IPCC 2021 AR6 Impact Assessment Method

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Content

1 New Impact Method – IPCC 2021 AR6

The Intergovernmental Panel on Climate Change (IPCC) released the sixth Assessment Report (AR6) containing an updated table of Greenhouse Gas (GHG) metrics[1] that can be further applied to calculate different Impact Assessment categories. Then, a new method was prepared for openLCA according to the impact categories in the AR6 (and their units), also considering the black carbon mentioned in the fifth Assessment Report (AR5)[2]. To check the details regarding the Life Cycle Impact Assessment Method (LCIAM) implementation, please see Section 1.1.

The last openLCA method package 2.1.2 was released on 30th November together with the ecoinvent 3.8 database. Now, version 2.1.3 of the method is available, including this new Impact Assessment Method (IPCC 2021 AR6). The IPCC 2021 AR6 is also available as a separate file in Nexus, which can be imported to the current openLCA method version applied by the user. Both installation options are described in Section 1.2.

1.1 openLCA implementation

The IPCC 2021 AR6 provides different impact categories and reference units (Table 1), implemented in openLCA.

Table 1 – Impact Categories, Description and Reference Unit included in openLCA method package

NAME	DESCRIPTION	REFERENCE UNIT
IPCC 2021 AGTP 100	Absolute Global Temperature-change Potential	pW m^-2 yr
IPCC 2021 AGTP 50	Absolute Global Temperature-change Potential	pW m^-2 yr
IPCC 2021 AGWP 100	Absolute Global Warming Potential	pW m^-2 yr
IPCC 2021 AGWP 20	Absolute Global Warming Potential	pW m^-2 yr
IPCC 2021 AGWP 500	Absolute Global Warming Potential	pW m^-2 yr
IPCC 2021 CGTP 100	combined-GTP	yr*kg CO2 eq
IPCC 2021 CGTP 50	combined-GTP	yr*kg CO2 eq
IPCC 2021 GTP 100	Global Temperature-change Potential	kg CO2 eq
IPCC 2021 GTP 50	Global Temperature-change Potential	kg CO2 eq
IPCC 2021 GWP 100	Global Warming Potential	kg CO2 eq
IPCC 2021 GWP 20	Global Warming Potential	kg CO2 eq
IPCC 2021 GWP 500	Global Warming Potential	kg CO2 eq

In order to add the CFs provided in the report to the openLCA method, a mapping of the flows described in the method and the flows available in the openLCA was performed. As an example,

[1] According to https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf

[2] According to https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

the flow "Allyl cyanide" was mapped as "3-Butenenitrile", and therefore the CFs provided by the AR6 were applied (Figure 1).

Impact factors: 3-Butenenitrile

Impact assessment method	Impact category	Impact factor	Unit
IPCC 2021 AR6	IPCC 2021 AGTP 100	3.3E-8	pW m^-2 yr / kg
	IPCC 2021 AGTP 50	4.35E-8	pW m^-2 yr / kg
	IPCC 2021 AGWP 100	4.16E-5	pW m^-2 yr / kg
	IPCC 2021 AGWP 20	4.08E-5	pW m^-2 yr / kg
	IPCC 2021 AGWP 500	4.16E-5	pW m^-2 yr / kg
	IPCC 2021 CGTP 100	0.054	yr*kg CO2 eq / kg
	IPCC 2021 CGTP 50	0.045	yr*kg CO2 eq / kg
	IPCC 2021 GWP 20	0.002	kg CO2 eq / kg

Figure 1 – CFs added in openLCA (example flow 7f07d65e-adf9-3f4f-9f5f-1a9ebcdd4552)

In general, the characterization factors implemented are according to the ones provided in the AR6. The only exception is the CFs added to black carbon flows, included according to the IPCC AR5. The addition of the CFs for the black carbon flows (REF_IDs, according to Table 2) does not affect the results calculated for any current openLCA database, as these flows were created exclusively for the method implementation. Therefore they are not yet applied for any process. However, the openLCA user now can use these flows (considered in the newly released method). The CFs considered for these new black carbon flows are available in Figure 2.

Impact factors: Particulates, < 2.5 um, black carbon

Impact assessment method	Impact category	Impact factor	Unit
IPCC 2021 AR6	IPCC 2021 GTP 100	90.7	kg CO2 eq / kg
	IPCC 2021 GTP 50	110.0	kg CO2 eq / kg
	IPCC 2021 GWP 100	658.6	kg CO2 eq / kg
	IPCC 2021 GWP 20	2421.1	kg CO2 eq / kg

Figure 2 – CFs considered for black carbon, according to AR5

Table 2 – Flows included as black carbon

REF_ID	NAME	CATEGORY
34489FD3-940B-472F-A741-7524745D464D	Particulates, < 2.5 um, black carbon	Emission to air - unspecified
16CA9D1C-AAC8-4D5E-A4EE-A1256933A1C6	Particulates, < 2.5 um, black carbon	Emission to air - low population density
879BD0A8-26E3-4E8A-9DB2-0A439C455E4F	Particulates, > 10 um, black carbon	Emission to air - low population density, long-term
A5246E8F-D7F0-4E4B-9E3F-64B0AFE8A27A	Particulates, < 2.5 um, black carbon	Emission to air - lower stratosphere + upper troposphere
243F99F7-E13D-4F08-B86C-63799DEA793D	Particulates, > 2.5 um, and < 10um, black carbon	Emission to air - low population density, long-term
10450108-1A0B-40D2-8368-CBD50B665093	Particulates, > 2.5 um, and < 10um, black carbon	Emission to air - low population density
F1A6A1C8-D204-4CAC-892C-C941ED44D3AE	Particulates, > 10 um, black carbon	Emission to air - high population density
3EEBE485-931B-4E11-B5D5-AD6116E40562	Particulates, < 2.5 um, black carbon	Emission to air - low population density, long-term
C8E65413-C37B-488A-9DBC-9A7B491F0B28	Particulates, > 2.5 um, and < 10um, black carbon	Emission to air - high population density
4378AA6F-185E-469E-8257-0D909E8D5003	Particulates, > 2.5 um, and < 10um, black carbon	Emission to air - unspecified
7F7498E3-E3D9-4572-BC0F-A1B1D54705F0	Particulates, > 10 um, black carbon	Emission to air - unspecified
36665EDC-FBC1-457E-9B6D-68AB76566960	Particulates, > 10 um, black carbon	Emission to air - low population density
84AFCD29-88FE-42E7-9FC8-6C07EFF5461E	Particulates, < 2.5 um, black carbon	Emission to air - high population density

1.2 Get the new method IPCC 2021 AR6 for openLCA

openLCA method package 2.1.3, including not only IPCC 2021 AR6 but also the previously available impact assessment methods, is available in Nexus (https://nexus.openlca.org/databases). It is also possible to download only the IPCC 2021 AR6 method if you want to keep working with the current method package installed in your database.

Therefore, you have two alternatives to include IPCC 2021 AR6 in openLCA. The first alternative is to download the openLCA method 2.1.3 from Nexus and import the new method as a JSON-LD file (Figure 3).

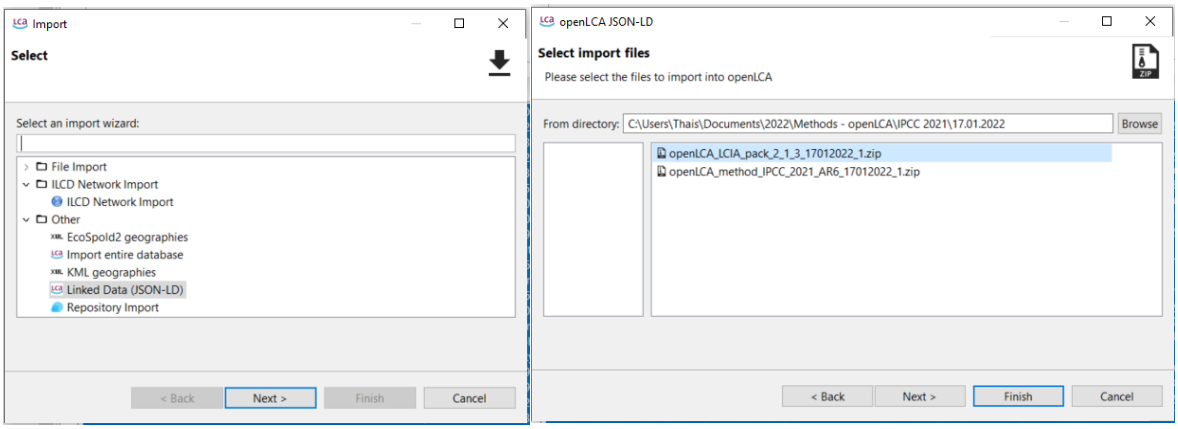

Figure 3 - Importing the new method package (2.1.3)

The second option is to download the JSON-LD file containing only the IPCC 2021 AR6 method, and import it into openLCA (Figure 4).

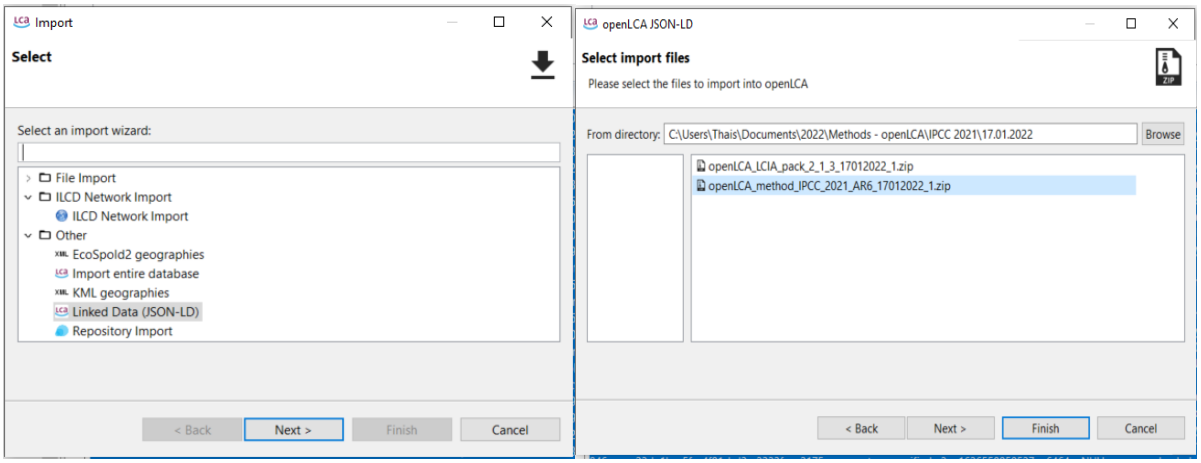

Figure 4 - Importing the new method (IPCC 2021 AR6)

2 Support

GreenDelta GmbH, developer of openLCA, offers openLCA users prioritized and guaranteed professional openLCA support via the GreenDelta helpdesk: https://www.openlca.org/service-contracts/. Public (*User2User*) support for openLCA is available via https://ask.openlca.org/.

In case you have other questions not addressed by this report, need further clarifications on any of the points commented, or have comments about the IPCC 2021 AR6 method in openLCA method package, please contact us.