LIFE TECHNICAL GUIDE – 01

Measuring the Biodiversity Pressure Index (BPI) and definition of Biodiversity Minimum Performance (BMP)

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Contact:
LIFE Institute
Rua Victor Benato, 210 – Bosque Zaninelli – Pilarzinho
ZIP Code: 82.120-110 – Curitiba – PR – Brasil
Phone: +55 41 3253 7884
www.institutolife.org
contato@institutolife.org

OBJECTIVE

To present the concept and method of obtaining the Biodiversity Pressure Index (BPI), as well as the Biodiversity Minimum Performance (BMP) that each organization/producer must achieve in biodiversity conservation actions and ecosystem services, considering the size and impact of the activity.

APPLICATION

This document applies to organizations/producers in preparation for LIFE Certification, LIFE Certified organizations/producers, as well as others interested in incorporating biodiversity management into their business models.

For a complete assessment of the LIFE Methodology for Business and Biodiversity, the LIFE Standard for Business and Biodiversity, Technical Guide 02 and complementary documents should also be considered.

For LIFE Certified organizations in previous versions, this document becomes effective after the end of the certification cycle, that is, on recertification. For other organizations/producers, this document applies automatically as of the date of publication.

INDEX

1. INTRODUCTION

The Biodiversity Pressure Index (BPI) is an index developed by the LIFE Institute to define, compare and monitor, in a same scale, the pressure of any organization/producer to biodiversity and ecosystem services, serving as an important management tool.

From the calculation of the BPI, organizations and producers who wish to contribute to biodiversity may know and carry out the minimum performance in conservation actions that would be more appropriate to their size and impact.

This document introduces the concept and the manner of obtaining the Biodiversity Pressure Index (BPI) and the Biodiversity Minimum Performance (BMP) relating to every size and impact.

The information presented in this document is only a description of the calculations used. Obtaining the BPI/BMP is facilitated through the use of an automated calculation tool (LIFE Key software).

Organizations and producers who achieve or exceed the minimum performance set, can request a third-party assessment so as to obtain an external recognition on their performance in favor of biodiversity. In this case, LIFE Certification can be granted, through the Certifying Body, whenever an organization/producer:

- ✓ Achieves a Biodiversity Positive Performance (BPP) equal to or higher than Biodiversity Minimum Performance (BMP). This positive performance must be demonstrated through a Biodiversity and Ecosystem Services Action Plan (BAP), assessed and rated according to the document Technical Guide 02.
- ✓ Meets the minimum indicators for biodiversity management described in LIFE Standard for Business and Biodiversity.

2. BIODIVERSITY PRESSURE INDEX (BPI)

Aiming to establish a metric for scaling and comparing pressures to biodiversity, making it possible to define relative performance for conservation, the Biodiversity Pressure Index (BPI) was developed.

To calculate the BPI five environmental aspects are measured and evaluated. These aspects were selected from the performance of public meetings for the definition and selection of relevant variables for the index, both for their relation to the main causes of global biodiversity loss[1] and for their data collection in organizations of any size and sector.

As a result of this analysis, we selected those aspects that had higher viability and ease of data collection and direct relationship with official data available: waste generation; water consumption; energy consumption; land use; greenhouse gas emission.

The BPI is obtained through information relative to the quantity and severity relating to these five selected environmental aspects.

Information on the quantity of environmental aspects assessed, or "Quantity Value", refers to a direct relationship between the data of the organization/producer compared to an official data for this aspect in the European Union. This comparison generates a quantity value of impact for each environmental aspect referring to its contribution to the regional total.

Information on severity, or "Severity Value", considers specific information for each environmental aspect, which allows to define their criticality: water availability in the region, potential for global warming from the gases emitted, impact of the energy sources used, hazard and disposal of waste generated by, and fragility of the ecoregion occupied by the enterprise. This information, although qualitative, is quantitatively represented by the severity values.

By multiplying the quantity values of impact by their severity factors, "Pressure Values" (PV) are generated for each environmental aspect. For comparison purposes, these pressure values are

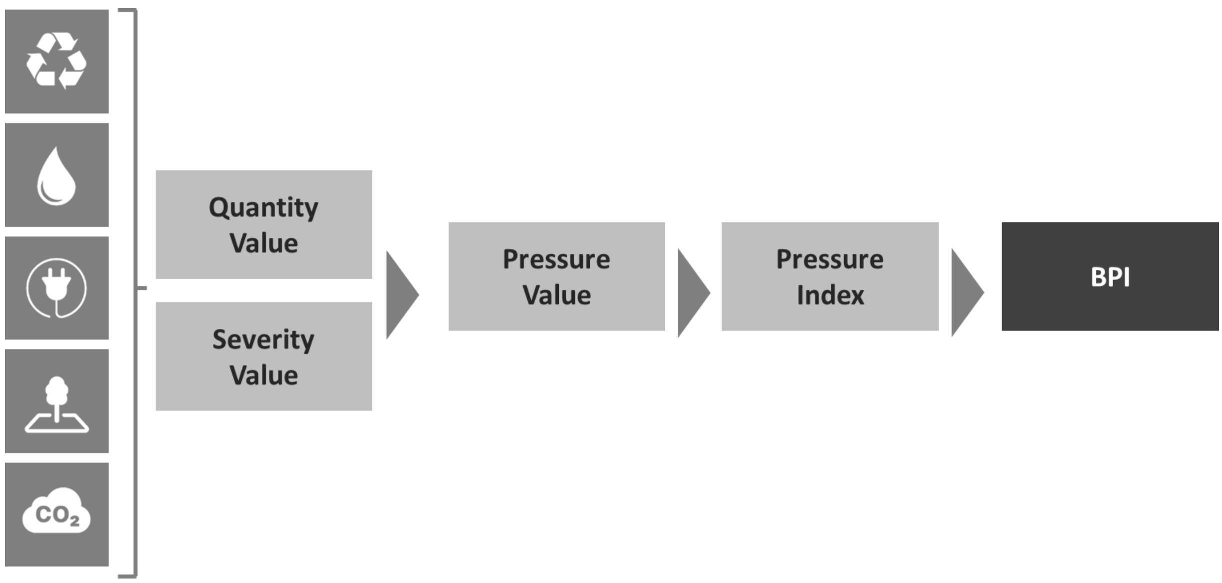
[1] Destruction of habitats; climate changes; introduction of invasive exotic species; over-exploitation of species; pollution (*Millennium Ecosystem Assessment*, 2005).

transformed into "Pressure Indexes" (PI), with the purpose of being mathematically distributed on the same scale, from zero to one thousand. This distribution has as reference the value of greatest impact known in the region for each environmental aspect.

The simple average of the Pressure Indexes (PI) for each one of the environmental aspects, results in the Biodiversity Pressure Index (BPI). The BPI is presented in a dimensionless value, on a scale from zero to one thousand.

Figure 1 represents the steps for calculating the BPI. Detailed information, applied equations and necessary data from organizations/producers for the calculation can be found in the next sections of the document.

Figure 1. Steps for calculating the Biodiversity Pressure Index (BPI)



Note: Quantity Value, Severity Value, Pressure Value and Pressure Index: calculated individually by environmental aspect.

2.1 CALCULATION OF THE BIODIVERSITY PRESSURE INDEX (BPI)

This section of the document introduces the steps and equations used to calculate the BPI.

2.1.1 Quantity Values (QV) and Severity Values (SV) of Environmental Aspects

Table 1 presents the equations used to calculate the quantity and severity values for each environmental aspect.

Table 1 - Equations of Quantity Values (QV) and Severity Values (SV) to calculate the BPI for each environmental aspect

ENVIRONMENTAL ASPECT	QUANTITY	SEVERITY
Waste Generation	$QV_{WASTE} = \frac{WG}{RV_{WASTE}}$	$SV_{WASTE} = \frac{\sum_{i=1}^{n}(\%WG_i \times ID_i)}{ID_{max}}$
Water Consumption	$QV_{WATER} = \frac{WU}{RV_{WATER}}$	$SV_{WATER} = \frac{DAB_{OHR}}{DAB_{CHR}}$
Energy Consumption	$QV_{ENERGY} = \frac{EC}{RV_{ENERGY}}$	$SV_{ENERGY} = \frac{\sum_{i=1}^{n}(\%EC_i \times IE_i)}{IE_{max}}$
Land Use	$QV_{LAND\ USE} = \frac{\sum_{i=1}^{n} LU_O \times (1 - MSA)}{LU_E}$	$SV_{LAND\ USE} = \frac{E_{if}}{100}$
Greenhouse Gas Emissions	$QSV_{GHG} = \left(\frac{\sum_{i=1}^{n}(GE_i \times GWP_i)}{RV_{GHG}}\right)$	

Table 2 describes the terms that make up the equations presented in Table 1.

Table 2 – Terms used in the equations for the quantity and severity values

EQUATION	TERMS USED
QV_{WASTE}	QV_{WASTE}= Quantity Value for Waste WG= Total quantity of hazardous and non-hazardous waste generated by the organization/producer (t/year) RV_{WASTE}= Reference Value for waste (t/year) according to *Item 3* in Appendix.
QV_{WATER}	QV_{WATER}= Quantity Value for Water WU= Consumption of water used by the organization/producer (m^3/year) RV_{WATER}= Reference Value for water (m^3/year), according to *Item 3* in Appendix.
QV_{ENERGY}	QV_{ENERGY}= Quantity Value for Energy EC= Total quantity of energy consumed by the organization/producer (toe/year) RV_{ENERGY}= Reference Value for Energy (toe/year), according to *Item 3* in Appendix.
$QV_{LAND\ USE}$	$QV_{LAND\ USE}$= Quantity Value for land use LU_O= Land use of the organization/producer (hectares) LU_E= Original land use of the ecoregion in which the organization/producer is located (hectares), according to *Item 4* in Appendix. MSA = Value of the land use class in accordance with Mean Species Abundance, according to *Item 4* in Appendix.
QSV_{GHG}	QSV_{GHG}= Quantity and Severity Value for Greenhouse Gases GE_i= Quantity of greenhouse gas emissions *i* emitted by the organization/producer GWP_i= Global warming potential of greenhouse gas *i* according to *Item 4* in Appendix. RV_{GHG}= Reference value for greenhouse gases (tCO_2e/year) according to *Item 3* in Appendix.
SV_{WASTE}	SV_{WASTE}= Severity Value for Waste. WG_i= Percentage of waste generation with type "*i*" destination. ID_i= Impact of destination "*i*" (ID) listed to *Item 4* in Appendix. ID_{max}= Maximum impact observed between "*i*" types of destination.
SV_{WATER}	SV_{WATER}= Severity Value for the water aspect. DAB_{CHR}= Demand-Availability Balance DAB_{OHR}=Demand-Availability Balance of the country where the organization/producer is located, listed to *Item 4* in Appendix.
SV_{ENERGY}	SV_{ENERGY}= Severity value for the energy aspect. EC_i= Percentage of the energy source type *i* consumed by the organization/producer. IE_i= Impact of the energy source *i* consumed by the organization/producer, according to *Item 4* in Appendix. IE_{max}= Maximum impact observed between energy sources according to *Item 4* in Appendix.
$SV_{LAND\ USE}$	$SV_{LAND\ USE}$= Severity value for the land use aspect. E_{IF}= Ecoregion importance factor, according to *Item 4* in Appendix.

2.1.2 Pressure Values of Environmental Aspects (PV)

In Table 3, the equations used to obtain the Pressure Value (PV_i) of each aspect *i* are listed.

Table 3 - Calculation of the pressure value for each environmental aspect

ENVIRONMENTAL ASPECT	PRESSURE VALUE OF THE ASPECT
Waste Generation	$PV_i = QV_i \times SV_i$
Water Consumption	
Energy Consumption	
Land Use	
Greenhouse Gas Emissions	$PV_{GHG} = QSV_{GHG}$

2.1.3 Pressure Indexes of Environmental Aspects (PI)

The Pressure Values (PV) are transformed into Pressure Indexes (PI), which allow the representation of the pressure of each environmental aspect on the same scale, dimensionless, ranging from zero to 1,000. The Pressure Index (PI) is calculated individually for each environmental aspect by the following equation:

$$PI_i = \left(1 - \frac{1}{1 + a_i PV_i}\right) x\ 1000$$

Where in:

PI_i = Pressure Index of aspect *i*

a_i= Correction factor[2] of aspect *i*, which allows *PI* to range between 0 and 1,000

PV_i = Pressure Value of aspect *i*

[2] See details in *Item 1* in the Appendix.

2.1.4 Biodiversity Pressure Index (BPI)

The BPI is presented in a dimensionless value, on a scale from zero to one thousand. It is obtained by the simple arithmetic average of the Pressure Indexes (PI) of the five environmental aspects assessed:

$$BPI = \frac{PI_{WASTE} + PI_{WATER} + PI_{ENERGY} + PI_{LAND\ USE} + PI_{GHG}}{5}$$

Information on the reference values used in EU can be found in the *Item 3*, in Appendix **(Reference Information to calculate the BPI in EU)**.

2.2 DATA REQUIRED TO CALCULATE THE BIODIVERSITY PRESSURE INDEX (BPI)

This document section presents the data from the organization/producer that need to be informed to calculate the BPI.

To calculate the BPI, it is necessary to define clearly and objectively which unit is being assessed. In addition, data from the five environmental aspects of the assessment base year (January to December) must be considered.

2.2.1 Waste Generation

a) Inform the total amount of waste generated by the organization/producer in tons/year, adding all the following situations:

i) Any waste, whether treated or not, forwarded to third parties, whether through donation or sale, for treatment, storage or final elimination
ii) Waste send to landfills, own or third party
iii) Waste stored, internally or by third parties

iv) Household and production waste generated within the property
v) Other wastes not receiving internal treatment in the organization/property

The data reported must refer to the total waste generated in all processes - direct and indirect, productive, administrative and from maintenance - as long as performed on the physical site which is being assessed.

b) There is no need to inform wastes destined internally for:

i) Production of biogas
ii) Incineration
iii) Co-processing
iv) Reuse
v) Recycling

All consumption of water, energy and land use relating to these processes must be informed on the other environmental aspects to calculate the pressure of the organization/property.

c) Inform dangerousness of wastes generated in:

i) Hazardous Waste
ii) Non-hazardous waste

d) Inform the destination of the waste informed in item (a) in:

i) Reuse
ii) Recycling
iii) Composting
iv) Landfarming
v) Co-processing
vi) Biogas
vii) Storage
viii) Incineration
ix) Landfill with biogas utilization
x) Landfill

When the destination is different from these categories, the organization/producer may select that with the characteristics closest to the informed destination.

Wastes from agricultural production, even if destined to industry, must be recorded as primary production waste and classified according to the type of destination (e.g.: recycling, co-processing, etc.). If the industry receiving this waste is undergoing assesses by LIFE Methodology, this material, in this unit assessed, must be considered as an input and not as waste.

Industrial waste used in agriculture must be informed as "landfarming", to calculate the impact of the waste from the plant assessed.

2.2.2 Water Consumption

a) Inform the volume of consumptive water use[3] of all processes, direct and indirect, carried out in the physical unit assessed.

i) **Primary sector:** inform the sum of the values for "green footprint" (water from precipitation stored in plants, evaporated or transpired) and for "blue footprint" (surface or underground water incorporated into the process).

- Agricultural crops: water consumption estimates for each crop can be obtained through online tool from the Water Footprint Network initiative.
- Animal production: water consumption estimates can be obtained by extrapolation of the individual consumption per animal/head, including watering, washing, etc.
- Forestry: water consumption estimates for the *Pinus* and *Eucalyptus* genera can be obtained through the LIFE Key calculation tool[4] . In these cases, it is necessary to inform the area planted with each gender and the location of plantations.

[3] Non-consumptive uses do not need to be reported, e.g.: aquaculture, hydroelectricity, water for dilution and/or purification of effluents.

[4] Estimates obtained through the LIFE/IPEF project of Forestry water consumption.

ii) **Secondary sector:** the organization must inform only the consumptive use of blue water (water collected less the water discarded, either as effluent or process losses).

iii) **Tertiary sector:** the organization must inform only the consumption of blue water. The consumption of blue water can be informed through consumption records, being possible to discount the return volume to the basin only when this information is available.

b) Inform the country where the assessed enterprise is located.

2.2.3 Energy Consumption

a) Inform the total amount of energy consumed (own or acquired by the business unit). Inform the distribution of consumption by sources used:

i) Energy from the electricity produced by country (grid)
ii) Biofuels (ethanol)
iii) Biofuels (Oils and Biodiesel)
iv) Biogas
v) Biomass (wood)
vi) Biomass (residual)
vii) Mineral Coal
viii) Sea Energy
ix) Wind
x) Natural Gas
xi) Geothermal
xii) Hydroelectricity
xiii) Non-renewable residual
xiv) Nuclear
xv) Oil and derived
xvi) Solar

2.2.4 Land use

a) Inform the area and the land use, according to occupation classes in accordance with MSA (Mean Species Abundance[5]) adaptation.

b) Inform the ecoregion in which the organization/producer is located:

The organization can define its ecoregion by entering the location data on the map provided by the LIFE Key software.

For the calculation of the $IP_{ÁREA}$, the business unit must present only one ecoregion. Therefore, all occurrences related to the land use of the business unit must have the same ecoregion option selected in LIFE Key. If the business unit is between two or more ecoregions, the one with the highest percentage should be considered.

c) In the case of agricultural properties bound to leasing contracts or others, inform only the land users relating to the contract[6] .

d) External land users to the assessed properties, bound only to conservation actions, must not be accounted for to calculate the BPI.

2.2.5 Greenhouse Gas Emissions

a) The total amount of emissions of all greenhouse gases;

The organization/producer must inform the Total Emissions of each one of the Greenhouse Gases (tCO_2e/year), considering the Scopes 1+2+3 of the GHG Protocol tool. More detailed information

[5] Mean Species Abundance (MSA) is an indicator that describes the changes in the environment in relation to the original ecosystem. The MSA is an indicator of naturalness or intactability of biodiversity, defined as mean abundance of original species in the land use in question in relation to their abundance in undisturbed ecosystems. An land use with an MSA of 100% (1.0) means having a biodiversity similar to the natural situation. An MSA of 0% (0.0) means a completely destroyed ecosystem without remaining original species. The relationship of the MSA classes for land use are in the *Item 4*, in Appendix.

[6] In these cases, legal environmental compliance is mandatory for the entire land use of the property, even if the contract is bound to a partial area. This mandatory legal compliance must be provided for in contract.

on the scopes of the GHG Protocol is listed in *Item 4* in Appendix, and in the Reference Document related to the subject.

The GHG Protocol also has a calculation tool specific for the primary sector. Other tools for the inventory of emissions will be accepted, as long as also using the IPCC (Intergovernmental Panel on Climate Change) guidelines[7].

The BPI assesses the negative pressures to biodiversity for all environmental aspects considered. Thus, for this step, only greenhouse gas emissions will be accounted for, and not carbon sequestration. Carbon fixation projects, validated by a third party[8], may score as indirect action for biodiversity conservation (strategic line "Group 4" – Technical Guide 02).

3. BIODIVERSITY MINIMUM PERFORMANCE (BMP)

The Biodiversity Minimum Performance (BMP) refers to the minimum score to be achieved in conservation actions by an organization/producer depending on its pressure on biodiversity and its size (turnover).

It is determined from the Biodiversity Pressure Index (BPI) and the turnover (TO) of the organization/producer, through the following equation:

$$\text{BMP} = 50 \times \text{BPI}^{x} \times \text{TO}^{y}$$

Where in:

BMP: Biodiversity Minimum Performance
BPI: Biodiversity Pressure Index
TO: Turnover (dollar)
x, y: calibration factors of BMP

[7] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.
[8] Validation by recognized initiatives relative to the topic or by consulting works based in detailed, justified and recognized methodologies.

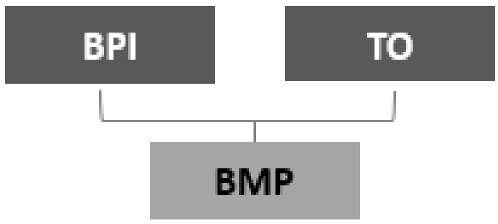
The Turnover of the organization/producer must be converted into dollars, considering the currency conversion rate on the date of December 31 of the base year referring to the calculation of the BPI.

Additional information used to calculate the BMP is available in the Appendix of this document.

Where the BMP is calculated the organization has to evaluate and compare it with its Biodiversity Positive Performance (BPP). Biodiversity Positive Performance (BPP) is related to the score of the organization's Biodiversity and Ecosystem Services Action Plan (BAP). The methodology for scoring BPP can be found on LIFE Technical Guide 02.

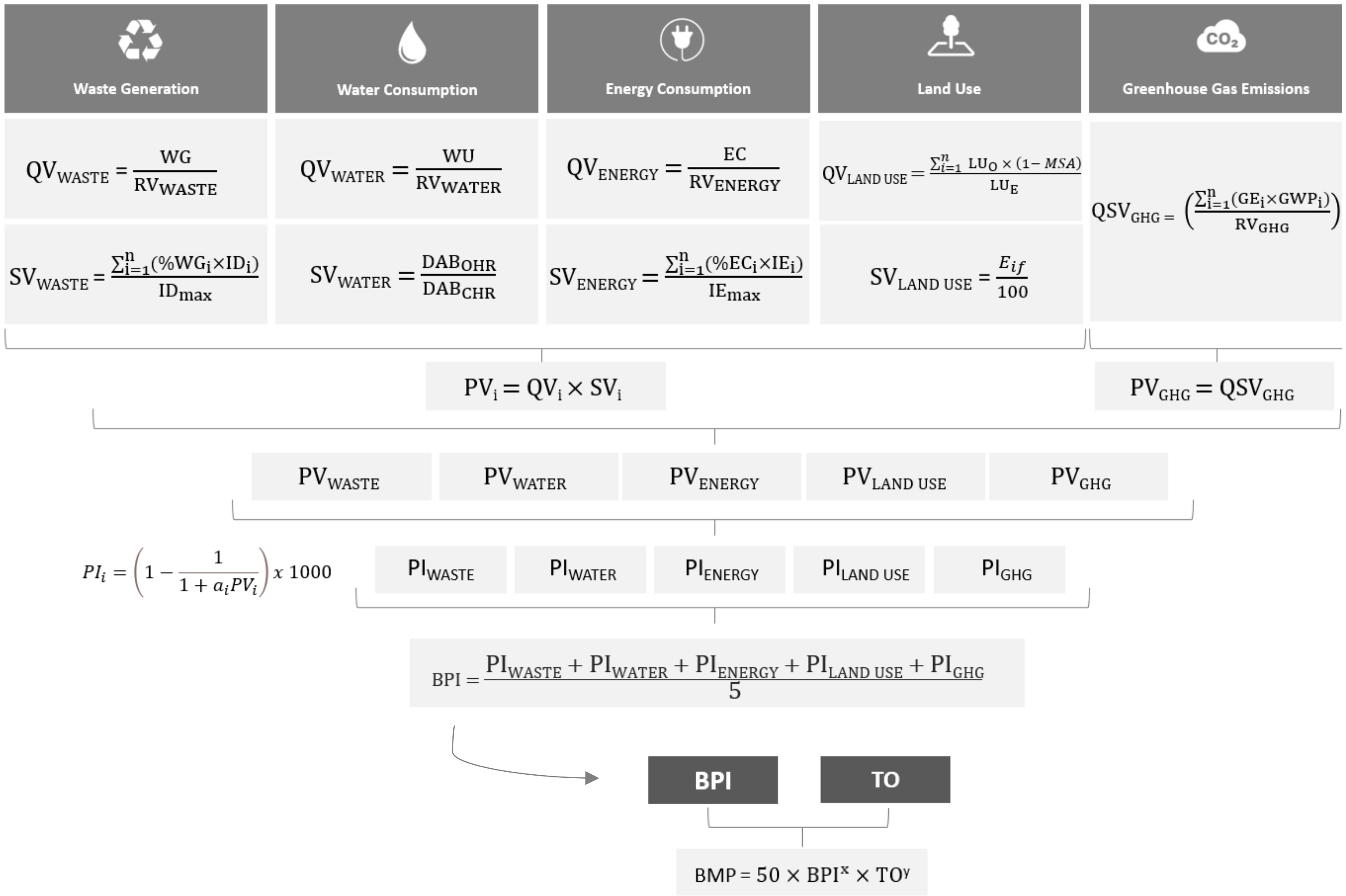
Figure 2 presents a simplified BMP calculation scheme.

Figure 2. BMP calculation scheme



4. FLOW CHARTS FOR CALCULATING BPI AND BMP

Figure 3. Flow charts for calculating BPI and BMP



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6. GLOSSARY

The terms used in this document are available in the LIFE Glossary.

7. APPENDIX

1. Factor a_i

Factor a_i is the Correction Factor of distribution scale of the Pressure Indexes. The correction factors are determined at European Union level, aimed at establishing a distribution scale of the impacts from the higher values for each individual impact (productive unit) in the European Union. The factor is set so that the maximum value observed for the environmental aspect is equivalent to the value of 950 in a scale from 0 to 1,000.

The Correction Factors presently used in European Union are: **(i) Waste: 1,804,835; (ii) Water: 1,925,155; (iii) Energy: 4,273; (iv) Land Use: 5,326; (v) Greenhouse Gases: 1,971.**

2. Calibration factors of BMP

The factors of equation BMP are the ones that adjust the region's conservation performance according to the current practices of organizations, so that all enterprises seek to achieve the best practices. Current practices of organizations in conservation are researched and assessed by local experts.

Calibration factors of BMP in Europe: x) 0.42; y) 0.29.

3. Reference Values (RV) for environmental aspects

The Reference Value (RV) represents the whole, in terms of quantity, regional impact in one year.

ASPECT	REFERENCE VALUE (RV)	DOCUMENT	YEAR	BASE YEAR	INFORMATION USED
WASTE	2,260,515,093.00 t/year	Eurostat Database	2020	2016	Estimated generation of total urban solid waste in the European Community.
GASES	3,977,716,368.85 tCO_2e/year	Data viewer on greenhouse gas emissions and removals, sent by countries to UNFCCC and the EU Greenhouse Gas Monitoring Mechanism (EU Member States).	2020	2017	Total greenhouse gas emissions in the UE in CO2e converted through the GWP metric.
ENERGY	640,200,000.00 toe/year	Eurostat Database	2020	2017	Total energy supply in the European Union (EU) *Except Malta.
WATER	195,047,000,000.00 m^3/year	Eurostat Database	2018	2017	Demand for water that corresponds to the flow of withdrawal, that is, water collected intended to various consumption uses.
		WordoMeter Database	2017	2017	

4. References for the calculation of the Severity Value

a) Impact of Destination (ID) of non-hazardous waste generated by the organization

ASPECT	Reduction of the volume of waste to be disposed in a landfill	Reduction of the potential for contamination of the waste	Generation of new products	Energy reuse	Reduction of the consumption of natural resources	Generation of other waste	Area degradation	Generation of liquid effluents / Possibly contaminated water bodies	Generation of pollutant gases	**Sum of the impact**	**Process score**	**Severity Index**
Destination	**Positive Impact**					**Negative Impact**						
Reuse	0	0	0	0	0	0	0	0	0	0	1	**0**
Recycling	0	0	0	0	0	1	0	1	0	2	2	**4**
Composting	0	0	0	1	0	0	0	1	0	2	2	**4**
Landfarming	0	0	0	0	0	0	0	1	1	2	4	**8**
Co-processing	0	0	0	0	0	1	0	1	1	3	3	**9**
Biogas	0	0	0	1	0	0	1	1	1	4	3	**12**
Storage	0	0	1	1	-	0	0	1	0	3	4	**12**
Incineration	0	0	1	0	1	1	-	-	1	4	4	**16**
Landfill with biogas utilization	1	1	0	0	1	1	1	1	1	7	5	**35**
Landfill	1	1	1	1	1	1	1	1	1	9	5	**45**

***The impact score of the disposal of the waste considers positive (+) and negative (-) environmental aspects**					
Positive Impact Score (+)	**0**	Presence of positive impact	**Negative Impact Score (-)**	**0**	Absence of positive impact
	1	Absence of positive impact		**1**	Presence of positive impact
	-	Not Applicable		-	Not Applicable
**** The destination process is scored according to the waste management hierarchy adapted and adopted by the LIFE Institute**					
Step in Waste Management	Reuse	Recycling	Energy Recovery (using raw materials)	Energy Recovery (no use of raw materials)	Final waste disposal
Score	1	2	3	4	5

Source: LIFE Institute - 2021

b) Impact of Destination (ID) of hazardous waste generated by the organization

ASPECT	Reduction of the volume of waste to be disposed in a landfill	Reduction of the potential for contamination of the waste	Generation of new products	Energy reuse	Reduction of the consumption of natural resources	Generation of other waste	Area degradation	Generation of liquid effluents / Possibly contaminated water bodies	Generation of pollutant gases	Flammability	Corrosivity	Reactivity	Toxicity	Pathogenicity	**Sum of the impact**	**Process score**	**Severity Index**
Destination	**Positive Impact**					**Negative Impact**											
Reuse	0	0	0	0	0	0	0	0	0	10	10	10	10	10	50	1	**50**
Recycling	0	0	0	0	0	10	0	10	0	10	10	10	10	10	70	2	**140**
Landfarming	0	0	0	0	0	0	0	10	10	10	10	10	10	10	70	3	**210**
Co-processing	0	0	0	0	0	10	0	10	10	10	10	10	10	10	80	3	**240**
Biogas	0	0	0	0	0	0	0	10	10	10	10	10	10	10	70	4	**280**
Storage	0	0	10	10	-	0	0	10	0	10	10	10	10	10	80	4	**320**
Incineration	0	0	10	0	10	10	-	-	10	10	10	10	10	10	90	4	**360**
Landfill with biogas utilization	10	10	0	0	10	10	10	10	10	10	10	10	10	10	120	5	**600**
Landfill	10	10	10	10	10	10	10	10	10	10	10	10	10	10	140	5	**700**

***The impact score of the disposal of the waste considers positive (+) and negative (-) environmental aspects**					
Positive Impact Score (+)	**0**	Presence of positive impact	**Negative Impact Score (-)**	**0**	Absence of positive impact
	10	Absence of positive impact		**10**	Presence of positive impact
	-	Not Applicable		**-**	Not Applicable

**** The destination process is scored according to the waste management hierarchy adapted and adopted by the LIFE Institute**					
Step in Waste Management	Reuse	Recycling	Energy Recovery (using raw materials)	Energy Recovery (no use of raw materials)	Final waste disposal
Score	1	2	3	4	5

Source: LIFE Institute - 2021

c) Demand-Availability Balance (DAB) by country

Country	Water availability in the region (m³/s)	Water demand in the region (m³/s)	Demand-Availability Balance (DAB)
Austria	2,473.4	110.7	0.045
Belgium	570.8	141.4	0.248
Bulgaria	665.9	176.4	0.265
Croatia	3,361.2	21.7	0.006
Cyprus	31.7	7.2	0.228
Czechia	412.2	51.8	0.126
Denmark	190.3	28.2	0.148
Estonia	412.2	54.7	0.133
Finland	3,488.1	208.1	0.060
France	6,690.8	868.6	0.130

Country	Water availability in the region (m³/s)	Water demand in the region (m³/s)	Demand-Availability Balance (DAB)
Germany	4,883.3	789.0	0.162
Greece	2,156.3	324.9	0.151
Hungary	3,297.8	136.0	0.041
Ireland	1,648.9	24.0	0.015
Italy	6,056.6	1084.2	0.179
Latvia	1,109.8	6.50	0.006
Lithuania	792.7	11.89	0.015
Luzembourg	126.8	1.43	0.011
Malta	1.6	1.40	0.863
Netherlands	2,885.6	288.91	0.100
Poland	1,934.3	351.63	0.182
Portugal	2,441.7	153.38	0.063
Romania	6,722.5	204.65	0.030
Slovakia	1,585.5	18.39	0.012
Slovenia	1,014.7	29.05	0.029
Spain	3,551.5	1015.35	0.286
Sweden	5,517.5	75.31	0.014

Source: LIFE Institute - 2021

d) Severity Value for Water

Country	$SV_{WATER} = DAB_{OHR} / DAB_{CHR}$
Austria	0.051891608
Belgium	0.287196970
Bulgaria	0.307103896
Croatia	0.007479417
Cyprus	0.264272727
Czechia	0.145688811
Denmark	0.171545455
Estonia	0.153891608
Finland	0.069145041
France	0.150467579
Germany	0.187283501
Greece	0.174664773
Hungary	0.047812500
Ireland	0.016873689
Italy	0.207483341
Latvia	0.006788961
Lithuania	0.017386364
Luzembourg	0.013039773
Malta	1.000000000
Netherlands	0.116049201

Country	$SV_{WATER} = DAB_{OHR} / DAB_{CHR}$
Poland	0.210707526
Portugal	0.072811983
Romania	0.035286664
Slovakia	0.013445455
Slovenia	0.033178977
Spain	0.331375812
Sweden	0.015820925

Source: LIFE Institute - 2021

e) Electric grid composition (%), by energy source

Country	Mineral Coal	Nuclear	Hydro Electricity	Wind	Solar	Geothermal
Austria	24.58	0.00	56.72	10.18	0.00	8.52
Belgium	36.33	47.56	1.26	10.55	4.06	0.23
Bulgaria	45.77	38.99	8.32	3.26	3.53	0.13
Croatia	39.28	0.00	47.65	11.86	0.59	0.61
Cyprus	90.71	0.00	0.00	4.88	4.41	0.00
Cz.Republic	57.12	35.23	3.87	0.85	2.79	0.14
Denmark	39.79	0.00	0.06	56.76	3.39	0.00
Estonia	89.03	0.00	0.28	10.69	0.00	0.00
Finland	37.36	34.71	18.60	9.06	0.27	0.00
France	10.53	69.88	11.24	6.29	2.03	0.02
Germany	50.92	13.14	4.22	23.28	8.31	0.13
Greece	67.97	0.00	8.48	15.23	8.29	0.04
Hungary	44.51	48.28	0.67	2.21	4.31	0.03
Ireland	63.65	0.00	3.88	32.46	0.00	0.00
Italy	65.81	0.00	16.54	7.07	8.57	2.00
Latvia	63.61	0.00	33.93	2.46	0.00	0.00
Lithuania	26.77	0.00	25.14	40.27	2.02	5.80
Luxembourg	27.61	0.00	51.17	15.08	6.14	0.00
Malta	90.25	0.00	0.00	0.00	0.00	9.75
Netherlands	82.28	3.16	0.06	9.78	4.32	0.40
Poland	87.86	0.00	1.77	9.89	0.49	0.00
Portugal	51.40	0.00	19.53	26.21	2.49	0.37
Romania	36.36	19.21	28.72	12.45	3.27	0.00
Slovakia	25.06	55.32	17.16	0.01	2.26	0.19
Slovenia	30.72	37.05	30.40	0.04	1.80	0.00
Spain	42.10	21.39	10.10	20.93	5.49	0.00
Sweden	9.49	39.12	39.29	12.10	0.00	0.00

Source: Eurostat – Electricity production by source, 2019

f) Impact of energy sources used by the organization (IE)

IMPACT													
COMPONENT	**WATER**		**AIR**			**SOIL**					**BIOTA**		**IMPACT OF ENERGY SOURCE (IE)**
ENVIRONMENTAL FACTOR	Water use and / or consumption	Generation of effluents	Emissions of greenhouse gases	Atmospheric emissions	Noise emissions	Movement of soil			Land use	Generation of solid waste	Occupation of areas	Generation of effluents and solid residues; atmospheric emissions	
POTENTIAL IMPACT	Change in water availability	Change in water quality	Contribution to increased climate warming	Change in air quality	Change in noise levels	Intensification of silting processes	Intensification of erosive processes	Generation of induced earthquakes	Changes in landscape and land use	Change in soil quality	Habitat change and / or reduction	Structural and / or functional change of ecosystems	
ENERGY SOURCE													
Biofuels (Ethanol)	9	5	2	5	1	2	5	n.s	9	1	5	3	**47**
Biofuel (Oils and Biodiesel)	9	5	2	5	1	2	5	n.s	5	5	5	3	**47**
Biogas	2	1	3	3	1	n.s	n.s	n.s	2	1	n.s	n.s	**13**
Biomass (wood)	3	1	9	7	3	2	2	n.s	7	3	9	3	**49**
Biomass (residual)	1	1	3	5	1	1	1	n.s	5	3	1	3	**25**
Mineral Coal	9	8	10	10	7	9	9	9	10	10	10	9	**110**
Sea Energy	n.s	n.s	n.s	n.s	2	n.s	n.s	n.s	1	n.s	5	1	**9**
Wind	n.s	n.s	n.s	n.s	6	n.s	1	n.s	9	n.s	2	n.s	**18**
Natural Gas	9	7	9	7	7	4	4	9	9	5	8	6	**84**
Geothermal	1	6	1	2	4	1	1	9	9	5	5	1	**45**
Hydroelectricity	9	1	1	3	3	10	9	2	10	1	9	1	**59**
Non-renewable residual	1	5	10	7	5	1	1	n.s	5	n.s	2	1	**38**
Nuclear	10	6	1	3	7	9	9	9	10	10	9	5	**88**
Petroleum and byproducts	9	8	10	10	7	4	4	9	9	8	4	6	**88**
Solar	5	1	1	n.s	1	1	1	n.s	6	6	5	5	**32**

n.s = not significant

g) Land use (Mean Species Abundance - MSA adaptation)

MSA	Classes of Soil Use
1.0	• Areas permanently covered with snow or ice considered as undisturbed areas. • Areas permanently without vegetation (for example, deserts, high alpine areas). • Minimal disturbance, where flora and fauna species abundance are near pristine. • Grassland or scrubland-dominated vegetation (for example, steppe, tundra, or savannah).
0.7	• Forests with extractive use and associated disturbance like hunting and selective logging, where timber extraction is followed by a long period of re-growth with naturally occurring tree species. • Grasslands where wildlife is replaced by grazing livestock.
0.5	• Areas originally covered with forest or woodlands, where vegetation has been removed, forest is re-growing or has a different cover and is no longer in use. • Agricultural production intercropped with (native) trees. Trees are kept for shade or as wind shelter.
0.3	• Subsistence and traditional farming, extensive farming, and low external input agriculture.
0.2	• Planted forest often with exotic species.
0.1	• Forests and woodlands that have been converted to grasslands for livestock grazing. • High external input agriculture, conventional agriculture, mostly with a degree of regional specialization, irrigation-based agriculture, drainage-based agriculture.
0.05	• Areas more than 80% built up.

Source: Globio 3 – 2009 (Adapted)

h) Ecoregions of European Union

a) Original land use and priority conservation of ecoregions in European Union

Ecoregion	Original land use (ha)	Overlapping of land use conservation priority database	Ecoregion Importance Factor(E_{if})
Crete Mediterranean forests	770,378.67	770,378.67	100.00
Cyprus Mediterranean forests	525,449.09	525,449.09	100.00
Iberian conifer forests	3,446,101.73	3,446,101.73	100.00
Mediterranean acacia-argania dry woodlands and succulent thickets	232,534.43	232,534.43	100.00
Mediterranean woodlands and forests	2,458.00	2,458.00	100.00
Southeastern Iberian shrubs and woodlands	268,168.71	268,168.71	100.00
Tyrrhenian-Adriatic Sclerophyllous and mixed forests	7,824,272.49	7,824,272.49	100.00
Azores temperate mixed forests	218,074.60	218,074.60	100.00
Corsican montane broadleaf and mixed forests	363,364.55	363,364.54	100.00
South Appenine mixed montane forests	1,309,479.52	1,309,478.39	100.00
Canary Islands dry woodlands and forests	465,859.22	465,858.76	100.00
Madeira evergreen forests	74,164.73	74,164.52	100.00
Southwest Iberian Mediterranean sclerophyllous and mixed forests	7,008,156.14	7,008,126.53	100.00
Aegean and Western Turkey sclerophyllous and mixed forests	7,635,681.86	7,635,555.52	100.00
Pindus Mountains mixed forests	2,315,927.04	2,315,862.58	100.00
Iberian sclerophyllous and semi-deciduous forests	29,789,114.72	29,786,998.49	99.99
Northwest Iberian montane forests	5,740,590.75	5,738,649.75	99.97
Northeastern Spain and Southern France Mediterranean forests	8,932,153.37	8,925,233.65	99.92
Illyrian deciduous forests	1,664,068.52	1,662,407.29	99.90
Italian sclerophyllous and semi-deciduous forests	10,060,224.66	10,049,188.80	99.89
Euxine-Colchic broadleaf forests	15,070.95	14,592.22	96.82
Dinaric Mountains mixed forests	1,659,958.55	1,054,365.37	63.52
Rodope montane mixed forests	2,966,659.23	1,766,788.75	59.55
Pyrenees conifer and mixed forests	2,543,322.89	1,480,773.47	58.22
Scandinavian Montane Birch forest and grasslands	5,234,378.86	2,759,710.51	52.72
Appenine deciduous montane forests	1,614,718.12	829,641.15	51.38
Carpathian montane forests	9,139,307.21	3,806,743.47	41.65
Pontic steppe	2,435,051.96	918,656.42	37.73
Alps conifer and mixed forests	12,539,119.06	3,796,115.15	30.27
Cantabrian mixed forests	7,887,524.26	2,238,174.00	28.38
Baltic mixed forests	11,022,013.33	2,830,999.34	25.68
Balkan mixed forests	12,430,536.13	3,093,135.31	24.88

Ecoregion	Original land use (ha)	Overlapping of land use conservation priority database	Ecoregion Importance Factor(E_{if})
Pannonian mixed forests	25,991,173.98	6,394,192.91	24.60
Scandinavian and Russian taiga	57,858,526.35	14,166,179.81	24.48
North Atlantic moist mixed forests	1,553,126.30	310,084.52	19.97
Western European broadleaf forests	47,489,202.61	8,576,189.73	18.06
Central European mixed forests	36,998,830.89	6,563,864.09	17.74
Lake	573,300.62	72,967.21	12.73
Atlantic mixed forests	38,965,825.62	4,534,777.22	11.64
Celtic broadleaf forests	5,136,012.88	582,234.84	11.34
Po Basin mixed forests	4,193,635.42	443,674.75	10.58
Sarmatic mixed forests	26,897,165.98	2,684,084.06	9.98
East European forest steppe	1,975,922.86	162,610.93	8.23

Source: LIFE Institute. Ecoregion Importance Factor calculed through the overlaping of 4 conservation priority area European database: The habitat's Directive (Directive 92/43/EEC), Key Biodiversity Areas (KBA`s), Natura 2000 and Biodiversity Hotspots (Conservation International).

i) Greenhouse Gases and their global warming potential (GWP) for a period of 100 years

Gas	Chemical formula	GWP
Carbon Dioxide	CO_2	1
Methane	CH_4	21
Nitrous Oxide	N_2O	310
Hydrofluorocarbon (HFC)		
HFC-125	C_2HF_5	2,800
HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1,300
HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	3,800
HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	140
Perfluorocarbons (PFC)		
Perfluoromethane (tetrafluoroethane)	CF_4	6,500
Perfluorethane (Hexafluoroethane)	C_2F_6	9,200
Sulfur hexafluoride	SF_6	23,900

Source: Report of IPCC: Climate change 2001: The scientific basis. (Adapted)

5. Factors for Unit Conversation:

a) Relations between Units

Exponential	Equivalence	Practical relations
(k) kilogram = 10^3	1 m^3 = 6.28981 barrels	
(M) mega = 10^6	1 barrel = 0.158987 m^3	1 toe year = 7.2 boe year
(G) giga = 10^9	1 joule = 0.239 cal	1 boe year = 0.14 toe year
(T) tera = 10^{12}	1 Btu = 252 cal	1 toe year = 0.02 boe day
(P) peta = 10^{15}	1 m^3 of oil = 0.872 t (in 1994)	1 boe day = 50 toe year
(E) exa = 10^{18}	1 toe = 10,000 Mcal	

Source: 2016 Unit converter and glossary – Internacional Energy Agency (IEA)

b) Coefficients of Caloric Equivalence

Multiplied by → from	to	(m^3) Fuel oil	(1,000 m^3) Dry natural gas	(t) Mineral Coal 5,200	(m^3) LPG	(t) Firewood	(t) Charcoal
Mineral Coal 5,200	(t)	0.52	0.56	1.00	0.80	1.58	0.76
Charcoal	(t)	0.67	0.73	1.31	1.05	2.06	1.00
Dry natural gas	(1,000 m^3)	0.92	1.00	1.78	1.43	2.80	1.36
LPG	(m^3)	0.64	0.70	1.25	1.00	1.97	0.95
Firewood	(t)	0.33	0.36	0.63	0.51	1.00	0.49
Fuel oil	(m^3)	1.00	1.09	1.94	1.56	3.06	1.48

Source: Ministry of Mines and Energy- 2013 (Adapted)

c) Conversion Factors for Mass

Multiplied by → from	to	kg	t	tl	tc	lb
Kilogram	(kg)	1	0.001	0.000984	0.001102	2.2046
Metric Ton	(t)	1,000	1	0.984	1.1023	2,204.6
Long ton	(tl)	1,016	1.016	1	1.12	2,240
Short ton	(tc)	907.2	0.9072	0.893	1	2,000
Pound	(lb)	0.454	0.000454	0.000446	0.0005	1

Source: 2016 Unit converter and glossary – International Energy Agency (IEA)

d) Conversion Factors for Volume

Multiplied by to / from		m^3	l	gal (US)	gal (UK)	bbl	ft^3
Cubic meters	(m^3)	1	1,000	264.2	220	6.289	35.3147
Liters	(l)	0.001	1	0.2642	0.22	0.0063	0.0353
Gallons	(US)	0.0038	3.785	1	0.8327	0.02381	0.1337
Gallons	(UK)	0.0045	4.546	1.201	1	0.02859	0.1605
Barrels	(bbl)	0.159	159	42	34.97	1	5.615
Cub feet	($feet^3$)	0.0283	28.3	7.48	6.229	0.1781	1

Source: 2016 Unit converter and glossary – International Energy Agency (IEA)

e) Conversion Factors for Energy

Multiplied by to / from		J	BTU	cal	kWh
Joule	(J)	1	947.8×10^{-6}	0.23884	277.7×10^{-9}
British Thermal Unit	(BTU)	1.055×10^{3}	1	252	293.07×10^{-6}
Calorie	(cal)	4.1868	3.968×10^{-3}	1	1.163×10^{-6}
Kilowatt-hour	(kWh)	3.6×10^{6}	3412	860×10^{3}	1
Ton of oil equivalent	(toe)	41.87×10^{9}	39.68×10^{6}	10×10^{9}	11.63×10^{3}
Barrel of oil equivalent	(boe)	5.95×10^{9}	5.63×10^{6}	1.42×10^{9}	1.65×10^{3}

Source: 2016 Unit converter and glossary – International Energy Agency (IEA)

f) Mean Coefficients of Equivalence for Gaseous Fuels

Multiplied by to / from 1,000 m^3	giga-calorie	toe (10,000 kcal/kg)	boe	tec (7,000 kcal/kg)	giga-joule	millions BTU	megawatt-hour (860 kcal/kWh)
Coke oven gas	4.3	0.43	3.03	0.614	18.00	17.06	5.00
Dry natural gas	8.8	0.88	6.20	1.257	36.84	34.92	10.23
Humid natural gas	9.93	0.993	6.99	1.419	41.58	39.40	11.55

Source: Ministry of Mines and Energy – 2013 (Adapted)

g) Mean Coefficients of Equivalence for Liquid Fuels

Multiplied by → to from m^3	giga-calorie	toe (10,000 kcal/kg)	Boe	tec (7,000 kcal/kg)	giga-joule	millions BTU	megawatt-hour (860 kcal/kWh)
Anhydrous ethyl alcohol	5.34	0.534	3.76	0.763	22.35	21.19	6.21
Hydrated ethyl alcohol	5.01	0.510	3.59	0.728	21.34	20.22	5.93
Asphalts	10.18	1.018	7.17	1.455	42.63	40.40	11.84
Petroleum coke	8.73	0.873	6.15	1.247	36.53	34.62	10.15
Refinery gas	6.55	0.655	4.61	0.936	27.43	26.00	7.62
Automotive gasoline	7.70	0.770	5.42	1.099	32.22	30.54	8.95
Aviation gasoline	7.63	0.763	5.37	1.090	31.95	30.28	8.88
LPG	6.11	0.611	4.30	0.872	25.56	24.22	7.10
Agents, Lubrication	8.91	0.891	6.27	1.272	37.29	35.34	10.36
Naphtha	7.65	0.765	5.39	1.093	32.05	30.37	8.90
Fuel oil	9.59	0.959	6.75	1.370	40.15	38.05	11.15
Diesel Oil	8.48	0.848	5.97	1.212	35.52	33.66	9.87
Other petroleum based energy sources	8.90	0.890	6.27	1.271	37.25	35.30	10.35
Other non-petroleum based energy sources	8.90	0.890	6.27	1.271	37.25	35.30	10.35
Petroleum	8.90	0.890	6.27	1.271	37.25	35.30	10.35
Aviation kerosene	8.22	0.822	5.79	1.174	34.40	32.60	9.56
Illuminating kerosene	8.22	0.822	5.79	1.174	34.40	32.60	9.56
Solvents	7.81	0.781	5.50	1.115	32.69	30.98	9.08

Source: Ministry of Mines and Energy – 2013 (Adapted)

h) Mean Coefficients of Equivalence for Solid Fuels

Multiplied by → to from ton	giga-calorie	toe (10,000 kcal/kg)	boe	tec (7,000 kcal/kg)	giga-joule	millions BTU	megawatt-hour (860 kcal/kWh)
Tar	8.55	0.855	6.02	1.221	35.80	33.93	9.94
Imported metallurgical coal	7.40	0.740	5.21	1.057	30.98	29.36	8.61
Steam coal 3,100 kcal/kg	2.95	0.295	2.08	0.421	12.35	11.70	3.43
Steam coal 3,300 kcal/kg	3.10	0.310	2.18	0.443	12.98	12.30	3.61
Steam coal 3,700 kcal/kg	3.50	0.350	2.46	0.500	14.65	13.89	4.07
Steam coal 4,200 kcal/kg	4.00	0.400	2.82	0.571	16.75	15.87	4.65
Steam coal 4,500 kcal/kg	4.25	0.425	2.99	0.607	17.79	16.86	4.94
Steam coal 4,700 kcal/kg	4.45	0.445	3.13	0.636	18.63	17.66	5.18
Steam coal 5,900 kcal/kg	5.60	0.560	3.94	0.800	23.45	22.22	6.51

Steam coal 6,000 kcal/kg	5.70	0.570	4.01	0.814	23.86	22.62	6.63
Unspecified steam coal	2.85	0.285	2.01	0.407	11.93	11.31	3.31
Steam coal 5,200 kcal/kg	4.90	0.490	3.45	0.700	20.52	19.44	5.70
Charcoal	6.46	0.646	4.55	0.923	27.05	25.63	7.51
Mineral coal coke	6.90	0.690	4.86	0.986	28.89	27.38	8.02
Firewood	3.10	0.310	2.18	0.443	12.98	12.30	3.61
Lye	2.86	0.286	2.01	0.409	11.97	11.35	3.33
Molasses	1.85	0.185	1.30	0.264	7.75	7.34	2.15

Source: Ministry of Mines and Energy – 2013 (Adapted)

i) Densities and Calorific Values – 2012

Energetic	Density kg/m³ (1)	Higher calorific value kcal/kg	Inferior calorific value kcal/kg
Tar	1,000	9,000	8,550
Anhydrous ethyl alcohol	791	7,090	6,750
Hydrated ethyl alcohol	809	6,650	6,300
Asphalts	1,025	10,500	9,790
Biodiesel (B100)	880	9,345	9,000
Imported metallurgical coal	-	7,700	7,400
Steam coal 3,100 kcal/kg	-	3,100	2,950
Steam coal 3,300 kcal/kg	-	3,300	3,100
Steam coal 3,700 kcal/kg	-	3,700	3,500
Steam coal 4,200 kcal/kg	-	4,200	4,000
Steam coal 4,500 kcal/kg	-	4,500	4,250
Steam coal 4,700 kcal/kg	-	4,700	4,450
Steam coal 5,200 kcal/kg	-	5,200	4,900
Steam coal 5,900 kcal/kg	-	5,900	5,600
Steam coal 6,000 kcal/kg	-	6,000	5,700
Unspecified steam coal	-	3,000	2,850
Charcoal	250	6,800	6,460
Mineral coal coke	600	7,300	6,900
Petroleum coke	1,040	8,500	8,390
Electricity [1]	-	860	860
Hydraulic Power [1]	1,000	860	860
Coke oven gas [2]	-	4,500	4,300
Refinery gas	0.780	8,800	8,400
Liquefied Petroleum Gas	552	11,750	11,100
Dry natural gas [2,3]	0.740	9,256	8,800
Humid natural gas [2,3]	0.740	10,454	9,930
Automotive gasoline	742	11,220	10,400
Aviation gasoline	726	11,290	10,600

Energetic	Density kg/m³ (1)	Higher calorific value kcal/kg	Inferior calorific value kcal/kg
Gathered firewood	300	3,300	3,100
Commercial firewood	390	3,300	3,100
Lye	1090	3,030	2,860
Agents, Lubrication	875	10,770	10,120
Molasses	1,420	1,930	1,850
Naphtha	702	11,320	10,630
Fuel oil	1,000	10,085	9,590
Diesel Oil	840	10,750	10,100
Other petroleum based energy sources	864	10,800	10,200
Other non-petroleum based energy sources	864	10,800	10,200
Petroleum	884	10,800	10,190
Aviation kerosene	799	11,090	10,400
Illuminating kerosene	799	11,090	10,400
Solvents	741	11,240	10,550

Source: Ministry of Mines and Energy – 2013 (Adapted)

[1] kcal/kWh
[2] kcal/m³
[3] At a temperature of 20 °C, for derivatives of petroleum and natural gas

j) Conversion Factors for mean toe

Energy Source	Unit	toe
Tar	m³	0.855
Anhydrous ethyl alcohol	m³	0.534
Hydrated ethyl alcohol	m³	0.510
Asphalts	m³	1.018
Biodiesel (B100)	m³	-
Imported metallurgical coal	T	0.740
Steam coal 3,100 kcal/kg	T	0.295
Steam coal 3,300 kcal/kg	T	0.310
Steam coal 3,700 kcal/kg	T	0.350
Steam coal 4,200 kcal/kg	T	0.400
Steam coal 4,500 kcal/kg	T	0.425
Steam coal 4,700 kcal/kg	T	0.445
Steam coal 5,200 kcal/kg	T	0.490
Steam coal 5,900 kcal/kg	T	0.560
Steam coal 6,000 kcal/kg	T	0.570
Unspecified steam coal	T	0.285
Charcoal	T	0.646

Energy Source	Unit	toe
Mineral coal coke	T	0.690
Petroleum coke	m^3	0.873
Electricity	MWh	0.086
Coke oven gas	10^3m^3	0.430
Refinery gas	10^3m^3	0.655
Liquefied petroleum gas	m^3	0.611
Dry natural gas	10^3m^3	0.880
Humid natural gas	10^3m^3	0.993
Automotive gasoline	m^3	0.770
Aviation gasoline	m^3	0.763
Hydraulic	MWh	0.086
Commercial firewood	T	0.310
Lye	T	0.286
Agents, Lubrication	m^3	0.891
Molasses	T	0.185
Naphtha	m^3	0.765
Fuel oil (medium)	m^3	0.959
Diesel Oil	m^3	0.848
Other non-renewable	Toe	1.000
Other renewable	Toe	1.000
Other petroleum based energy sources	m^3	0.890
Other non-petroleum based energy sources	m^3	0.890
Petroleum	m^3	0.891
Aviation kerosene	m^3	0.822
Illuminating kerosene	m^3	0.822
Solvents	m^3	0.781
Uranium contained in UO_2	Kg	73.908
Uranium U_3O_8	Kg	10.139

Source: Ministry of Mines and Energy -2015 (Adapted)

6. Scopes of GHG Protocol Program

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
Energy			
Generation of Energy	• Stationary combustion (boilers and turbines used in the production of energy, heat, or steam; fuel pumps; fuel cells; burning of discarded gases or flaring) • Mobile combustion (trucks, vessels, and trains for transporting fuels) • Fugitive emissions (CH_4 leak from transmission and from storage installations; HFC emissions from storage installations; SF_6 emissions from transmission and distribution equipment)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (mining and extraction of fuels, energy for refining and processing of fuels) • Process emissions (productions of fuels, SF_6 emissions) • Mobile combustion (transport of fuels / waste, business trips, employee commuting to-from work) • Fugitive emissions (CH_4 and CO_2 from landfills, pipelines, SF_6 emissions)
Oil & Gas	• Stationary combustion (process heaters, motors, turbines, burning of discarded gases or flaring, incinerators, oxidants, production of electricity, heat, and steam) • Process emissions (process vents, equipment vents, routine and maintenance activities, non-routine activities) • Mobile combustion (transport of raw materials, products, waste; vehicles belonging to the company) • Fugitive emissions (leaks from pressurized equipment, sewage treatment, dams)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (use of products as fuel or combustion for the production of acquired materials) • Mobile combustion (transport of raw materials, products, and waste; employees' business trips; employee commuting to-from work; use of products as fuel) • Process emissions (use of product as raw material or emissions resulting from the production of acquired materials) • Fugitive emissions (CH_4 and CO_2 from landfills or from the production of acquired materials)

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
Coal Mining	• Stationary combustion (flaring and use of methane, use of explosives, fires in mines) • Mobile combustion (mining equipment, transport of coal) • Fugitive emissions (CH_4 emissions from coal mines and coal deposits)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (use of product as fuel) • Mobile combustion (transport of coal or waste, employees' business trips, employee commuting to-from work) • Process emissions (gasification)
		Metals	
Aluminum	• Stationary combustion (processing of bauxite into aluminum; coke baking; use of lime; sodium carbonate and fuel; CHP) • Process emissions (anodic oxidation, electrolysis, PFC) • Mobile combustion (transport pre-and post-casting smelting, ore trucks) • Fugitive emissions (CH_4, HFC and PFC from fuel pipes, SF_6 as blanket gas)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (processing of raw materials and production of coke by third parties, manufacture of machinery for the production line) • Mobile combustion (transport services, business trips, employee's trips) • Process emissions (during the production of acquired materials) • Fugitive emissions (CH_4 and CO_2 from mining and landfills, emissions from outsourced processes)
Iron and steel	• Stationary combustion (flows of coke, coal, and carbonate; boilers; burners) • Process emissions (oxidation of pig-iron, consumption of reducing agent, carbon content of pig-iron and ferroalloys) • Mobile combustion (on-site transport) • Fugitive emissions (CH_4, N_2O)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (mining equipment, production of acquired materials) • Process emissions (production of ferroalloys) • Mobile combustion (transport of raw materials, products, waste and intermediary products) • Fugitive emissions (CH_4 and CO_2 from sanitary landfills)
		Chemicals	
Nitric acid, ammonia, adipic acid, urea, petrochemicals	• Stationary combustion (boilers, burners, reducing furnaces, flame reactors, steam reformers)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (production of acquired materials, waste combustion)

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
	• Process emissions (oxidation or reduction of substrates, removal of impurities, N_2O by-products, catalytic cracking, and several other individual emissions from each process) • Mobile combustion (transport of raw materials, products and waste) • Fugitive emissions (use of HFC, leakage from storage tanks)		• Process emissions (production of acquired materials) • Mobile combustion (transport of raw materials, products and waste; business trips, employee commuting to-from work) • Fugitive emissions (CH_4 and CO_2 from sanitary landfills and ducts)
Minerals			
Cement and lime	• Process emissions (calcination of limestone) • Stationary combustion (clinker over, drying of raw materials, energy production) • Mobile combustion (quarry operations, on-site transport)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (production of acquired materials, waste combustion) • Process emissions (production of acquired clinker and lime) • Mobile combustion (transport of raw materials, products and waste; business trips, employee commuting to-from work)
Waste			
Landfills, waste combustion, water services	• Stationary combustion (incinerators, boilers, burners) • Process emissions (sewage treatment, nitrogen loading) • Fugitive emissions (emissions of CH_4 and CO_2 from the decomposition of waste and animal product) • Mobile combustion (transport of waste or products)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (recycled waste used as fuel) • Process emissions (recycled waste used as raw materials) • Mobile combustion (transport of waste or products, business trips, employee commuting to-from work)

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
		Pulp & Paper	
Pulp & Paper	• Stationary combustion (production of steam and energy, emissions derived from fossil fuels from the calcination of calcium carbonate in lime ovens, drying of products using infrared dryers powered by fossil fuels) • Mobile combustion (transport of raw materials, products, and waste; operation of harvesting equipment) • Fugitive emissions (CH_4 and CO_2 from waste)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (production of acquired materials, waste combustion) • Process emissions (production of acquired materials) • Mobile combustion (transport of raw materials, products, and waste; business trips, employee commuting to-from work) • Fugitive emissions (landfill emissions of CH_4 and CO_2)
		Production of HFC, PFC, SF_6 and HCFC-22	
Production of HCFC-22	• Stationary combustion (energy consumption, heat or steam) • Process emissions (ventilation of HFC) • Mobile combustion (transport of raw materials, products and waste) • Fugitive emissions (use of HFC)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (production of acquired materials) • Process emissions (production of acquired materials) • Mobile combustion (transport of raw materials, products and waste; business trips, employee commuting to-from work) • Fugitive emissions (leakages in the use of the product, CH_4 and CO_2 from landfills)
		Production of Semiconductors	
Production of Semiconductors	• Process emissions ((C_2F_6, CH_4, CHF_3, SF_6, NF_3, C_3F_8, C_4F_8, N_2O used in the fabrication of wafers, CH_4 created from the processing of C_2F_6 and C_3F_8) • Stationary combustion (oxidation of volatile organic waste; production of energy, heat, or steam)	• Stationary combustion (consumption of energy, heat or steam acquired)	• Stationary combustion (production of imported materials, combustion of waste, losses in T&D of energy acquired higher in the value chain) • Process emissions (production of acquired materials, outsourced elimination of gases from processes and remnants from storage tanks)

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
	• Fugitive emissions (leakages in the storage of process gases, leakages of remnants from storage tanks) • Mobile combustion (transport of raw materials, products and waste)		• Mobile combustion (transport of raw materials, products and waste; business trips, employee commuting to-from work) • Fugitive emissions (emissions of CH_4 and CO_2 from landfills, leakages of remnants in storage tanks of process gases lower in the value chain).
Other Sectors			
Sector of services / organizations with activities performed in offices	• Stationary combustion (production of energy, heat or steam) • Mobile combustion (transport of raw materials or waste) • Fugitive emissions (mainly emissions of HFC during the use of refrigeration and air-conditioning equipment)	• Stationary combustion (energy consumption, heat or steam acquired)	• Stationary combustion (production of acquired materials) • Process emissions (production of acquired materials) • Mobile combustion (transport of raw materials, products and waste; business trips, employee commuting to-from work)

Source: Specifications of the GHG Protocol Program – 2nd Edition.

NOTES ON DEVELOPMENT OF THIS DOCUMENT

Version 1.0: approved on 08/25/2022, by the LIFE Institute Board of Directors. Initial issue of the document.

Version 1.0-R1: approved on 08/31/2023, by the LIFE Institute Board of Directors. Change of document layout and insertion of the new LIFE Institute logo.

