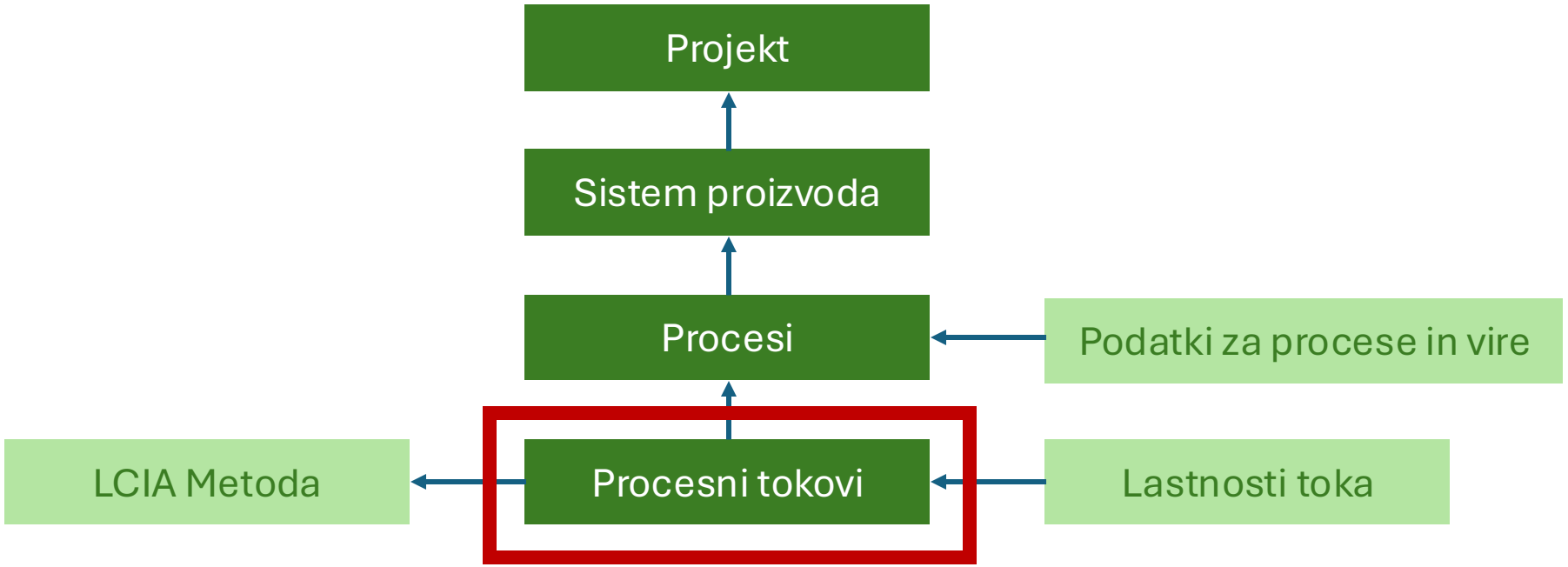


https://www.ecoinvent.org/

Ustvarjanje tokov

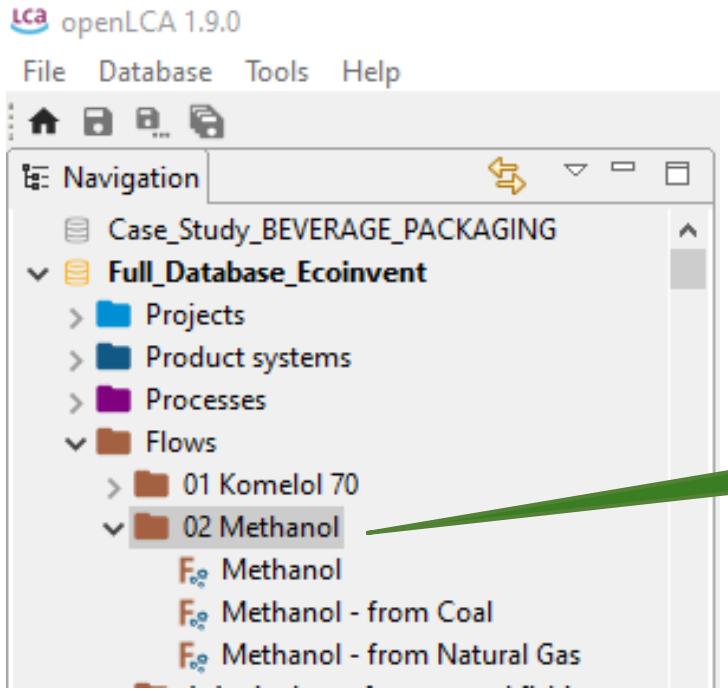
MODELIRANJE TOKOV ZA PROIZVODNI SISTEM





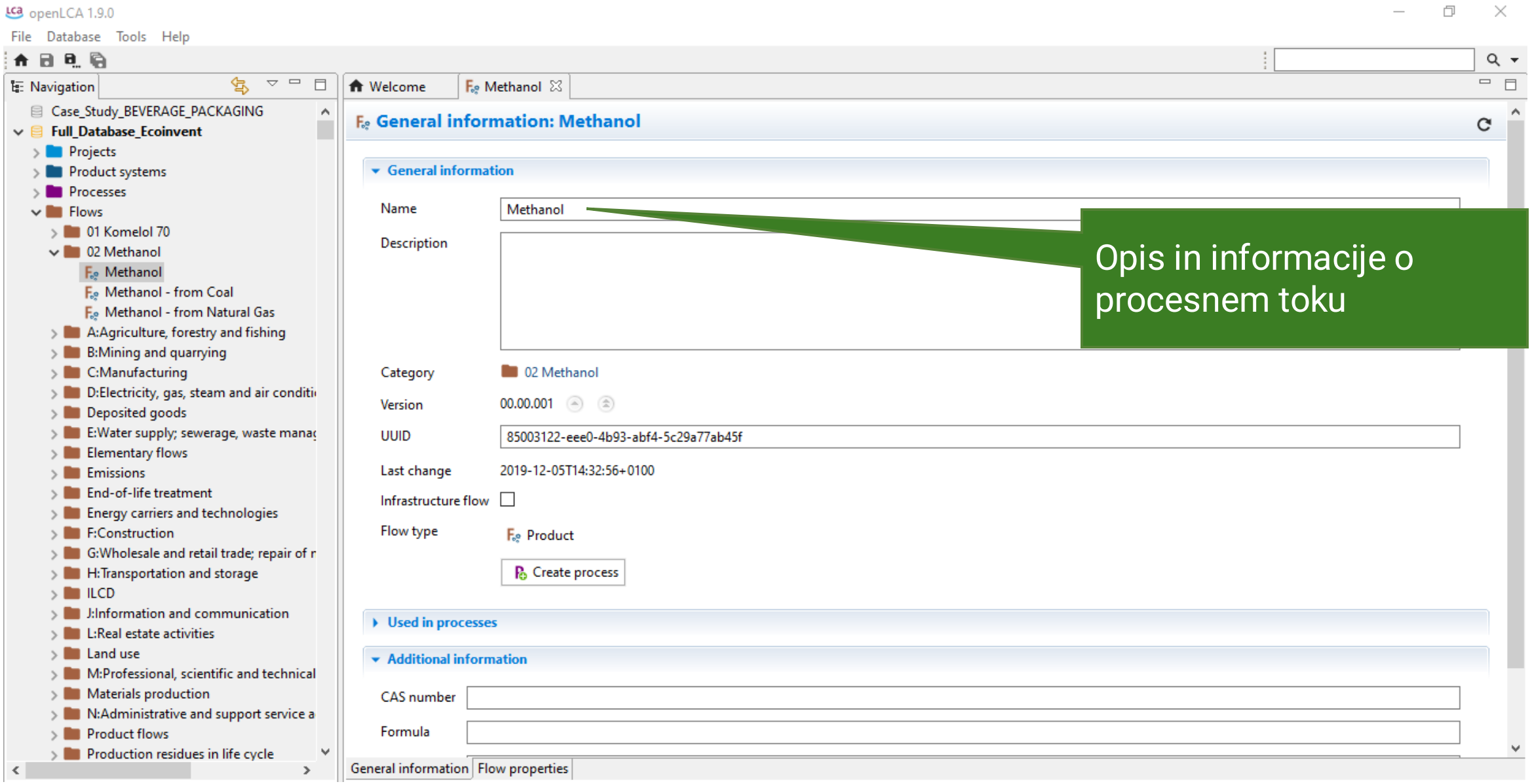
Smer puščice ponazarja smer toka informacij

Tokovi: ustvarjanje tokov



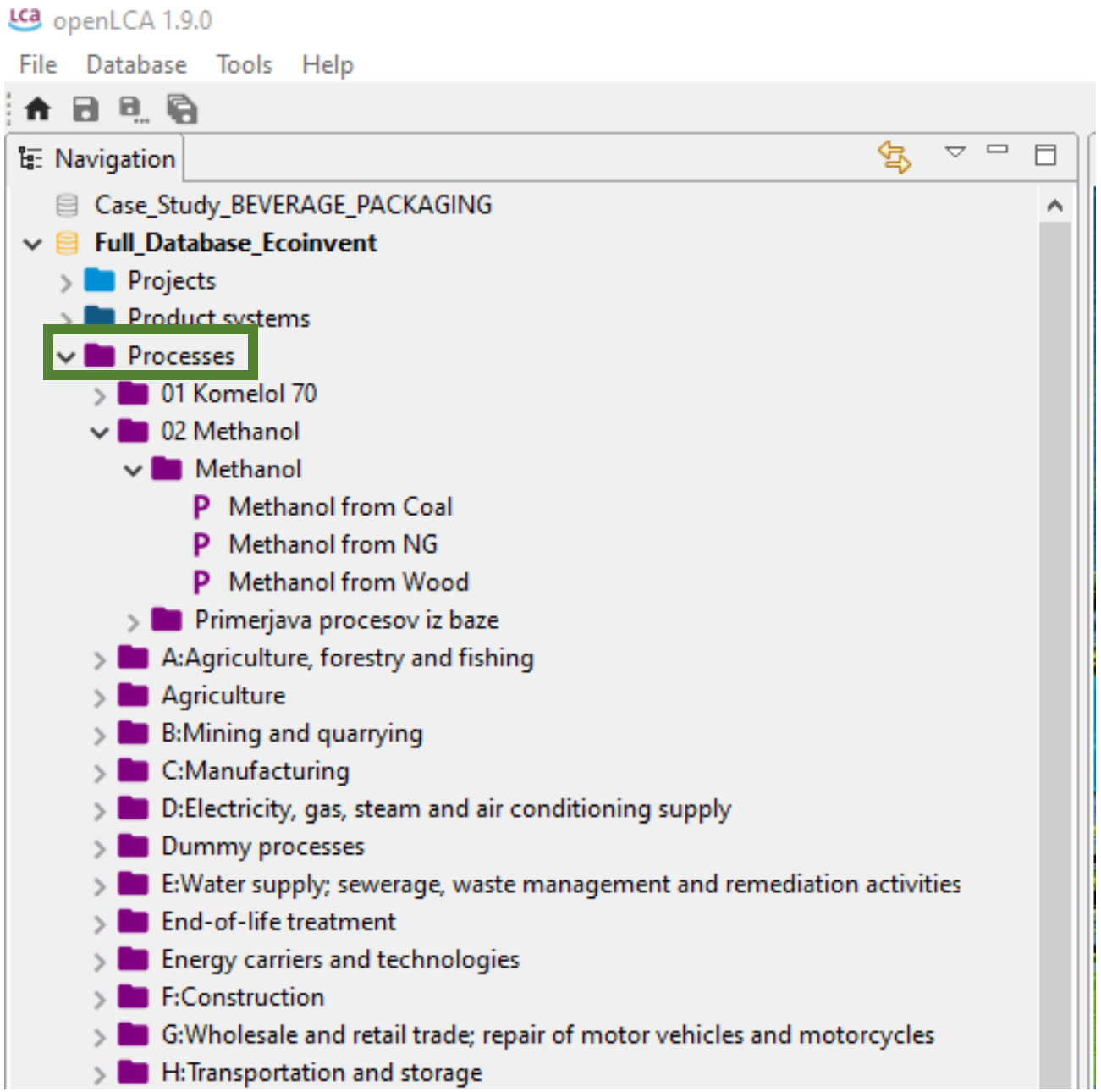
Ustvarjanje novega procesnega toka

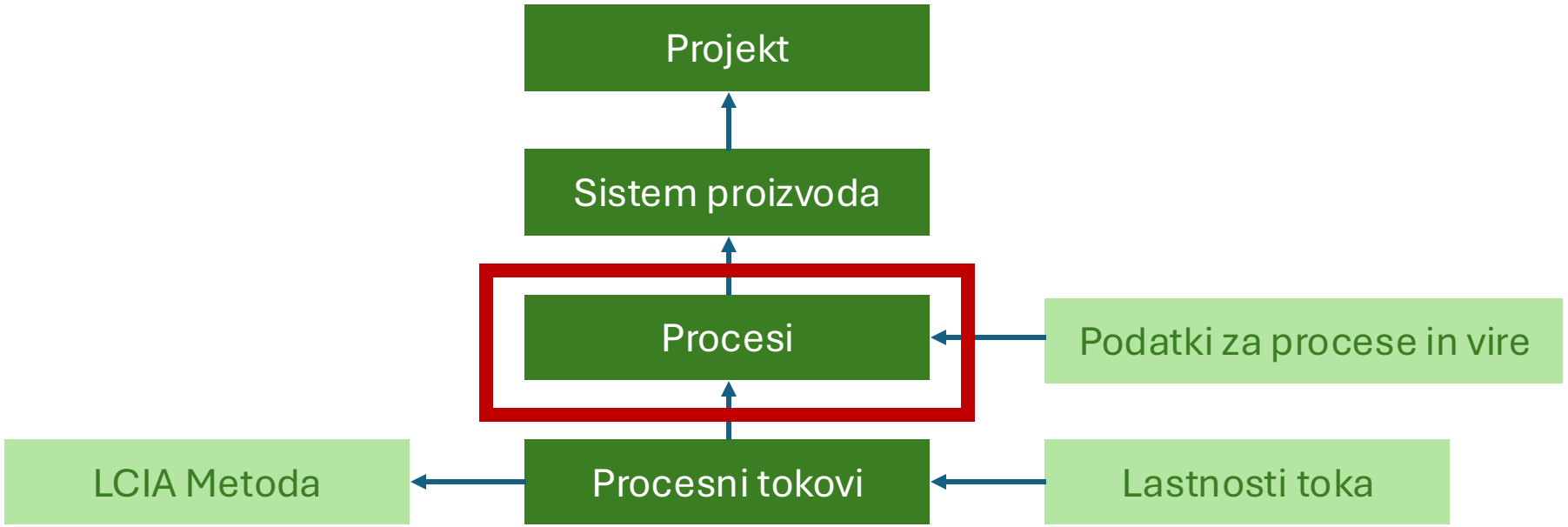
Tokovi: ustvarjanje tokov



Ustvarjanje procesov

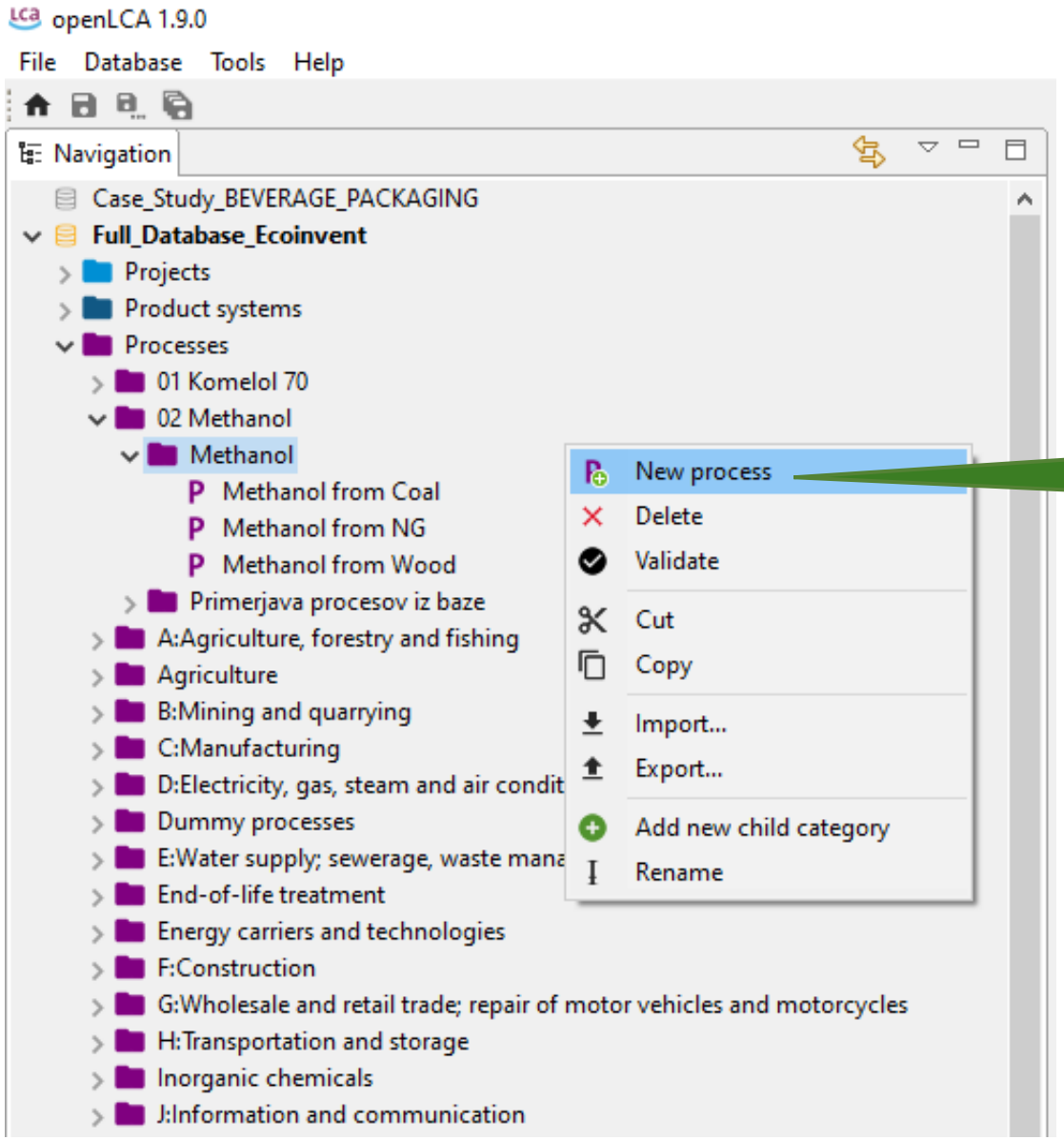
MODELIRANJE PROCESOV
ZA SISTEM PROIZVODNJE
METANOLA





Smer puščice ponazarja smer toka informacij

Procesi: ustvarjanje novega procesa

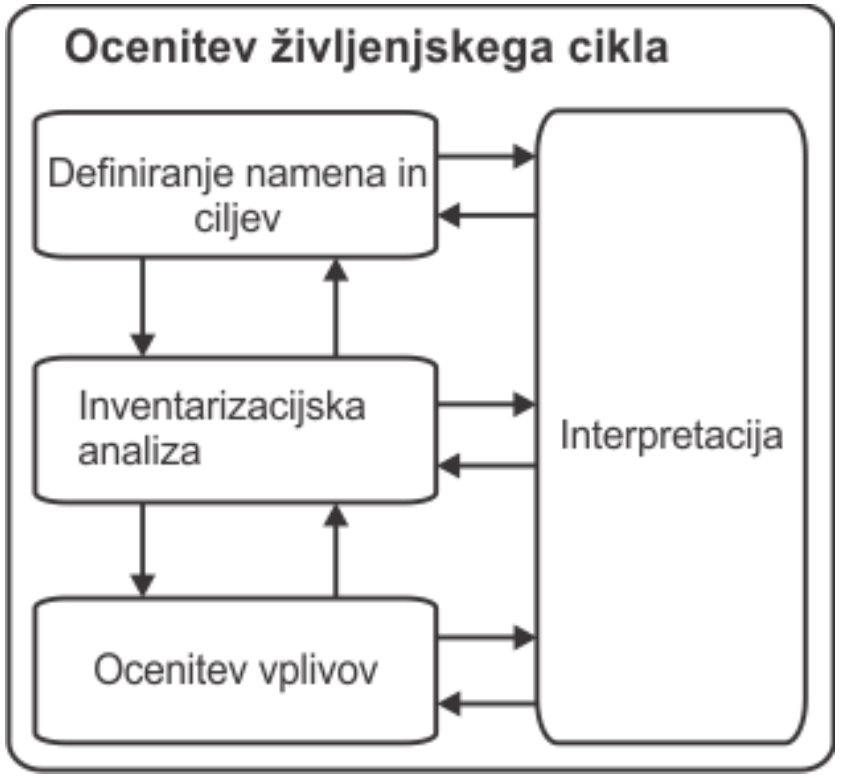


Ustvarjanje novega procesa

Podatki za inventarizacijo

Inventarizacija =

popis življenjskega cikla tj. količinsko porabo virov (energije in materialov) in okoljskih emisij, povezani s specifičnim življenjskim ciklom proizvoda.



ISO 14040:2006

Procesi: ustvarjanje procesov

Ustvarjanje procesov glede na vtoke v skladu s tabelo:

1 kg of methanol from Natural Gas | methanol production (Ecoinvent 3.2)

Procesni tok	Količina	Enota	Provider (ponudnik)
heat, district or industrial, natural gas | market group for heat, district or industrial, natural gas - GLO	6.930000	MJ	market group for heat, district or industrial, natural gas | heat, district or industrial, natural gas | APOS, U - GLO
water, deionised, from tap water, at user | market for water, deionised, from tap water, at user - GLO	0.850000	kg	market for water, deionised, from tap water, at user | water, deionised, from tap water, at user | APOS, U - GLO
natural gas, high pressure | market group for natural gas, high pressure - GLO	0.651795	m3	market group for natural gas, high pressure | natural gas, high pressure | APOS, U - GLO
electricity, medium voltage | market group for electricity, medium voltage – GLO	0.074000	kWh	market group for electricity, medium voltage | electricity, medium voltage | APOS, U - GLO
Water, cooling, unspecified natural origin	0.008160	m3	
Aluminijev oksid | market for aluminium oxide – GLO	0.000240	kg	market for aluminium oxide | aluminium oxide | APOS, U - GLO
Bakrov oksid | market for copper oxide – GLO	0.000090	kg	market for copper oxide | copper oxide | APOS, U - GLO
cink | market for zinc – GLO	0.000030	kg	market for zinc | zinc | APOS, U - GLO
nikelj, 99.5% | market for nickel, 99.5% - GLO	0.000020	kg	market for nickel, 99.5% | nickel, 99.5% | APOS, U - GLO
molibden | market for molybdenum - GLO	0.000010	kg	market for molybdenum | molybdenum | APOS, U - GLO

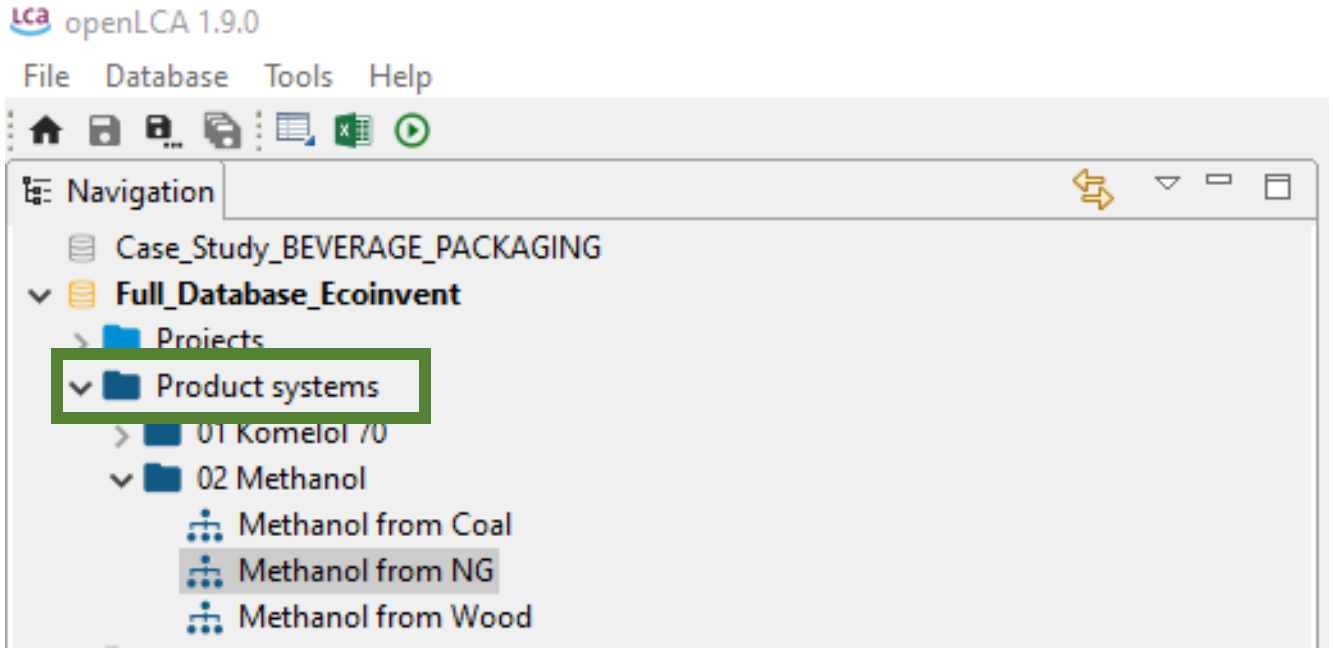
Procesi: ustvarjanje procesov

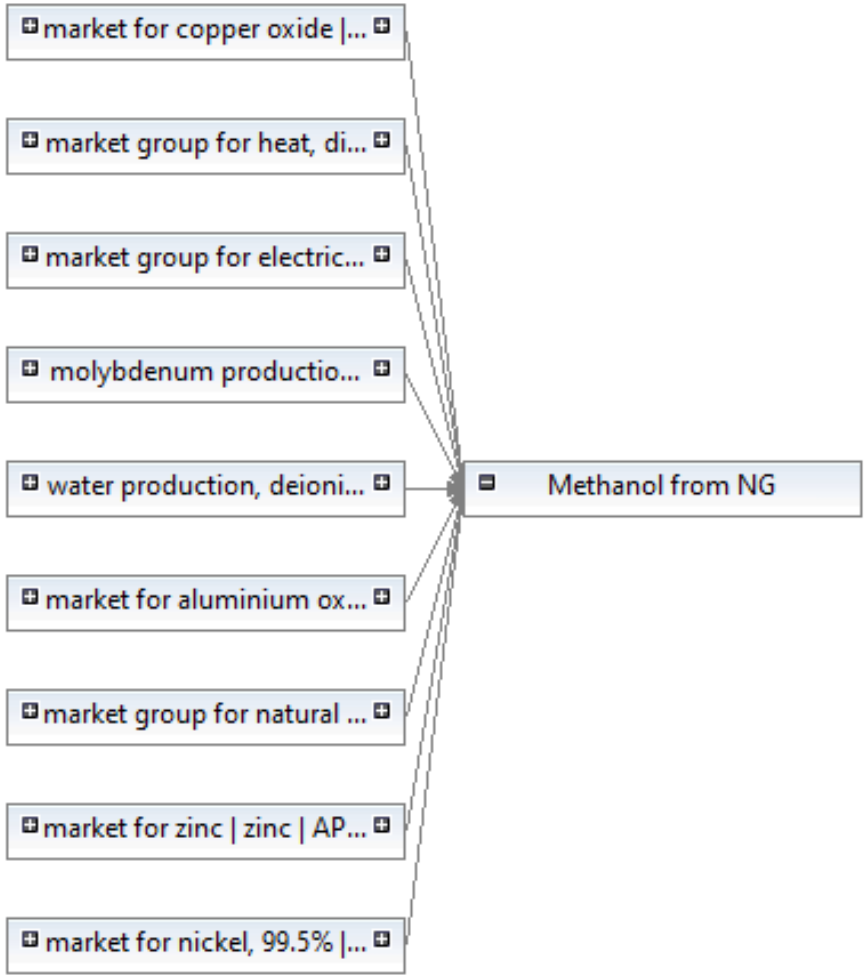
Ustvarjanje procesov glede na vtoke v skladu s tabelo:

1 kg methanol, from biomass | methanol production, from synthetic gas (Ecoinvent 3.2)

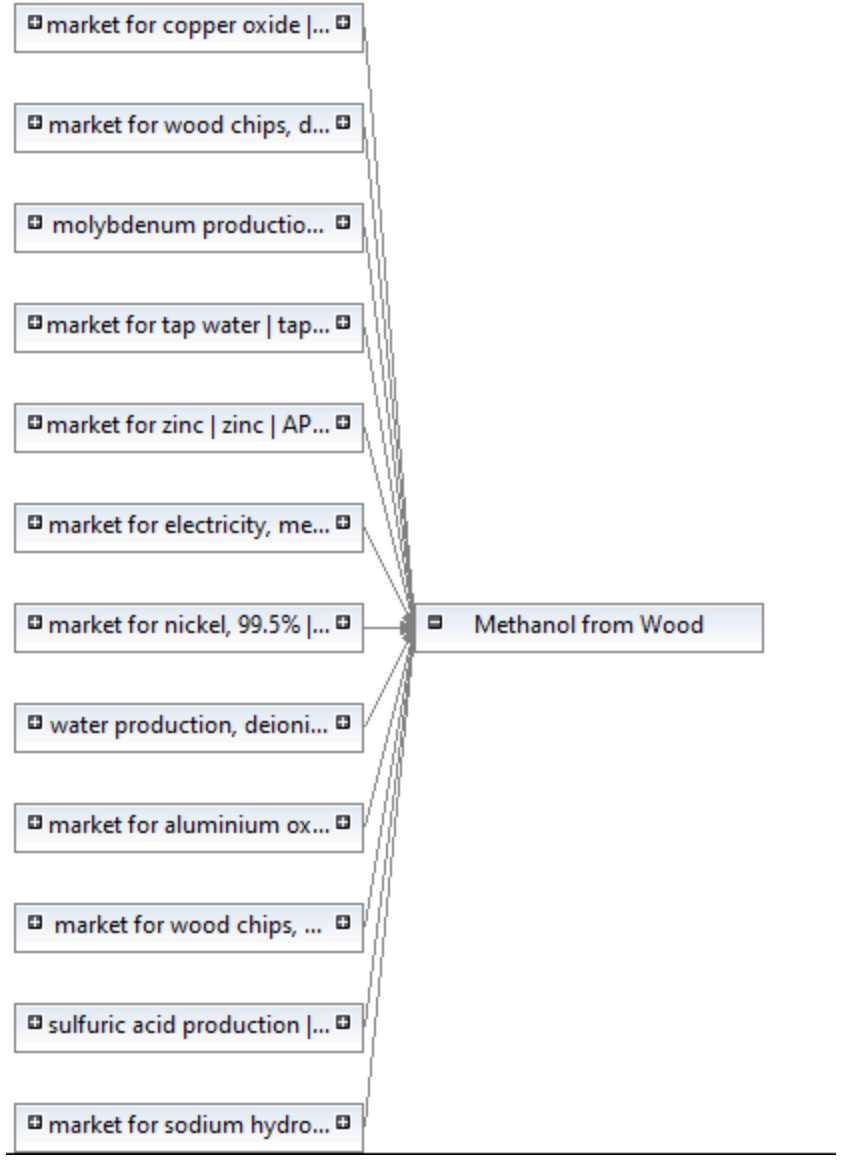
Procesni tok	Količina	Enota	Provider (ponudnik)
wood chips, wet, measured as dry mass | market for wood chips, wet, measured as dry mass - CH	5.290897	kg	market for wood chips, wet, measured as dry mass | wood chips, wet, measured as dry mass | APOS, U - CH
tap water | market for tap water - CH	10.268143	kg	market for tap water | tap water | APOS, U - CH
wood chips, dry, measured as dry mass | market for wood chips, dry, measured as dry mass - RER	1.461855	kg	market for wood chips, dry, measured as dry mass | wood chips, dry, measured as dry mass | APOS, U - RER
water, deionised, from tap water, at user | market for water, deionised, from tap water, at user - GLO	0.849971	kg	market for water, deionised, from tap water, at user | water, deionised, from tap water, at user | APOS, U - GLO
electricity, medium voltage | market for electricity, medium voltage - CH	0.668501	kWh	market for electricity, medium voltage | electricity, medium voltage | APOS, U - CH
sulfuric acid | market for sulfuric acid - GLO	0.047518	kg	market for sulfuric acid | sulfuric acid | APOS, U - GLO
Natrijev hidroksid, without water, in 50% solution state | market for sodium hydroxide, without water, in 50% solution state - GLO	0.011960	kg	market for sodium hydroxide, without water, in 50% solution state | sodium hydroxide, without water, in 50% solution state | APOS, U - GLO
Aluminijev oksid | market for aluminium oxide - GLO	0.000240	kg	market for aluminium oxide | aluminium oxide | APOS, U - GLO
Bakrov oksid | market for copper oxide – GLO	0.000090	kg	market for copper oxide | copper oxide | APOS, U - GLO
cink | market for zinc – GLO	0.000030	kg	market for zinc | zinc | APOS, U - GLO
nikelj, 99.5% | market for nickel, 99.5% - GLO	0.000020	kg	market for nickel, 99.5% | nickel, 99.5% | APOS, U - GLO
molibden | market for molybdenum - GLO	0.000010	kg	market for molybdenum | molybdenum | APOS, U - GLO

Sistem proizvoda
analiza in rezultati





Metanol iz zemeljskega plina



Metanol iz lesne biomase

Ocena okoljskih vplivov življenjskega cikla

pretvorba rezultatov inventarizacije (popisa) v različne vrste okoljskih vplivov.

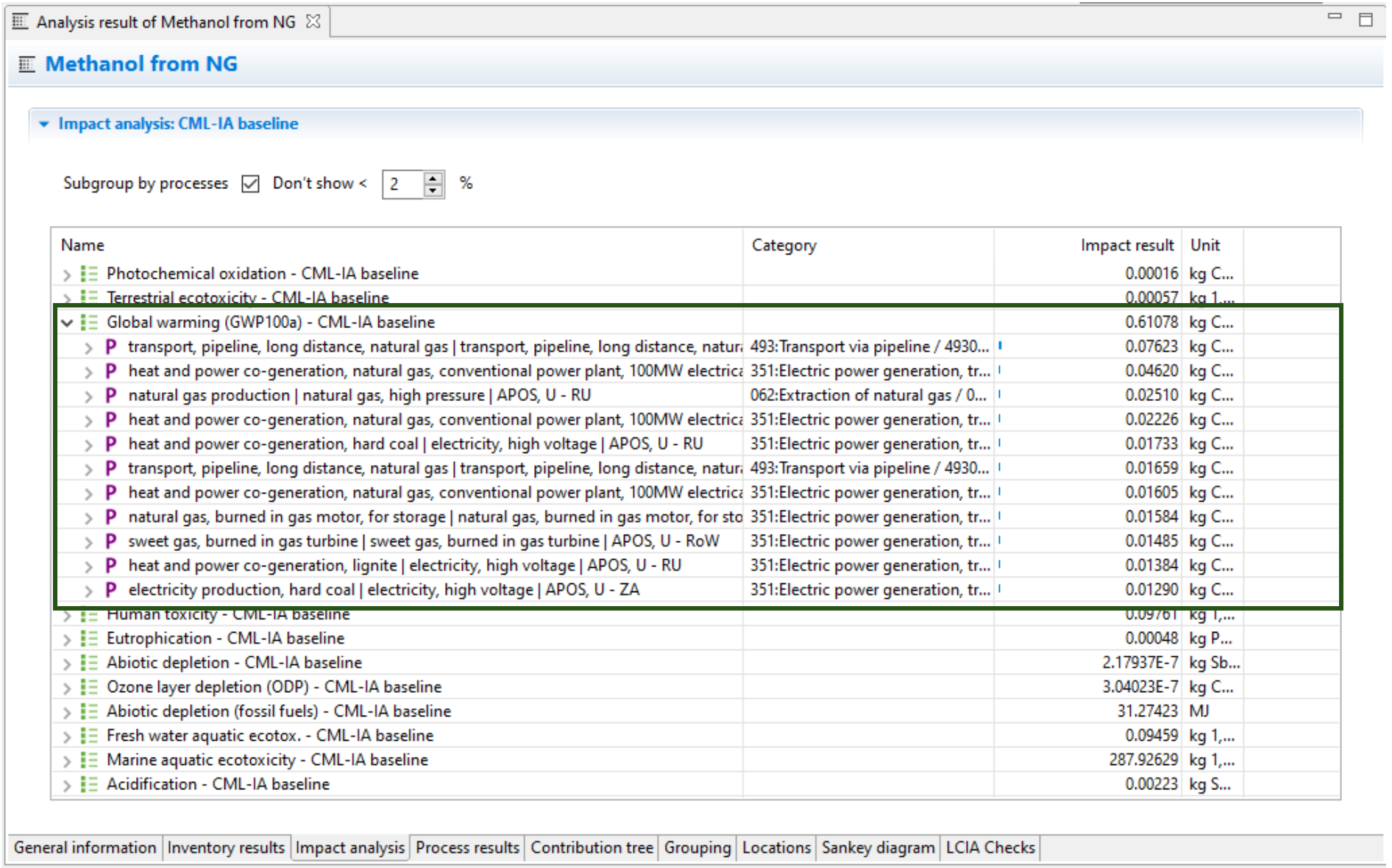
Obravnavane kategorije vplivov:

- **zakisljevanje** [kg SO2 ekv.]
- **evtrofikacija** [kg PO_4^{3-} ekv.]
- **podnebne spremembe** [kg CO_2 ekv.]
- **človeško zastrupljanje** [kg 1,4-DB ekv.]
- **tanjšanje ozonske plasti** [kg CFC-11 ekv.]

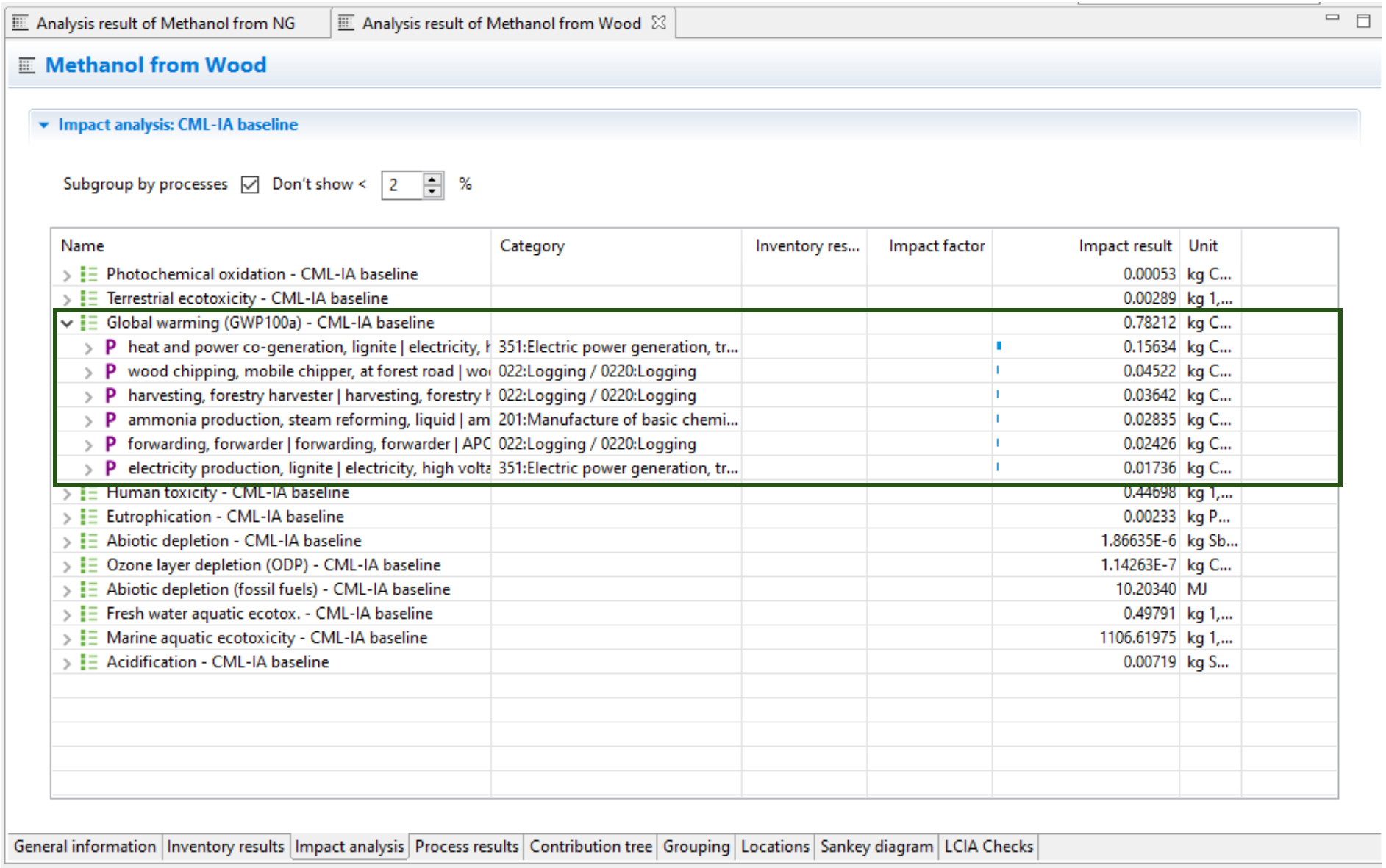
Metoda ocenjevanja: CML 2001 (Institute of the Faculty of Science of Leiden University)

(Metode LCIA na voljo v razdelku http://www.openlca.org/download_page#LCIA_methods).

Kazalci, ki se običajno uporabljajo v analizi LCA

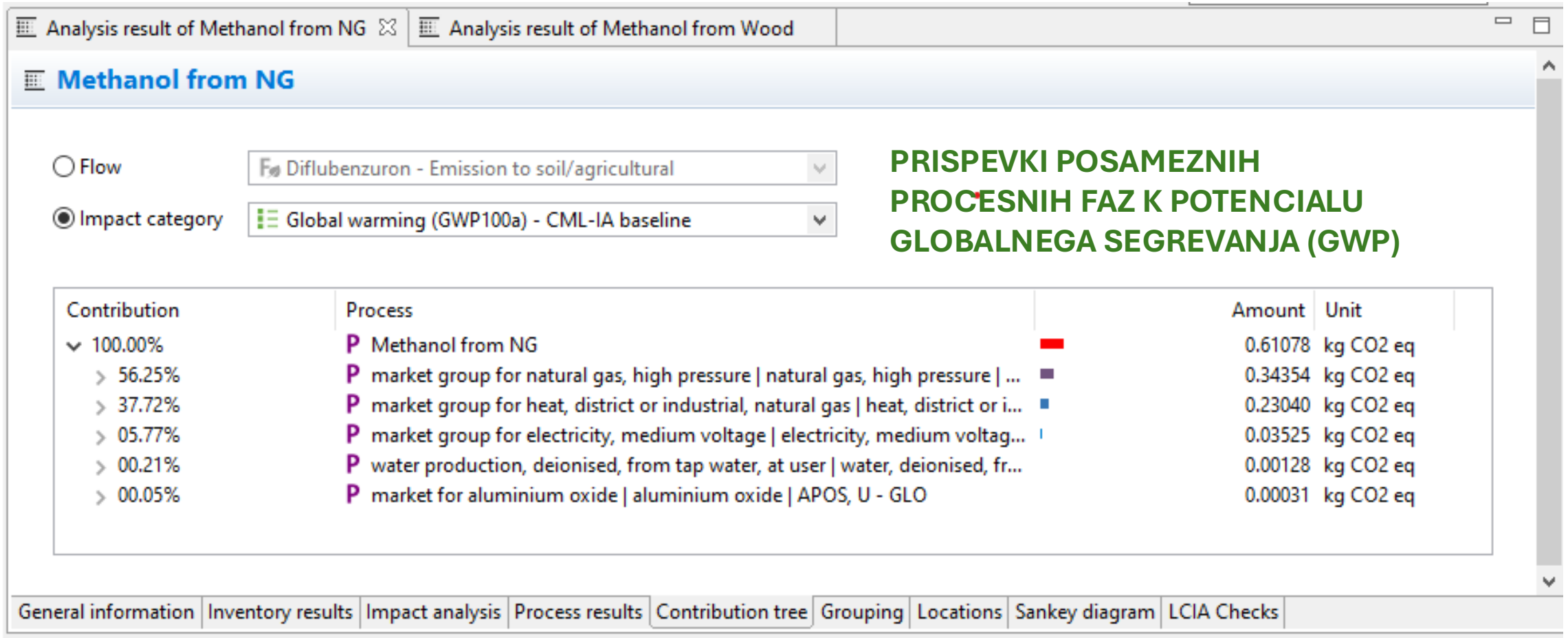


METANOL IZ ZEMELJSKEGA PLINA

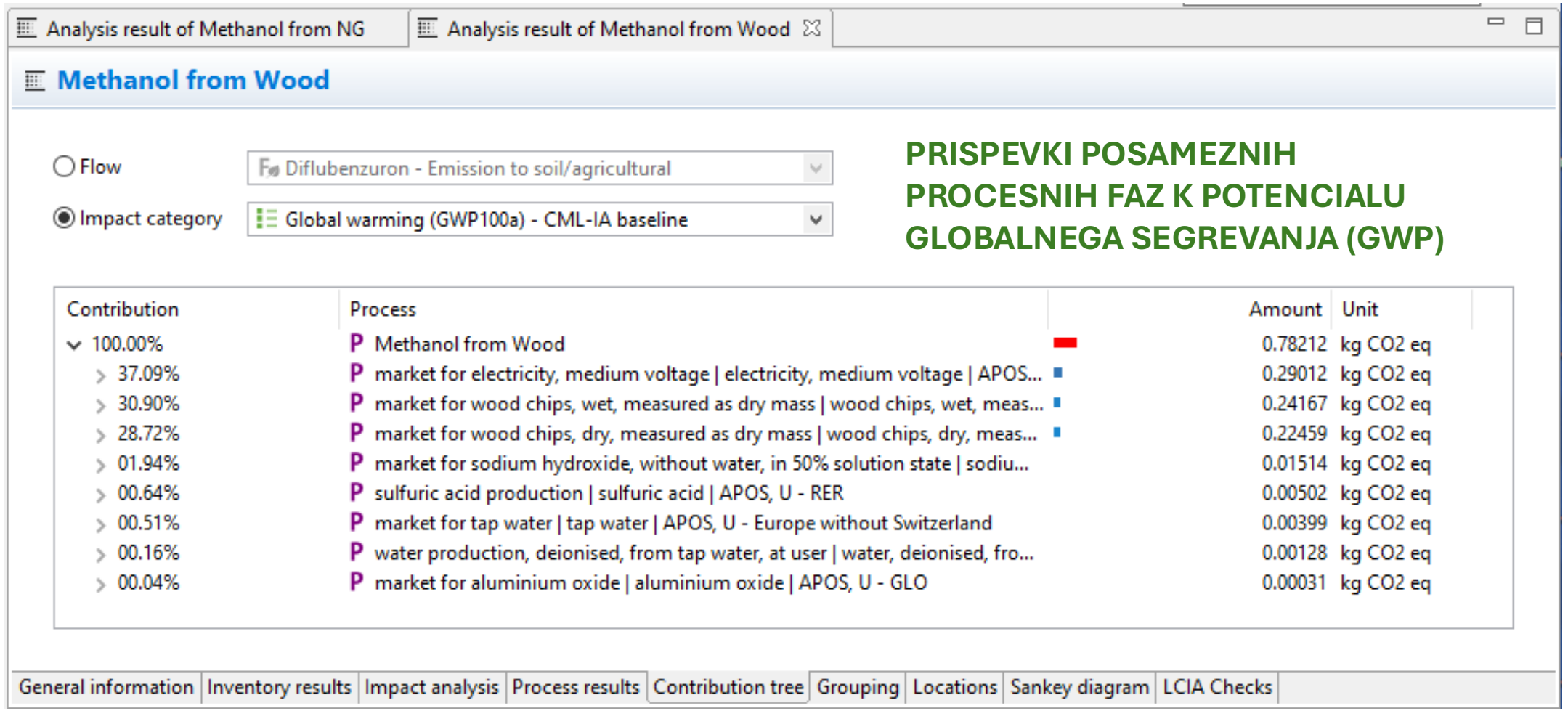


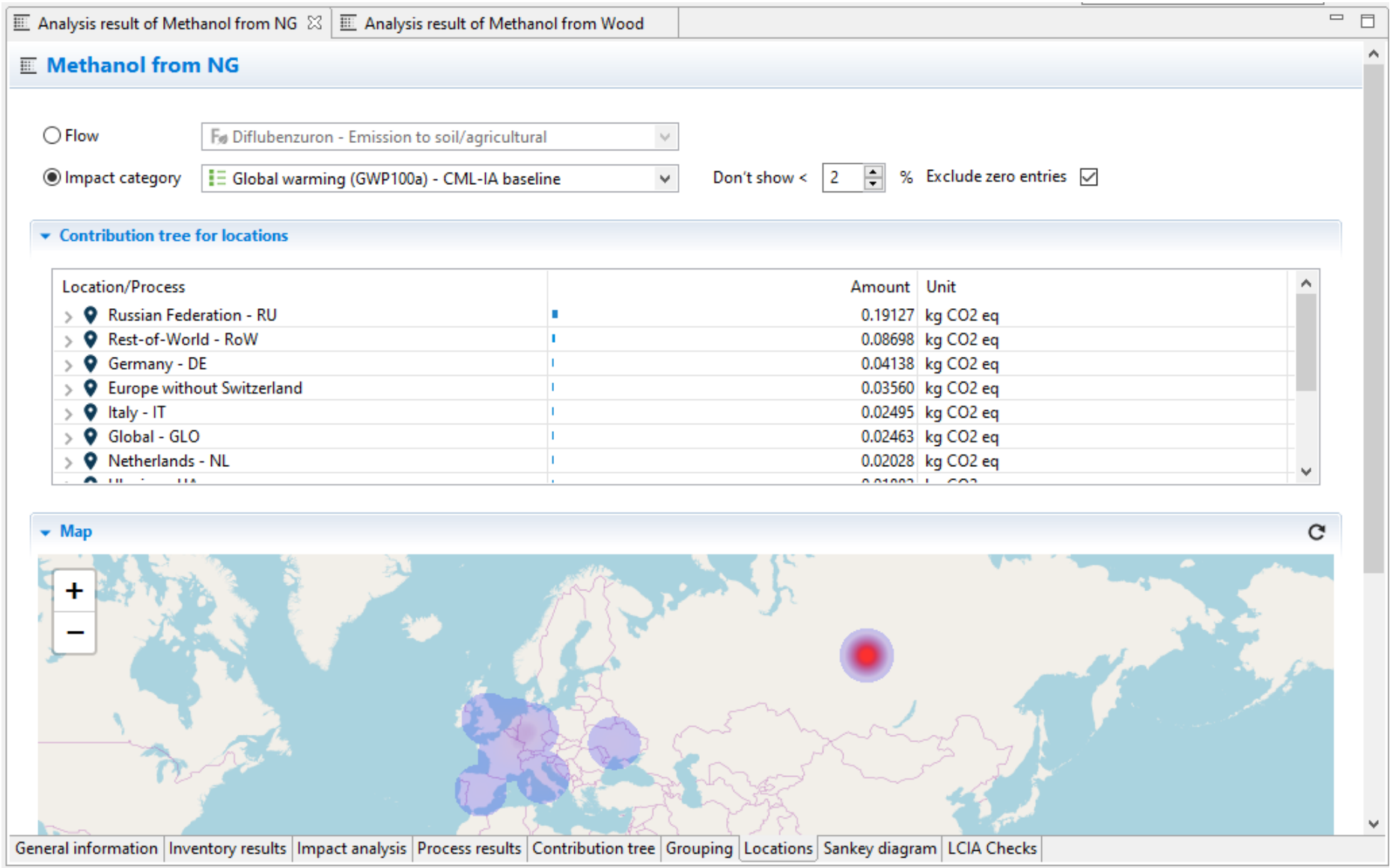
METANOL IZ LESNE BIOMASE

METANOL IZ ZEMELJSKEGA PLINA



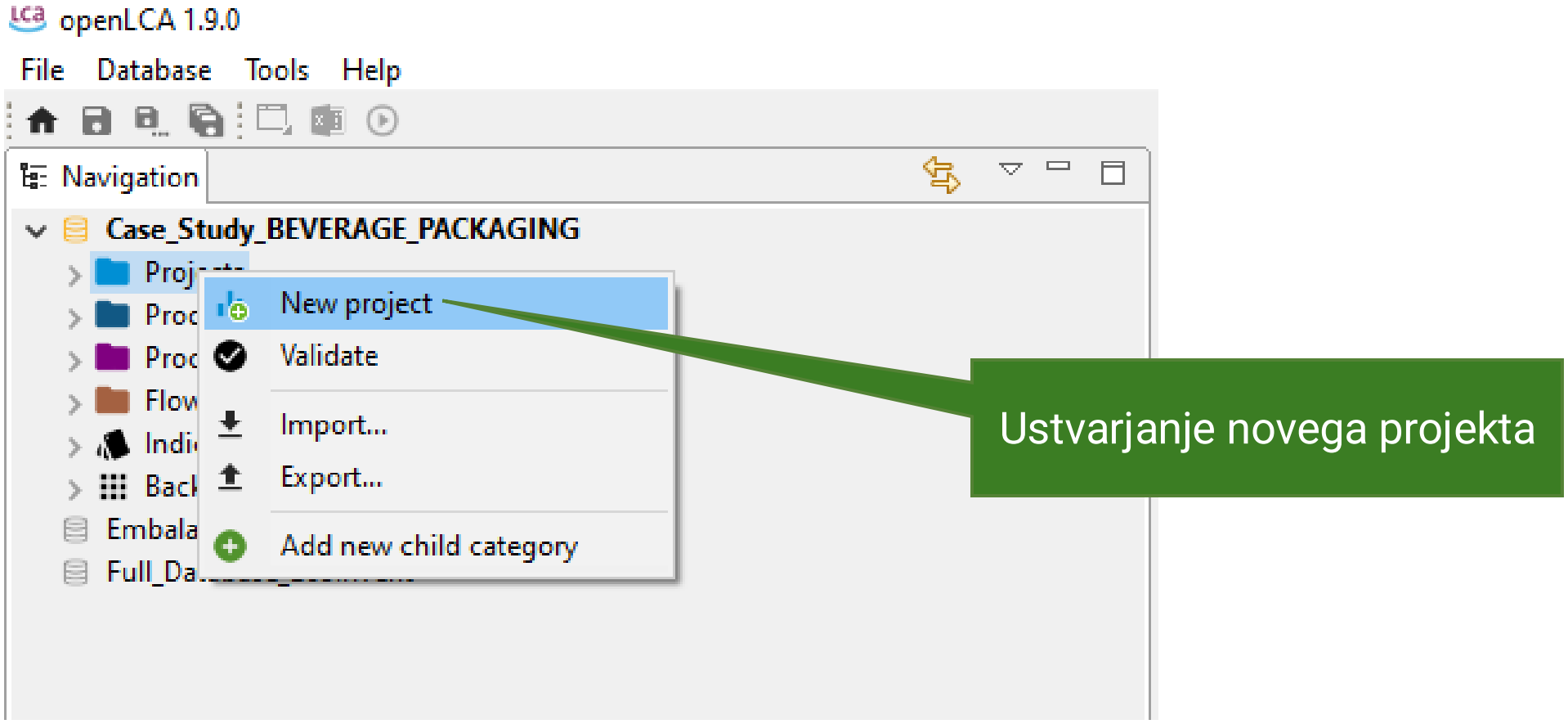
METANOL IZ LESNE BIOMASE

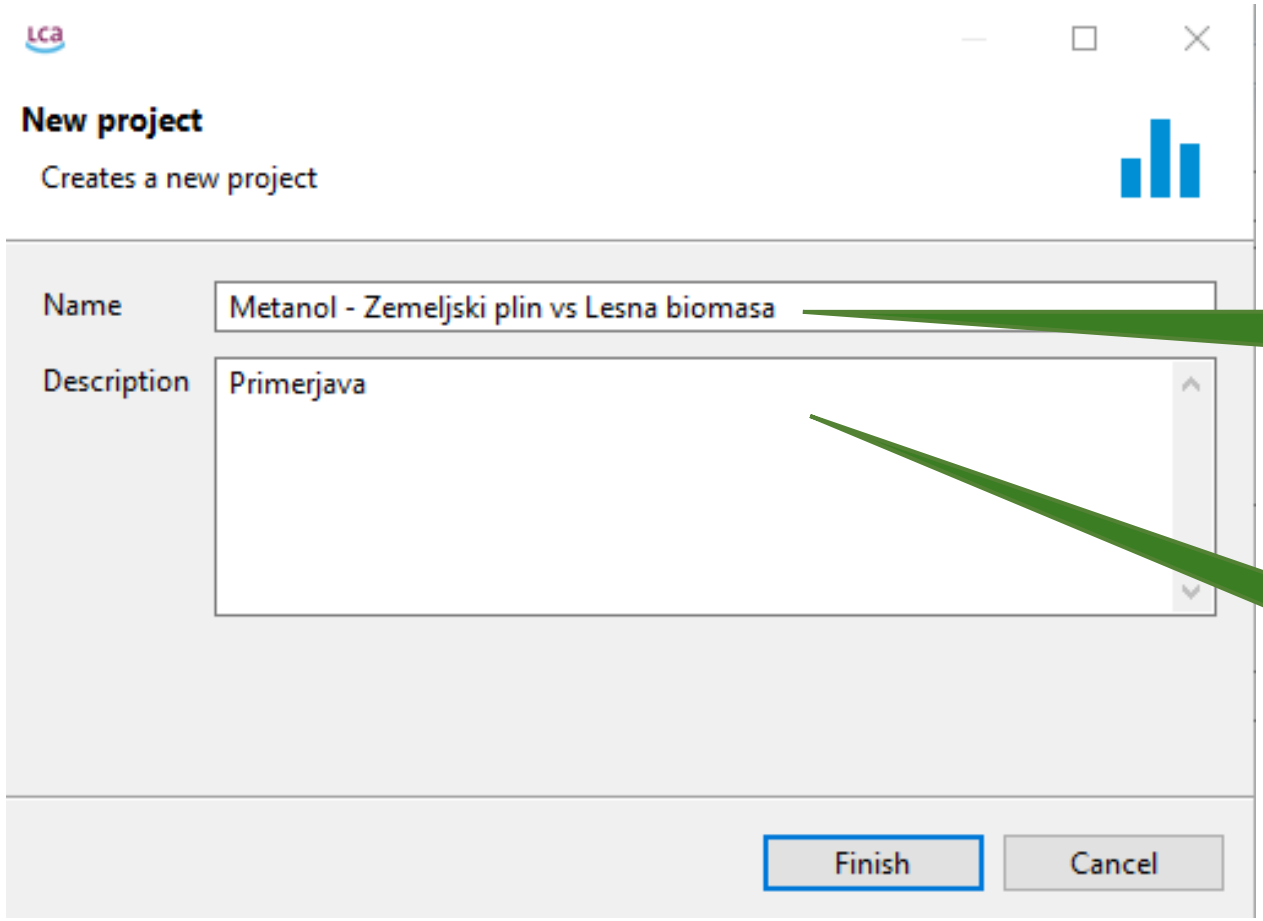




METANOL IZ ZEMELJSKEGA PLINA

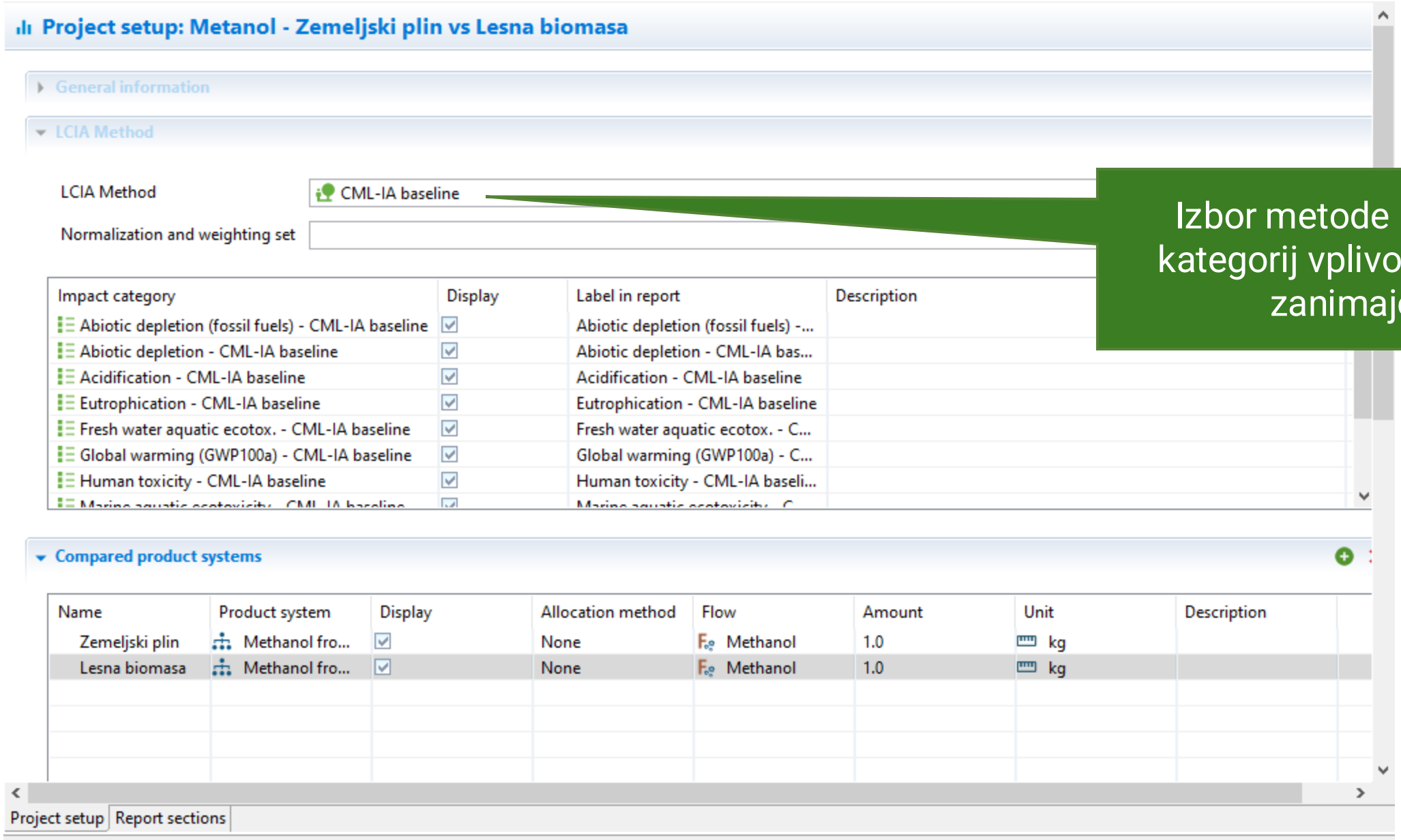
Ustvarjanje projekta
PRIMERJAVA METANOL
ZEMELJSKI PLIN – LESNA BIOMASA


openLCA 1.9.0
File
Database
Tools
Help
Navigation
Case_Study_BEVERAGE_PACKAGING
New project
Validate
Import...
Export...
Add new child category
Ustvarjanje novega projekta

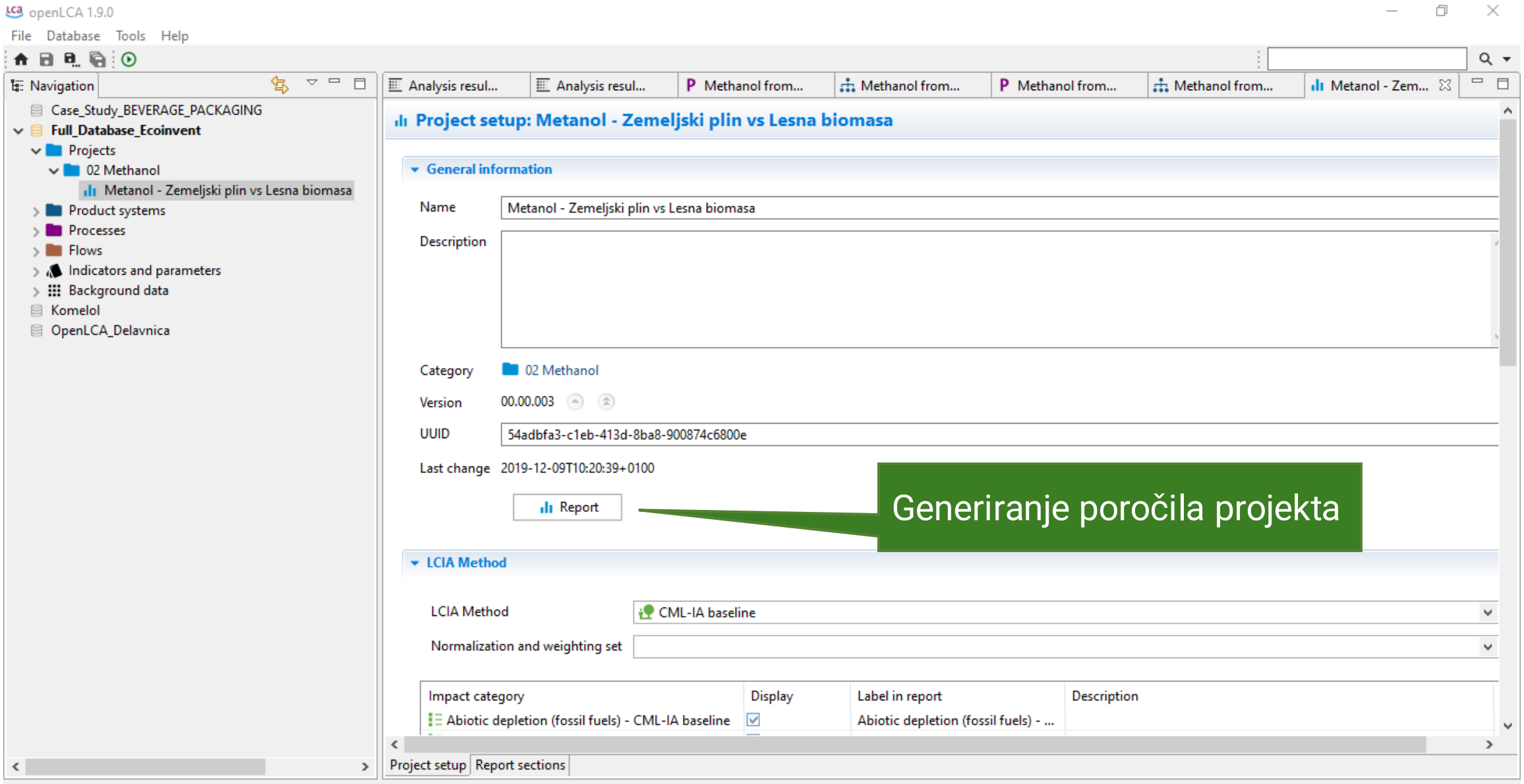


Poimenovanje projekta

Dodaten opis



Izbor metode LCIA in kategorij vplivov, ki nas zanimajo


openLCA 1.9.0
File Database Tools Help
Navigation
Case_Study_BEVERAGE_PACKAGING
Full_Database_Ecoinvent
Projects
02 Methanol
Metanol - Zemeljski plin vs Lesna biomasa
Product systems
Processes
Flows
Indicators and parameters
Background data
Komelol
OpenLCA_Delavnica
Analysis resul...
Analysis resul...
Methanol from...
Methanol from...
Methanol from...
Methanol from...
Metanol - Zem...
Project setup: Metanol - Zemeljski plin vs Lesna biomasa
General information
Name
Metanol - Zemeljski plin vs Lesna biomasa
Description
Category
02 Methanol
Version
00.00.003
UUID
54adbfa3-c1eb-413d-8ba8-900874c6800e
Last change
2019-12-09T10:20:39+0100
Report
Generiranje poročila projekta
LCIA Method
LCIA Method
CML-IA baseline
Normalization and weighting set
Impact category
Display
Label in report
Description
Abiotic depletion (fossil fuels) - CML-IA baseline
Abiotic depletion (fossil fuels) - ...
Project setup
Report sections

Projekt: Rezultati

Metanol - Zemeljski plin vs Lesna biomasa | Report viewer

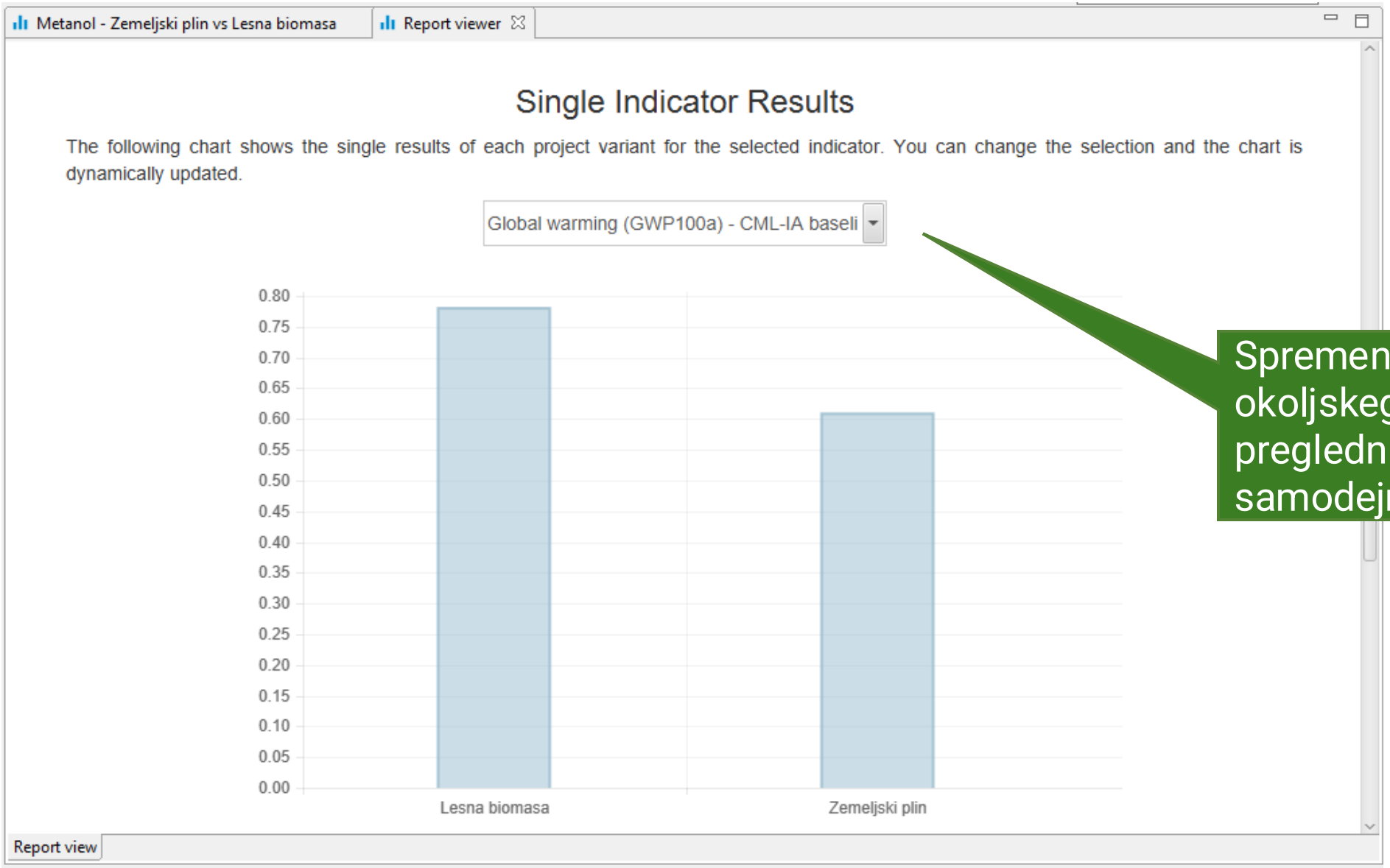
LCIA Results

This table shows the LCIA results of the project variants. Each selected LCIA category is displayed in the rows and the project variants in the columns. The unit is the unit of the LCIA category as defined in the LCIA method.

Impact category	Lesna biomasa	Zemeljski plin	Unit
Abiotic depletion - CML-IA baseline	1.86635e-6	2.17937e-7	kg Sb eq
Abiotic depletion (fossil fuels) - CML-IA baseline	1.02034e+1	3.12742e+1	MJ
Acidification - CML-IA baseline	7.19014e-3	2.23047e-3	kg SO2 eq
Eutrophication - CML-IA baseline	2.32781e-3	4.84583e-4	kg PO4--- eq
Fresh water aquatic ecotox. - CML-IA baseline	4.97915e-1	9.45897e-2	kg 1,4-DB eq
Global warming (GWP100a) - CML-IA baseline	7.82122e-1	6.10777e-1	kg CO2 eq
Human toxicity - CML-IA baseline	4.46975e-1	9.76099e-2	kg 1,4-DB eq
Marine aquatic ecotoxicity - CML-IA baseline	1.10662e+3	2.87926e+2	kg 1,4-DB eq
Ozone layer depletion (ODP) - CML-IA baseline	1.14263e-7	3.04023e-7	kg CFC-11 eq
Photochemical oxidation - CML-IA baseline	5.30163e-4	1.58186e-4	kg C2H4 eq
Terrestrial ecotoxicity - CML-IA baseline	2.89222e-3	5.71117e-4	kg 1,4-DB eq

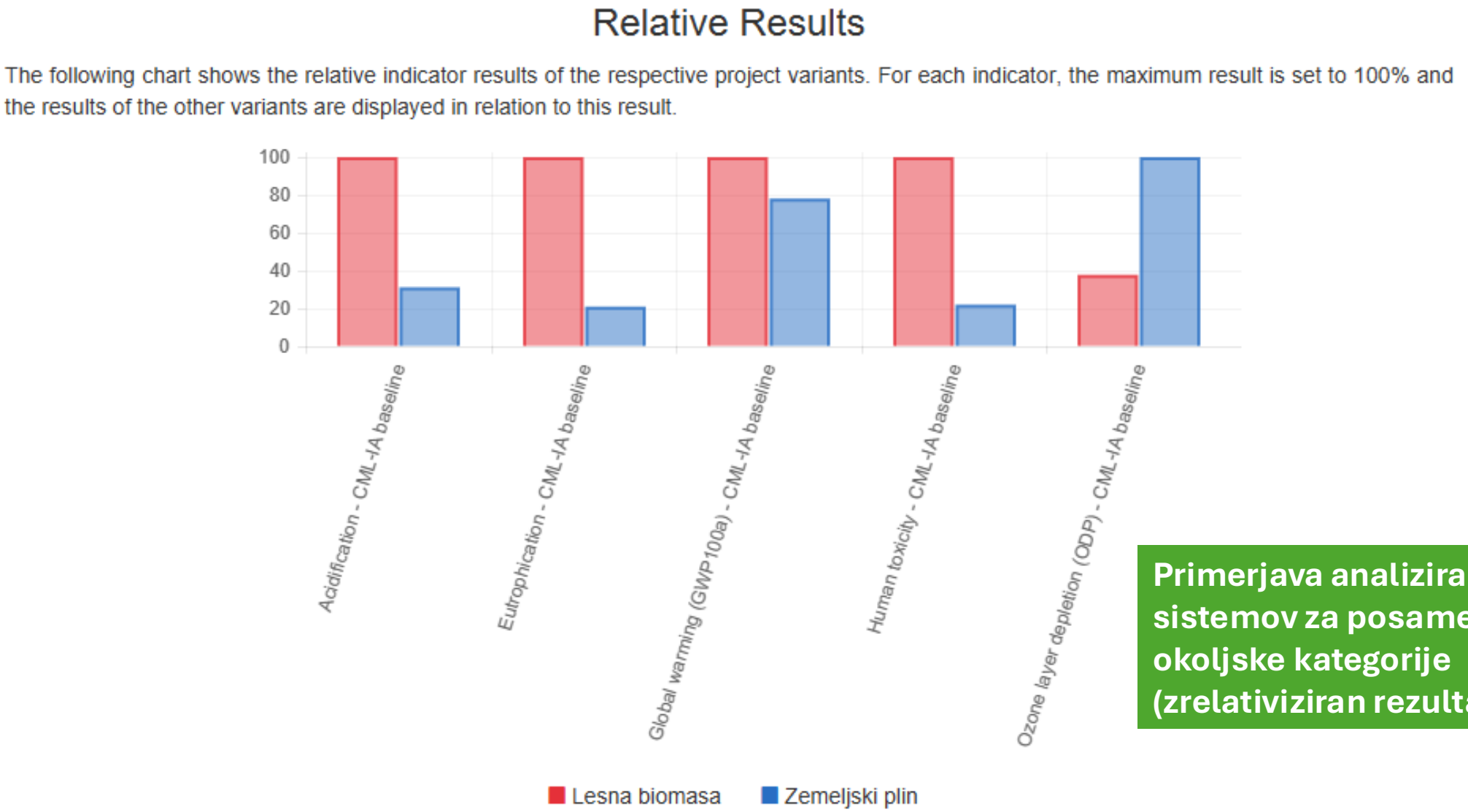
Report view

Projekt: Rezultati (kazalec GWP)



Spremenite kategorijo okoljskega vpliva in preglednica se samodejno posodobi

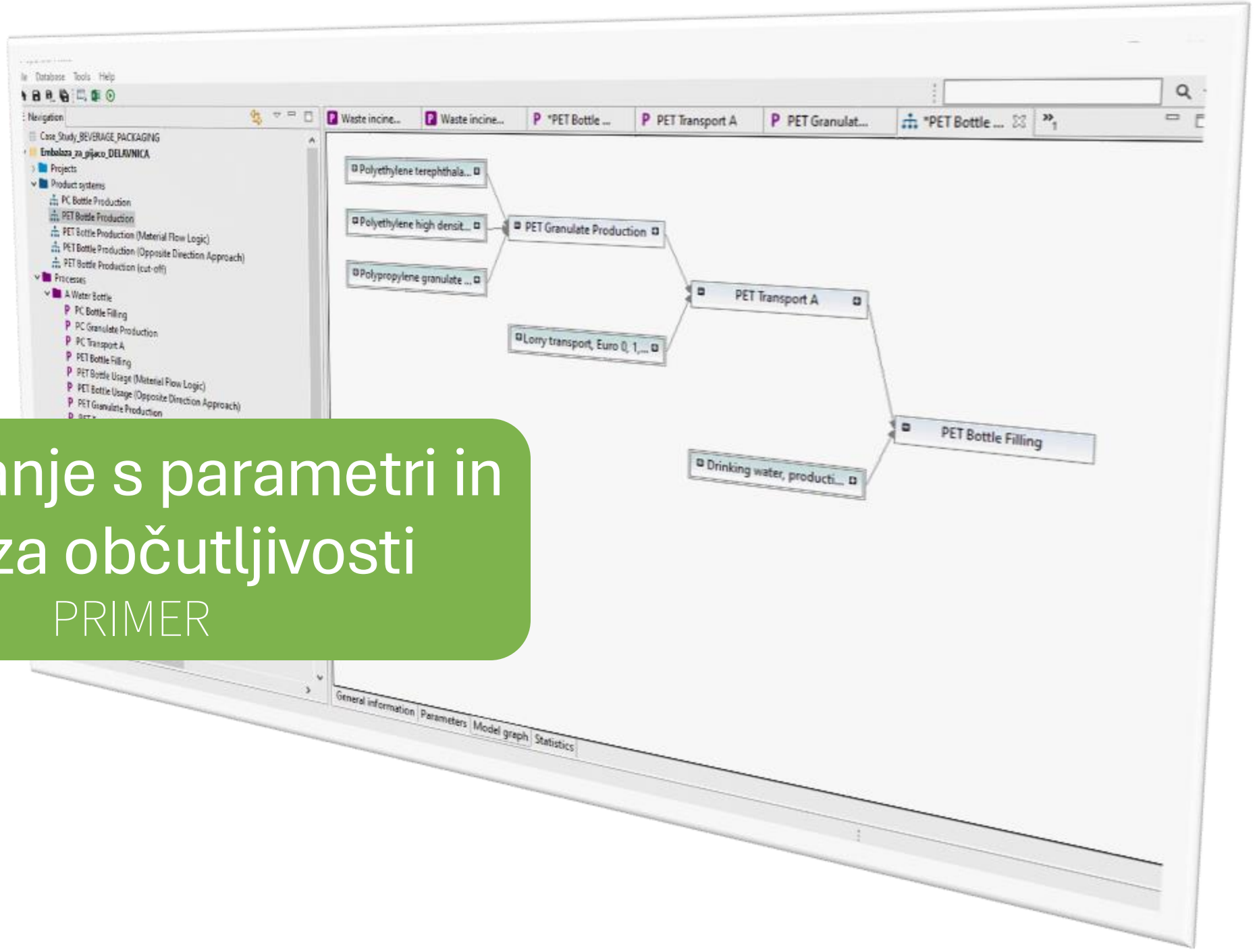
Projekt: Rezultati (zrelativizirani)



Primerjava analiziranih sistemov za posamezne okoljske kategorije (zrelativiziran rezultat)

Modeliranje s parametri in analiza občutljivosti

PRIMER

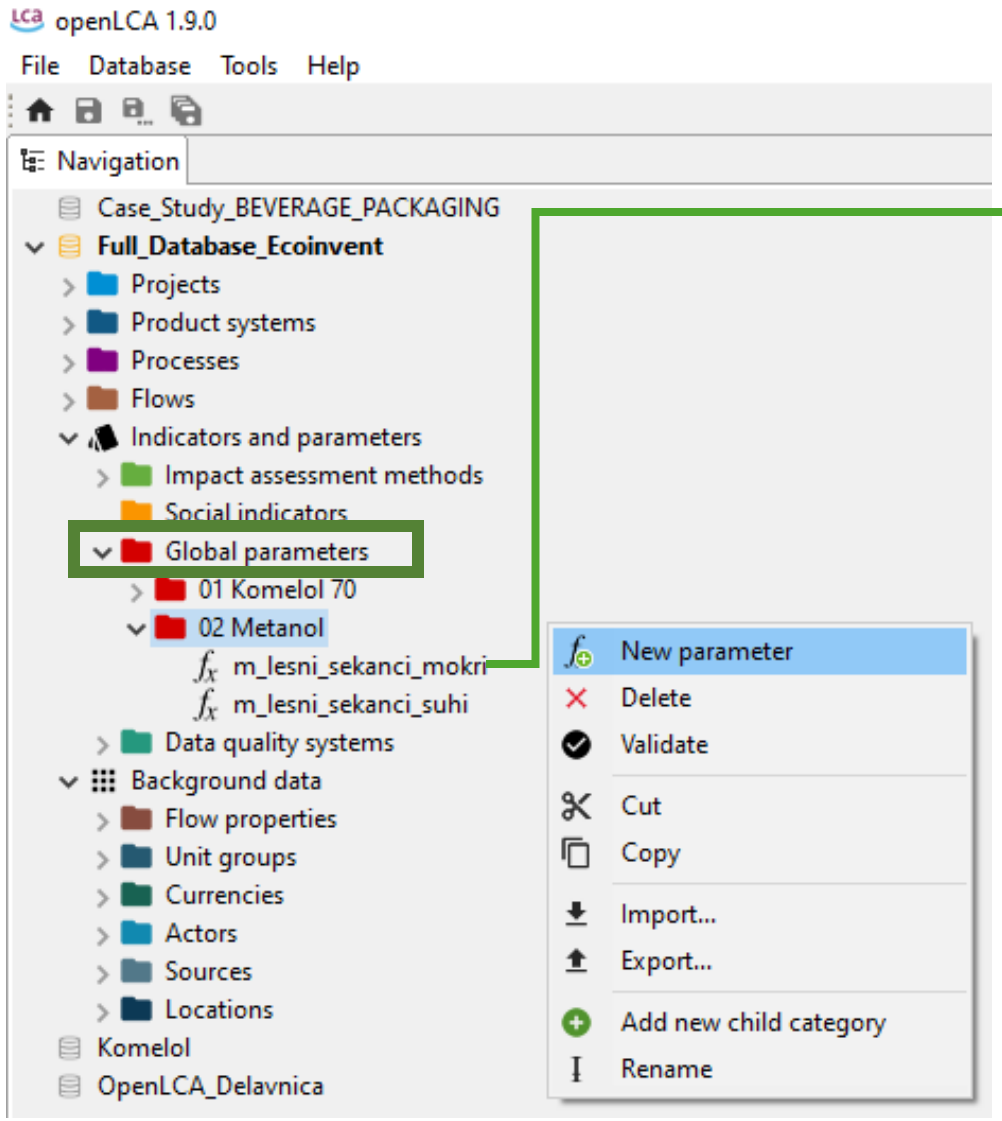


- možnost ustvarjanja različic življenjskega cikla s spreminjanjem vhodnih vrednosti
- lokalni in globalni parametri
- parametri so lahko povezani z drugimi parametri (tj. odvisni parametri)
- koristno za preliminarne podatke: podatke lahko na koncu analize enostavno spremenimo
- zmanjšana verjetnost računskih napak

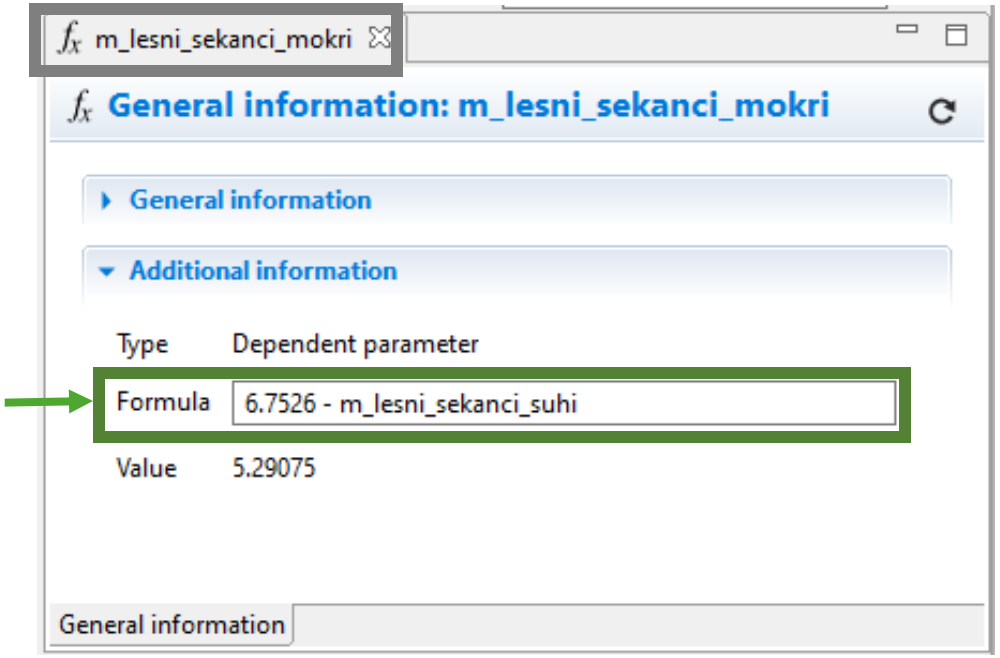
PRIMER:

„Kako delež suhih sekancev vpliva na celoten okoljski vpliv?“

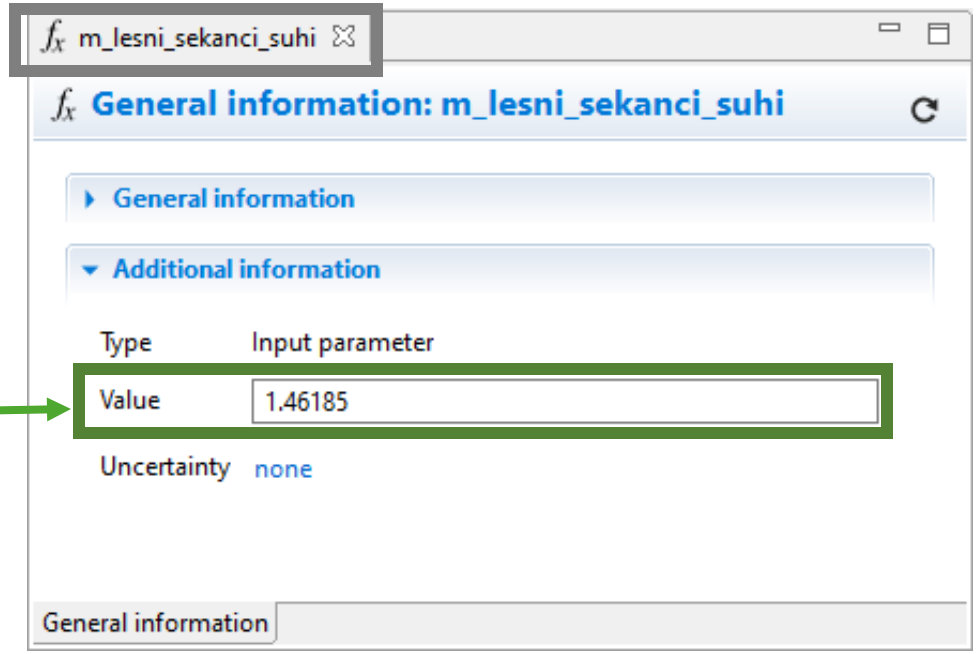
Globalni parametri: nastavitve

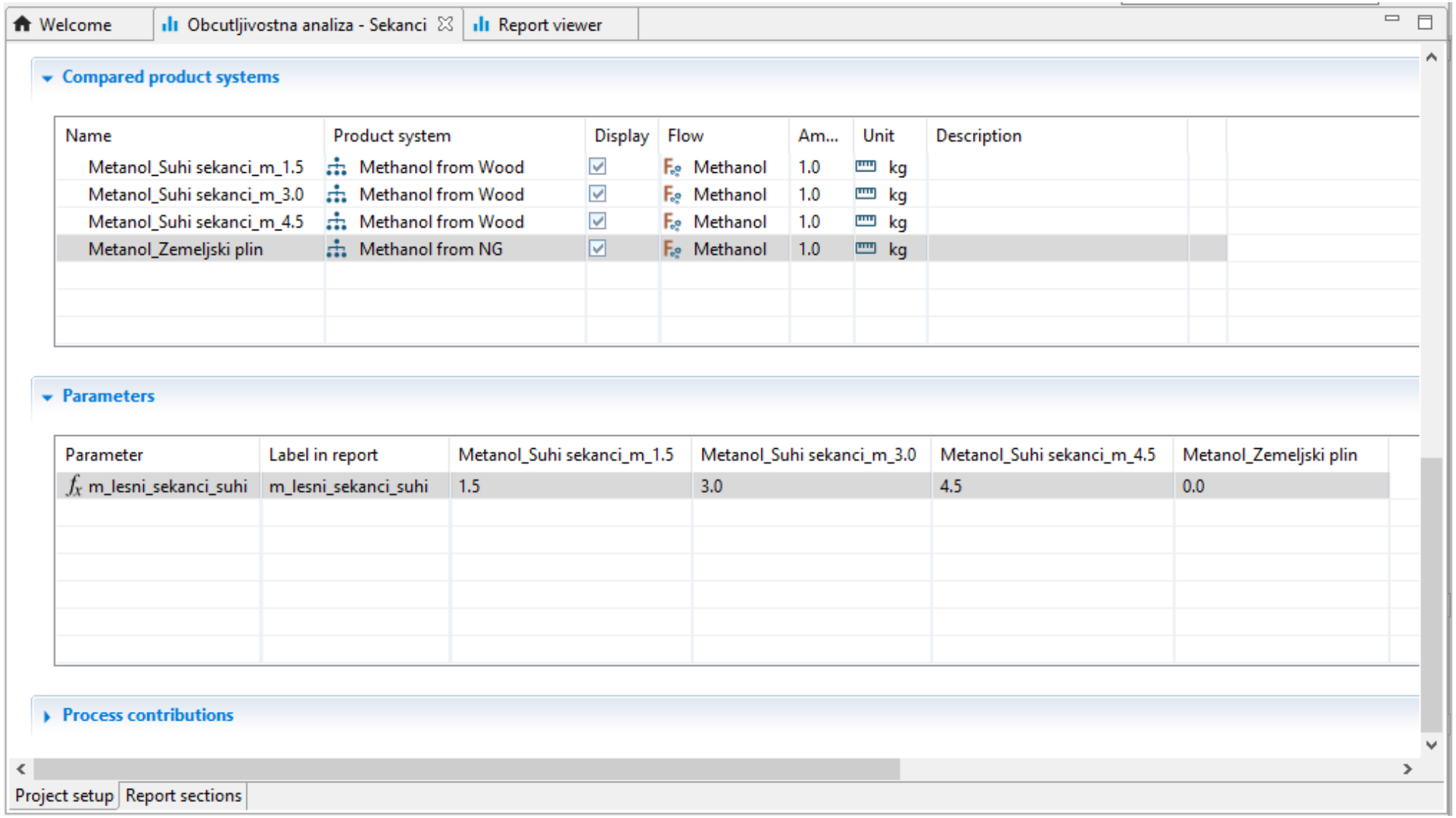


Odvisni globalni parameter



Globalni

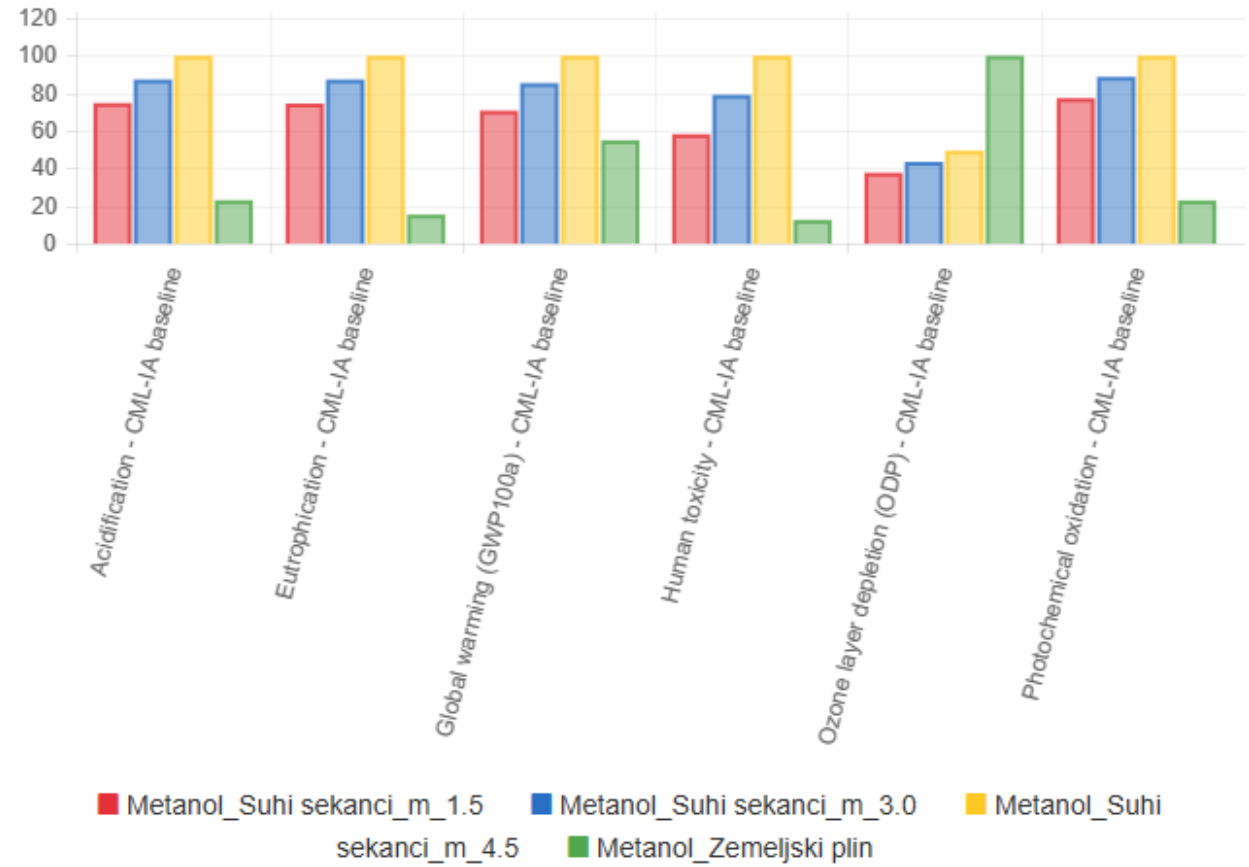



Welcome
Obcutljivostna analiza - Sekanci
Report viewer
Compared product systems
Name
Product system
Display
Flow
Am...
Unit
Description
Metanol_Suhi sekanci_m_1.5
Methanol from Wood
Methanol
1.0
kg
Metanol_Suhi sekanci_m_3.0
Methanol from Wood
Methanol
1.0
kg
Metanol_Suhi sekanci_m_4.5
Methanol from Wood
Methanol
1.0
kg
Metanol_Zemeljski plin
Methanol from NG
Methanol
1.0
kg
Parameters
Parameter
Label in report
Metanol_Suhi sekanci_m_1.5
Metanol_Suhi sekanci_m_3.0
Metanol_Suhi sekanci_m_4.5
Metanol_Zemeljski plin
m_lesni_sekanci_suhi
m_lesni_sekanci_suhi
1.5
3.0
4.5
0.0
Process contributions
Project setup
Report sections

Kako delež suhih sekancev vpliva na celoten okoljski vpliv?

Relative Results

The following chart shows the relative indicator results of the respective project variants. For each indicator, the maximum result is set to 100% and the results of the other variants are displayed in relation to this result.



- Predstavljen **praktični primer izvedbe** okoljske analize dveh sinteznih poti za proizvodnjo metanola (iz zemeljskega plina in lesne biomase)
- Glede na nastavljene parametre proizvodnja metanola iz zemeljskega plina izkazuje nižje okoljske vplive
- OpenLCA je uporabno orodje za celostno ocenjevanje okoljskih vplivov pri razvoju proizvodov / procesov:
  - **nizki stroški** nabave opreme,
  - **enostavna namestitev** in **uporaba**,
  - funkcije za **profesionalno modeliranje** in sodelovanje v **timu**,
  - obsežen **nabor podatkov**,
  - **preglednost**.
- Študija primera je namenjena za izobraževalne namene in je potrebna nadaljnje izpopolnitve.

THANK YOU

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