LIFE TECHNICAL GUIDE - 01

LIFE-BR-TG01-3.2-English

Version 3.2 - Brazil - English

(MAY/2018)

OBJECTIVE

To establish the minimum performance that each organization/producer must achieve in biodiversity and ecosystem services conservation actions, considering its size and impact.

APPLICATION

This document applies to organizations and producers who want to contribute to the conservation of biodiversity and ecosystem services and require a support tool to assess and monitor their impacts and their minimum performance for conservation.

For LIFE certified organizations in previous versions, this document will become effective from their first follow-up audit after its publication. For other organizations/producers, this document will automatically apply from the publication date.

APPROVAL

Document approved by the LIFE Institute Board of Directors.

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LIST OF ACRONYMS

ANA: Brazilian National Water Agency

A_O: Area of the organization/producer

A_{OE}: Ecoregion original area

A_{RE}: Area with plant coverage remnant of the ecoregion

BCA: Performance in Biodiversity Conservation Actions

BCA_{min}: Minimum score to be reached by an organization/producer according to its estimated impact to biodiversity (BII) and size (gross income).

BII: Biodiversity Impact Index

boe: Barrel of oil equivalent

DAB_{CHR}: Demand-Availability Balance of the country's most critical hydrographic region

DAB_{OHR}: Demand-Availability Balance of the hydrographic region where the organization/producer is located

EC: Total amount of energy consumed

EC_i: Energy consumption from source *i*

EG: Total amount of greenhouse gas emissions

EG_i: Amount of greenhouse gas emitted *i*

GHG: Greenhouse Gases

GR: Gross revenue

GWP: Global warming potential

IA: Impact value

ID_i: Impact of type *i* waste destination

ID_{max}: Maximum impact observed among the types of waste destination

IE_i: Impact of energy source *i*

IE_{max}: Maximum impact observed among energy sources

II_i: Impact index of aspect *i*

IPCC: Intergovernmental Panel on Climate Change

IPEA: Brazilian Institute for Applied Economic Research

LIFE-BR-TG02: LIFE Technical Guide 02

m^3/s: Cubic meter per second

m^3: Cubic meter

MCid: Brazilian Ministry of Cities

MME: Brazilian Ministry of Mines and Energy

MTC: Brazilian Ministry of Science and Technology

NIS: National Interconnected System

APBE: Action Plan for Biodiversity and Ecosystem Services

PROBIO: Project for the Conservation and Sustainable Use of Brazilian Biological Diversity

QSV_{GHG}: Quantity and severity value for the greenhouse gases aspect

QV: Quantity value

RV: Reference value

SNIS: National Information System on Sanitation

SV: Severity value

tCO_2e: Ton of CO_2 equivalent

Tep (toe): Ton of Oil Equivalent

WG: Total amount of hazardous and non-hazardous waste generated

WG_i: Waste generated of type *i*

WU: Total amount of water used

WWF: World Wide Fund for Nature

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1. INTRODUCTION

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

From the calculation of the BII, 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 Impact Index (BII)[1] and the minimum performance in biodiversity conservation actions (BCA_{min}) relating to every size and impact.

In addition to the use of these tools for public and private management, 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 whenever an organization/producer:

- ✓ Achieves a performance in biodiversity conservation equal to or higher than the minimum set according to the methodology herein described. This positive performance must be demonstrated through an Action Plan for Biodiversity and Ecosystem Services (APBE), assessed and rated according to the document LIFE-BR-TG02.
- ✓ Meets the minimum indicators for biodiversity management described in LIFE Certification Standards (LIFE-BR-CS).

This document applies to industry, services, and the primary sector (farming areas: agriculture, forestry, animal production and aquaculture), whereas it does not apply to extractivism activities.

[1] Called BEIV (Biodiversity Estimated Impact Value) in the previous versions.

2. BIODIVERSITY IMPACT INDEX (BII)

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

The 5 environmental aspects measured and assessed to calculate the BII 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[2] 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 usage; energy consumption; footprint; greenhouse gas emission.

The BII is obtained through information relative to the quantity and severity relating to these 5 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 country. This comparison generates a quantity value of impact for each environmental aspect referring to its contribution to the national 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, health hazard, the disposal of waste generated by the activities, and national fragility of the ecoregion occupied by the enterprise. This information, although qualitative, is quantitatively represented by the severity values, which range between 0 and 1 and may be called severity factors.

By multiplying the quantity values of impact by their severity factors, “Impact Values” (IV) are generated for each environmental aspect. For comparison purposes, these impact values are transformed into “Impact Indexes” (II), 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 country for each environmental aspect.

The simple average of the Impact Indexes (II) for each one of the environmental aspects, results in the Biodiversity Impact Index (BII).

The following sections of the document present the steps for calculating the BII and the required Information from organizations and producers for its calculation.

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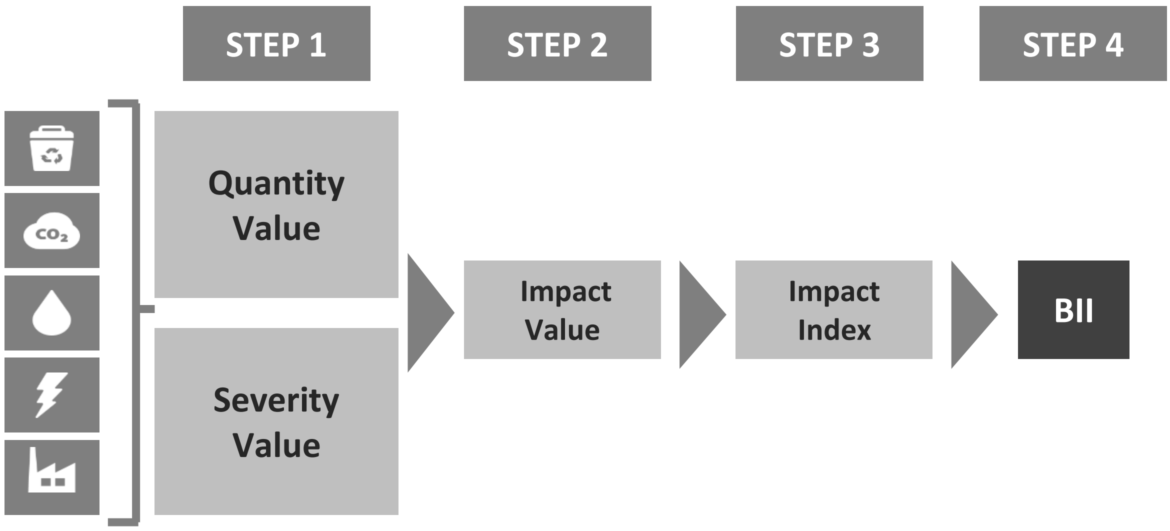
[2] Destruction of habitats; climate changes; introduction of invasive exotic species; over-exploitation of species; pollution (*Millennium Ecosystem Assessment*, 2005).

2.1 CALCULATION OF THE BIODIVERSITY IMPACT INDEX (BII)

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

FIGURE 1. Steps for calculating the Biodiversity Impact Index (BII).



2.1.1 Quantity and Severity Values

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 BII 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	$QV_{ENERGY} = \frac{EC}{RV_{ENERGY}}$	$SV_{ENERGY} = \frac{\sum_{i=1}^{n}(\%EC_i \times IE_i)}{IE_{max}}$
Occupation of Natural Areas	$QV_{AREA} = \frac{A_O}{A_E}$	$SV_{AREA} = 1 - \frac{A_{RE}}{A_{OE}}$
Emission of Greenhouse Gases	$QSV_{GHG} = \left(\frac{\sum_{i=1}^{n}(GE_i \times GWP_i)}{RV_{GHG}}\right)$	

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}= National Reference Value for waste (t/year) according to 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 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 Appendix.

EQUATION	TERMS USED
QV_{AREA}	QV_{AREA}= Quantity Value for Area A_O= Area of the organization/producer (hectares) A_{OE}= Original area of the ecoregion in which the organization/producer is located (hectares), according to 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 (tCO_2e/year) GWP_i= Global warming potential of greenhouse gas *i* according to Appendix. RV_{GHG}= Reference value for greenhouse gases (tCO_2e/year) according to 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 in the 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 of country's most critical hydrographic region listed in the Appendix. DAB_{OHR}= Demand-Availability Balance of the hydrographic region where the organization/producer is located, listed in the 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 the Appendix. IE_{max}= Maximum impact observed between energy sources according to Appendix.
SV_{AREA}	SV_{AREA}= Severity value for the occupation aspect of natural areas. A_{OE}= Original area of the ecoregion in which the organization/producer is located (hectares), according to Appendix. A_{RE}= Area of remaining vegetation in the ecoregion in which the organization/property is located.

2.1.2 Impact Values

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

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

ENVIRONMENTAL ASPECT	IMPACT VALUE OF THE ASPECT
Waste Generation	$IV_i = QV_i \times SV_i$
Water Consumption	
Energy Consumption	
Occupation of Natural Areas	
Emission of Greenhouse Gases	$IV_{GHG} = QSV_{GHG}$

2.1.3 Impact Indexes

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

$$II_i = \left(1 - \frac{1}{1 + a_i IV_i}\right) \times 1000$$

Wherein:

II = Impact Index of aspect *i*

a_i= Correction factor[3] of aspect *i*, which allows *II* to range between 0 and 1,000

IV = Impact Value of aspect *i*

2.1.4 Calculation of the Biodiversity Impact Index

The Biodiversity Impact Index is obtained by the simple arithmetic average of the Impact Indexes (II) of the five environmental aspects assessed:

$$BBI = \frac{II_{WATER} + II_{ENERGY} + II_{GHG} + II_{WASTE} + II_{AREA}}{5}$$

[3] See details in the Appendix.

The information herein presented is only a description of the calculations used. Achieving the BII is facilitated through the use of an automated calculation tool provided by LIFE Institute, upon request.

Information on the reference values used in Brazil, herein mentioned, as well as for unit conversion, can be found in the Appendix **(Reference Information to calculate the BII in Brazil)**.

2.2 DATA REQUIRED TO CALCULATE THE BII

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

Prior to the calculation, it is necessary to define clearly and objectively which unit is being assessed. This information will be used as reference for the entire assessment process, considering the scope rule for LIFE Certification.

For situations not provided for in this document or in the support tools mentioned therein, the organization/producer must present its own estimate to the auditor, justifying the data presented during the audit. In case of impossibility of assessing one or more cultures or activities in particular, the auditor may temporarily relieve the organization/producer from inserting the environmental aspect in question into the calculation of the BII, recording on the audit report the need for effort and follow-up of tools and methodologies over time to collect these data.

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 use of area relating to these processes must be informed on the other environmental aspects to calculate the impact of the organization/property.

The auditor may request and assess information on wastes eventually not included in the calculation for the purposes of checking compliance with Principles 2, 5 and 8 of LIFE Certification Standards.

c) Inform health hazards 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. In such cases, the auditor must mention and justify this choice in the audit report.

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.

If the value presented is an estimate, due to the absence of previous records, the auditor must assess the coherence of the figures provided and record on the audit report the need to begin periodic controls.

2.2.2 Water Consumption

a) Inform the volume of consumptive water use[4] 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[5] .

   - Animal production: water consumption estimates can be obtained by extrapolation of the individual consumption per animal/head, including watering, washing, etc.

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

[5] *The Water Footprint Assessment Tool* Available at: http://waterfootprint.org/en/resources/interactive-tools/water-footprint-assessment-tool/

- Forestry: water consumption estimates for the *Pinus* and *Eucalyptus* genera can be obtained through the LIFE Key calculation tool[6] . In these cases, it is necessary to inform the area planted with each gender and the location of plantations.

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 hydrographic region where the assessed enterprise is located.

The organization can define its hydrographic region more accuracy by entering the location data on the map provided by the LIFE Key tool.

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 National Interconnected System (NIS)

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

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

xii) Hydroelectricity

xiii) Non-renewable residual

xiv) Nuclear

xv) Oil and derived

xvi) Solar

2.2.4 Occupation of Areas

a) Inform the *area* (hectares), distributed according to occupancy classes in accordance with MSA (Mean Species Abundance[7]).

b) Inform the ecoregion in which the organization/producer is located. The organization can define its ecoregion more accurately by entering the location data on the map provided by the LIFE Key tool.

c) In the case of agricultural properties bound to leasing contracts or others, inform only the areas relating to the contract[8] .

d) External areas to the assessed properties, bound only to conservation actions, must not be accounted for to calculate the BII.

2.2.5 Emission of Greenhouse Gases

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.[9]. For the year zero of certification, information pertaining only to Scopes 1+2 will be accepted. More detailed

[7] 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 area in question in relation to their abundance in undisturbed ecosystems. An area 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 occupation of area are in the Appendix. For more details: http://www.globio.info/background-msa

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

[9] Cross-sectoral GHG Protocol Tool. Available at http://twixar.me/sVP

information on the scopes of the GHG Protocol is listed in the Appendix and in the document LIFE-BR-RD003.

The GHG Protocol also has a calculation tool specific for the primary sector[10]. Other tools for the inventory of emissions will be accepted, as long as also using the IPCC (Intergovernmental Panel on Climate Change) guidelines[11].

The BII assesses the negative impacts 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[12], may score as indirect action for biodiversity conservation (strategic line "G4" - LIFE-BR-TG02).

[10] GHG Protocol Agricultural Guidelines. Available at http://twixar.me/cVP

[11] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Available at: http://twixar.me/xVP

[12]Validation by recognized initiatives relative to the topic or by consulting works based in detailed, justified and recognized methodologies.

3. MINIMUM PERFORMANCE IN ACTIONS FOR BIODIVERSITY CONSERVATION (BCA_{MIN})

The minimum performance in biodiversity conservation for the LIFE Certification is determined by two factors: the Biodiversity Impact Index (BII) and the company's Gross Revenue (GR).

The BCA_{min} is obtained through the following equation:

$$BCA_{min} = 50 \times \mathrm{BII}^{x} \times \mathrm{GR}^{y}$$

Wherein:

BII: Biodiversity Impact Index

GR: Gross Revenue

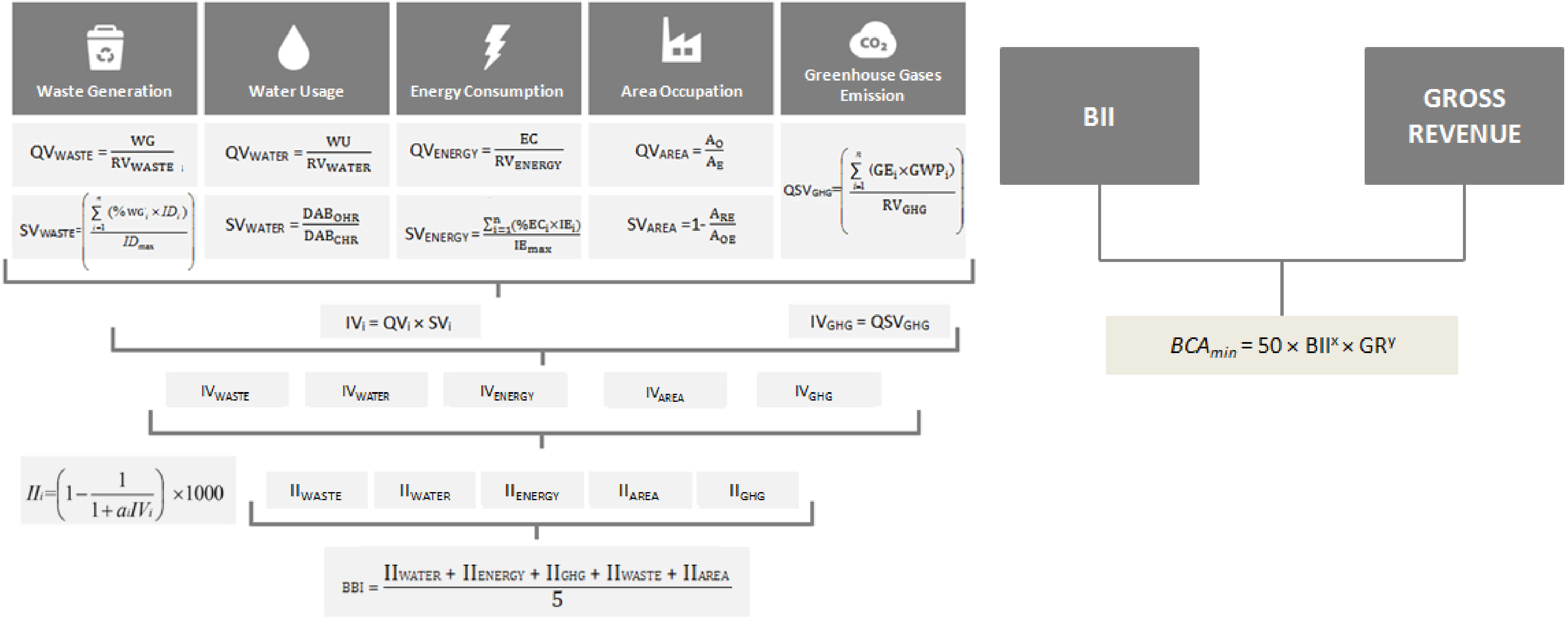
x, y: calibration factors of BCA_{min}

Considering the assessment and scoring of the Action Plan for Biodiversity and Ecosystem Services Action Plan (APBE) of the organization/producer ($BCA_{achieved}$[13]), the $BCA_{to\ be\ achieved}$ is calculated:

$$BCA_{to\ be\ achieved} = BCA_{min} - BCA_{achieved}$$

[13] LIFE-BR-TG02

4. FLOW CHARTS FOR CALCULATING BII AND BCA_{MIN}



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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 Impact Indexes. The correction factors are determined nationally, aimed at establishing a distribution scale of the impacts from the higher values for each individual impact (productive unit) in the country. In each country, 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 Brazil are: **(i) Waste: 7,345; (ii) Water: 6,615; (iii) Energy: 2,358; (iv) Area: 7,923; (v) Greenhouse Gases: 7,995.**

2. Calibration factors of BCA_{min}

The factors of equation $BCA_{\mathbf{min}}$ are the ones that adjust the country'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 BCA_{min} in Brazil: x) 0,42; y) 0,29.

3. Reference Values (RV) for environmental aspects

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

ASPECT	REFERENCE VALUE (RV)	DOCUMENT	YEAR	BASE YEAR	INFORMATION USED
WASTE	188,163,813 t/year	Diagnosis of Urban Solid Waste	2012	2008	Estimated generation of total urban solid waste in the country, a result of municipal inventories.
		Diagnosis of Solid Waste Management in Brazil	2016	2014/2012	
GASES	2,192,601,000 tCO_2e/year	Second National Communication of Brazil to the United Nations Framework Convention on Climate Change	2010	2005	Total greenhouse gas emissions in the country in CO_2e converted through the GWP metric.
ENERGY	305,589,000 toe/year	National Energy Balance	2015	2014	Domestic supply of domestic energy, value that includes both end-use energy and conversions that take place in processing centers, such as: refineries, power generation centers, etc.
WATER	617,536,607,520 m^3/year	Systematic Survey of Agricultural Production	2016	2015	Demand for water that corresponds to the flow of withdrawal, that is, water collected intended to various consumption uses (blue water), plus water evapotranspirated during the agricultural production process (green water).
		Water Footprint Assessment Tool			
		Conjuncture of Water Resources in Brazil	2015	2013/2014	

4. References for the calculation of the Severity Valor

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**

Positive Impact: 0 - Presence of positive impact / 1 - Absence of positive impact.
Negative Impact: 0 - Absence of negative impact / 1 - Presence of negative impact
Max ID: 45

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	0	**50**
Recycling	0	0	0	0	0	10	0	10	0	10	10	10	10	10	70	1	**70**
Landfarming	0	0	0	0	0	0	0	10	10	10	10	10	10	10	70	1	**70**
Co-processing	0	0	0	0	0	10	0	10	10	10	10	10	10	10	80	1	**80**
Biogas	0	0	0	10	0	0	10	10	10	10	10	10	10	10	90	2	**180**
Storage	0	0	10	10	-	0	0	10	0	10	10	10	10	10	80	3	**240**
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**

Positive Impact: 0 - Presence of positive impact / 10 - Absence of positive impact.

Negative Impact: 0 - Absence of negative impact / 10 - Presence of negative impact

Max ID: 700

c) Demand-Availability Balance (DAB) by Hydrographic Region

Hydrographic Region	Water availability in the region (m^3/s)	Water demand in the region (m^3/s)	Demand-Availability Balance (DAB)
Amazon Hydrographic Region	73,748	78.8	0.00107
Tocantins-Araguaia Hydrographic Region	5,447	135.6	0.02489
Paraguay Hydrographic Region	782	30	0.03836
Western Northeast Atlantic Hydrographic Region	320	23.7	0.07406
Paraná Hydrographic Region	5,956	736	0.12357
Parnaíba Hydrographic Region	379	50.9	0.13430
São Francisco Hydrographic Region	1,886	278.8	0.14783
Southeast Atlantic Hydrographic Region	1,145	213.7	0.18664
Uruguay Hydrographic Region	565	155.4	0.27504
East Atlantic Hydrographic Region	305	112.3	0.36820
South Atlantic Hydrographic Region	647	295.4	0.45657
Eastern Northeast Atlantic Hydrographic Region	91	262	2.87912

d) Severity Value for Water

Hydrographic Region	VSa = BDD(RHO)/BDD(RHC)
Amazon Hydrographic Region	0.000371121
Tocantins-Araguaia Hydrographic Region	0.008646541
Paraguay Hydrographic Region	0.013324613
Western Northeast Atlantic Hydrographic Region	0.025723998
Paraná Hydrographic Region	0.042920347
Parnaíba Hydrographic Region	0.046646458
São Francisco Hydrographic Region	0.051344175
Southeast Atlantic Hydrographic Region	0.064824494
Uruguay Hydrographic Region	0.095530636
East Atlantic Hydrographic Region	0.127885121
South Atlantic Hydrographic Region	0.158579232
Eastern Northeast Atlantic Hydrographic Region	1.000000000

e) Participation by energy source in the National Interconnected System

Energy source	Participation in the total electricity production in Brazil
Biodiesel	0.00%
Biogas	0.00%
Biomass (wood)	0.00%
Biomass (residual)	7.52%
Mineral Coal	3.30%
Sea Energy	0.00%
Wind	2.06%
Ethanol	0.00%
Natural Gas	13.39%
Geothermal	0.00%
Hydroelectricity	64.06%
Non-renewable residual	0.00%
Nuclear	2.57%
Petroleum	7.11%
Solar	0.01%

Source: 2013 National Energy Balance - Ministry of Mines and Energy

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

IE_{max}= 110

g) Mean Species Abundance (MSA)

MSA	Classes of Soil Cover
1	Forests or other natural preserved or naturally without coverage ecosystems
0.7	Natural or little explored ecosystems
0.5	Altered natural ecosystems; areas in recovery, production in biodiverse systems, squares/native gardens
0.3	Low impact crops
0.2	Forest plantations
0.1	Intensive farming and livestock, artificial pasture, artificial reservoirs and squares/conventional gardens
0.05	Built-out areas

h) 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

Adapted from: Second National Communication of Brazil to the United Nations Framework Convention on Climate Change - Volume 1.

i) Ecoregions of Brazil

a) Original and remnant areas of terrestrial ecoregions of Brazil

Ecoregion	Original area (ha)	Remaining area (ha)
Campinaranas of Alto Rio Negro	8,097,018.53	154,880.00
Forests of the Interior of Paraná/Paranaíba	44,471,197.84	3,655,168.00
Savannas of the Guyanas	7,810,248.84	650,496.00
Mangroves of Maranhão	1,420,390.15	154,880.00
Coastal forest of Bahia	11,957,910.29	1,424,896.00
Araucaria Forests	26,459,380.91	3,221,504.00
Floodplains of Gurupá	994,016.56	123,904.00
Forests of the Interior of Bahia	25,607,062.55	3,779,072.00
Negro/Branco Interfluve	4,880,148.15	805,376.00
Dry forests of Mato Grosso	42,887,310.92	8,673,280.00
Humid Chaco	152,373.39	30,976.00
Rupestrian Fields	2,975,353.68	619,520.00
Rio Piranhas Mangroves/Ilha Grande Mangroves/São Francisco River Mangroves	952,021.76	216,832.00
Dry Forest of Chiquitano	7,068,488.15	1,672,704.00
Northeastern Swamps	483,563.86	123,904.00
Coastal Forests of Pernambuco	1,797,612.24	495,616.00
Coastal Forests of Serra do Mar	12,557,215.14	3,655,168.00
Atlantic Coast Mudflats	924,553.84	278,784.00
Japurá/Solimões-Negro Interfluve	23,572,308.81	7,960,832.00
Forests of the Interior of Pernambuco	2,291,852.63	774,400.00
Southern Fields	23,341,787.81	8,301,568.00
Tocantins-Araguaia/Maranhão Interfluve	19,371,014.33	7,155,456.00
Forests of Caqueta	1,284,699.38	650,496.00
Floodplains of Marajó	8,285,075.30	4,212,736.00
Savannah	205,679,296.90	104,853,760.00
Caatinga	75,459,926.65	43,056,640.00
Tepuis	516,151.97	309,760.00
Forests of Babaçu do Maranhão	14,336,095.92	8,735,232.00
Floodplains of Monte Alegre	6,744,059.64	4,212,736.00
Xingu/Tocantins-Araguaia Interfluve	26,842,076.62	16,850,944.00
Dry Forests of the Northeast	12,119,509.64	8,053,760.00
Solimões/Japurá Interfluve	3,645,373.67	2,447,104.00
Madeira/Tapajós Interfluve	67,838,902.32	47,764,992.00
Lowland Forests of the Guyanas	8,563,652.97	6,288,128.00

Ecoregion	Original area (ha)	Remaining area (ha)
Altitude Forests of the Guyanas	2,730,212.64	2,013,440.00
Purus/Madeira Interfluve	17,710,235.04	13,257,728.00
Uamatá/Trombetas Interfluve	47,197,632.22	36,148,992.00
Coastal Mudflats of the Northeast	979,821.72	774,400.00
Floodplains of Iquitos	3,198,498.28	2,571,008.00
Pantanal	15,163,835.40	12,297,472.00
Floodplains of Purus	14,604,515.88	12,421,376.00
Tapajós/Xingu Interfluve	34,130,683.92	29,365,248.00
Forests of the Guyanas	6,857,215.98	6,133,248.00
Amazon Southwest	32,578,735.36	29,272,320.00
Juruá/Purus Interfluve	24,538,386.00	23,510,784.00

Source: LIFE Institute/Federal University of Goiás, 2014. Adapted from: MMA (2005); WWF (2014).

b) Priority Ranking of Marine Ecoregions in Brazil

Ranking/Priority	Marine Ecoregion
1	Amazon
2	Eastern Brazil
3	Southeastern Brazil
4	Northeastern Brazil
5	Rio Grande
6	Islands of São Pedro and São Paulo
7	Fernando de Naronha and Atol das Rocas
8	Islands of Trindade and Martim Vaz

The priority of the marine ecoregions in Brazil combines both the borders of the ecoregions, according to the Marine Ecoregions of the World (2007), the degree of priority and biological importance defined by the Conservation Overview of Marine and Coastal Ecosystems (MMA, 2010) and the extension of each priority area (in km²), resulting in the following equation:

$$\boldsymbol{PC_{em}} = \sum_{i=1}^{n} (\boldsymbol{S_i})^{GI}$$

Wherein:
PC_{em} = priority of the marine ecoregion for conservation
S_i = size of the priority area i, as defined by MMA (2010) - (km^2)
GI = value of the degree of importance of the priority area i

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: 2013 National Energy Balance - Ministry of Mines and Energy

b) Coefficients of Caloric Equivalence

Multiplied by → from	to	(m^3)	(1,000 m^3)	(t)	(m^3)	(t)	(t)
		Fuel oil	Dry natural gas	Mineral Coal 5,200	LPG	Firewood	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: 2013 National Energy Balance - Ministry of Mines and Energy

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: 2013 National Energy Balance - Ministry of Mines and Energy

d) Conversion Factors for Volume

Multiplied by from →	to	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: 2013 National Energy Balance - Ministry of Mines and Energy

e) Conversion Factors for Energy

Multiplied by from →	to	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: 2013 National Energy Balance - Ministry of Mines and Energy

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)
Piped gas Rio de Janeiro	3.8	0.38	2.68	0.543	15.91	15.08	4.42
Piped gas São Paulo	4.5	0.45	3.17	0.643	18.84	17.86	5.23
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: 2013 National Energy Balance - Ministry of Mines and Energy

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: 2013 National Energy Balance - Ministry of Mines and Energy

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
Sugarcane bagasse	2.13	0.213	1.50	0.304	8.92	8.45	2.48
Guarapa	0.62	0.062	0.44	0.089	2.61	2.47	0.72
Imported metallurgical coal	7.40	0.740	5.21	1.057	30.98	29.36	8.61
National metallurgical coal	6.42	0.642	4.52	0.917	26.88	25.47	7.47
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: 2013 National Energy Balance - Ministry of Mines and Energy

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
Sugarcane bagasse [1]	130	2,257	2,130
Biodiesel (B100)	880	9,345	9,000
Sugarcane juice	-	623	620

Energetic	Density kg/m³ (1)	Higher calorific value kcal/kg	Inferior calorific value kcal/kg
Imported metallurgical coal	-	7,700	7,400
National metallurgical coal	-	6,800	6,420
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 [2]	-	860	860
Hydraulic Power [2]	1,000	860	860
Piped gas Rio de Janeiro [3]	-	3,900	3,800
Piped gas São Paulo [3]	-	4,700	4,500
Coke oven gas [3]	-	4,500	4,300
Refinery gas	0.780	8,800	8,400
Liquefied Petroleum Gas	552	11,750	11,100
Dry natural gas [3,4]	0.740	9,256	8,800
Humid natural gas [3,4]	0.740	10,454	9,930
Automotive gasoline	742	11,220	10,400
Aviation gasoline	726	11,290	10,600
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

Energetic	Density kg/m³ (1)	Higher calorific value kcal/kg	Inferior calorific value kcal/kg
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: 2013 National Energy Balance - Ministry of Mines and Energy
1 Bagasse with 50% humidity
2 kcal/kWh
3 kcal/m³
4 At a temperature of 20 °C, for derivatives of petroleum and natural gas

j) Conversion Factors for mean toe

Energy Source	Unit	toe
Tar	m^3	0.855
Anhydrous ethyl alcohol	m^3	0.534
Hydrated ethyl alcohol	m^3	0.510
Asphalts	m^3	1.018
Sugarcane bagasse	T	0.213
Biodiesel (B100)	m^3	-
Guarapa	T	0.062
Imported metallurgical coal	T	0.740
National metallurgical coal	T	0.642
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
Mineral coal coke	T	0.690
Petroleum coke	m^3	0.873
Electricity	MWh	0.086
Piped gas Rio de Janeiro	$10^3 m^3$	0.880
Piped gas São Paulo	$10^3 m^3$	0.450

Energy Source	Unit	toe
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: 2015 National Energy Balance - Ministry of Mines and Energy

6. Scopes Brazilian 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)	• 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
	• Fugitive emissions (leaks from pressurized equipment, sewage treatment, dams)		
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)

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
Chemicals			
Nitric acid, ammonia, adipic acid, urea, petrochemicals	• Stationary combustion (boilers, burners, reducing furnaces, flame reactors, steam reformers) • 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)	• 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 (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	• 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
	the decomposition of waste and animal product) • Mobile combustion (transport of waste or products)		
	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	• Stationary combustion (consumption of energy, heat or	• Stationary combustion (production of imported materials, combustion of waste, losses in T&D of energy

Sector	Emission Source Scope 1	Emission Source Scope 2	Emission Source Scope 3
	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) • Fugitive emissions (leakages in the storage of process gases, leakages of remnants from storage tanks) • Mobile combustion (transport of raw materials, products and waste)	steam acquired)	acquired higher in the value chain) • Process emissions (production of acquired materials, outsourced elimination of gases from processes and remnants from storage tanks) • 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 Brazilian GHG Protocol Program – 2nd Edition.