



PRACTICE
Greenhealth®

Greenhealth Cost of Ownership (GCO) Calculator

Version 1.0

User Guide



Prepared by TRUCOST[™]

ABOUT PRACTICE GREENHEALTH

Practice Greenhealth is a nonprofit membership organization founded on the principles of positive environmental stewardship and best practices by organizations in the healthcare community.

Practice Greenhealth has initiated the development of a Greenhealth Cost of Ownership (GCO) Calculator Version 1.0 as part of its Greening the Supply Chain Initiative, to help healthcare providers adopt environmentally preferable purchasing practices that consider 'submerged' environmental costs.

ABOUT TRUCOST

Trucost helps companies and investors to achieve success by understanding environmental issues in business terms. Our data-driven insights enable organizations to manage risks and identify opportunities for growth.

We are the world's leading experts in quantifying and valuing the environmental impacts of operations, supply chains, products and financial assets. By putting a monetary value on pollution and resource use, we integrate natural capital into business and investment decisions.

With offices in Europe, the US and Asia, Trucost works with businesses worldwide to increase revenues, improve communications, meet marketplace expectations and comply with regulatory requirements.

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2. INTRODUCTION AND OBJECTIVES

The purpose of this tool is to support hospitals and Group Purchasing Organizations (GPOs) in considering environmental costs in their procurement decision-making, and ultimately to minimize both financial costs and environmental impacts. For the purposes of this tool, environmental costs refer to realized financial costs that are linked to environmentally damaging or resource consuming activities, such as water and energy consumption and end of life disposal.

This tool incorporates only the direct financial costs associated with the functioning of a product. As such the tool excludes indirect costs such as the cost born by society due to environmental impacts, or intangible reputational costs.

Hospitals and GPOs can use this tool to account for many environmental costs that occur from the purchase of products through to their disposal. By considering their Total Cost of Ownership (TCO), a more holistic cost comparison for different product alternatives is provided. By considering costs beyond the cost of purchasing the product, such as the cost of energy and water the product requires, cost of any supplemental parts, and the cost of end of life disposal, the tool allows users to identify which product / scenario has the lowest total cost and the lowest environmental cost¹. In addition, the tool presents the cost of acquiring the product as a percent of the Total Cost of Ownership, which helps to highlight the financial significance of environmental, product use, and disposal costs, which can provide valuable insights that support better procurement decisions.

This tool allows you to complete two levels of analysis, depending on your objectives, desired level of accuracy and data availability:

- The **screening assessment** is appropriate for a high-level product screening, as it requires fewer costs to be entered and industry average data is prepopulated based on your responses.
- The **detailed assessment** is appropriate for a more comprehensive product review, as it includes additional cost categories and allows you to overwrite the prepopulated industry average data.

¹ Costs currently paid by hospitals that are linked to environmentally damaging or resource consuming activities. See the glossary for more information.

3. SCOPE AND STRUCTURE OF THE TOOL

3.1. SCOPE

The scope of this tool has been defined through an initial scoping phase completed by Trucost in partnership with Practice Greenhealth and the Total Cost of Ownership (TCO) Steering Committee. This GCO calculator can be used across product types, but has been designed for hospitals and GPOs, and includes cost categories that are specific for healthcare products. Examples are costs from cleaning and sterilizing products, and costs associated with disposing of healthcare-specific categories of waste such as regulated medical waste and pharmaceutical waste.

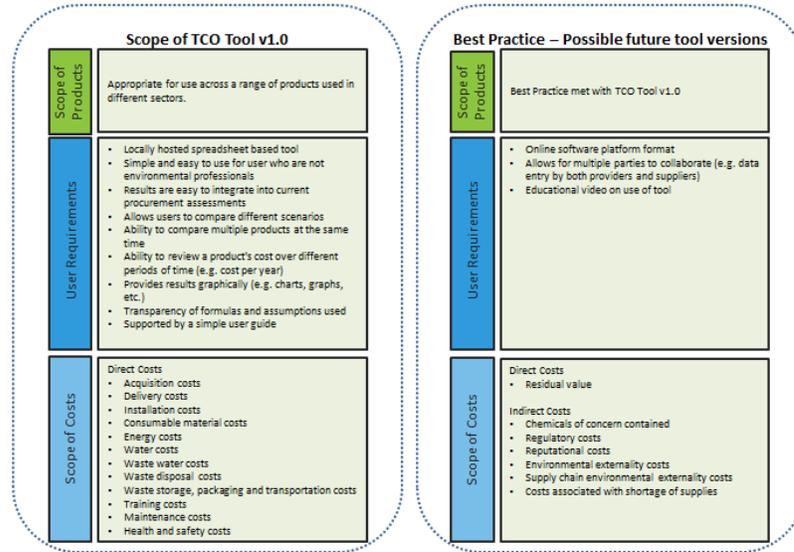
The GCO calculator was developed with the following key principles in mind: ease of use; flexibility to enable the comparison of multiple products of scenarios; delivery of insights on key aspects of product ownership costs; and providing a high degree of transparency on the underlying methods and sources.

To achieve the principle of ease of use, Version 1 of the GCO calculator only captures the direct costs of acquiring, operating and disposing a product. By focusing on direct costs, supply chain professionals capture more readily available costs to maintain the procurement process timeline. This version of the tool does not incorporate indirect costs such as regulatory costs, reputational costs, or health or ecological consequences resulting from environmental impacts. These costs are neither easy to measure nor readily available.

The snapshot below summarizes the scope of the current version of the tool and possible future versions.

GREENHEALTH COST OF OWNERSHIP (GCO) CALCULATOR - USER GUIDE

Snapshot a: Scope of the total cost of ownership tool and possible future developments



The tool allows users to complete two different levels of TCO assessment depending on purpose and availability of data. The snapshot below highlights what costs are included in each type of assessment. As highlighted in the cells in green, the detailed assessment incorporates data for several additional product cost categories such as delivery, installation, maintenance (from labor and supplemental parts that can be needed to operate the product), training, and health and safety costs.

Snapshot b: Costs included by type of assessment (the costs highlighted in green are the ones only included in the detailed assessment).

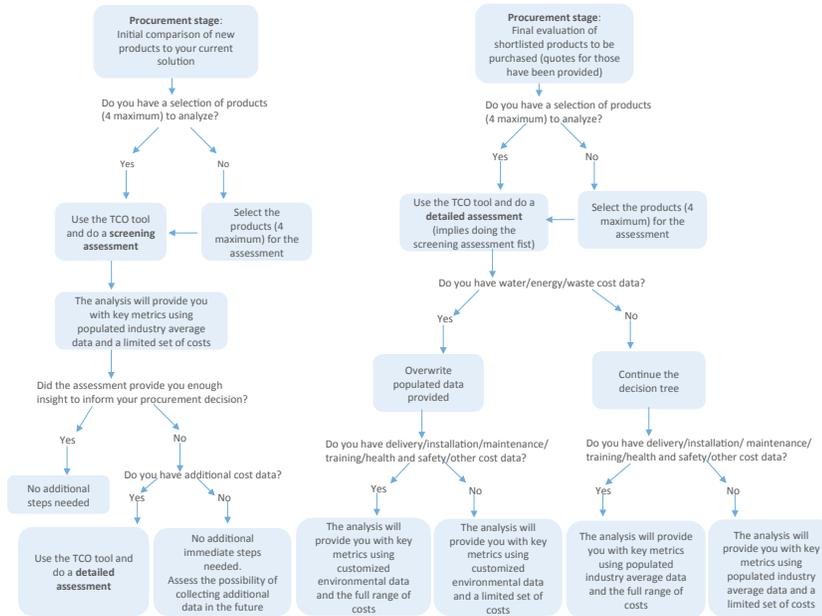
COST TYPE	TYPE OF ASSESSMENT	
	DATA INPUT (SCREENING ASSESSMENT)	DATA INPUT (DETAILED ASSESSMENT)
ACQUISITION COSTS		
Purchase costs	✓	✓
Delivery costs		✓
Installation costs		✓
Other acquisition costs		✓
OPERATIONAL COSTS		
Electricity costs	✓	✓
Fuel costs (natural gas, diesel or gasoline)	✓	✓
Water costs (incoming water plus outgoing/waste water)	✓	✓
Cleaning and sterilizing costs	✓	✓
Maintenance - Labor costs		✓
Maintenance- Supplemental parts costs		✓
Training costs		✓
Health and safety costs		✓
Other operational costs		✓

DISPOSAL COSTS		
Waste disposal cost	✓	✓
Other disposal costs (waste storage, waste packaging and waste transportation costs)		✓

3.2. CHOOSING THE TYPE OF ASSESSMENT

The tool allows for two levels of assessment: a screening assessment of products where less data is available, and a detailed assessment where additional cost data is available. The screening assessment is most useful as an initial assessment, for example, in cases where you are investigating a product for the first time and you would like to compare it to an existing solution to understand what some of the non-acquisition costs might be. The detailed assessment is most useful when you are ready to make a purchasing decision and would like to compare a shortlist of options in detail. The detailed assessment enables a more complete comparison of procurement options but requires additional data. The decision tree presented below is designed to assist you in deciding which level of assessment is best suited to your circumstances. You can either choose to do a screening assessment or a detailed assessment. However, please note that you will always have to start by completing a screening assessment as a first step. After doing a screening assessment, you can either choose to undertake a detailed assessment or stop the analysis there. Section 4 How to use the tool explains this in more detail. Please see snapshot f: Structure of the tool for the two types of assessment provided. Data you enter in the screening assessment will be carried over to the detailed assessment, with the exception of waste data because it has different levels of granularity in the detailed assessments.

Snapshot c: Type of assessment decision tree



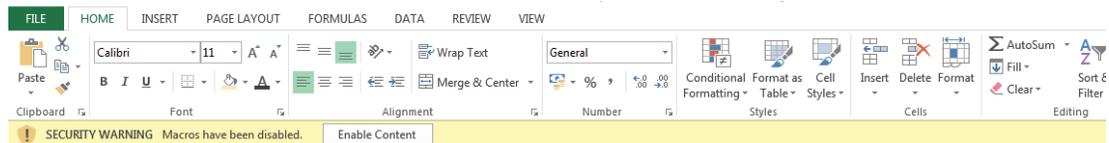
4. HOW TO USE THE TOOL

This section describes the key steps required to use the tool, as well as details on how to save and share the results of the analysis.

4.1. STEPS IN THE JOURNEY

The tool runs within Microsoft Excel and contains several macros to enhance its full functionality. When opening the tool, please enable the macros by selecting “Enable Content” to ensure that the tool will function correctly. The snapshot below provides an example of the security message that you may see when opening the tool in Microsoft Excel 2013.

Snapshot d: Security message for enabling macros.



You will then arrive at the introduction page (shown in the snapshot below), which describes the key steps required to complete a screening or detailed assessment.

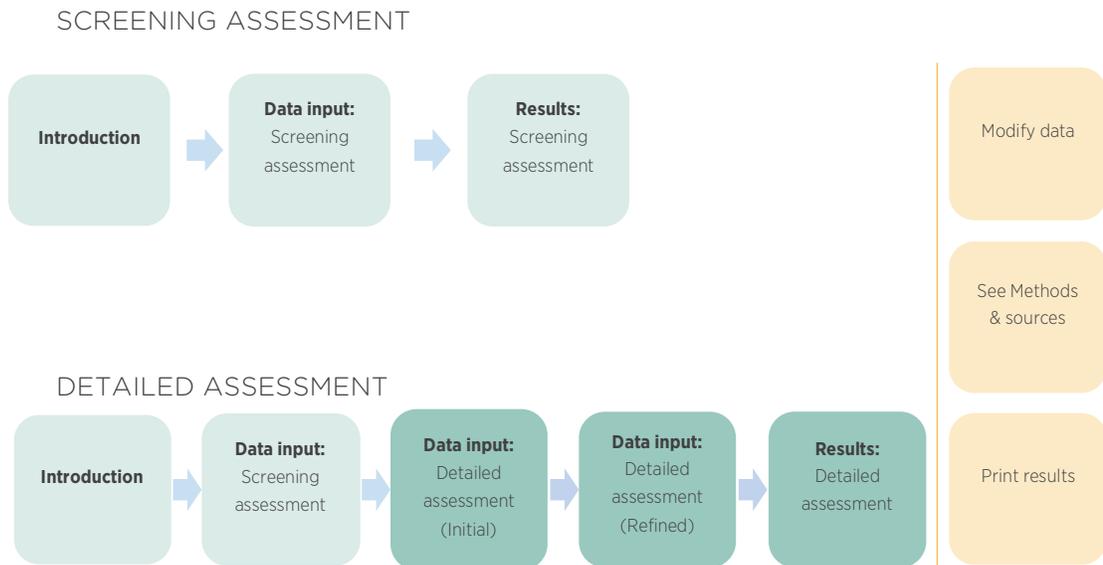
Snapshot e: Instructions in the introduction page

INSTRUCTIONS	
Your Journey	
Step 1	Select Screening assessment in the upper right-hand side of this page. This will take you to the Data input: Screening assessment page, where you will be able to add information for different products/scenarios. Please enter data in the green fields of this page. For more information see Cell coloring below.
Step 2	Review the findings by selecting Screening results in the upper right-hand side of the page. This will take you to the Results: Screening assessment page which presents the Total Cost of Ownership for the product / scenarios and identifies key costs from purchase to disposal. If you would like to modify data, select Screening assessment in the upper right-hand side of the Results: Screening assessment page and this will take you back to data entry.
Step 3	If you would like to run a detailed assessment (for more information on which level of analysis is most appropriate for your needs see the type of assessment decision tree in the User guide), please complete steps 1-3 and then select Detailed assessment (Initial) in the upper right-hand side of the page. This will take you to the Data input: Detailed assessment (Initial) page, where you will be able to add information for additional cost categories.
Step 4	Select Detailed assessment (Refined) in the upper right-hand side of the page. This will take you to the Data input: Detailed assessment (Refined) page, where you will be able to overwrite industry average values when you have primary data available. If you do not have primary data, please go to step 6.
Step 5	Select Detailed results in the upper right-hand side of the page. This will take you to the Results: Detailed assessment page which incorporates the additional and overwritten data, and provides strengthened results. If you would like to modify data, select Screening assessment in the upper right-hand side of the Results: Detailed assessment page and this will take you back to data entry.
Step 6	Remember to save your analysis after using the tool by selecting File/ Save from the menu bar. For sharing your results, a button is provided at the top of the result pages allowing you to save as a PDF the results. You will be able to save the PDF in your computer, attach it to an email and share it with other stakeholders. For more information see Saving and sharing below.

If you only wish to do a screening assessment, you can simply go through steps 1 and 2. If you would like to strengthen the analysis and do a detailed assessment, you can then complete the extra steps 3 to 5 which allow you to enter data for additional cost categories and overwrite the prepopulated industry average data. Step 6 will allow you to save and share the results of the analysis. Step 6 applies to both the screening and detailed assessments.

The snapshot below shows how the different pages of the tool are interconnected for each type of analysis. As shown in the snapshot, if you wish to complete a detailed assessment you will first need to complete a screening assessment. This ensures consistency between the two types of analysis.

Snapshot f: Structure of the tool for the two types of assessments provided.



On the upper right-hand side of each page you will see several navigation buttons that will allow you to efficiently navigate the tool. The following table defines the function of each navigation button and identifies which pages in the tool can be altered and which are for information only.

Snapshot g: Description of navigation buttons

NAVIGATION BUTTON	FUNCTIONALITY	CAN DATA BE ALTERED?
Home	Back to introduction page	No
Screening assessment	Directed to data entry page	Yes - cells in green
Detailed assessment (Initial)	Directed to data entry page	Yes - cells in green
Detailed assessment (Refined)	Directed to data entry page	Yes - cells in light blue
Screening results	Directed to results page	No
Detailed results	Directed to results page	No
Methods & sources	Directed to key calculations, data sources and unit conversions	No
Save as PDF	Saves the results in a PDF format	N/A
Print	Prints the current page	N/A

4.2. ENTERING DATA

This section provides a description of key items to take into account when entering data in the tool. It highlights which are the critical data points that have to be entered in the tool so that it can generate results. The section also covers which is the data entry needed for the main product and for the supplemental parts depending on its typology. It also provides guidance on how to undertake unit conversions when needed. Finally, it provides useful information on altering the data in the tool, such as how to modify the data after it has been entered or how to overwrite and reset data.

CRITICAL DATA ENTRY

While there is no need for you to enter data for every parameter that can be entered into the tool, there are a few data points that are critical which are required in order to get results. A list of critical data points is provided in the table below.

Snapshot h: Critical data entry

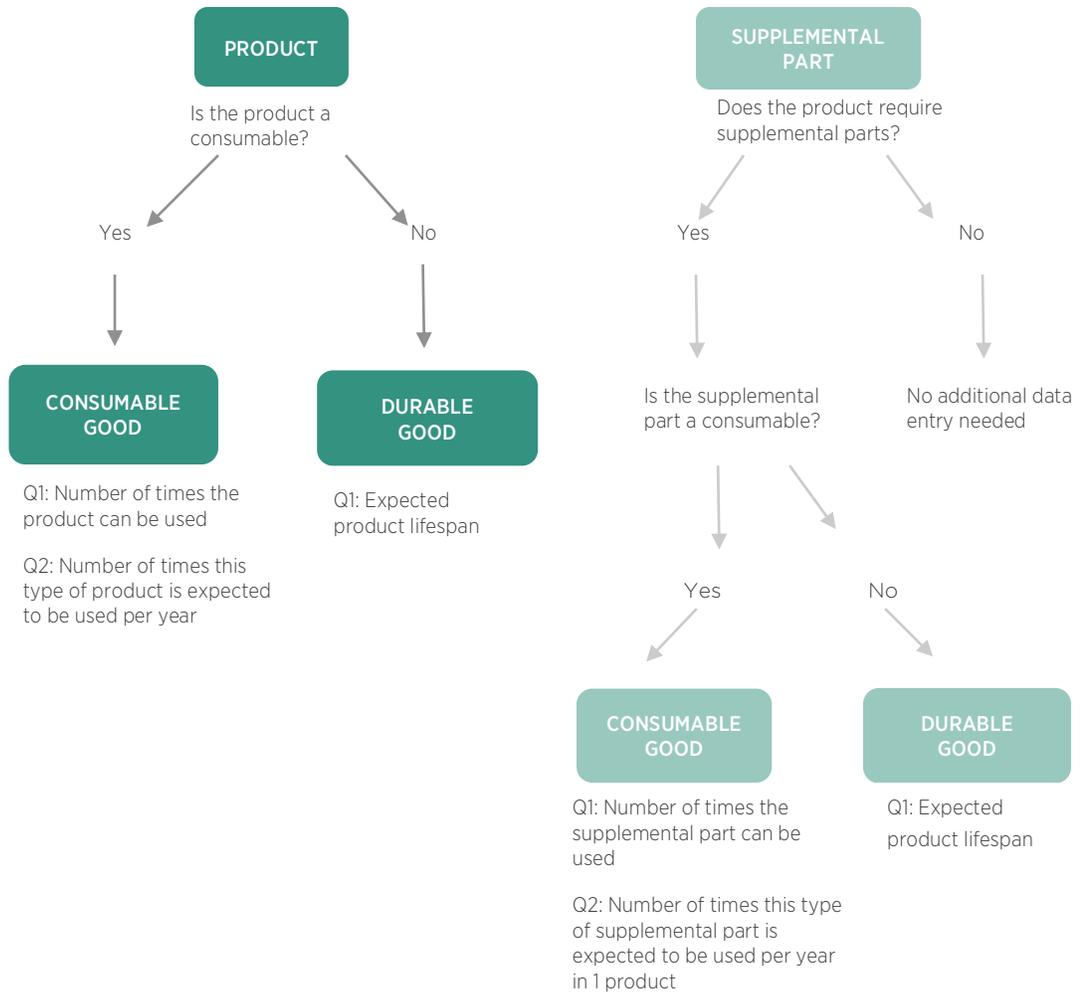
PARAMETER	FORMAT OR UNIT	WHY IS IT CRITICAL?	WHERE CAN I ENTER THIS PARAMETER?
Location	State or United States	It allows determining default cost data	Data input: screening assessment, General data section.
Discount rate	%	It allows determining the TCO in present value terms	
Investment horizon	year	It allows determining the TCO for a period of time	
If product is consumable: Number of times the product can be used	# uses	It allows determining the TCO per year	
If product is consumable: Number of times this type of product is expected to be used per year	# uses/ year	It allows determining the TCO per year	
If product is durable: Expected product lifespan	years	It allows determining the TCO per year	

DATA ENTRY FOR THE MAIN PRODUCT VERSUS FOR SUPPLEMENTAL PARTS

When entering data, please bear in mind that the tool allows you to add data for the main product (see Product in the snapshot below), as well as for supplemental parts required in the operation of the main product. For example, a lighting fixture will require the bulb to be replaced once the existing bulb is expired. The tool collects data for two supplemental parts that can be needed to operate the product. For both the product and the supplemental parts, the tool differentiates between durable and consumable goods and determines the Total Cost of Ownership accordingly. The data entry decision tree in the snapshot below visualizes the data collected by the tool.

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Snapshot i: Product (left) and supplemental parts (right) data entry.



The table below summarizes the type of data to be entered for the main product and supplemental part depending on the typology of these goods.

Snapshot j: Data entry per type of product

TYPOLOGY	MAIN PRODUCT	SUPPLEMENTAL PART
Consumable	Number of times the product can be used	Number of times the supplemental part can be used.
	Number of times this type of product is expected to be used per year)	Number of times this type of supplemental part is expected to be used per year in 1 product.
Durable	Expected product lifespan	Expected lifespan for the supplemental part

For example if the main product is a durable good and the supplemental part is a consumable good, for the main product you will need to enter the Expected

product lifespan, and for the supplemental part 1) the Number of times the supplemental part can be used and 2) the Number of times this type of supplemental part is expected to be used per year in 1 product. Please note that as stated in the figure and table above, a supplemental part is not necessarily a consumable good and can be a durable good. For example, a freezer requires a fuse to operate, and this fuse will be replaced after certain years coinciding with the end of its lifespan. In this example the freezer is the main product and a durable good, and the fuse is the supplemental part and a durable good as well.

UNIT CONVERSIONS

When doing unit conversions you can either do those in a calculator device (and add the result of the conversion in the tool), or you can use the GCO calculator itself for doing the calculation. For example, you know that for Product A the weight sent to disposal associated with 1 product is 0.4 tons and you would like to convert it to pounds, as the tool collects waste data in this unit. If you do not know how to do the unit conversion, you can click the Unit conversions button that appears on the data entry pages and is shown in the snapshot below.

Snapshot k: Example of “Unit conversions” button provided by the tool

OPERATIONAL COSTS		UNIT CONVERSIONS
Only applicable to products that use ELECTRICITY		Unit
<i>Option 1. If annual cost data is available:</i>		
Annual cost from electricity use associated with 1 product		\$/year
<i>Option 2. If annual cost data is not available:</i>		
Annual operating hours		hours/year
Product power		watts
Electricity cost		\$/kWh

By clicking this button you will be directed to the methods and sources page and you will find out that the conversion from ton to pounds is done when multiplying by 2000. Then, you could either 1) use your calculator, multiply 0.4 by 2000, obtain the value in pounds and add it in the tool, or 2) click on the cell “weight sent to disposal associated with 1 product” for Product A and add: = 0.4 *2000. If you chose to go for the second option, you would get automatically the result in that cell without the need of using a calculator. For any other unit conversions you would just need to add your data and the associated conversion factor, which you can gather from the methods and sources page, following this format: = (data available)*(relevant factor).

ALTERING DATA

- **Adding waste data**

Most of the data you enter in the data input: screening assessment page will be carried over to the data input: detailed assessment page so that you do not have to enter the data twice. Waste data has a different level of granularity in these pages thus you will need to enter waste data in the screening and also in the detailed assessment. In the screening assessment data is gathered for one type of waste (you can add data for the most relevant one) and in the detailed assessment data is gathered for three types of waste (A, B, C) and also for supplemental parts.

- **Overwriting data**

You are able to overwrite data in the light blue cells of the page data input: detailed assessment (refined). However, to maintain consistency between the pages, any data that has been overwritten will be reset to default data when you go back to the data entry. For example, if you do the steps 1-6 of analysis journey described previously and have completed a detailed assessment and then you click the navigation button to take you back to Screening assessment or Detailed assessment (initial), you will be directed to the data entry pages and any overwritten data will be restored to default data. This will ensure that if you change the data selected from the dropdown lists (such as the location or the type of waste) this change will also be reflected in the default data provided in the detailed assessment, as default costs will be automatically updated when you select new categories of data.

To avoid any issues, we recommend that:

- If you are overwriting operational data, add a comment in the section Your comments on the data input: screening assessment page with the primary data you have available and you are planning to use for overwriting default values.
- If you are overwriting disposal data add a comment in the section Your comments on the data input: detailed assessment (initial) page with the primary data you have available.

By making use of the Your comments section, you will be able to review those comments and reenter any data that you entered in the tool previously.

Another option is to save the tool (by doing file/save) after going from steps 1-6 of the journey and not coming back to the data entry pages. This way, next time you open the tool you will land in the results: detailed assessment page

and the results will remain the same, thus they will still incorporate overwritten data.

- **Modifying data**

You can modify the supporting data (such as the investment horizon, discount rate or product acquisition costs) by clicking the navigation button Screening assessment in the upper right-hand side of the results pages and altering the data in the green cells.

Please note that if you wish to modify the data for additional cost categories (such as delivery costs or installation costs) you will be able to do so by clicking the navigation button Detailed assessment (initial) and altering the data in the green cells. Finally, if you wish to modify data that you have previously entered you can do so by clicking the navigation button Detailed assessment (refined) and altering the data in the light blue cells. The snapshot below compiles the costs that can be altered by clicking the corresponding navigation buttons that appear in the tool.

Snapshot 1. Modifying data in the tool

NAVIGATION BUTTON	FUNCTIONALITY	COSTS THAT CAN BE ALTERED
Screening assessment	Directed to Data input: screening assessment	Main costs. Example: product acquisition costs, discount rate, investment horizon.
Detailed assessment (initial)	Directed to Data input: detailed assessment (initial)	Additional costs. Example: delivery costs, installation costs, supplemental parts costs.
Detailed assessment (refined)	Directed to Data input: detailed assessment (refined)	Default costs. Example: electricity, water, waste costs.

- **Resetting data**

You can reset data that you have overwritten to default cost data by clicking the Reset buttons that appear in the data input: detailed assessment (refined). This will allow you to eliminate any data you have overwritten. The snapshot below shows an example of this button, which is available to reset operational costs and also disposal costs.

Snapshot m: Example of reset button provided by the tool

OPERATIONAL COSTS		RESET OPERATIONAL COSTS
Only applicable to products that use ELECTRICITY		Unit
<i>Option 1. If annual cost data is available:</i>		
Annual cost from electricity use associated with 1 product		\$/year
<i>Option 2. If annual cost data is not available:</i>		
Annual operating hours		hours/year
Product power		watts
Electricity cost		\$/kWh

You will also find a Reset all button that appears in the introduction page of the tool. By clicking this button, you will be able to reset all the data you have entered, which can be useful when you want to do the analysis for a different product comparison and start from scratch. This button is shown in the snapshot below.

Snapshot n: “Reset all” button provided by the tool in the Introduction page



Practical notes:

Listed below are some suggestions that will aid you in completing a TCO assessment:

- Cost categories not specifically identified in the tool can be added in the data entries “Other acquisition”, “Other operational” and “Other disposal costs” of the page data input: detailed assessment (initial).
- Discount rates included in the tool are expressed in real terms, meaning that it is not necessary to adjust for inflation.²
- As mentioned before, if you decide to do a detailed assessment, you will first have to run a screening assessment. This avoids having inconsistencies between the two types of assessments.

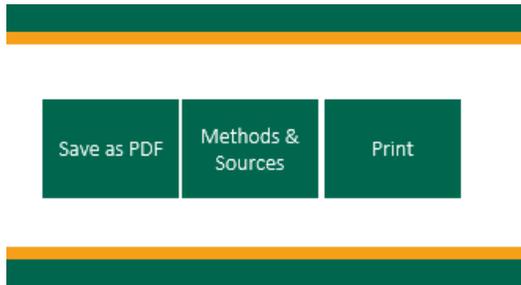
² Real interest rate= Nominal rates – Inflation.

4.3. SAVING AND SHARING THE RESULTS

You can save this file as you would for any other excel document (File/Save). Before saving the analysis, please make sure you have entered information into the section “Contract Information” that appears on the data input pages. This section tracks data on several items such as the contract identifier (used to register the comparison of product or scenario alternatives) and the date of the analysis. For tracking purposes, the date of analysis should be updated in the contract information section when you are updating previously completed Cost of Ownership analyses.

A button is provided at the top of each of the result pages allowing you to save the information as a PDF. This button is shown in the snapshot below.

Snapshot o. “Save as PDF” button provided by the tool in the results pages



By pressing the Save as PDF button you will be able to store in your computer the results in a pdf format. This document will contain the results visualization composed by the different graphs. In case you also want to share the results, you can simply attach the pdf document in an email and distribute those electronically to your colleagues and external stakeholders. When saving the results as a PDF please make sure you do not save the PDF with the exact same name more than once. Otherwise you will get an error message. To avoid this, simply name the consequent PDFs using different names (for example version 1, version 2 etc.).

In addition, a button is provided at the top of each page allowing you to print all the information contained in the tool, from the data that you will input to the results passing through the key calculations and the industry average data sources. If you have particular interest in the information provided in any of the pages, you will be able to print it by pressing the button “Print”. This can be particularly useful for sharing the information from the results pages with other stakeholders when a paper copy is needed.

5. METHODOLOGY

This section summarizes the methodology as well as the main assumptions and limitations of the tool. It also provides details on the sources used for the data prepopulated as a default by the tool.

You will also be able to access information on the key formulas used and the default data sources by selecting the navigation button “Methods & sources” that appears in the results pages of the tool.

5.1. METHODS

The Greenhealth calculator assesses the costs that accrue from purchase to disposal of different products or scenarios. Those costs are calculated for the investment horizon selected (see Investment horizon under the section Financial parameters)³. This can help to inform long-term investment decisions as the tool captures recurrent costs incurred up to a 20-year time horizon.

Costs included within the tool are classified as follows:

1. *Acquisition costs* – Costs incurred once, when the product is purchased (units in \$)
2. *Operational costs* – Costs incurred on a yearly basis (units in \$/year)
3. *Disposal costs* – Costs incurred once, when the product is disposed (units in \$)

In order to determine the costs that take place each year, different approaches are taken depending on whether the product is consumable or durable. If the product is consumable, the yearly cost will be calculated using the following formula:

If the product is consumable⁴:

(Equation 1)

$$\text{Number of products used per year} = \frac{\text{No. times this type of product is expected to be used per year}}{\text{No. times the product can be used}}$$

The number of products used per year will enable you to determine the costs incurred in each year over the investment horizon. For example, if the number of times this type of product is expected to be used per year by the hospital is 10, and

³ The maximum investment horizon allowed by the tool is 20 years.

⁴ **Number of times this type of product is expected to be used per year:** The number of times will be the same for disposable, reusable and reprocessed and will depend on the hospital needs. For example, if it is a consumable used on surgeries, the number of times it will be used will depend on the number of surgeries taking place in the hospital in a year. **Number of times the product can be used:** This will be 1 time for disposable consumables, and >1 time for reusable or reprocessed consumables. This parameter is applicable to consumable goods.

the number of times the product can be used is 5, the number of products used per year will be 2. If the investment horizon is 10 years:

- Acquisition costs will be incurred twice per year (as there are 2 products used per year)
- Disposal costs will be incurred twice per year (as there are 2 products used per year)
- Operational cost will be incurred twice per year (as there are 2 products used per year)

If the product is durable:

(Equation 2)

Number of products used per year = 1

The expected product lifespan will be used to determine the timing of product acquisition and disposal over the investment horizon. For example, if the investment horizon is 10 years and the product has 5 years of expected life:

- Acquisition costs be incurred in year 1 and year 6.
- Disposal costs will be incurred in in year 5 and year 10.
- Operational cost will be incurred every year from year 1 to year 10.

As the analysis takes into account the costs that happen over time, it is desirable to discount costs occurring in future years so that costs can be compared. The default discount rate included in the tool is 3% as recommend by the Interagency Working Group from the U.S. Government or USIAWG (2015). This is a relatively low discount rate which is therefore a conservative value and places a greater degree of importance to costs that will happen in the future. However, the financial department of your hospital may use a different discount rate for assessing long-term investments. If that is the case, you can simply overwrite the default discount rate provided by the tool with the preferred discount rate.

The formulas used to calculate the figures that appear in the results pages are presented below.

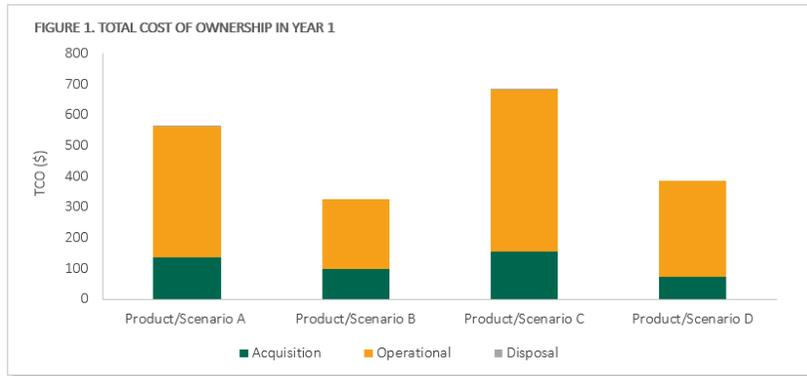
Total Cost of Ownership in a given year (Equation 3)

$$PV = C_t / (1+r)^t$$

Where:
 PV=Present Value
 C_t= Cost in year t
 r= Discount rate (for example 3%)
 t= Year

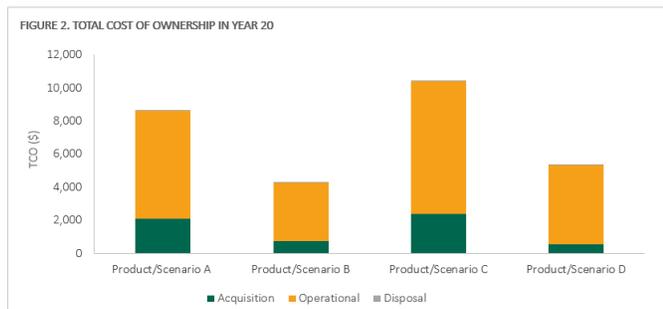
This formula is used to determine the Present Value of the Total cost of Ownership in year 1 (figure 1) and at the end of the investment horizon (figure 2) in the results pages:

Snapshot p: Total Cost of Ownership in year 1



Only for illustrative purposes.

Snapshot q: Total Cost of Ownership in year 20



Only for illustrative purposes.

Cumulative Total Cost of Ownership (Equation 4)

$$PV \text{ cumulative} = PV_1 + PV_2 + \dots + PV_i$$

Where:

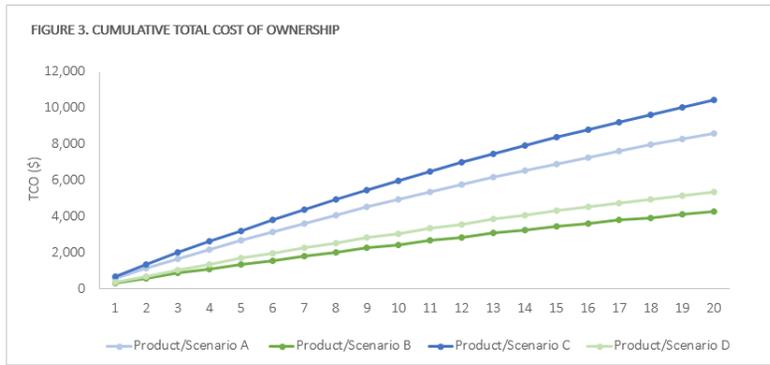
PV₁ = Present Value in year 1

PV₂ = Present Value in year 2

PV_i = Present Value at the end of the investment horizon (for example in year 20)

This formula is used to determine the cumulative Present Value of the Total Cost of Ownership (figure 3) in the results pages:

Snapshot r: Cumulative Total Cost of Ownership



Only for illustrative purposes.

Annual Average Total Cost of Ownership (Equation 5)

$$PV \text{ average} = PV \text{ cumulative} / \text{Investment}$$

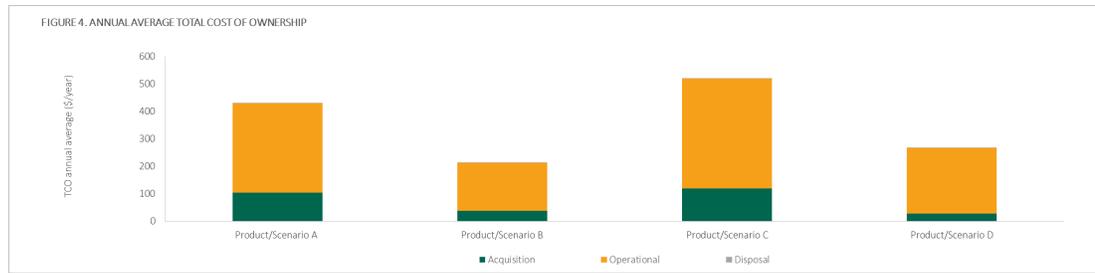
Where:

PV cumulative = Sum of PV over the investment horizon

Investment horizon = Number of years over which the Total Cost of Ownership will be calculated (for example 20)

This formula is used to determine the annual average Present Value of the Total Cost of Ownership (figure 4) in the results pages:

Snapshot s: Annual average Total Cost of Ownership



Only for illustrative purposes.

5.2. INDUSTRY AVERAGE DATA

In the absence of data provided by the user, the GCO calculator will be automatically populated with industry average data. The automatically populated data will vary depending on your responses to the following questions in the tool:

- Location
- Does the product use electricity?
- Does the product use fuel?
- Does the product use water?
- Does the product require cleaning and sterilizing?
- Type of waste associated with the product
- Type of waste associated with the supplemental parts

Practical notes:

- One of the key parameters that determines the industry average data is the location you select in the data input pages. This is why it is particularly important that you use the dropdown list to select the location of the hospital where the product will be used. If the location is not known, please select the United States so that the country average is used.
- On the page data input: detailed assessment (refined) you will be able to overwrite the industry average data provided by the tool by default.

The table below summarizes the industry average data provided, in terms of its scope, granularity and data sources.

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Snapshot t: Summary of the industry average data provided

INDUSTRY AVERAGE DATA	SCOPE	UNITS	GRANULARITY	SOURCE
Energy	Electricity Natural gas Diesel Gasoline	\$/kWh \$/cubic feet \$/gallon \$/gallon	Regional ⁵	EIA (2015a, 2015b, 2015c)
Water	Incoming and outgoing water cost	\$/gallon	Regional	Black & Veatch (2013)
Waste	Solid waste Recycling waste Regulated Medical Waste Hazardous waste RCRA ⁶ Pharmaceutical waste Non- RCRA Pharmaceutical waste Composting waste Universal waste (cost) ⁷ Universal waste (revenue) ⁸ Universal waste (unknown) ⁹	\$/lb	Country level	Practice Greenhealth (2016)

In addition, the tool itself provides the description of the data used for each data point provided, as well as the full reference, so that you can access the original data source if desired. This information can be found in the methods & sources page.

The snapshots below provide the types of information contained on the methods & sources page for: 1) energy costs at a country level, and 2) electricity costs at a region level as an example.

⁵ The regions considered are: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific. The states you select in the tool will be mapped to those regions following the United States Census Bureau (2016).

⁶ As mentioned by EPA (2016), “the Resource Conservation and Recovery Act (RCRA) is the public law that creates the framework for the proper management of hazardous and non-hazardous solid waste”.

⁷ For hospitals that have to pay for disposing universal waste. This value represents a cost for the hospital.

⁸ For hospitals that obtain revenue when selling universal waste.

⁹ This value represents a cost for the hospital and can be selected when the user is not aware if the hospital obtains revenue or pays to dispose universal waste.

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Snapshot u: Country level industry average data for energy costs

COSTS DATA							
COUNTRY SPECIFIC							
ENERGY							
Data type	Geography	Value	Unit	Data source	Year of publication	Description	Full reference
Electricity	United States	0.107	\$/kwh	EIA	2015	Average electricity cost from January 2015 till October 2015 for the Commercial sector. The commercial sector is applicable to service-providing facilities, therefore applicable to hospitals.	EIA (2015a). Electric Power Monthly with Data for October 2015. U.S. Department of Energy. [Online]. Available at: https://www.eia.gov/electricity/monthly/current_year/december2015.pdf
Natural gas		0.008	\$/cubic feet			Average natural gas cost from January 2015 till October 2015 for the Commercial sector. The commercial sector is applicable to service-providing facilities, therefore applicable to hospitals.	EIA (2015b). Natural gas prices. [Online]. Available at: https://www.eia.gov/dnav/hgh/ng_pr_sum_doc_us_m.htm . U.S. Department of Energy, Washington, DC
Diesel		2.707	\$/gallon			Average diesel cost from January 2015 till December 2015.	EIA (2015c). Retail gasoline and diesel prices. [Online]. Available at: https://www.eia.gov/dnav/wpet/pet_pri_gnd_dcus_rus_a.htm . U.S. Department of Energy, Washington, DC
Gasoline		2.423	\$/gallon			Average gasoline cost (regular) from January 2015 till December 2015.	EIA (2015c). Retail gasoline and diesel prices. [Online]. Available at: https://www.eia.gov/dnav/wpet/pet_pri_gnd_dcus_rus_a.htm . U.S. Department of Energy, Washington, DC

Snapshot v: Regional industry average data for electricity

REGION SPECIFIC							
Data type	Geography	Value	Unit	Data source	Year of publication	Description	Full reference
Electricity	New England	0.156	\$/kwh	EIA	2015	Average electricity cost from January 2015 till October 2015 for the Commercial sector. The commercial sector is applicable to service-providing facilities, therefore applicable to hospitals.	EIA (2015a). Electric Power Monthly with Data for October 2015. U.S. Department of Energy. [Online]. Available at: https://www.eia.gov/electricity/monthly/current_year/december2015.pdf
	Middle Atlantic	0.133					
	East North Central	0.099					
	West North Central	0.093					
	South Atlantic	0.096					
	East South Central	0.103					
	West South Central	0.079					
	Mountain	0.099					
	Pacific	0.184					

Snapshot w: Country level industry average data for waste costs

COUNTRY SPECIFIC							
Data type	Geography	Value	Unit	Data source	Year of publication	Description	Full reference
Solid waste	United States	0.05	\$/lb	Practice Greenhealth	2016	Median values collected by Practice Greenhealth for different types of health related waste costs. The values are calculated as a result of dividing the total annual costs by the total annual waste volume for different US hospitals. The costs are based on 2014 data and include additional waste fees, such as tipping fees.	Practice Greenhealth (2016). Personal communication on waste cost data collected in 2015.
Recycling waste		0.04					
Regulated Medical Waste		0.30					
Hazardous waste		2.22					
Non-RCRA Pharmaceutical waste		0.58					
RCRA Pharmaceutical waste		2.49					
Composting waste		0.07					
Universal waste (cost)		0.28					
Universal waste (revenue)		0.17					
Universal waste (unknown)		0.18					

Please note that EIA (2015) publishes energy costs for different sectors. The costs for the commercial sector were included in the tool, as this sector relates to service-providing facilities including hospitals.

Moreover, as the sources used present data for different years, all data has been inflated to 2015 prices to ensure comparability. This was done by using the inflation rates provided by the World Bank (2015).

5.3. ASSUMPTIONS

Key assumptions underpinning the GCO calculator’s analysis are provided below:

- Maintenance costs (under operational costs) include the cost of labor to maintain the product in good service, and the cost of acquiring supplemental parts. Thus, the cost associated with acquiring supplemental parts is mapped to maintenance costs of the main product.
- The cost of disposing supplemental parts is mapped to disposal costs. This will capture the whole waste disposal cost of medical devices that require supplemental parts.
- The number of times a product is cleaned and sterilized is assumed to be the same as the number of times the product is used.
- Data for cleaning and sterilizing can be provided as water, energy and labor costs associated with cleaning/sterilizing. In this case, costs will be mapped to “Operational – Water”, “Operational -- Energy” and “Operational – Maintenance”. If data for cleaning and sterilization costs is not provided split for those categories, cleaning and sterilizing costs will be included as part of “Operational – Other” in figure 5 of the results pages (instead of being mapped separately to energy, water and maintenance costs).

5.4. LIMITATIONS

The key limitation of the tool is that it is dependent on the user gathering complete and accurate data in a comparable way from a variety of sources. Thus, the results of the Total Cost of Ownership analysis are only as reliable as the data inputted into the calculator.

In order to ensure that the calculator is simple and easy to use, this version of the tool captures a defined but not exhaustive set of costs. However, the tool provides the option to include additional cost categories in the category “Other acquisition costs”, “Other operational costs” and “Other disposal costs”, which appears within the page data input: detailed assessment (initial).

Moreover, the industry average data that is prepopulated in the tool relates to 2015 prices and does not capture any future price fluctuations, due to complexity of predicting these potential changes. Finally, this version of the tool does not include any costs associated with regulation, reputation, and health or ecological consequences associated with environmental impacts.

6. FAQs

How can I choose which types of products to assess in the GCO calculator?

The GCO calculator is designed to be applied to any group of products that have the same function. It is particularly useful for products that have environmentally friendly alternatives, such as a reusable/reprocessing option (mainly relevant to consumables), an energy/water efficient option (mainly relevant to durable goods) or a waste reduction option (relevant to both consumable and durable goods). Examples of these products are surgical consumables such as trocars (disposable versus reusable trocars) or surgical equipment such as decontaminators (usual versus energy efficient decontaminators).

As environmentally friendly alternatives can be more expensive to purchase than the conventional product, this Total Cost of Ownership analysis can help demonstrate that, in the long term, environmentally friendly products can create cost savings. Even if the initial acquisition cost for an environmentally friendly product is higher, when considering its costs over time, this product can actually be cheaper for the hospital. For example, if a product is energy efficient, operational costs will be lower than the conventional product, leading to long-term cost reductions.

Where can I find data that I don't have?

Some of the potential sources of information are the Financial Department of your hospital or external sources such as the product supplier. There are three main types of information to be added to the tool: general cost data, product specifications data and product functioning data.

- *General cost data:* This data is not linked specifically to the product and it relates to general cost data. An example of this type of cost data would be the cost of electricity for the hospital (see data entry in the tool for electricity cost). This data can be gathered from the Financial Department of the hospital or from external sources such as the water and energy utility or waste management company.
- *Product specifications data:* This data is linked specifically to the product and it relates to its own characteristics. An example of this type of data

would be the product expected product lifespan. This data can be obtained from the product supplier.

- *Product functioning data:* This data is linked specifically to the product and it relates to its functioning. An example of this type of data would be the annual operating hours. This data can be gathered from the Facilities Department of the hospital or any other department that collects data on medical device use.

In the right hand side of the data input pages of the tool there is a column that contains possible sources of information.

Snapshot x: Possible sources of information in the data input pages of the GCO calculator

Possible sources of information
Hospital (Procurement Department)

Possible sources of information
Hospital (Financial Department)
Hospital (Financial Department)

Possible sources of information
Product supplier
Product supplier
Product supplier

How can I approach suppliers to ask for some of this data?

Before contacting your suppliers, we recommend you check their websites for product specifications. You may be able to find information on the purchase cost, power source and energy consumption. You can then approach your supplier to fill the data gaps. In the engagement process, there are two considerations that suppliers should be aware of in order to provide the data you need:

- The data points you need relate to one product only. For example, you may be interested in the installation costs, which relate to the cost of installing one product.
- The data you need has different time spans depending on the type of cost. Acquisition and disposal costs will happen only once during the lifetime of the product (thus the units will be \$), whereas operational costs recur on a yearly basis (thus the units will be \$/year). For example, you may be interested in the operational training costs associated with one product per year.

If suppliers are particularly interested in understanding your data requirements, you could send them the GCO calculator and User Guide. The calculator provides detailed information on the data you need for different items while the guide provides background information on the analysis and objectives of the assessment.

Which discount rate should I choose?

It will depend on your needs. The lower the discount rate, the more importance will be given to the costs that will happen in the future, such as operational and disposal costs. Therefore, by choosing a lower discount rate, you will give more relevance to environmental costs that happen after purchase, such as energy and water costs from the operational phase, and waste costs from the disposal phase. The default discount rate included in the tool is 3% as recommended by the Interagency Working Group from the U.S. Government or USIAWG (2015).

How can I convert from uses per patient to uses per year?

If the product is consumable, you will have to fill the data entry “Number of times this type of product is expected to be used per year”. This parameter will depend on hospital needs. If the metric available for the medical device selected is uses/patient, you can convert it to uses/year. To do this, multiply the uses/patient associated with the device by the number of hospital patients that would need this device for their treatment in one year.

For example:

- Number of times the product can be used = 3 uses/patient
- Hospital patients that would need this device for their treatment in one year = 100 patient/year

(Equation 1)

Number of times this type of product is expected to be used per year: $3 \text{ uses/patient} \times 100 \text{ patients/year} = 300 \text{ uses/year.}$

Does the calculator provide guidance on unit conversions?

Yes. The page methods & sources, which is accessible from any of the pages of the tool, provides guidance on unit conversions. The calculator collects values for diesel, gasoline and water in US gallons; in cubic feet for natural gas; and in pounds for waste. The unit conversions provided will help you enter data in those units in the tool.

The snapshot below shows the type of information you will be able to find on the methods & sources page of the GCO calculator.

Snapshot y: Unit conversions guidance in the methods & sources page of the GCO calculator

UNIT CONVERSIONS

Conversion type	From	To	Related data entry in the TCO tool
Mass	1 short ton (ton)	2000 pounds (lbs)	Waste data
	1 ounce (oz)	0.0625 pounds (lbs)	
	1 kilogram (kg)	2.205 pound (lbs)	
	1 metric ton (tonne)	2205 pound (lbs)	
Volume	1 cubic foot (ft ³)	7.4805 US gallon (gal)	Fuel data (diesel, petrol) and water data
	1 barrel (bbl)	42 US gallon (gal)	
	1 liter (l)	0.2642 US gallon (gal)	
	1 cubic meter (m ³)	264.2 US gallon (gal)	
	1 US gallon (gal)	0.134 cubic foot (ft ³)	Fuel data (natural gas)
	1 barrel (bbl)	5.615 cubic foot (ft ³)	
	1 liter (l)	0.035 cubic foot (ft ³)	
	1 cubic meter (m ³)	35.315 cubic foot (ft ³)	

What can I do if the results I get when using the tool are zero?

It can be possible that the results you get when navigating to the result pages are zero. This may be due to one of the following facts: you did not enter critical data, or the data you entered was not consistent.

Critical data is the one that is contained in the General data section that is located in the beginning of the data entry pages of the tool. For example, the location, discount rate and investment horizon are critical parameters that allow determining the total cost of ownership of different products. In addition, if you are analyzing consumable products you would need to enter the number of times the product can be used and the number of times this type of product is expected to be used per year. If you are analyzing durable products you will need to enter data on the expected product lifespan.

Inconsistent data is entered when the information added does not correspond to the type of product being assessed. If you reply with *Yes* to the question *Is the product a consumable?* and then you add data for the expected product lifespan, you will be entering data in an inconsistent way. Similarly, if you reply with *No* to the question *Is the product a consumable?* and then you add data for the number of times the product can be used and the number of times this type of product is expected to be used per year, this will also be considered as inconsistent data entry. As the total cost of ownership is calculated differently depending on the type of product (see section 5.1 Methods), ensuring the data you enter is consistent is key for obtaining results.

Thus, if you get zero results when you arrive to the result pages, please review you have entered all the critical data mentioned above, and that the data you have entered corresponds to the type of product being assessed.

How can I interpret and communicate the results to my team or to external stakeholders?

Clearly interpreting and communicating the results of the tool are important to ensure that they are incorporated into procurement decision making. In the results pages for both screening and detailed assessments, the tool provides you information on three key metrics. The snapshot below shows the key metrics for a 20-year period of investment as an example.

Snapshot z: Key metrics in the results pages of the GCO calculator for a 20-year period of investment

Key metrics	Product/Scenario A	Product/Scenario B	Product/Scenario C	Product/Scenario D
Percentage of Acquisition cost versus Total Cost of Ownership in year 20	25%	19%	23%	11%
Minimum Total Cost of Ownership cost in year 20	Product B			
Minimum environmentally related cost (energy, water, waste) in year 20	Product C			

In using these key metrics, the following should be considered:

- The “Percentage of acquisition cost versus Total Cost of Ownership” at the end of the investment horizon informs the relevance of acquisition costs when compared to operational and disposal costs. A lower percentage implies that the acquisition costs are not significant when compared to the remaining costs. If that is the case, it is important to consider those additional costs and not only focus on the acquisition cost when considering procurement decisions. This is because the product that has the lowest acquisition price can actually be the most expensive in the long run.
- The “Minimum Total Cost of Ownership” at the end of the investment horizon takes into account all the costs included in the tool, from purchase to disposal. This metric can be important when the procurement strategy of the hospital aims to reduce financial costs, as it identifies the product with the lowest cost.

- The “Minimum environmentally related costs” at the end of the investment horizon takes into account the costs due to the environmental inputs (resource use) and outputs (waste generation). This metric shows the product with the lowest environmentally related cost, and is important when the procurement strategy of the hospital aims at reducing resource use and waste generation in the supply chain.

The information captured in these three key metrics will help initiate a discussion with your team about which product to purchase. The product selection will depend on the aims of your organization. If you want to reduce financial costs, you would purchase the product that has the minimum Total Cost of Ownership. If you want to reduce resource use and waste generation, you would purchase the product that has the minimum environmentally related cost.

In order to communicate those results, it can be helpful to print the results pages of the tool. This can enable distribution of the findings among stakeholders. Printing the data input pages is also recommended, so that those who have not used the tool can access the information and understand the data entries.

7. GLOSSARY OF TERMS

TERM	DEFINITION
Total Cost of Ownership	The Total Cost of Ownership considers additional costs beyond the product's purchase cost including the costs to operate and dispose the product. This provides valuable information that informs procurement decisions when assessing different product alternatives.
Discount rate	The value used to determine the present value of future costs. The selection of a high discount rate implies providing lower importance to the costs that will happen in the future.
Investment horizon	The number of years over which the Total Cost of Ownership will be calculated (for example 20 years).
Expected product lifespan	The expected number of years the product will be in use. This typically can be found in the product description from the product's manufacturer.
Consumable goods	Consumables are products that can only be used once, or a limited number of times if cleaned/sterilized or reprocessed, before they must be replaced. Some examples of consumables include gloves and trocars.
Durable goods	Durable goods are products that can be used for extended periods of time; commonly for several years. Examples of durable goods are computers, wheelchairs and heart rate monitors
Supplemental part	A supplemental part allows a product to function and has to be replaced over time. An example, are spare bulbs for lighting fixtures.
Acquisition costs	The costs associated with buying a product. These include purchase costs, installation costs, and delivery costs.
Operational costs	Ongoing costs that are associated with the product functioning. Examples of operational costs include electricity, fuel, water, cleaning, sterilizing and maintenance costs.
Disposal costs	Costs associated with discarding the product. Disposal costs for hospitals depend on the type of waste; (for example Regulated Medical Waste or recycling waste).
Environmental costs	Direct financial costs that relate to environmental inputs (resources such as energy and water) or outputs (waste).
Present value	Value that future costs have at present. The rationale is that events which take place in the future have lower relevance at present, and thus should be discounted. The higher the discount rate, the lower the present value, and thus importance, of future costs.

8. REFERENCES

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