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ISAR SDG Reporting

Core SDG Indicators for Entity Reporting:
TUTORIAL SESSIONS

Environmental indicators

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Environmental Indicators

Module B

Core SDG Indicators for Entity Reporting

Training Manual

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Learning Objectives

By the end of this module, you will:

a) Be able to define and calculate the following core indicators in the environmental area:

- ✓ Water recycling and reuse;
- ✓ Water use efficiency;
- ✓ Water stress;
- ✓ Reduction of waste generation;
- ✓ Waste reused, re-manufactured and recycled;
- ✓ Hazardous waste;
- ✓ Greenhouse gas emissions (scope 1);
- ✓ Greenhouse gas emissions (scope 2);
- ✓ Ozone-depleting substances and chemicals;
- ✓ Renewable energy;
- ✓ Energy efficiency.

b) Be able to critically assess existing potential sources of information to calculate environmental indicators in your company

c) Understand how to design a system to collect the information that is required to calculate environmental indicators

d) Refer to examples of companies already using and disclosing environmental indicators

B.1 Sustainable use of water

B.1.1 Water recycling and reuse

B.1.2 Water use efficiency

B.1.3 Water stress

B.1 Sustainable use of water

B.1.1 Water recycling and reuse

B.1.2 Water use efficiency

B.1.3 Water stress

B.1.1 Water recycling and reuse: Definition

Water recycling and reuse is **the total volume of water that a reporting entity recycles and/or reuses during the reporting period**. This includes:

- Water that is **directly reused** for different purposes, for example:
  - ✓ Irrigation (in agriculture)
  - ✓ Heating and cooling
  - ✓ Washing
  - ✓ Cleaning
  - ✓ pH adjustment
  - ✓ Fire protection
  - ✓ Production line needs

- Water that is **treated and reused (recycled)**, i.e., water that needs to be treated to reduce the level of contaminants and impurities before being reused

B.1.1 Water recycling and reuse: Measurement methodology

Two indicators can be calculated:

1) **Total volume of water recycled and reused;**
2) **Total volume of water recycled and reused as a percentage of the total water withdrawal and total water received from a third party.**

B.1.1 Water recycling and reuse: Measurement methodology

Two indicators can be calculated:

1) **Total volume of water recycled and reused;**
2) **Total volume of water recycled and reused as a percentage of the total water withdrawal and total water received from a third party.**

This indicator should be expressed in total cubic meters (m3).

If there is a need to convert liters (l, ℓ or L) into cubic meters, it is important to know that:

- 1,000 l = 1 m3
- 1 megaliter = 1,000 m3

To calculate this indicator, the procedure should be distinguished based on the following question:

Do your facilities have water or flow meters?

B.1.1 Water recycling and reuse: Measurement methodology

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water recycled and/or reused at the site.
- Data on the total volume of water recycled and/or reused need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site)

If facilities DO NOT have water or flow meters :

- If water or flow meters do not exist, the water recycled and reused needs to be estimated.
- The volume of recycled and reused water can be calculated based on the volume of water demand of the entity that is satisfied by recycled and/or reused water, rather than by further withdrawals/supplies from third parties.

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B.1.1 Water recycling and reuse: Measurement methodology

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water recycled and/or reused at the site.
- Data on the total volume of water recycled and/or reused need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site) **=> SEE NEXT SLIDE**

If facilities DO NOT have water or flow meters :

- If water or flow meters do not exist, the water recycled and reused needs to be estimated.
- The volume of recycled and reused water can be calculated based on the volume of water demand of the entity that is satisfied by recycled and/or reused water, rather than by further withdrawals/supplies from third parties.

B.1.1 Water recycling and reuse: Measurement methodology

	Metric wording	Type of data to be reported	Unit of measure		Source (function, documents and/or software or database)	Limits (by authorization, law, etc)	Notes and Comments	Data Gatherer's Name
31/01/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	2.837	Operations manager, operating information system			John Collins
28/02/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	3.457	Operations manager, operating information system		good increase	John Collins
31/03/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	3.287	Operations manager, operating information system			John Collins
30/04/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	2.986	Operations manager, operating information system		less due to problems at the plant	John Collins
31/05/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	3.017	Operations manager, operating information system			John Collins
30/06/2018	Water recycling and reuse	Total volume of water recycled and reused	m^3	2.967	Operations manager, operating information system			John Collins
Total				18.551				

EXAMPLE of an excel spreadsheet to keep track of water recycling and re-use

B.1.1 Water recycling and reuse: Measurement methodology

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water recycled and/or reused at the site.
- Data on the total volume of water recycled and/or reused need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site)

If facilities DO NOT have water or flow meters :

- If water or flow meters do not exist, the water recycled and reused needs to be estimated.
- The volume of recycled and reused water can be calculated based on the volume of water demand of the entity that is satisfied by recycled and/or reused water, rather than by further withdrawals/supplies from third parties **=> SEE NEXT SLIDE**

B.1.1 Water recycling and reuse: Measurement methodology

CALCULATION EXAMPLE

A business site has a production cycle that requires 10 m3 of water per cycle. The entity withdraws/is supplied by a third party water for one production process cycle and then reuses it. By counting the production cycles for which the water is reused, it is possible to calculate the amount of water recycled and reused. So, if the entity reuses the water for an additional four cycles, the total volume of water recycled is 40 m3. If the entity knows the number of units produced through the production cycle, it is also possible to estimate the amount of water recycled and/or reused per unit produced.

Let us assume that for each production cycle, the entity produces 160 units. If we refer to the numbers above, we would have 5 production cycles, 40 m3 of water recycled and reused and 800 units produced. We can then say that the entity recycles and/or reuses 0.05 m3 of water per unit produced, calculated as:

40 m3 / 800 units = 0.05 m3 per unit

To estimate the total volume of water recycled and reused at the end of the period, it is then sufficient to know the amount of units produced over a certain reporting period. So, if the entity has produced 10,000,000 units over a certain reporting period, we can calculate the total volume of water recycled and reused as:

10,000,000 units x 0.05 m3 = 500,000 m3

The estimation above based on the amount of water recycled and/or reused per unit can be done by collecting data at a certain facility during a certain period (e.g., one month) and can be used to calculate the water recycled and/or reused at other facilities, producing similar products and having a similar production process.

B.1.1 Water recycling and reuse: Measurement methodology

Two indicators can be calculated:

1) Total volume of water recycled and reused;
2) **Total volume of water recycled and reused as a percentage of the total water withdrawal and total water received from a third party.**

This indicator is expressed in percentage terms (%) and is defined in the following way:

Total volume of water recycled and reused DIVIDED BY Total water withdrawal and total water received from third party

B.1.1 Water recycling and reuse: Measurement methodology

The **numerator (Total volume of water recycled and reused)** is calculated as explained above at point 1).

The **denominator (Total water withdrawal and total water received from third party)** takes into account water withdrawn either directly by the organization or through intermediaries, such as water utilities.

It is calculated as the **sum of all water drawn into the boundaries of the entity for any use over the course of the reporting period from different sources**, as exemplified in the below table:

		January 2018	February 2018	March 2018	…
Water withdrawn and received by source	Surface water (m3)	1000			
	Groundwater (m3)	0			
	Seawater (m3)	2300			
	Produced water (m3)	0			
	Third-party water (m3)	5000			
	Total	8300			

B.1.1 Water recycling and reuse: Measurement methodology

As entities should be **striving to improve the amount of water recycling and reuse**, it is suggested to calculate a third indicator that should be expressed in terms of change with reference to the previous reporting period.

So the indicator should be calculated as:

Total volume of water recycled and reused at time t MINUS Total volume of water recycled and reused at time t-1

CALCULATION EXAMPLE

If the volume of water recycled and reused in year 2018 is equal to 100,800 m3 and the volume of water recycled and reused in year 2017 is equal to 98,300 m3 the change of water recycled and reused per net value added is equal to +2,500 m3. This signals an improvement as the amount of water recycled and reused has increased.

B.1.1 Water recycling and reuse: Potential sources of information

- The calculation of the indicators involves **water data collected at each facility/site through direct measurement (through water meters)**. Water should be metered and measured cubic meters (or in liters). If such information is collected, it can be found in **internal reporting system (operational information system tracking physical units and recording water flows) and/or environmental accounting systems/environmental management systems** especially for what concerns the resource recycling quantities and costs. If these instruments are not used at their facilities and thus estimation is required, reporting entities would need to disclose the fact that they are using estimates.
- Also, information collected in **accounts payable based on water suppliers' bills** can be used to calculate this indicator. It is also possible to find information to calculate this indicator in accounts receivable when reused water is considered a product and when payment is made by the receiving unit.

B.1.1 Water recycling and reuse: Potential sources of information

- It is also possible to implement **a water audit** for specific facilities or office buildings for identifying where and how water is used. It can be developed following the below steps:
  - understand who is the decision maker and the owner of the information on water,
  - determine the characteristics of the facility and its various buildings (e.g., size, etc.), the operating schedules, and employees,
  - identify the type of indoor and outdoor water usages, water supply sources (e.g., utility, private well),
  - collect available records about water use metering and water-energy billing. These information can be used to define some preliminary estimates of per employee water use/reuse/recycling,
  - run facility survey and talk to the people who are familiar with the daily operations, particularly the manager of operations and maintenance, to understand how water is used in the various areas of the site. Interview relevant staff and employees to confirm and deepen the information obtained,
  - check water-using equipment and water treatment systems,
  - try to measure flow-rates for each type of water-consuming equipment. This can be done by using temporary strap-on meters on water pipes or by using a bucket or plastic bag and a stopwatch (for simpler processes, such as cleaning or cooking).

B.1 Sustainable use of water

B.1.1 Water recycling and reuse

B.1.2 Water use efficiency

B.1.3 Water stress

B.1.2 Water use efficiency: Definition

Water use efficiency is **the water use per net value added in the reporting period**.

Specifically:

- **water use is defined as water withdrawal plus total water received from a third party** (i.e., water withdrawn either directly by the organization or through intermediaries, such as water utilities).

B.1.2 Water use efficiency: Measurement methodology

Two indicators can be calculated:

1) **The ratio between water use in a reporting period and the net value added for the same reporting period;**
2) **The change of water use per net value added between two reporting.**

B.1.2 Water use efficiency: Measurement methodology

Two indicators can be calculated:

1) **The ratio between water use in a reporting period and the net value added for the same reporting period;**
2) **The change of water use per net value added between two reporting.**

This indicator is defined as: **Total volume of water used DIVIDED BY Net value added**

The numerator of this indicator should be expressed in total cubic meters (m3). If there is a need to convert liters (l, ℓ or L) into cubic meters, it is important to know that:

- 1,000 l = 1 m3
- 1 megaliter = 1,000 m3

The denominator of this indicator is expressed in monetary terms (e.g., $, £, €).

Therefore, the indicator is expressed in terms of m3 per $, or £, or € etc.

B.1.2 Water use efficiency: Measurement methodology

To calculate the numerator of this indicator, the procedure should be distinguished based on the following:

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water used at the site.
- Data on the total volume of water used need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site)

If facilities DO NOT have water or flow meters :

- If the entity does not use water or flow meters, most likely the most important part of the denominator is represented by water received from third parties, therefore, the denominator can be estimated based on the amount of water received (that is usually indicated in the water suppliers' bills).
- Estimates can also be based on coefficients (area statistics) relating water use to another characteristic usually representing a proxy of the volume of business activity, such as number of employees or production values and volume and applying it to a site-specific amount of that characteristic

B.1.2 Water use efficiency: Measurement methodology

To calculate the numerator of this indicator, the procedure should be distinguished based on the following:

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water used at the site.
- Data on the total volume of water used need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site) **=> SEE NEXT SLIDE**

If facilities DO NOT have water or flow meters :

- If the entity does not use water or flow meters, most likely the most important part of the denominator is represented by water received from third parties, therefore, the denominator can be estimated based on the amount of water received (that is usually indicated in the water suppliers' bills).
- Estimates can also be based on coefficients (area statistics) relating water use to another characteristic usually representing a proxy of the volume of business activity, such as number of employees or production values and volume and applying it to a site-specific amount of that characteristic

B.1.2 Water use efficiency: <u>Measurement methodology</u>

		Type of data to be reported	Unit of measure		Source (function, documents and/or software or database)	Limits (by authorization, law, etc)	Notes and Comments	Data Gatherer's Name
31/01/2018	Water use	Total volume of water used	m^3	12.345	Operations manager, operating information system			Pamela Robin
28/02/2018	Water use	Total volume of water used	m^3	13.006	Operations manager, operating information system			Pamela Robin
31/03/2018	Water use	Total volume of water used	m^3	12.500	Operations manager, operating information system			Pamela Robin
30/04/2018	Water use	Total volume of water used	m^3	14.567	Operations manager, operating information system		too high	Pamela Robin
31/05/2018	Water use	Total volume of water used	m^3	13.234	Operations manager, operating information system			Pamela Robin
30/06/2018	Water use	Total volume of water used	m^3	11.890	Operations manager, operating information system		good decrease	Pamela Robin
Total				77.542				

EXAMPLE of an excel spreadsheet to keep track of water use

B.1.2 Water use efficiency: Measurement methodology

To calculate the numerator of this indicator, the procedure should be distinguished based on the following:

If facilities have water or flow meters :

- It is suggested that the indicator is calculated at facility-level/individual business site level where appropriate documentation and reporting should exist based on water or flow meters that are used to directly measure the quantity of water used at the site.
- Data on the total volume of water used need to be collected with reference to a relevant time unit (e.g., day, week, month) so that it can be cumulated with reference to the total reporting period.
- An excel spreadsheet could be designed in the following way (where the months – first column – could be broken down into weeks or even days, depending on the frequency of measurement at the specific site)

If facilities DO NOT have water or flow meters :

- If the entity does not use water or flow meters, most likely the most important part of the denominator is represented by water received from third parties, therefore, the denominator can be estimated based on the amount of water received (that is usually indicated in the water suppliers' bills).
- Estimates can also be based on coefficients (area statistics) relating water use to another characteristic usually representing a proxy of the volume of business activity, such as number of employees or production values and volume and applying it to a site-specific amount of that characteristic **=> SEE NEXT SLIDE**

B.1.2 Water use efficiency: Measurement methodology

CALCULATION EXAMPLE

Let’s assume that according to industry statistics , a company producing steel uses 66 m3 per ton of steel.

To estimate the total volume of water used at the end of the period, it is sufficient to know the amount of tons produced over a certain reporting period. So, if the entity has produced 20,000 tons over a certain reporting period, we can calculate the total volume of water recycled and reused as:

20,000 tons x 66 m3 = 1,320,000 m3

Alternatively, the estimation above – based on the amount of water used per unit – can be done by collecting data at a certain facility during a certain period (e.g., one month) and can be used to calculate the water used at other facilities, producing similar products and having a similar production process.

B.1.2 Water use efficiency: Measurement methodology

The denominator of this indicator (net value added) is calculated as explained in the section about economic indicators **(A.1.3. Net value added).**

B.1.2 Water use efficiency: Measurement methodology

Two indicators can be calculated:

1) The ratio between water use in a reporting period and the net value added for the same reporting period;
2) **The change of water use per net value added between two reporting.**

This indicator is calculated as:

$$\frac{\text{Total volume of water used at time t}}{\text{Net value added at time t}} \quad \text{MINUS} \quad \frac{\text{Total volume of water used at time t-1}}{\text{Net value added at time t-1}}$$

CALCULATION EXAMPLE

For example:

If the volume of water used in year t per net value added (i.e., the water use efficiency) is equal to 23,000 m3 per € and the volume of water used in year t-1 per net value added is equal to 25,000 m3 per € the change of water use per net value added is equal to -2,000 m3 per €. This signals an improvement in the water use efficiency (as the water used per € of net value added is lower).

B.1.2 Water use efficiency: Potential sources of information

- The calculation of the indicators involves **water data collected at each facility/site through direct measurement (through water meters)**. Water should be metered and measured cubic meters (or in liters). If such information is collected, it can be found in **internal reporting system (operational information system tracking physical units and recording water flows) and/or environmental accounting systems/environmental management systems** especially for what concerns the water quantities and costs. If these instruments are not used at their facilities and thus estimation is required, reporting entities would need to disclose the fact that they are using estimates.
- Also, information collected in **accounts payable based on water suppliers' bills** can be used to calculate this indicator.
- It is also possible to implement a **water audit** for specific facilities or office buildings for identifying where and how water is used (see what suggested for indicator B.1.1 on this point).

B.1 Sustainable use of water

B.1.1 Water recycling and reuse

B.1.2 Water use efficiency

B.1.3 Water stress

B.1.3 Water stress: Definition

Water stress is defined as **total water withdrawn with a breakdown by sources** (e.g., surface, ground, sea) **and with reference to water- stressed or water-scarce** areas (expressed as a percentage of total withdrawals).

Water stress can refer to the **availability, quality, or accessibility of water.**

Since an organization can affect the availability of water for others, it is important to disclose the entity's water withdrawal from all areas with water stress (if applicable) with a breakdown of this total by the above mentioned withdrawal source categories. **The amount of water withdrawal from areas with water stress specifies an entity's impacts in sensitive locations and is useful to understand where improvement actions are most needed.**

B.1.3 Water stress: Measurement methodology

To calculate this indicator, an entity can follow three steps:

STEP 1: report a breakdown of the total water withdrawal by surface water, groundwater, seawater, produced water, and third-party water.

Step 1

		All areas 2018	Areas with water stress 2018	Water stress 2018
Water withdrawn and received by source	Surface water (m3)	1000		
	Groundwater (m3)	0		
	Seawater (m3)	2300		
	Produced water (m3)	0		
	Third-party water (m3)	5000		
	Total	8300		

B.1.3 Water stress: Measurement methodology

STEP 2: determine which withdrawals (at specific facilities or sites) are located in areas with water stress

There are **publicly available tools** for assessing areas with water stress such as:

- the World Resources Institute 'Aqueduct Water Risk Atlas' (www.wri.org/our-work/project/aqueduct/)
- the WWF 'Water Risk Filter' (www.waterriskfilter.panda.org)

Based on these tools, water stress in an area may be assessed using either of the following indicators and their thresholds :

- The ratio of total annual water withdrawal to total available annual renewable water supply (i.e., baseline water stress) is high (40-80%) or extremely high (>80%);
- The ratio of water consumption-to-availability (i.e., water depletion) is moderate (dry-year depletion, where for at least 10% of the time, the monthly depletion ratio is >75%), high (seasonal depletion, where for one month of the year on average, the depletion ratio is >75%), or very high (ongoing depletion, where the depletion ratio on average is >75%).

B.1.3 Water stress: Measurement methodology

STEP 2: determine which withdrawals (at specific facilities or sites) are located in areas with water stress

Step 2

		All areas 2018	Areas with water stress 2018	Water stress 2018
Water withdrawn and received by source	Surface water (m3)	1000	300	
	Groundwater (m3)	0		
	Seawater (m3)	2300		
	Produced water (m3)	0		
	Third-party water (m3)	5000		
	Total	8300	300	

B.1.3 Water stress: Measurement methodology

STEP 3: express the total water withdrawn with a breakdown by sources (e.g., surface, ground, sea) and with reference to water- stressed or water-scarce areas as a percentage of total withdrawals

The table below summarizes the result of the three steps:

Step 3

		All areas 2018	Areas with water stress 2018	Water stress 2018
Water withdrawn and received by source	Surface water (m3)	1000	300	30%
	Groundwater (m3)	0		0%
	Seawater (m3)	2300		0%
	Produced water (m3)	0		0%
	Third-party water (m3)	5000		0%
	Total	8300	300	3.6%

B.1.3 Water stress: Potential sources of information

- Regarding the assessment of basins where water challenges are pronounced, many entities use their own **internal knowledge** of the basins where they operate.
- There are also a **number of external datasets** that can assist entities in this process and there are also free web-based tools (with online instructions) that use these datasets to conduct calculations, such as:
  - ✓ WBCSD Global Water Tool
  - ✓ WRI Aqueduct Water Risk Atlas
  - ✓ WWF-DEG Water Risk Filter (Quick View)
  - ✓ WFN Water Footprint Assessment Tool
- Additional sources of information to gather data for the calculation of this indicator are the **bills of water suppliers (for water received from third parties) as well as the information that can be derived from water withdrawal licenses and permits that are required by entities if they want to use ground or surface water**.

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B.2 Waste Management

B.2.1 Reduction of waste generation

B.2.2 Waste reused, re-manufactured and recycled

B.2.3 Hazardous waste

B.2 Waste Management

B.2.1 Reduction of waste generation

B.2.2 Waste reused, re-manufactured and recycled

B.2.3 Hazardous waste

B.2.1 Reduction of waste generation: Definition

Reduction of waste generation measures the **change in the entity's waste generation per net value added**.

Specifically:

- ❑ Waste is intended as a non-product output with a negative or zero market value
- ❑ Water and air-polluting emissions – although they are non-product output – are not regarded as waste

B.2.1 Reduction of waste generation: Definition

The waste generated during a reporting period can be mainly **classified in two different ways**:

1) according to its **quality**:

- ✓ mineral waste (that is safe by nature and can be discharged without requiring special landfill technology and/or long-term landfill management) such as rock, brick and glass,
- ✓ non-mineral waste (that requires special landfill technology and/or long-term landfill management. Non-mineral waste can be mineralized through waste treatment technology) including agricultural and industrial waste.

B.2.1 Reduction of waste generation: Definition

The waste generated during a reporting period can be mainly **classified in two different ways**:

1) according to its **quality**:

- ✓ mineral waste (that is safe by nature and can be discharged without requiring special landfill technology and/or long-term landfill management) such as rock, brick and glass,
- ✓ non-mineral waste (that requires special landfill technology and/or long-term landfill management. Non-mineral waste can be mineralized through waste treatment technology) including agricultural and industrial waste.

2) according to the different **treatment technologies** applied to waste itself:

- ✓ Reusing, re-manufacturing, and recycling
  - Reuse is the additional use of a component, part or product after it has been removed from a clearly defined service cycle (it does not include a manufacturing process),
  - Re-manufacturing is the additional use of a component, part, or product after it has been removed from a clearly defined service cycle in a new manufacturing process,
  - Recycling is recovery and reuse of waste materials for the production of new goods.
- ✓ Waste incineration, which mineralizes waste and reduces the volume of solid residuals.
- ✓ Sanitary landfills, i.e., controlled areas of land on which waste is disposed of, in accordance with standards, rules or orders established by a regulatory body
- ✓ Open dumpsite, i.e., an uncontrolled area of land on which waste is disposed, either legally or illegally.

B.2.1 Reduction of waste generation: Measurement methodology

This indicator should be calculated in the following way:

$$\frac{\textbf{Total waste generated at time t}}{\textbf{Net value added at time t}} \quad \textbf{MINUS} \quad \frac{\textbf{Total waste generated at time t-1}}{\textbf{Net value added at time t-1}}$$

Waste should be weighted or metered.

As waste can be solid, liquid or have a paste-like consistency, it can be measured in kilograms and tons, liters or cubic meters. However, for the purpose of this indicator, **waste should be reported according to weight (kg, t)** and not volume (liters, m3).

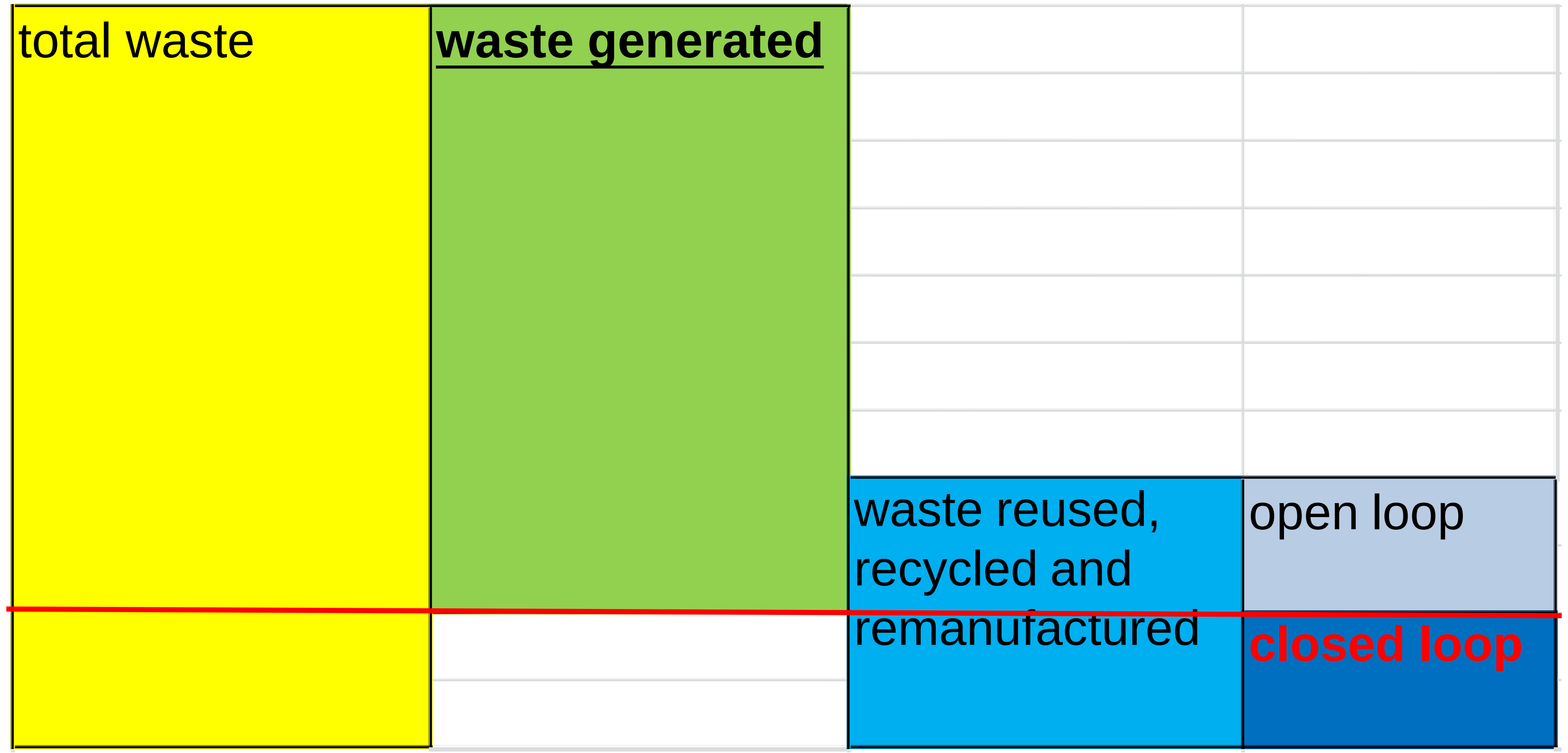
Country-based Environment Agencies usually provide conversion tools to assist organizations in calculating tonnages (conversion factors based on the waste density and volume, mass balances, or similar information, e.g., https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/519078/LIT_10134.xls, https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memorandum_04192016_508fnl.pdf)

B.2.1 Reduction of waste generation: Measurement methodology

To calculate the "**total waste generated**" entities shall distinguish between:

- **Open-loop** reusing, re-manufacturing, and recycling, where waste is not returned to the processes of the reporting entity (but it is rather returned to the market),
- **Closed-loop** reusing, re-manufacturing, and recycling, where waste is returned to the processes of the reporting entity.

The **amount of waste generated** over a certain reporting period is **calculated excluding the amount that is treated either on-site or off-site through closed-loop recycling**, **reuse or remanufacturing processes**



B.2.1 Reduction of waste generation: Measurement methodology

Waste Generated	Quality and classification				TOTAL	
Treatment Technology	Mineral		Non-mineral			
	2018	2017	2018	2017	2018	2017
Open-loop reuse, remanufacturing, recycling	83.7	23.7	105.8	74	189.5	97.7
Reuse	58.6	10.8	15.2	21.5	73.8	32.3
Remanufacturing	8.3	5.4	8.4	8.1	16.7	13.5
Recycling	16.8	7.5	82.2	44.4	99	51.9
Incineration	87.5	52.4	45.4	74.5	132.9	126.9
Low-temperature	9.2	12.2	7.3	14.3	16.5	26.5
High-temperature	75.3	9.9	19	18.6	94.3	28.5
Cement kilns	3	30.3	19.1	41.6	22.1	71.9
Sanitary landfills	78.2	104.5	130.5	21.3	208.7	125.8
Landfills for bioactive materials	35.8	10.3	22.5	10.4	58.3	20.7
Landfills for stablized materials	39.3	21.9	51.1	3	90.4	24.9
Landfills for inert materials	3.1	72.3	56.9	7.9	60	80.2
Open dumpsite	67	0.2	12.3	5.4	79.3	5.6
Temporary stored on-site	14.6	42	46.8	55.2	61.4	97.2
TOTAL	331	222.8	340.8	230.4	671.8	453.2
Closed-loop reuse, remanufacturing, recycling	-10	-12	-5.2	-3	-15.2	-15
Reuse	-10	-12	-2.1	-2	-12.1	-14
Remanufacturing	0	0	-1.5	-1	-1.5	-1
Recycling	0	0	-1.6	0	-1.6	0
TOTAL WASTE GENERATED	321	210.8	335.6	227.4	656.6	438.2

CALCULATION EXAMPLE

Referring to the column TOTAL of year 2018 on the right, the total waste generated is calculated as:

the sum of total mineral and non-mineral waste in 2018 (331.0 + 340.8) minus the sum of closed-loop re-used, remanufactured and recycled mineral and non-mineral waste in 2018 (10.0 + 5.2), i.e., 656.6 tons

In 2017, the total waste generated is calculated in the same way and is equal to:

438.2 tons ((222.8 + 230.4) MINUS (12+3))

Assuming that the net value added in 2018 is equal to 1,000€ and in 2017 is equal to 1,100€.

So in the end, this indicator is calculated as:

$$\frac{656.6}{1,000} \text{ MINUS } \frac{438.2}{1,100} = 0.6566 \text{ MINUS } 0.3984$$

= 0.2582 tons per €

B.2.1 Reduction of waste generation: Potential sources of information

- Waste should be weighed or metered at each specific business site.
- If entities might find it difficult to meter the quantity of waste produced, it is possible to calculate the amount of waste generated in a reporting period via bills from the waste management company (information provided by the waste disposal contractor usually includes, along with the type of waste, also the amount of waste managed (in kilos or tons)).
- The data required for the calculation of these indicators and the related information flows are normally managed by a Facility manager or a General services administrator. When such positions are not present in an entity, the related information is to be found in the accounts payable as part of the waste management costs calculation of the reporting period.
- Some websites can be used to estimate waste generation based on some variables such as number of employees or square meters occupied by facilities

(e.g., https://www2.calrecycle.ca.gov/wastecharacterization/general/rates, https://www2.calrecycle.ca.gov/WasteCharacterization/General/Rates. For the estimation of waste generation of commercial buildings see: http://www.zerowastedesign.org/waste-calculator/)

B.2 Waste Management

B.2.1 Reduction of waste generation

B.2.2 Waste reused, re-manufactured and recycled

B.2.3 Hazardous waste

B.2.2 Waste reused, re-manufactured and recycled: Definition

This indicator refers to **the amount of waste reused, re-manufactured, and recycled**. As explained also for the indicator B.2.1:

- **Reuse consists in the further use of a component, part or product after it has been removed from a clearly defined service cycle**. Reuse **does not involve a manufacturing process**; however, cleaning, repair or refurbishing may be performed between uses.
- **Re-manufacturing is the further use of a component, part or product after it has been removed from a clearly defined service cycle in a new manufacturing process** that goes beyond cleaning, repair or refurbishing.
- **Recycling is recovery and reuse of materials from scrap or other waste materials for the production of new goods**. Pre-treatment processes that condition the waste for recycling are regarded as part of the recycling path.

It is possible to further distinguish between open- and closed-loop reuse, re-manufacturing and recycling (see indicator B.2.1)

B.2.2 Waste reused, re-manufactured and recycled: Measurement methodology

Two indicators can be calculated:

1) **Total amount of reused, remanufactured and recycled waste;**
2) **Total amount of waste reused, remanufactured and recycled normalized by the net value added.**

B.2.2 Waste reused, re-manufactured and recycled: Measurement methodology

Two indicators can be calculated:

1) **Total amount of reused, remanufactured and recycled waste;**
2) **Total amount of waste reused, remanufactured and recycled normalized by the net value added.**

The amount of reused, re-manufactured, and recycled waste should be recognized in the period in which it is treated and should be **measured in kilos and tons** (see on this point indicator B.2.1. Reduction of waste generation).

When possible, it would be preferably to distinguish among the three options, and specifically, between reuse and recycling versus remanufacturing, so that it is possible to calculate the following two indicators:

- **Total reused and recycled waste generated at time t**
- **Total remanufactured waste generated at time t**

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B.2.2 Waste reused, re-manufactured and recycled: Measurement methodology

Waste Generated	Quality and classification				TOTAL	
Treatment Technology	Mineral		Non-mineral			
	2018	2017	2018	2017	2018	2017
Open-loop reuse, remanufacturing, recycling	83.7	23.7	105.8	74	189.5	97.7
Reuse	58.6	10.8	15.2	21.5	73.8	32.3
Remanufacturing	8.3	5.4	8.4	8.1	16.7	13.5
Recycling	16.8	7.5	82.2	44.4	99	51.9
Incineration	87.5	52.4	45.4	74.5	132.9	126.9
Low-temperature	9.2	12.2	7.3	14.3	16.5	26.5
High-temperature	75.3	9.9	19	18.6	94.3	28.5
Cement kilns	3	30.3	19.1	41.6	22.1	71.9
Sanitary landfills	78.2	104.5	130.5	21.3	208.7	125.8
Landfills for bioactive materials	35.8	10.3	22.5	10.4	58.3	20.7
Landfills for stablized materials	39.3	21.9	51.1	3	90.4	24.9
Landfills for inert materials	3.1	72.3	56.9	7.9	60	80.2
Open dumpsite	67	0.2	12.3	5.4	79.3	5.6
Temporary stored on-site	14.6	42	46.8	55.2	61.4	97.2
TOTAL	331	222.8	340.8	230.4	671.8	453.2
Closed-loop reuse, remanufacturing, recycling	-10	-12	-5.2	-3	-15.2	-15
Reuse	-10	-12	-2.1	-2	-12.1	-14
Remanufacturing	0	0	-1.5	-1	-1.5	-1
Recycling	0	0	-1.6	0	-1.6	0
TOTAL WASTE GENERATED	321	210.8	335.6	227.4	656.6	438.2

CALCULATION EXAMPLE

Assuming we are including both open-loop and closed-loop reused, remanufactured and recycled waste, in 2017, we would have:

Total reused, remanufactured and recycled waste generated at time t (in 2017)

= 97.7 + 15.0 = 112.7

We can also calculate

- **Total reused and recycled waste generated at time t (in 2017) = 32.3 + 51.9 + 14 + 0 = 98.2**
- **Total remanufactured waste generated at time t (in 2017) = 13.5 + 1 = 14.5**

B.2.2 Waste reused, re-manufactured and recycled: Measurement methodology

Two indicators can be calculated:

1) Total amount of reused, remanufactured and recycled waste;
2) **Total amount of waste reused, remanufactured and recycled normalized by the net value added.**

This indicator should be calculated in the following way:

$$\frac{\text{Total amount of waste reused, remanufactured and recycled generated at time t}}{\text{Net value added at time t}}$$

- In order to normalize data on waste generation figures and to be consistent with the way in which indicator "B.2.1. Reduction of waste generation" is calculated, reused, re-manufactured and recycled waste should be divided by the amount of net value added (expressed in €, $, £, etc.) generated in the same reporting period (see indicator A.1.3. Net Value added).
- The unit of measure of this indicator is kilos or tons of waste per €, per $, etc.

B.2.2 Waste reused, re-manufactured and recycled: **Measurement methodology**

Waste Generated	Quality and classification				TOTAL	
Treatment Technology	Mineral		Non-mineral			
	2018	2017	2018	2017	2018	2017
Open-loop reuse, remanufacturing, recycling	83.7	23.7	105.8	74	189.5	97.7
Reuse	58.6	10.8	15.2	21.5	73.8	32.3
Remanufacturing	8.3	5.4	8.4	8.1	16.7	13.5
Recycling	16.8	7.5	82.2	44.4	99	51.9
Incineration	87.5	52.4	45.4	74.5	132.9	126.9
Low-temperature	9.2	12.2	7.3	14.3	16.5	26.5
High-temperature	75.3	9.9	19	18.6	94.3	28.5
Cement kilns	3	30.3	19.1	41.6	22.1	71.9
Sanitary landfills	78.2	104.5	130.5	21.3	208.7	125.8
Landfills for bioactive materials	35.8	10.3	22.5	10.4	58.3	20.7
Landfills for stablized materials	39.3	21.9	51.1	3	90.4	24.9
Landfills for inert materials	3.1	72.3	56.9	7.9	60	80.2
Open dumpsite	67	0.2	12.3	5.4	79.3	5.6
Temporary stored on-site	14.6	42	46.8	55.2	61.4	97.2
TOTAL	331	222.8	340.8	230.4	671.8	453.2
Closed-loop reuse, remanufacturing, recycling	-10	-12	-5.2	-3	-15.2	-15
Reuse	-10	-12	-2.1	-2	-12.1	-14
Remanufacturing	0	0	-1.5	-1	-1.5	-1
Recycling	0	0	-1.6	0	-1.6	0
TOTAL WASTE GENERATED	321	210.8	335.6	227.4	656.6	438.2

CALCULATION EXAMPLE

If we refer to the Table and we want to calculate this indicator for year 2017 (assuming we are including both open-loop and closed-loop reused, remanufactured and recycled waste):

Total reused, remanufactured and recycled waste generated at time t

= 97.7 + 15.0 = 112.7

Let us assume that the net value added in 2017 was equal to €1,100

So that this indicator is equal to

112.7/1,100 = 0.102 tons per €

B.2.2 Waste reused, re-manufactured and recycled: Measurement methodology

Two indicators can be calculated:

1) **Total amount of reused, remanufactured and recycled waste;**
2) **Total amount of waste reused, remanufactured and recycled normalized by the net value added.**

To be consistent with the previous indicator, the difference between year t and year t-1 should be also computed for these indicators so that it is possible to monitor the level of progress the organization has made toward waste reuse, re-manufacture, and recycle efforts.

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B.2.2 Waste reused, re-manufactured and recycled: Potential sources of information

- In many countries, various forms of waste treatment are required by law, and, normally, a waste disposal contractor is involved in open-loop recycling. Therefore, relevant information for a specific reporting period can be found on the bills from the waste management company (information provided by the waste disposal contractor usually includes, along with the type of waste, also the amount of waste managed (in kilos or tons)).
- When the waste generated by a company can be sold (e.g., because it represents a suitable raw material for another manufacturing company), relevant information can be found on the invoice issued by the company selling waste materials (accounts receivable).
- When the recycled, reused or remanufactured material is returned to the processes of the reporting entity (closed-loop), the related figures should be collected at each business site and reported through operational reporting.
- The data required for the calculation of these indicators and the related information flows are normally managed by a Facility manager or a General services administrator or by a plant manager. The related information can also be found in the accounts receivable, when waste materials is sold to other companies, or in the bills of materials if waste is reused in the reporting entity processes.

B.2 Waste Management

B.2.1 Reduction of waste generation

B.2.2 Waste reused, re-manufactured and recycled

B.2.3 Hazardous waste

B.2.3 Hazardous waste: Definition

This indicator refers to the **amount of waste with hazardous characteristics.** The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal has defined the following list of hazardous characteristics:

- ✓ 1 H1 Explosive
- ✓ 3 H3 Flammable liquids
- ✓ 4.1 H4.1 Flammable solids
- ✓ 4.2 H4.2 Substances or wastes liable to spontaneous combustion
- ✓ 4.3 H4.3 Substances or wastes, which, in contact with water, emit flammable gases
- ✓ 5.1 H5.1 Oxidizing
- ✓ 5.2 H5.2 Organic Peroxides
- ✓ 6.1 H6.1 Poisonous (Acute
- ✓ 6.2 H6.2 Infectious substances
- ✓ 8 H8 Corrosives
- ✓ 9 H10 Liberation of toxic gases in contact with air or water
- ✓ 9 H11 Toxic (Delayed or chronic)
- ✓ 9 H12 Ecotoxic
- ✓ 9 H13 Capable, by any means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.

B.2.3 Hazardous waste: Definition

Waste is classified as hazardous also when:

- ✓ as a result of being radioactive, is subject to other national or international control systems
- ✓ it is defined as, or considered to be, hazardous waste by the domestic legislation in the country where the waste is generated by the reporting entity.

B.2.3 Hazardous waste: Measurement methodology

Two indicators can be calculated:

1) **Total amount of hazardous waste;**
2) **Total amount of hazardous waste normalized by the net value added.**

B.2.3 Hazardous waste: Measurement methodology

Two indicators can be calculated:

1) **Total amount of hazardous waste;**
2) **Total amount of hazardous waste normalized by the net value added.**

B.2.3 Hazardous waste: Measurement methodology

Two indicators can be calculated:

1) **Total amount of hazardous waste;**
2) **Total amount of hazardous waste normalized by the net value added.**

The total amount of hazardous waste generated during a reporting period is defined as the sum of the amounts of all types of hazardous waste (see Definition).

It should be measured in kilos and tons.

B.2.3 Hazardous waste: Measurement methodology

Treatment Technology	Hazardous Waste	
	2018	2017
Open-loop reuse, remanufacturing, recycling	38	2.1
Reuse	1.1	0
Remanufacturing	0.6	1.1
Recycling	36.3	1
Incineration	12.2	26.8
Low-temperature	5.7	10.3
High-temperature	5.2	9.6
Cement kilns	1.3	6.9
Sanitary landfills	55.6	34.7
Landfills for bioactive materials	12.8	33.3
Landfills for stablized materials	3.8	0.9
Landfills for inert materials	39	0.5
Open dumpsite	0.4	5.2
Temporary stored on-site	1.4	0.3
TOTAL	107.6	69.1
Closed-loop reuse, remanufacturing, recycling	-0.1	-0.2
Reuse	-0.1	-0.2
Remanufacturing	0	0
Recycling	0	0
TOTAL WASTE GENERATED	107.5	68.9

CALCULATION EXAMPLE

If we refer to the Table when calculating the amount of hazardous waste generated over a certain reporting period, one should **exclude the amount that is treated either on-site or off-site through closed-loop recycling, reuse or remanufacturing processes, i.e., the recycled, reused or remanufactured waste materials returned to the processes of the reporting entity.**

The total amount of hazardous waste in year **2017** is then equal to:

69.1 MINUS 0.2 = 68.9 tons

The total amount of hazardous waste in year **2018** is equal to:

107.6 MINUS 0.1 = 107.5 tons

B.2.3 Hazardous waste: <u>Measurement methodology</u>

Two indicators can be calculated:

1) Total amount of hazardous waste;
2) **Total amount of hazardous waste normalized by the net value added.**

This indicator should be calculated in the following way:

$$\frac{\text{Total amount of hazardous waste generated at time t}}{\text{Net value added at time t}}$$

In order to normalize data on hazardous waste, the amount of hazardous waste should be divided by the net value added (expressed in €, $, £, etc.) generated in the same reporting period (see indicator A.1.3. Net Value added). The unit of measure of this indicator is kilos or tons of waste per €, per $ etc.

CALCULATION EXAMPLE

For example:

If we refer to the Table in the previous slide, and we want to calculate this indicator for year 2017, knowing that the net value added for year 2017 is equal to € 1,100, this indicator is equal to:

68.9/1,100 = 0.063 tons per €

B.2.3 Hazardous waste: Measurement methodology

Similar to the other indicators on waste, also for hazardous waste, the difference between year t and year t-1 should be computed so that it is possible to monitor the level of progress the organization has made toward waste reuse, re-manufacture, and recycle efforts.

This indicator should be calculated in the following way:

$$\frac{\text{Total amount of hazardous waste generated at time t}}{\text{Net value added at time t}}$$

MINUS

$$\frac{\text{Total amount of hazardous waste generated at time t -1}}{\text{Net value added at time t-1}}$$

In addition, when possible, the total amount of hazardous waste should be broken down by disposal methods, e.g., reuse, recycling, composting, recovery, including energy recovery, incineration (mass burn), deep well injection, landfill, on-site storage, other (to be specified by the organization).

B.2.3 Hazardous waste: <u>Potential sources of information</u>

- Hazardous waste should be weighed or metered at each specific business site.
- When entities find it difficult to meter the quantity of hazardous waste produced, in line with what is advised for other indicators on waste management included in this guidance, it is suggested to use the bills from the waste management company to reconstruct the relevant information required to calculate this indicator. Information provided by the waste disposal contractor usually includes, along with the type of waste, also the amount of waste managed (in kilos or tons) and the disposal method. Usually, consignment notes to move hazardous waste are required and businesses need to keep records (known as a ‘register’) for a specific number of years at the premises that produced or stored the waste.
- The related information flows are normally managed by a Facility manager or a General services administrator. When such positions are not present in an entity, such information is to be found in the accounts payable as part of the waste management costs calculation of the reporting period.

B.3 Greenhouse gas emissions

B.3.1 Greenhouse gas emissions (scope 1)

B.3.2 Greenhouse gas emissions (scope 2)

B.3 Greenhouse gas emissions

B.3.1 Greenhouse gas emissions (scope 1)

B.3.2 Greenhouse gas emissions (scope 2)

B.3.1 Greenhouse gas emissions (scope 1): Definition

The indicator “Greenhouse gas emissions (scope 1)” is defined as **direct greenhouse gas (GHG) emissions** per unit of net value added.

Scope 1 covers emissions that occur inside an entity’s organizational boundary and are also referred to as Direct GHG. They are “emissions from sources that are owned or controlled by the organization” , such as:

- ✓ Stationary Combustion: from the combustion of fossil fuels (e.g. natural gas, fuel oil, propane, etc.) for comfort heating or other industrial applications
- ✓ Mobile Combustion: from the combustion of fossil fuels (e.g. gasoline, diesel) used in the operation of vehicles or other forms of mobile transportation
- ✓ Process Emissions: emissions released during the manufacturing process in specific industry sectors (e.g. cement, iron and steel, ammonia)
- ✓ Fugitive Emissions: unintentional release of GHG from sources including refrigerant systems and natural gas distribution

B.3.1 Greenhouse gas emissions (scope 1): Measurement methodology

This indicator is defined in the following way:

$$\frac{\text{Scope 1 GHG (tons of } CO_2\text{)}}{\text{Net value added}}$$

The calculation of GHG (scope 1) is most commonly and easily done by means of **an excel file (a tool)** that can be downloaded from www.ghgprotocol.org

The calculation methodology is based on the use of some emissions factors that are specific for each fuel/material type. In fact, in the excel sheets, it is possible to find some conversion coefficients, i.e., the **Global Warming Potentials (GWPs)**, to translate different gases into emissions of carbon dioxide (CO_2).

GWP values convert GHG emissions data for non-CO_2 gases into units of CO_2 equivalent.

Companies can choose which GWPs to use by selecting a specific IPCC (Intergovernmental Panel on Climate Change) protocol.

B.3.1 Greenhouse gas emissions (scope 1): Measurement methodology

To apply the GHG Protocol stationary combustion spreadsheet tool, the following steps should be taken :

Step 1

Collect data on the quantity of fuel combusted on a volume, mass, or energy basis. These data can be based on fuel receipts, purchase records, or metering of the amount of fuel entering the combustion device. The following are the most common methods to collect data (in order of accuracy):

- ✓ On-site metering (i.e., flow meters or scales) of the mass or volume flow of fuel at the input point to one or more combustion units.
- ✓ Purchase or delivery records of the mass or volume of fuel entering facility. This mass balance approach should also account for inventory stock changes.

  The calculation formula is the following: FuelB = FuelP + (FuelST – FuelSE)

  Where: FuelB = Fuel combusted during period; FuelP = Fuel purchased or delivered during period; FuelST = Fuel stock at beginning of period;

  FuelSE = Fuel stock at end of period

- ✓ Fuel expenditure data on the amount of fuel purchased in monetary units that is then converted to physical units (i.e., mass, volume, or energy content) based on average prices. This approach should also account for inventory stock changes. Companies should try to obtain data on the specific price paid for fuels from suppliers if it is not internally available. If specific price data is not available, then average or likely prices will have to be assumed.

B.3.1 Greenhouse gas emissions (scope 1): Measurement methodology

Step 2

The calculation of the GHG emissions is automatically performed by the tool by inserting in the worksheet the amounts collected in Step 1.

Reporting entities need to insert the amount of fuels used during the reporting period, using the appropriate unit measures (e.g., natural gas, in cubic meters; lubricants in liters) and the tool automatically converts these amounts into GHG emissions.

In order to normalize data on GHG, the above amount should be divided by the amount of net value added (expressed in €, $, £, etc.) generated in the same reporting period (see indicator Net Value added). So, in the end, the unit of measure of this indicator is tons of CO2 per €, per $ etc.

B.3.1 Greenhouse gas emissions (scope 1): Measurement methodology

CALCULATION EXAMPLE

For example:

Using the Stationary Combustion Worksheet, it is possible to choose: Industry, Fuel type (e.g., solid fossil), Fuel, Amount of fuel, Units (e.g., kg or kWh). By doing the following choices:

- Industry: construction
- Fuel type (e.g., solid fossil): liquid fossil
- Fuel: gas/diesel oil
- Amount of fuel: 1,000 for the reporting period
- Units (e.g., kg or kWh): liters

The tool automatically calculates the amount of GHG emissions (tons) that, in this case, are equal to **2,685 tons** for the reporting period.

So if the net value added for the reporting period is equal to 10,000 £, the indicator will be calculated in the following way:

2,685 tons of CO_2 / 10,000 £ = 0.2685 tons of CO_2 per £

B.3.1 Greenhouse gas emissions (scope 1): Potential sources of information

- Data for the calculation of this indicator can be recovered from accounts payable, specifically from invoices of providers of fuels (where the unit of measure can be m3 or liters).
- The collection of these data needs to be done site by site, by a facility manager/general services administrator, by a quality manager or by an environmental/sustainability manager with the collaboration of the accounting department. Such data can then be cumulated both by legal entity and by country.

B.3 Greenhouse gas emissions

B.3.1 Greenhouse gas emissions (scope 1)

B.3.2 Greenhouse gas emissions (scope 2)

B.3.2 Greenhouse gas emissions (scope 2): Definition

This indicator is defined as **indirect GHG emissions** (from consumption of purchased electricity, heat or steam) per unit of net value added.

Specifically:

- ✓ Scope 2 covers emissions arising from the generation of secondary energy forms, e.g. electricity, that are purchased by the company for its own use. These emissions are considered 'indirect' because they are a consequence of activities of the reporting organization but actually occur at sources owned or controlled by another organization (i.e., owned or controlled by an electricity generator or utility)
- ✓ For many companies, the energy indirect (Scope 2) GHG emissions that result from the generation of purchased electricity can be much greater than their direct (Scope 1) GHG emissions.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

To calculate scope 2 emissions, the GHG Protocol Corporate Accounting and Reporting Standard (Corporate Standard) recommends multiplying activity data (MWhs of electricity consumption) by emission factors to arrive at the total GHG emissions impact of electricity use.

This approach uses the following calculation:

Emissions [tCO2] = Activity data [MWh] * Emission factor [tCO2/MWh]

Where:

- ✓ **Activity data** is the amount of electricity purchased and consumed in megawatt-hours (MWh). This value will generally be directly measured, specified in purchase contracts or estimated ;
- ✓ **Emission factor** represents an average value, for a given period of time, of emissions per MWh, for either a specific grid (location), supplier or energy generation source.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

There are two methods that can be used:

1) **Market-Based Method**
2) **Location-Based Method**

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

There are two methods that can be used:

1) **Market-Based Method**
2) **Location-Based Method**

- ✓ Method 1) quantifies scope 2 GHG emissions based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with contractual instruments, or contractual instruments on their own.
- ✓ The emission factors are derived from the GHG emission rate represented in the contractual instruments that meet Scope 2 Quality Criteria.
- ✓ The market-based method is based on supplier-specific emission factors, i.e., emission rates provided by an electricity supplier to its customers, reflecting the emissions associated with the energy it provides.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

There are two methods that can be used:

1) Market-Based Method
2) **Location-Based Method**

- ✓ Method 2) quantifies scope 2 GHG emissions based on average energy generation emission factors for defined geographic locations, including local, subnational, or national boundaries. Under this approach, emission factors represent average emissions from energy generation occurring within a defined geographic area and a defined time period. In particular, it reflects the average emissions intensity of grids on which energy consumption occurs.
- ✓ This method applies to all locations where grids are used for the distribution of energy. The location-based method is based on statistical emissions information and electricity output aggregated and averaged within a defined geographic boundary and during a defined time period.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

There are two methods that can be used:

1) Market-Based Method
2) **Location-Based Method**

- ✓ Grid average factors are usually available for most countries or grids and are published by several organizations and government bodies, such as countries' ministries of environment and/or energy. The International Energy Agency (IEA) provides grid average data per country and per year. In some countries grid average data are available for much shorter periods.
  - For example, RTE in France provides grid average figures in real time for every 30 minutes period. Another useful source of grid average emission factor information is the Institute for Global Environmental Strategies.
- ✓ These data are often provided in tables and can be downloaded from the web-sites of specific country-level agencies and institutions.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

3. State Output Emission Rates (eGRID2016)

State	Total output emission rates (lb/MWh)						
	CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2
AK	925.9	0.063	0.009	930.0	6.6	6.5	0.6
AL	912.9	0.069	0.010	917.5	0.4	0.4	0.4
AR	1,115.7	0.105	0.015	1,122.6	0.9	0.9	1.6
AZ	932.2	0.067	0.011	937.1	0.6	0.6	0.2
CA	452.5	0.026	0.003	454.1	0.5	0.4	0.0
CO	1,468.4	0.146	0.021	1,477.9	1.1	1.1	0.7
CT	498.5	0.061	0.008	502.1	0.3	0.3	0.0
DC	481.8	0.023	0.002	483.0	4.6	4.6	0.1
DE	887.4	0.033	0.004	889.3	0.4	0.4	0.1
FL	1,024.2	0.077	0.010	1,029.0	0.5	0.6	0.4
GA	1,001.8	0.086	0.013	1,007.4	0.4	0.3	0.4
HI	1,522.1	0.157	0.024	1,532.9	4.5	4.2	7.5
IA	997.9	0.051	0.016	1,003.9	0.8	0.9	1.0
ID	188.7	0.008	0.001	189.3	0.3	0.3	0.1
IL	811.3	0.048	0.012	816.0	0.4	0.4	1.0
IN	1,812.7	0.185	0.027	1,824.9	1.7	1.7	1.7

CALCULATION EXAMPLE

For example, let us assume the following case:

Company A is a globally integrated business that has operations in four different countries. To calculate their Scope 2 emissions, it uses the location-based method and they have collected data from each of the different sites.

USA: US site consumed 350,000 MWh in the reporting period. They also purchased 20,000 RECs (1 REC=1MWh) from a solar firm.

UK: UK office consumed 40,000 MWh in the reporting year.

India: India office consumed 65,000 MWh during the reporting year.

B.3.2 Greenhouse gas emissions (scope 2): Measurement methodology

3. State Output Emission Rates (eGRID2016)							
State	Total output emission rates (lb/MWh)						
	CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2
AK	925.9	0.063	0.009	930.0	6.6	6.5	0.6
AL	912.9	0.069	0.010	917.5	0.4	0.4	0.4
AR	1,115.7	0.105	0.015	1,122.6	0.9	0.9	1.6
AZ	932.2	0.067	0.011	937.1	0.6	0.6	0.2
CA	452.5	0.026	0.003	454.1	0.5	0.4	0.0
CO	1,468.4	0.146	0.021	1,477.9	1.1	1.1	0.7
CT	498.5	0.061	0.008	502.1	0.3	0.3	0.0
DC	481.8	0.023	0.002	483.0	4.6	4.6	0.1
DE	887.4	0.033	0.004	889.3	0.4	0.4	0.1
FL	1,024.2	0.077	0.010	1,029.0	0.5	0.6	0.4
GA	1,001.8	0.086	0.013	1,007.4	0.4	0.3	0.4
HI	1,522.1	0.157	0.024	1,532.9	4.5	4.2	7.5
IA	997.9	0.051	0.016	1,003.9	0.8	0.9	1.0
ID	188.7	0.008	0.001	189.3	0.3	0.3	0.1
IL	811.3	0.048	0.012	816.0	0.4	0.4	1.0
IN	1,812.7	0.185	0.027	1,824.9	1.7	1.7	1.7

CALCULATION EXAMPLE

To calculate Scope 2, each electricity figure would be multiplied by the grid average emissions factor (GAF) in each country in the following way:

Scope 2 [tCO2] = [350,000 (USA) x 0.05 + 20,000 (USA) x 0] + [40,000 (UK) x 0.4] + [65,000 (INDIA) x 0.80]

Scope 2 [tCO2] = 17,500 + 16,000 + 52,000 = 85,500 tons of CO2

Assuming that the net value added for the period is equal to 1000 $, the indicator will be:

85,500 tons of CO2 / 1000 $ = 85.5 tons of CO2 per $

B.3.2 Greenhouse gas emissions (scope 2): Potential sources of information

- In order to obtain activity data (MWh), it is suggested to consult utility bills.
- The collection of these data needs to be done site by site, by a facility manager/general services administrator, by a quality manager or by an environmental/sustainability manager with the collaboration of the accounting department. Such data can then be cumulated both by legal entity and by country.

B.4 Ozone-depleting substances and chemicals

B.4.1 Ozone-depleting substances and chemicals

B.4.1 Ozone-depleting substances and chemicals: Definition

This indicator aims at **quantifying an entity's dependency on ozone- depleting substances (ODS) and chemicals** per net value added.

ODS are all bulk chemicals/substances, existing either as a pure substance or as a mixture. These are generally chemicals containing chlorine and/or bromine.

The most important ozone-depleting substances and chemicals are controlled under the Montreal Protocol and are listed in Annex A, B, C or E of the Protocol (For a complete list see: http://ozone.unep.org/en/handbook-montreal-protocol-substances-deplete-ozone-layer/5)

B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

This indicator should be calculated in the following way:

$$\frac{\text{Total amount of ozone-depleting substances and chemicals at time t}}{\text{Net value added at time t}}$$

In the Annex of the Montreal Protocol, every substance controlled is listed together with a value expressing the ozone depletion potential (although it is important to mention that some numbers have been updated as per amendments to the Protocol).

An **ozone depletion potential value** indicates how much impact a certain substance has on the depletion of the ozone layer relative to a reference substance.

The reference substance normally taken is CFC-11 (i.e., chlorofluorocarbon) with an ozone depletion potential of 1; therefore, ozone depletion potential values are expressed in kg CFC-11 equivalents per kg of the respective substance.

B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
Group I						
CFC-11 (CCl3F) Trichlorofluoromethane	45	1	1	4750	4660	75-69-4
CFC-12 (CCl2F2) Dichlorodifluoromethane	100	1	0.82	10900	10200	75-71-8
CFC-113 (C2F3Cl3) 1,1,2-Trichlorotrifluoroethane	85	0.8	0.85	6130	5820	76-13-1
CFC-114 (C2F4Cl2) Dichlorotetrafluoroethane	190	1	0.58	10000	8590	76-14-2
CFC-115 (C2F5Cl) Monochloropentafluoroethane	1020	0.6	0.5	7370	7670	76-15-3
Group II						
Halon 1211 (CF2ClBr) Bromochlorodifluoromethane	16	3	7.9	1890	1750	353-59-3
Halon 1301 (CF3Br) Bromotrifluoromethane	65	10	15.9	7140	6290	75-63-8
Halon 2402 (C2F4Br2) Dibromotetrafluoroethane	20	6	13.0	1640	1470	124-73-2

CALCULATION EXAMPLE

For example, let's assume that

- during a certain reporting period, a company uses 200 kg of the ozone-depleting substance Halon-1211,
- Halon-1211 has an ozone depletion potential of 3 (as an example, see here below an extract of the table that can be downloaded from: https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances#self).

B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
Group I						
CFC-11 (CCl3F) Trichlorofluoromethane	45	1	1	4750	4660	75-69-4
CFC-12 (CCl2F2) Dichlorodifluoromethane	100	1	0.82	10900	10200	75-71-8
CFC-113 (C2F3Cl3) 1,1,2-Trichlorotrifluoroethane	85	0.8	0.85	6130	5820	76-13-1
CFC-114 (C2F4Cl2) Dichlorotetrafluoroethane	190	1	0.58	10000	8590	76-14-2
CFC-115 (C2F5Cl) Monochloropentafluoroethane	1020	0.6	0.5	7370	7670	76-15-3
Group II						
Halon 1211 (CF2ClBr) Bromochlorodifluoromethane	16	3	7.9	1890	1750	353-59-3
Halon 1301 (CF3Br) Bromotrifluoromethane	65	10	15.9	7140	6290	75-63-8
Halon 2402 (C2F4Br2) Dibromotetrafluoroethane	20	6	13.0	1640	1470	124-73-2

CALCULATION EXAMPLE

In order to understand the ozone-depleting contribution of Halon-1211, a reporting entity needs to multiply the amount of Halon-1211 (200 kg) by the ozone depletion potential value of 3 (kg CFC-11 equivalent/kg Halon-1211) to come to the ozone depletion contribution (ODC) as follows:

ODC = 200 kg X 3 = 600 kg CFC-11 equivalent

B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

Purpose and form	Substance	ODP	Total	
			2018	2017
Production				
produced ODS	HCFC-21	0.04	1000	500
Production of ODS			1000	500
Purchase				
purchased ODS embodied in				
- supplied goods				
- supplied equipment	CFC-112	1	100	
- traded goods				
purchased ODS for				
- goods manufactured				
- own production processes				
- own equipment	Halon-1301	10	2	1
- for trade				
Purchase of ODS			102	1
Stocks				
ODS in goods				
ODS as substance in containers			1	1
ODS in equipment	Halon-1301		1200	1300
ODS in use as process agent	HCFC-124		10	20
Stocks of ODS			1211	1321

CALCULATION EXAMPLE

The dependency of an enterprise on ozone-depleting substances is defined as:

Production of ODS + purchases of ODS + stocks of ODS

Where:

- Production of ODS means the amount of virgin (i.e., not recovered, reclaimed or recycled) ozone-depleting substances added by the reporting entity .
- Purchases of ODS can assume different forms:
  - Ozone-depleting substances embodied in supplied goods
  - Ozone-depleting substances embodied in equipment for own use
  - Ozone-depleting substances embodied in traded goods
  - Ozone-depleting substances as substances for goods manufactured
  - Ozone-depleting substances as substances for own production process
  - Ozone-depleting substances as substances for own equipment
- Stocks of ODS are defined as any ozone-depleting substance stored or accumulated on the reporting entity's premises for use, reclaim, recovery, recycling or destruction in the future. They include ODS substances in containers, in goods, in own equipment and in use as process agents.

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B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

Purpose and form	Substance	ODP	Total	
			2018	2017
Production				
produced ODS	HCFC-21	0.04	1000	500
Production of ODS			1000	500
Purchase				
purchased ODS embodied in				
- supplied goods				
- supplied equipment	CFC-112	1	100	
- traded goods				
purchased ODS for				
- goods manufactured				
- own production processes				
- own equipment	Halon-1301	10	2	1
- for trade				
Purchase of ODS			102	1
Stocks				
ODS in goods				
ODS as substance in containers			1	1
ODS in equipment	Halon-1301		1200	1300
ODS in use as process agent	HCFC-124		10	20
Stocks of ODS			1211	1321

CALCULATION EXAMPLE

Looking at the Table, this indicator for year 2017 is calculated through the following steps:

a) Conversion of specific substances into CFC equivalent

HCFC-21 500 kg X 0.04 = 20 kg CFC-11 equivalent (production)

CFC-112 0 kg X 1 = 0 kg CFC-11 equivalent (purchase)

Halon-1301 1 kg X 10 = 10 kg CFC-11 equivalent (purchase)

Halon-1301 1,300 kg X 10 = 13,000 kg CFC-11 equivalent (stock)

HCFC-124 20 kg X 0.04 = 0.8 kg CFC-11 equivalent (stock)

b) Calculation of the dependency of an enterprise on ozone-depleting substances:

Production of ODS + purchases of ODS + stocks of ODS

20 + 0 + 10 + 13,000 + 0.8 = 13,030.8 kg CFC-11 equivalent

c) Assuming that the net value added in year 2017 is equal to 11,000 €, the indicator is then calculated in the following way:

Total amount of ozone-depleting substances and chemicals in 2017

Net value added in 2017

= 13,030.8/11,000 = 1.18 kg CFC-11 equivalent per €

B.4.1 Ozone-depleting substances and chemicals: Measurement methodology

The difference between year t and year t-1 should be also computed so that it is possible to monitor the level of progress the organization has made toward ozone-depleting substances and chemicals.

This indicator should be calculated in the following way:

$$\frac{\text{Total amount of ozone-depleting substances and chemicals at time } t}{\text{Net value added at time } t}$$

MINUS

$$\frac{\text{Total amount of ozone-depleting substances and chemicals at time } t-1}{\text{Net value added at time } t-1}$$

B.4.1 Ozone-depleting substances and chemicals: Potential sources of information

- ODS should be weighed or metered at each specific business site (ODS should be measured in kilograms, metric tons, litres and cubic metres). This is an area that is regulated in many countries and therefore the information regarding this indicator should be found:
- When ODS are produced, in the operating information systems of each specific plant (as part of amounts of outcomes produced in a specific reporting period – see also the bills of materials);
- When ODS are purchased/stocked
  - if it is ODS for production processes, in the accounts payable and in the operating information systems of each specific plant. The owner of such information in this case should be the plant manager/the purchasing manager;
  - if it is ODS embodied in equipment in use outside production processes and part of general services (e.g., air conditioning, firefighting equipment), it can be derived from the description of the specific equipment bought by the entity at each facility. The owner of such information in this case should be the facility manager/general services administrator.

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B.5 Energy consumption

B.5.1 Renewable energy

B.5.2 Energy efficiency

B.5 Energy consumption

B.5.1 Renewable energy

B.5.2 Energy efficiency

B.5.1 Renewable energy: Definition

This indicator is defined as the **ratio of an entity's consumption of renewable energy to its total energy consumption** during the reporting period.

Types of renewable energy include, for example, solar energy, biomass, hydropower, geothermal energy, and ocean energy.

B.5.1 Renewable energy: Measurement methodology

This indicator should be calculated in the following way:

$$\frac{\text{Total consumption of renewable energy at time t}}{\text{Total energy consumption at time t}}$$

B.5.1 Renewable energy: Measurement methodology

To calculate the **numerator**, the company should:

- consider only the amount of renewable energy consumed, comprising:
  - renewable fuel sources (such as biofuels),
  - solar energy,
  - biomass,
  - hydropower,
  - geothermal energy,
  - ocean energy
- include heat from renewable sources and electricity from renewable sources.
  - renewable sources of electricity are comprised of: hydro, wind, solar (photovoltaic and solar thermal), geothermal, wave, tide and other marine energy, as well as the combustion of biofuels.
  - renewable sources of heat are: solar thermal, geothermal and the combustion of biofuels.

  So the numerator is the sum of all the sources of renewable energy (among the ones mentioned above) consumed by the reporting entity.

When computing the numerator, it is suggested to distinguish between different types of renewable energy resources, as these range from "infinite" renewable sources, such as solar power, to cyclical renewable resources, such as biomass.

B.5.1 Renewable energy: Measurement methodology

The **denominator** of this indicator, i.e., total energy consumption within the reporting entity can be calculated as:

Non-renewable fuel consumed + Renewable fuel consumed + Electricity, heating, cooling, and steam purchased for consumption + Self-generated electricity, heating, cooling, and steam, which are not consumed - Electricity, heating, cooling, and steam sold

Fuel consumption is expressed in joules or multiples. Electricity, heating, cooling, and steam consumptions are expressed in joules, watt-hours or multiples. However, both the numerator and the denominator should be expressed in joules. Therefore, conversion factors are needed.

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B.5.1 Renewable energy: Measurement methodology

NET CALORIFIC VALUES OF ENERGY PRODUCTS
GJ/ton

PRODUCTION, EXPORTS AND CHANGES IN STOCKS

HARD COAL	2011	2012	2013	2014
Standard factor	**25.8**	**25.8**	**25.8**	**25.8**
Argentina	24.7	24.7	24.7	24.7
Australia	27.1	27.0	26.9	26.9
Bangladesh	20.9	20.9	20.9	20.9
Botswana	23.6	23.6	23.6	23.6
Brazil	18.6	18.6	18.6	18.6
Bulgaria	17.4	17.2	20.0	27.2
Canada	24.7	24.7	25.1	25.0
Chile	15.7	17.4	22.0	22.0
China	20.6	19.9	19.9	20.1
Colombia	27.2	27.2	27.2	27.2
Czechia	26.7	26.9	27.8	27.0
Egypt	25.5	25.5	25.7	25.7
France	26.0	26.0	26.0	26.0
Georgia	25.0	25.0	28.0	25.1
Germany	29.3	27.4	27.7	27.6
India	18.9	18.9	17.0	16.8
Indonesia	26.1	25.8	25.8	25.8
Italy	26.6	26.6	26.6	26.6
Kazakhstan	18.6	18.6	18.6	18.6
Korea, Democratic People's Republic of	26.2	26.2	26.3	26.3
Korea, Republic of	19.3	18.6	18.6	18.6
Kyrgyzstan	18.6	18.6	18.6	18.6
Malaysia	26.4	26.4	26.4	26.4
Mexico	28.9	29.0	28.9	28.9

Different energy commodities have a different caloric content. To make them comparable they are converted into thermal equivalents using their respective **net caloric content.**

If the energy commodity is used in a country for which specific values are listed (i.e., there are **local conversion factors**) then these values should be used. Otherwise the standard values should be applied

These values can be derived from different web-resources and are usually presented in Tables like the ones reported here:

- Local values (https://unstats.un.org/unsd/energy/yearbook/2014/08i.pdf)

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B.5.1 Renewable energy: Measurement methodology

STANDARD NET CALORIFIC VALUES

(Terajoules per thousand metric tons, unless otherwise stated)

Hard coal	25.80
Brown coal	14.00
Peat	9.76
Oil shale	8.90
Coal coke	28.20
Patent fuel	20.70
Brown coal briquettes (BKB)	20.70
Coal tar	28.00
Coke-oven gas (original unit is TJ)	1.00
Gasworks gas (original unit is TJ)	1.00
Recovered gases (original unit is TJ)	1.00
Other coal products	20.00
Peat products	9.76
Conventional crude oil	42.30
Natural gas liquids	44.20
Additives and Oxygenates	30.00
Other hydrocarbons	36.00
Feedstocks	43.00
Refinery gas	49.50
Ethane	46.40
Liquefied petroleum gas	47.30
Naphtha	44.50
Aviation gasoline	44.30
Motor gasoline	44.30
Gasoline-type jet fuel	44.30

Different energy commodities have a different caloric content. To make them comparable they are converted into thermal equivalents using their respective **net caloric content.**

If the energy commodity is used in a country for which specific values are listed (i.e., there are local conversion factors) then these values should be used. Otherwise the **standard values** should be applied

These values can be derived from different web-resources and are usually presented in Tables like the ones reported here:

- Standard values (https://unstats.un.org/unsd/energy/balance/2014/05.pdf)

B.5.1 Renewable energy: Measurement methodology

CALCULATION EXAMPLE

For example:

Let us assume that an entity has consumed at time t, during a certain reporting period:

- biomass fuels, in particular:
  - 10,000 kg of coconut shells
  - 22,000 kg of wood charcoal
- 35,000 m3 of natural gas from Saudi Arabia
- 300 tons of hard coal from Albania

Assuming the following conversion factors :

- 17.9 MJ/kg for coconut shells,
- 29 MJ/kg for wood charcoal,
- 34.20 MJ/m3 for the natural gas from Saudi Arabia
- 27.21 GJ/t for the hard coal from Albania.

Knowing that: 1 Gigajoule = 1000 Megajoule

The total amount of energy consumed during a certain reporting period is calculated in the following way:

10,000 kg x 17.9 MJ/kg + 22,000kg x 29 MJ/kg + 35,000 m3 x 34.20 MJ/m3 + 300 tons x 27.21 GJ/t

179,000 MJ + 638,000 MJ + 1,197,000 MJ + 8,163,000 MJ = 10,177,000 MJ or 10,177 GJ

This is the denominator of the indicator, i.e., the total energy consumption at time t.

B.5.1 Renewable energy: Measurement methodology

CALCULATION EXAMPLE

The numerator is only the sum of the biomass fuels (i.e., the renewable energy sources), i.e., the total consumption of renewable energy at time t is:

179,000 MJ + 638,000 MJ = 817,000 MJ or 817 GJ

The indicator is thus calculated in the following way:

$$\frac{\text{Total consumption of renewable energy at time t} = 817\text{ GJ}}{\text{Total energy consumption at time t} = 10{,}177\text{ GJ}}$$

= 817/10,177 = 0.08

B.5.1 Renewable energy: Measurement methodology

In order to normalize data on renewable energy and to be consistent with the way the other environmental indicators are calculated, it is suggested to normalize the amount of joules of renewable energy by the amount of net value added (expressed in €, $, £, etc.) generated in the same reporting period (see indicator A.1.3. Net Value added). So, in the end, the unit of measure of this indicator is GJ or MJ per €, $ etc.

$$\frac{\text{Total consumption of renewable energy at time t}}{\text{Net value added at time t}}$$

CALCULATION EXAMPLE

Referring to the example used above and assuming that, at time t, the net value added is equal to $1,000, this indicator is calculated in this way:

Total consumption of renewable energy at time t = 817 GJ

Net value added at time t = $1,000

B.5.1 Renewable energy: Measurement methodology

The difference between year t and year t-1 should be also computed so that it is possible to monitor the level of progress the organization has made toward the use of renewable energy.

This indicator should be calculated in the following way:

$$\frac{\text{Total consumption of renewable energy at time t}}{\text{Net value added at time t}}$$

MINUS

$$\frac{\text{Total consumption of renewable energy at time t -1}}{\text{Net value added at time t-1}}$$

B.5.1 Renewable energy: Potential sources of information

- As the majority of entities purchase energy, the amount of energy consumed for a reporting period, subdivided into the different types, can be found by looking at the bills of the energy suppliers and of fuel providers.
- In many countries, renewable energy certificates, or RECs, are used to claim to have purchased renewable energy. So specific information about renewable energy can also be derived from these certificates when present.
- If the entity has an Energy manager, the collection of energy data is accomplished by this professional. Otherwise a facility manager/general services administrator can also be in charge of such information, with the collaboration of the accounting department (accounts payable for the energy bills). Such data should be collected at the level of each business unit/facility so that it can then be cumulated both by legal entity and by country.

B.5 Energy consumption

B.5.1 Renewable energy

B.5.2 Energy efficiency

B.5.2 Energy efficiency: Definition

This indicator is defined as an entity’s **energy consumption divided by net value added**.

B.5.2 Energy efficiency: Measurement methodology

This indicator should be calculated in the following way:

$$\frac{\text{Total consumption of energy at time t}}{\text{Net value added at time t}}$$

B.5.2 Energy efficiency: Measurement methodology

Total consumption of energy within the reporting entity can be calculated as (see also indicator B.5.1):

Non-renewable fuel consumed + Renewable fuel consumed + Electricity, heating, cooling, and steam purchased for consumption + Self-generated electricity, heating, cooling, and steam, which are not consumed - Electricity, heating, cooling, and steam sold

Fuel consumption is expressed in joules or multiples. Electricity, heating, cooling, and steam consumptions are expressed in joules, watt-hours or multiples. However, both the numerator and the denominator should be expressed in joules. Therefore, conversion factors are needed.

B.5.2 Energy efficiency: Measurement methodology

NET CALORIFIC VALUES OF ENERGY PRODUCTS
GJ/ton

PRODUCTION, EXPORTS AND CHANGES IN STOCKS

HARD COAL	2011	2012	2013	2014
Standard factor	**25.8**	**25.8**	**25.8**	**25.8**
Argentina	24.7	24.7	24.7	24.7
Australia	27.1	27.0	26.9	26.9
Bangladesh	20.9	20.9	20.9	20.9
Botswana	23.6	23.6	23.6	23.6
Brazil	18.6	18.6	18.6	18.6
Bulgaria	17.4	17.2	20.0	27.2
Canada	24.7	24.7	25.1	25.0
Chile	15.7	17.4	22.0	22.0
China	20.6	19.9	19.9	20.1
Colombia	27.2	27.2	27.2	27.2
Czechia	26.7	26.9	27.8	27.0
Egypt	25.5	25.5	25.7	25.7
France	26.0	26.0	26.0	26.0
Georgia	25.0	25.0	28.0	25.1
Germany	29.3	27.4	27.7	27.6
India	18.9	18.9	17.0	16.8
Indonesia	26.1	25.8	25.8	25.8
Italy	26.6	26.6	26.6	26.6
Kazakhstan	18.6	18.6	18.6	18.6
Korea, Democratic People's Republic of	26.2	26.2	26.3	26.3
Korea, Republic of	19.3	18.6	18.6	18.6
Kyrgyzstan	18.6	18.6	18.6	18.6
Malaysia	26.4	26.4	26.4	26.4
Mexico	28.9	29.0	28.9	28.9

Different energy commodities have a different caloric content. To make them comparable they are converted into thermal equivalents using their respective **net caloric content.**

If the energy commodity is used in a country for which specific values are listed (i.e., there are **local conversion factors**) then these values should be used. Otherwise the standard values should be applied

These values can be derived from different web-resources and are usually presented in Tables like the ones reported here:

- Local values (https://unstats.un.org/unsd/energy/yearbook/2014/08i.pdf)

B.5.2 Energy efficiency: Measurement methodology

STANDARD NET CALORIFIC VALUES

(Terajoules per thousand metric tons, unless otherwise stated)

Hard coal	25.80
Brown coal	14.00
Peat	9.76
Oil shale	8.90
Coal coke	28.20
Patent fuel	20.70
Brown coal briquettes (BKB)	20.70
Coal tar	28.00
Coke-oven gas (original unit is TJ)	1.00
Gasworks gas (original unit is TJ)	1.00
Recovered gases (original unit is TJ)	1.00
Other coal products	20.00
Peat products	9.76
Conventional crude oil	42.30
Natural gas liquids	44.20
Additives and Oxygenates	30.00
Other hydrocarbons	36.00
Feedstocks	43.00
Refinery gas	49.50
Ethane	46.40
Liquefied petroleum gas	47.30
Naphtha	44.50
Aviation gasoline	44.30
Motor gasoline	44.30
Gasoline-type jet fuel	44.30

Different energy commodities have a different caloric content. To make them comparable they are converted into thermal equivalents using their respective **net caloric content.**

If the energy commodity is used in a country for which specific values are listed (i.e., there are local conversion factors) then these values should be used. Otherwise the **standard values** should be applied

These values can be derived from different web-resources and are usually presented in Tables like the ones reported here:

- Standard values (https://unstats.un.org/unsd/energy/balance/2014/05.pdf)

B.5.2 Energy efficiency: Measurement methodology

CALCULATION EXAMPLE

For example:

Let’ assume that an entity has consumed at time t, during a certain reporting period:

- 150,000 m3 of natural gas from Saudi Arabia
- 900 tons of hard coal from Albania

Assuming the following conversion factors :

- o 34.20 MJ/m3 for the natural gas from Saudi Arabia
- o 27.21 GJ/t for the hard coal from Albania.

Knowing that:

1 Gigajoule = 1000 Megajoule

The total amount of energy consumed during a certain reporting period is calculated in the following way:

150,000 m3 x 34.20 MJ/m3 + 900 tons x 27.21 GJ/t

5,130,000 MJ + 24,489,000 MJ = 29,619,000 MJ or 29,619 GJ

This is the numerator of the indicator.

Assuming that the net value added is 10,000 £, the indicator is calculated in the following way:

29,619 / 10,000 = 2.96 GJ per £

B.5.2 Energy efficiency: Potential sources of information

- As the majority of entities purchase energy, the amount of energy consumed for a reporting period, subdivided into the different types, can be found by looking at the bills of the energy suppliers.
- If the entity has an Energy manager, the collection of energy data is accomplished by this professional. Otherwise a facility manager/general services administrator can also be in charge of such information, with the collaboration of the accounting department (accounts payable for the energy bills).
- Such data should be collected at the level of each business unit/facility so that it can then be cumulated both by legal entity and by country.

Self-assessment questions with solutions

1. If we know that an entity recycles and/or reuses 0.10 m3 of water per unit produced, and that the amount of units produced over a certain reporting period is equal to 1,000,000, the total volume of water recycled and reused at the end of the reporting period is:

- ❑ 100,000 m3
- ❑ 1,000,000 m3
- ❑ $100,000
- ❑ None of the above

1. If we know that an entity recycles and/or reuses 0.10 m3 of water per unit produced, and that the amount of units produced over a certain reporting period is equal to 1,000,000, the total volume of water recycled and reused at the end of the reporting period is:

- ❑ **100,000 m3**
- ❑ 1,000,000 m3
- ❑ $100,000
- ❑ None of the above

0.10 m3 x 1,000,000 = 100,000 m3

2. Water use efficiency is defined as the water use per net value added in the reporting period.

- ❑ True
- ❑ False

2. Water use efficiency is defined as the water use per net value added in the reporting period.

- ❑ **True**
- ❑ False

3. If the volume of water used in year t per net value added (i.e., the water use efficiency) is equal to 30,000 m3 per € and the volume of water used in year t-1 per net value added is equal to 35,000 m3 per € the change of water use per net value added is equal to:

- ❑ 5,000 m3 per €
- ❑ - 5,000 m3 per €
- ❑ 5,000 €.
- ❑ - 5,000 €

3. If the volume of water used in year t per net value added (i.e., the water use efficiency) is equal to 30,000 m3 per € and the volume of water used in year t-1 per net value added is equal to 35,000 m3 per € the change of water use per net value added is equal to:

- ❑ 5,000 m3 per €
- ❑ **- 5,000 m3 per €**
- ❑ 5,000 €.
- ❑ - 5,000 €

30,000 – 35,000 = - 5,000 m3 per €

4. A change in water use efficiency from year t-1 to year t equal to - 2,000 m3 per € signals an improvement in the water use efficiency

- ❑ True
- ❑ False

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- ❑ **True**
- ❑ False

5. Water stress is defined as total water withdrawn with a breakdown by sources (e.g., surface, ground, sea) and with reference to water- stressed or water-scarce areas (expressed as a percentage of total withdrawals).

- ❑ True
- ❑ False

5. Water stress is defined as total water withdrawn with a breakdown by sources (e.g., surface, ground, sea) and with reference to water- stressed or water-scarce areas (expressed as a percentage of total withdrawals).

- ❑ **True**
- ❑ False

6. Waste reuse is the additional use of a component, part, or product after it has been removed from a clearly defined service cycle in a new manufacturing process that goes beyond cleaning, repair or refurbishing, cost of bought in goods and services equal to $450, and depreciation equal to $250, the gross value added (GVA) is:

- ❑ True
- ❑ False

6. Waste reuse is the additional use of a component, part, or product after it has been removed from a clearly defined service cycle in a new manufacturing process that goes beyond cleaning, repair or refurbishing, cost of bought in goods and services equal to $450, and depreciation equal to $250, the gross value added (GVA) is:

- ❑ True
- ❑ **False**

7. If an entity has the following information: total mineral waste in year t = 400 tons; total non-mineral waste in year t = 200 tons; closed-loop re-used, remanufactured and recycled mineral and non-mineral waste in t = 100 tons, the total waste generated in year t is equal to:

- ❑ 200 tons
- ❑ 400 tons
- ❑ 600 tons
- ❑ 500 tons

7. If an entity has the following information: total mineral waste in year t = 400 tons; total non-mineral waste in year t = 200 tons; closed-loop re-used, remanufactured and recycled mineral and non-mineral waste in t = 100 tons, the total waste generated in year t is equal to:

- ❑ 200 tons
- ❑ 400 tons
- ❑ 600 tons
- ❑ **500 tons**

400 tons + 200 tons – 100 tons = 500 tons

8. Assuming that a reporting entity has an amount of total reused, remanufactured and recycled waste generated at time t equal to 200 tons, and that the net value added in year t is equal to €2,000, the total amount of waste reused, remanufactured and recycled normalized by the net value added is:

- ❑ 200 tons
- ❑ 10%
- ❑ 0.1 tons per €
- ❑ 0.1 tons

8. Assuming that a reporting entity has an amount of total reused, remanufactured and recycled waste generated at time t equal to 200 tons, and that the net value added in year t is equal to €2,000, the total amount of waste reused, remanufactured and recycled normalized by the net value added is:

- ❑ 200 tons
- ❑ 10%
- ❑ **0.1 tons per €**
- ❑ 0.1 tons

200 tons/€2000 = 0.1 tons per €

9. In many countries, various forms of waste treatment are required by law, and, normally, a waste disposal contractor is involved in open-loop recycling. Therefore, relevant information for a specific reporting period can be found on the bills from the waste management company.

- ❑ True
- ❑ False

9. In many countries, various forms of waste treatment are required by law, and, normally, a waste disposal contractor is involved in open-loop recycling. Therefore, relevant information for a specific reporting period can be found on the bills from the waste management company.

- ❑ **True**
- ❑ False

10. Which of the following is/are hazardous characteristic/s as defined by the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)?

- ❑ Organic Peroxides
- ❑ Infectious substances
- ❑ Flammable solids
- ❑ All of the above

10. Which of the following is/are hazardous characteristic/s as defined by the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)?

- ❑ Organic Peroxides
- ❑ Infectious substances
- ❑ Flammable solids
- ❑ **All of the above**

11. Scope 2 covers GHG emissions that occur inside an entity’s organizational boundary and are also referred to as Direct GHG. They are “emissions from sources that are owned or controlled by the organization”.

- ❑ True
- ❑ False

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- ❑ True
- ❑ **False**

12. Scope 2 covers emissions arising from the generation of secondary energy forms, e.g. electricity, that are purchased by the company for its own use (i.e., indirect GHG emissions)

- ❑ True
- ❑ False

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- ❑ **True**
- ❑ False

13. Let us assume that an entity operates in two different countries, USA and UK. We know that the US site consumed 500,000 MWh and the UK site purchased 200,000 RECs (1 REC=1MWh) from a solar firm and consumed 100,000 MWh in the reporting period. Assuming that the grid average emissions factor (GAF) in USA is equal to 0.05 and in UK to 0.4, their Scope 2 emissions would be equal to:

- ❑ 105,000 tons of CO_2
- ❑ 65,000 tons of CO_2
- ❑ 800,000 MWh
- ❑ None of the above

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- ❑ 105,000 tons of CO_2
- ❑ **65,000 tons of CO_2**
- ❑ 800,000 MWh
- ❑ None of the above

Scope 2 [tCO_2] = [500,000 (USA) x 0.05] + [200,000 x 0 + 100,000 (UK) x 0.4]

Scope 2 [tCO_2] = 25,000 + 40,000= 65,000 tons of CO_2

14. ODS are all bulk chemicals/substances, existing either as a pure substance or as a mixture. These are generally chemicals containing chlorine and/or bromine. The most important ozone-depleting substances and chemicals are controlled under the Montreal Protocol

- ❑ True
- ❑ False

14. ODS are all bulk chemicals/substances, existing either as a pure substance or as a mixture. These are generally chemicals containing chlorine and/or bromine. The most important ozone-depleting substances and chemicals are controlled under the Montreal Protocol

- ❑ **True**
- ❑ False

15. The dependency of an enterprise on ozone-depleting substances is defined as Production of ODS + purchases of ODS - stocks of ODS

- ❑ True
- ❑ False

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- ❑ True
- ❑ **False**

16. Which of the following represent/s examples of renewable energy?

- ❑ hydropower
- ❑ biofuels
- ❑ solar energy
- ❑ hard coal

16. Which of the following represent/s examples of renewable energy?

- ❑ **hydropower**
- ❑ **biofuels**
- ❑ **solar energy**
- ❑ hard coal

17. Let us assume that an entity has consumed at time t, during a certain reporting period, 50,000 m3 of natural gas from Saudi Arabia and 500 tons of hard coal from Albania. Assuming the following conversion factors: 34.20 MJ/m3 for the natural gas from Saudi Arabia and 27.21 GJ/t for the hard coal from Albania, what is the total amount of energy consumed during a certain reporting perio?

- ❑ 1,723,604 MJ
- ❑ 15,315,000 MJ
- ❑ 1,723,604 GJ
- ❑ 15,315,000 GJ

17. Let us assume that an entity has consumed at time t, during a certain reporting period, 50,000 m3 of natural gas from Saudi Arabia and 500 tons of hard coal from Albania. Assuming the following conversion factors: 34.20 MJ/m3 for the natural gas from Saudi Arabia and 27.21 GJ/t for the hard coal from Albania, what is the total amount of energy consumed during a certain reporting perio?

- ❑ 1,723,604 MJ
- ❑ **15,315,000 MJ**
- ❑ 1,723,604 GJ
- ❑ 15,315,000 GJ

50,000 m3 x 34.20 MJ/m3 + 500 tons x 27.21 GJ/t =

1,710,000 MJ + 13,605,000 MJ = 15,315,000 MJ

As 1 Gigajoule = 1000 Megajoule

18. Assuming that an entity has consumed at time t, during a certain reporting period, 50,000 MJ of energy and records a net value added equal to $10,000, the indicator “Energy efficiency” is:

- ❑ 5 GJ per $
- ❑ 5 MJ per $
- ❑ 5$
- ❑ None of the above

18. Assuming that an entity has consumed at time t, during a certain reporting period, 50,000 MJ of energy and records a net value added equal to $10,000, the indicator “Energy efficiency” is:

- ❑ 5 GJ per $
- ❑ **5 MJ per $**
- ❑ 5$
- ❑ None of the above

50,000 / 10,000 = 5 MJ per $