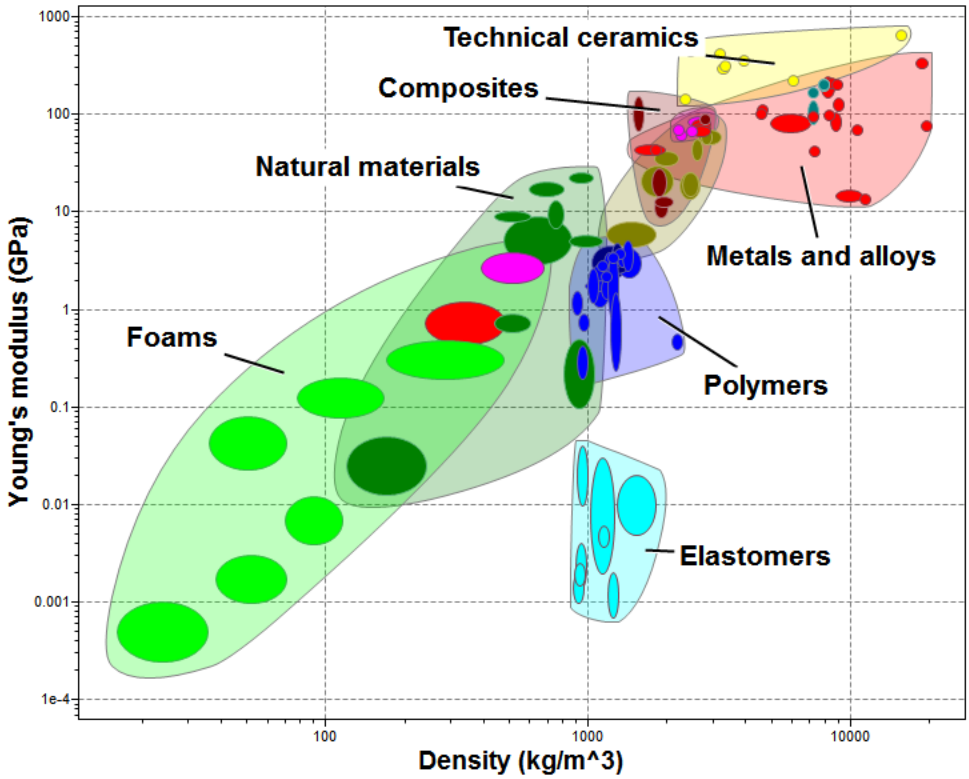
CES 2019 EDUPACK

Quick Start Exercises

January 2019



GRANTA
MATERIAL INSPIRATION

Contents

1 Introduction

1.1 About these exercises

These exercises provide an overview of the key tools and features in CES EduPack™, and form a set of tutorials to help you familiarize yourself with the software. You can work through them in order, or pick and choose relevant ones, to learn about and try out different software features.

1.2 Where to find additional help

Getting started

The Installation Guide is the starting point for anyone who has not yet installed CES EduPack.

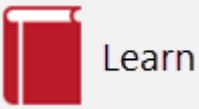
If you have any questions or issues about installation, you can refer to our Student FAQs.

Or see our FAQs for Educators.

The Video Tutorials are another way to learn about the core functionality of the software.

Further learning

The Software Help is accessed from the **Help** menu, or by pressing **F1**. It explains the core functionality and tools of the software.



The Learn site, accessible from the main toolbar, provides self-study learning resources for students, including tables of material indices and glossaries of materials terms.

Granta's Education Hub provides teaching and learning resources, including videos, case studies, and extra databases. You can register using your institutional email address.

2 Quick start exercises for CES EduPack

The exercises in this section give an overview of CES EduPack and will teach you how to use the core functionality. There is a comprehensive help file within the software that provides further guidance, as well as containing case studies and tutorials.

2.1 Main tools in CES EduPack

The main tools in CES EduPack are:

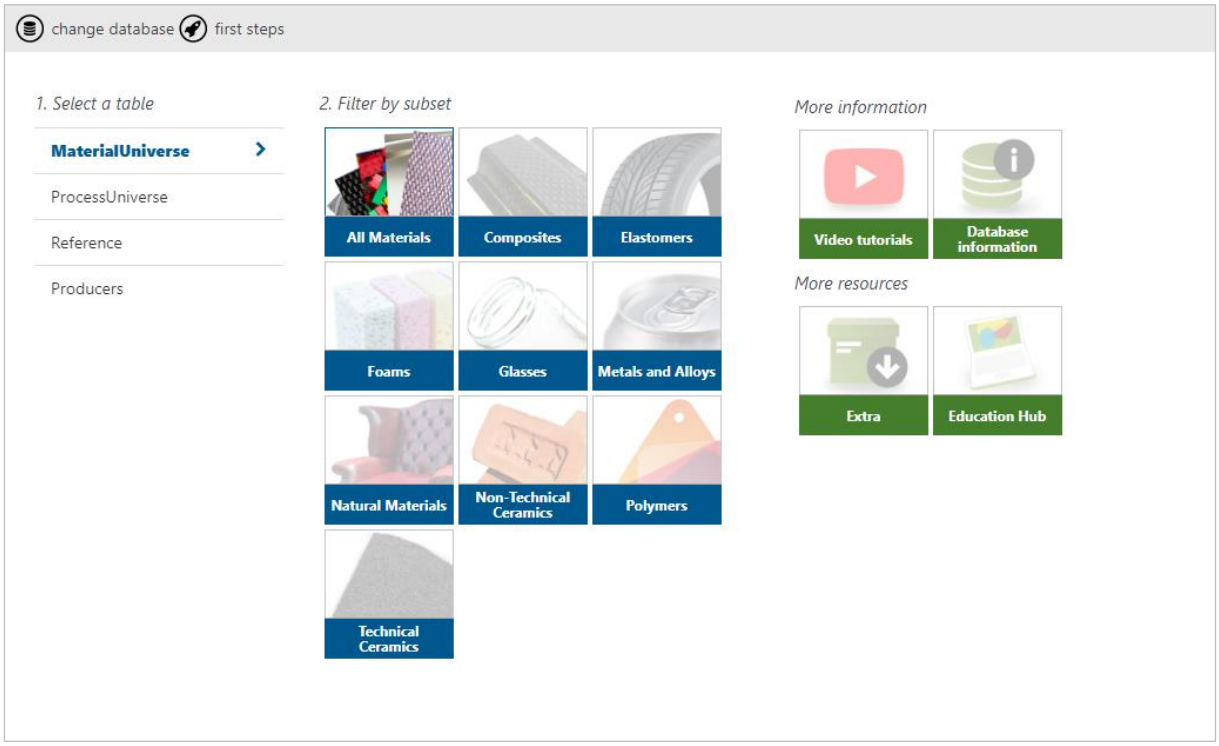
BROWSE	Explore the database and retrieve records via a hierarchical index or tree.
SEARCH	Find information via a full-text search of records.
SELECT	The central hub of CES EduPack, used to apply the Rational Material Selection methodology. A powerful selection engine that identifies records that meet an array of design criteria and enables trade-offs between competing objectives.
CHART	Create charts and add formatting and labels to illustrate your point.
ECO AUDIT	Quickly estimate the environmental impact of a product over its entire lifecycle and study *What If* design scenarios. The enhanced version also accounts for Secondary, Joining, and Finishing processes, and allows you to apply the same *What If* scenarios to the economic cost.
SYNTHESIZER TOOL	Predict performance of materials by modelling new hybrid materials, or modelling part cost of a design; and compare these results with existing records.

The following exercises cover the use and functionality of these tools.

2.2 Browsing and Searching

Exercise 1 — *Opening a database*

On starting CES EduPack, the **Databases** window will appear, showing all installed databases. The following exercises use the MaterialUniverse and ProcessUniverse tables which are found within all Granta material databases. After clicking on a database name in the **Databases** window to select it, the Homepage then opens to show a list of the available tables and a graphic for each subset.



From the homepage you can view more information on the database, select a subset, and access online resources for students and educators.

❖ Select Level 2 Engineering database

> **Note:** Unless otherwise stated, all exercises and screenshots in this guide were produced using Level 2 database. Results and images may differ if you complete these exercises using a different database.

❖ Read about the available data and applications

Click Database information to view a detailed description of the database.

Click Back to return to the homepage.

❖ Select a material subset

Click one of the subset icons, and notice that the Browse panel appears.

❖ Change to the PROCESSUNIVERSE table

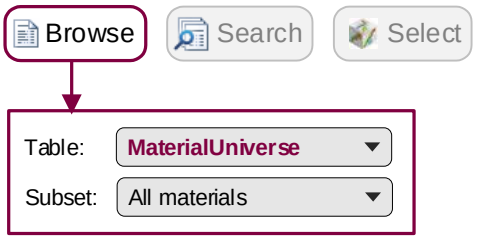
Click **ProcessUniverse** and notice that the Browse tree in the left panel updates.

❖ Close the HOMEPAGE

Click the cross at the top of the Homepage tab. This page can be reopened at any time by clicking **Home** on the main toolbar.

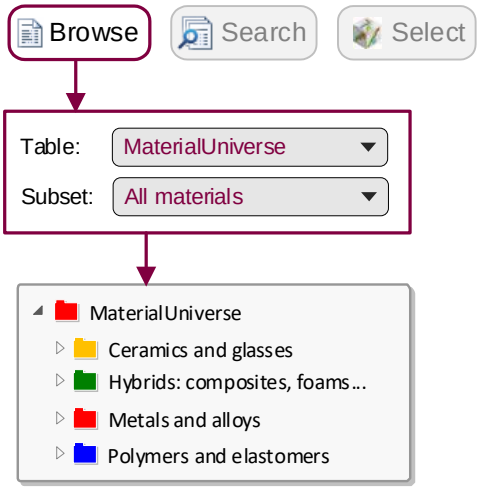
❖ Change to the MATERIALUNIVERSE table

With the Homepage closed, navigate to different tables using the **Table** list in the **Browse** panel.



Exercise 2 — *Browse material records*

❖ Select the MATERIALUNIVERSE table and the ALL MATERIALS subset



❖ Find the record for STAINLESS STEEL

Double-click a folder in the browse tree to view the records and folders below it.

❖ Open the FOLDER-LEVEL record for POLYMERS

Folder-level records provide a general overview of a material family, rather than containing data on a specific material. They have their own icon: .

❖ Open the POLYPROPYLENE record

Double-click the record name in the tree to view the datasheet.

Click ⓘ to view the science note for more information on the property and to drill down to the underlying science. In Level 3 databases, this will bring up the design note, which provides background information on properties, test notes, and selection guidelines. From a design note, there will be a link to the corresponding Science Note.

Right-click the datasheet to see a menu with further actions, for example, locate in Browse tree, copy the datasheet, print the datasheet, and export the data in an FE package format.

❖ Find processes that can shape POLYPROPYLENE, by clicking the ProcessUniverse link at the bottom of the datasheet.

Part of the Polypropylene Level 2 datasheet:

Polymers and elastomers > Polymers > Thermoplastics >

Description

Image

Caption

1. Polypropylene samples showing texture and transparency. © Chris Lefteri 2. Polypropylene glasses. © Thinkstock

The material

Polypropylene, PP, first produced commercially in 1958, is the younger brother of polyethylene - a very similar molecule with similar price, processing methods and application. Like PE it is produced in very large quantities (more than 30 million tons per year in 2000), growing at nearly 10% per year, and like PE its molecule-lengths and side-branches can be tailored by clever catalysis, giving precise control of impact strength, and of the properties that influence molding and drawing. In its pure form polypropylene is flammable and degrades in sunlight. Fire retardants make it slow to burn and stabilizers give it extreme stability, both to UV radiation and to fresh and salt water and most aqueous solutions.

Composition (summary) ⓘ

(CH2-CH(CH3))n

General properties

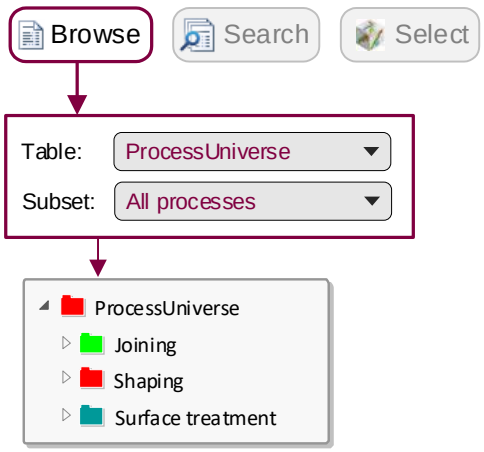
Density	ⓘ	890	-	910	kg/m^3
Price	ⓘ	* 1.7	-	1.77	USD/kg
Date first used	ⓘ	1957			

Mechanical properties

Young's modulus	ⓘ	0.896	-	1.55	GPa
Shear modulus	ⓘ	0.316	-	0.548	GPa
Bulk modulus	ⓘ	2.5	-	2.6	GPa
Poisson's ratio	ⓘ	0.405	-	0.427	

Exercise 3 — *Browse process records*

- Browse ProcessUniverse: All Processes



- Find the record for the shaping process INJECTION MOLDING, THERMOPLASTICS

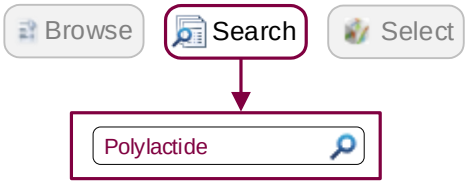
- Find the record for the surface treatment process VAPOR METALLIZING (PVD)

- Find the record for the joining process FRICTION WELDING (METALS)

- Find materials that can be DIE CAST, using the link to the MaterialUniverse at the bottom of the datasheet for GRAVITY DIE CASTING

Exercise 4 — *Searching*

- Find the material POLYLACTIDE



- Find the process VACUUM ASSISTED RTM

- Find the materials used as CUTTING TOOLS

  The search matches text on a datasheet. For example, a search for **cutting tools** would return all records with the phrase cutting tools in the record description or supporting information.

❖ Find the material CONCRETE

The search matches the record's folder name. If the search term appears in a folder name, all records under that folder will be returned; for example, a search for **concrete** would return all records in the folder named **Cement and concrete** e.g. Plaster of Paris.

❖ Enter the search term ALUM*

Records containing the term **Alumina** or **Aluminum** or **Alumino** are returned.

Advanced searches

The following search operators are available:

AND	Finds records containing both the search terms, so **steel AND alloy** returns only records containing both the words **steel** and **alloy**
OR	Finds records containing either search term, so **steel OR alloy** returns all records that contain **steel**, **alloy**, or **both**
NOT	Finds records containing the first search term, but not the second, so **steel NOT alloy** returns only records with the word **steel** but without the word **alloy**
Phrase Search	Finds the exact search term, so **"steel alloy"** will return only records containing the exact phrase **steel alloy**
Parentheses	Used to group search terms, so **iron AND (ore OR cast)** will return the records containing **iron** and containing either **ore**, **cast**, or **both**
Wildcards	Use **?** as a wildcard single character, or ***** as a wildcard representing any number of characters (cannot be used as the first character in a search string)

Note: AND operators are automatically added when a search has two or more terms and no other operators have been entered.

2.3 Creating property charts

Bar charts and bubble charts are a great way to visualize and communicate material properties, as well as being a key tool to support systematic materials selection.

Exercise 5 — *Create a bar chart*

❖ Select MaterialUniverse: All materials

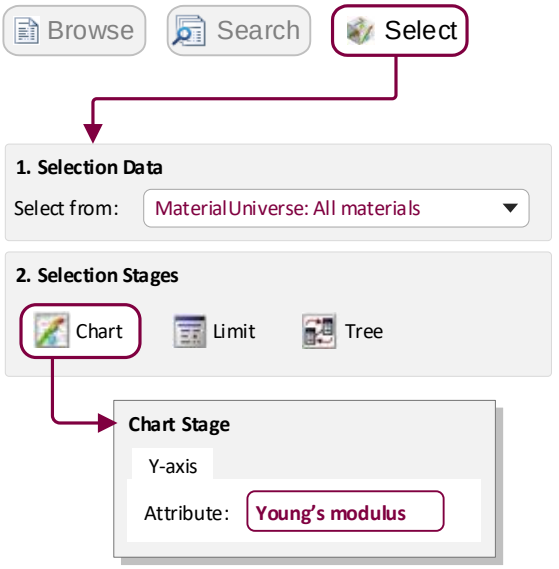
Click **Chart/Select**, and then select **MaterialUniverse: All materials**.

❖ Create a bar chart of YOUNG'S MODULUS (E)

Under Selection Stages, click **Chart**.

Set the y-axis attribute to **Young's modulus**, and click **OK**.

For a bar chart in CES EduPack, you do not set an x-axis: leave x-axis attribute set to <None>.



❖ Explore the chart

Click **Zoom in** and then drag to zoom in on an area of the chart.

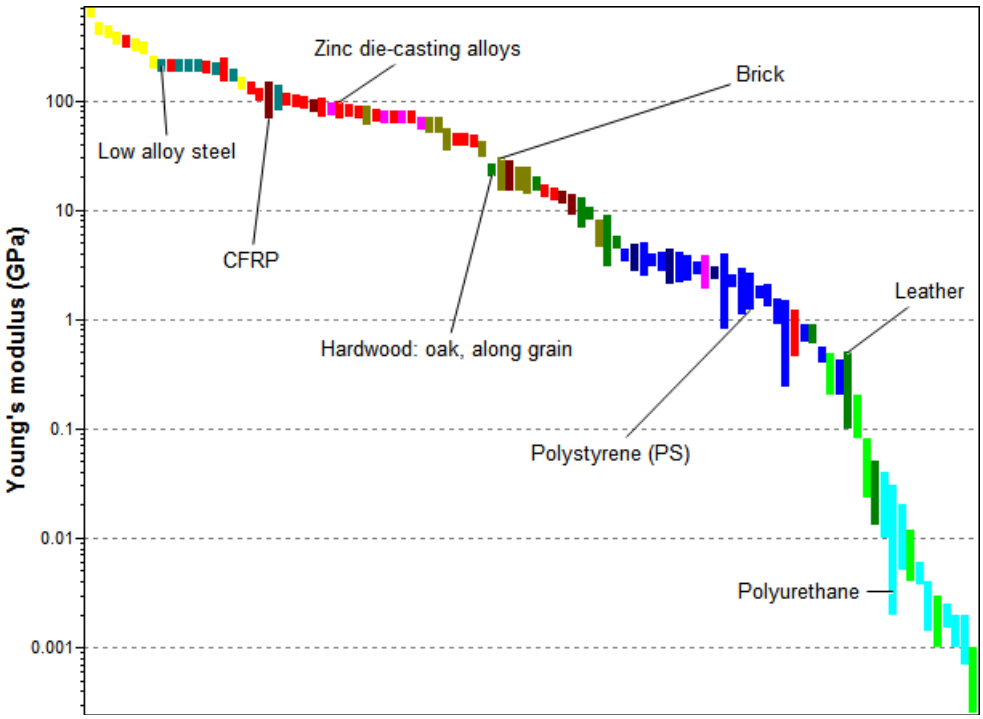
Click **Zoom out** to zoom out.

Click **Autoscale** to zoom back to view the whole chart again.

❖ Label records on the chart

Click a record on the chart and then drag to add and position a new data label.

To delete a data label, select it, and press DELETE. To delete all labels in the chart, press CTRL+A and then press DELETE.



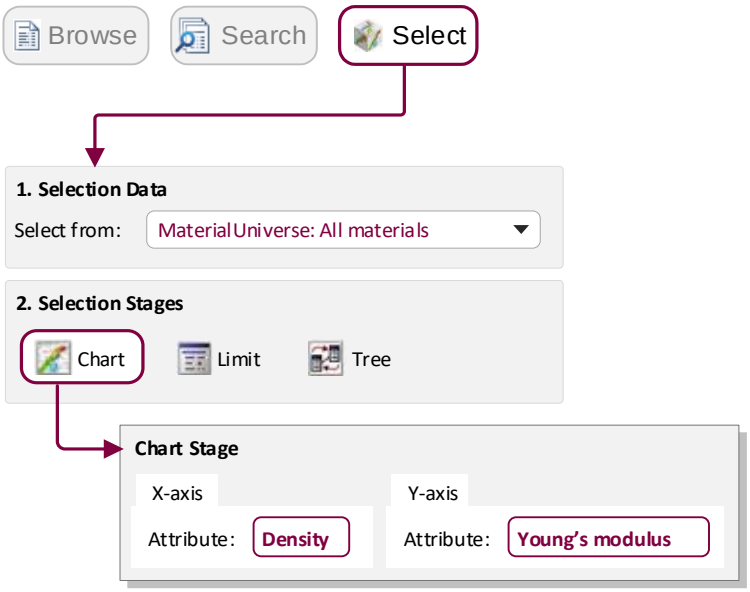
Exercise 6 — *Create a bubble chart*

❖ Make a bubble chart plotting YOUNG'S MODULUS (E) against DENSITY (ρ)

Under Selection Stages, click **Chart**.

Set the y-axis to **Young's modulus** and set the x-axis to **Density**.

Leave the Axis Settings as default values to create a log-log plot.



❖ Display family envelopes

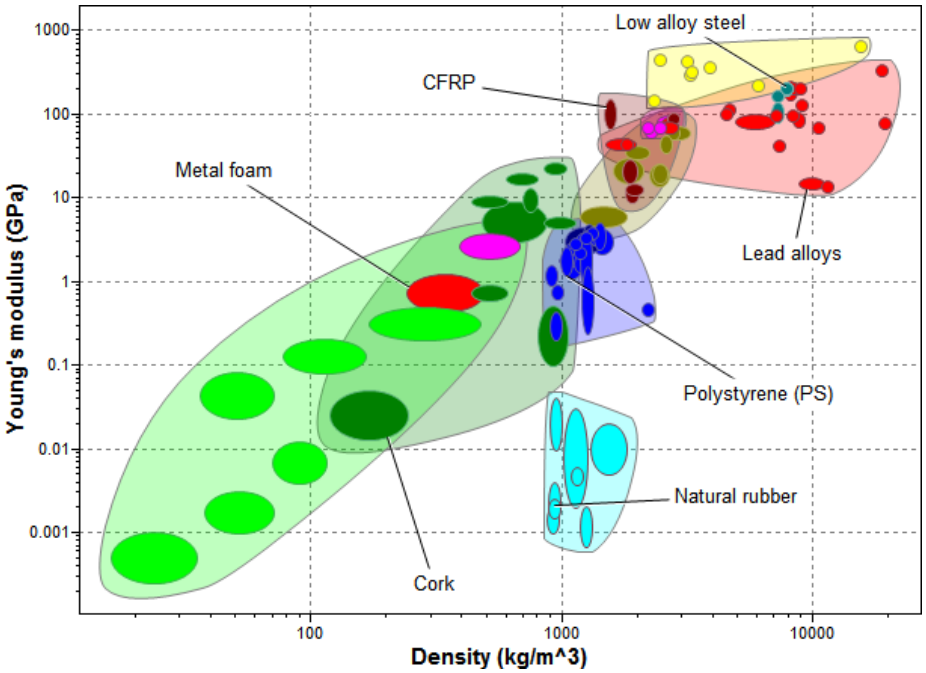
Click  to look at how data for a given family of materials cluster together.

❖ Label records on the chart

Hover the cursor over the record bubble to see the record name, and then label some records (click over a record and drag).

Try adding labels from the Results list: right-click a record in the list, and select **Label** on the shortcut menu, then then drag the label where you want it on the chart.

If the new label isn't visible at the current zoom, click **Autoscale**  to display the whole chart again.



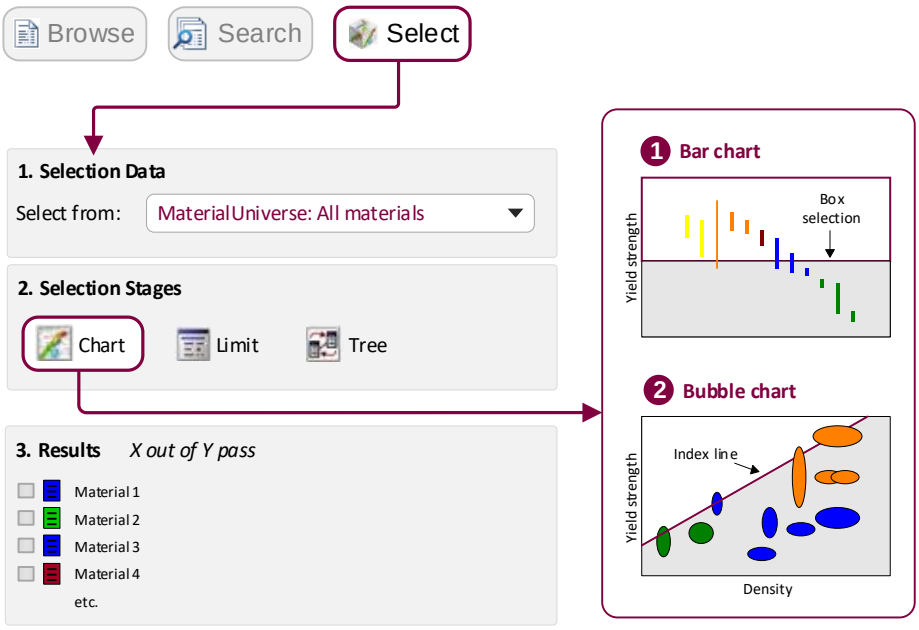
❖ Delete this stage

Select the stage in the Selection Stages list and press DELETE.

2.4 Filtering and screening

Exercise 7 — *Selection using a chart stage*

When plotted on a Chart Stage, records can also be filtered using the **Index line** and **Box selection** tools.

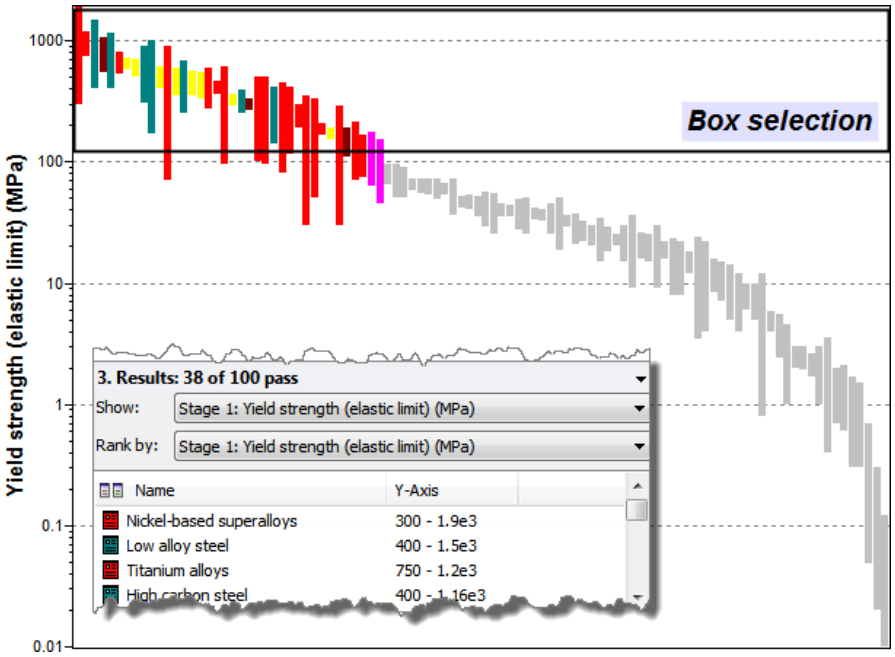


❖ Create a bar chart of YIELD STRENGTH (σ_y)

Set the y-axis to **Yield strength (elastic limit)**.

❖ Use a Box selection to identify materials with high values of YIELD STRENGTH

Click **Box selection**  , then drag to define the selection box.



❖ Add DENSITY (ρ) to the x-axis

Click **Chart Settings**  then click the X-Axis tab and select **Density** as the x-axis attribute.

❖ Use an INDEX LINE to identify materials with high values of the specific strength σ_y / ρ

Click **Index and display lines**  .

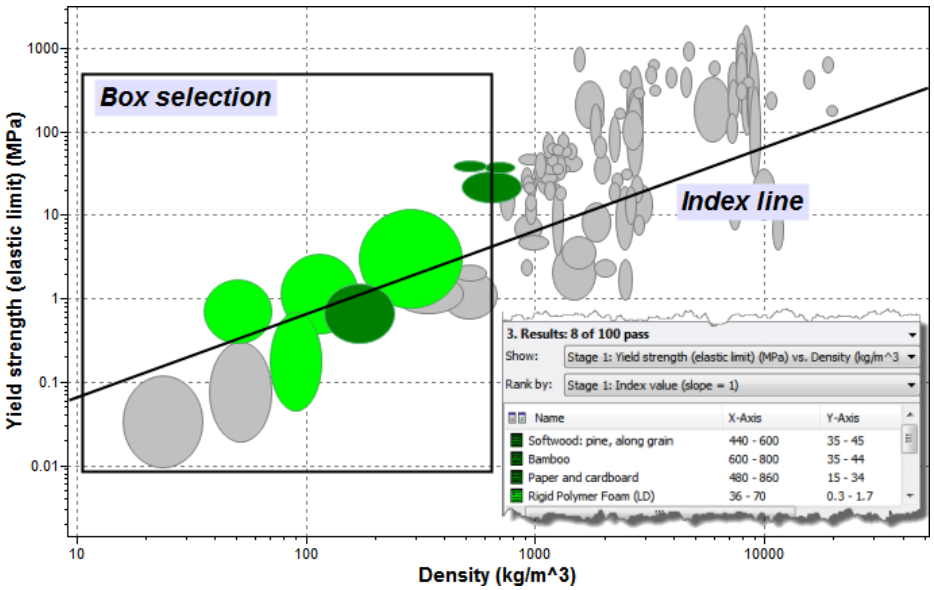
Use the default **Slope** value of 1.

The objective of the line is set to **Maximize the index** by default, which will result in selection of materials above the line, for high values of σ_y / ρ.

Click **OK** and then click the chart to position the line through a particular point.

Drag the line upwards to refine the selection to fewer materials.

❖ Add a Box selection to the chart to identify materials with low DENSITY that maximize the index.



❖ Rank the results by specific strength (YIELD STRENGTH / DENSITY)

Show: Stage 1: Yield strength v. Density

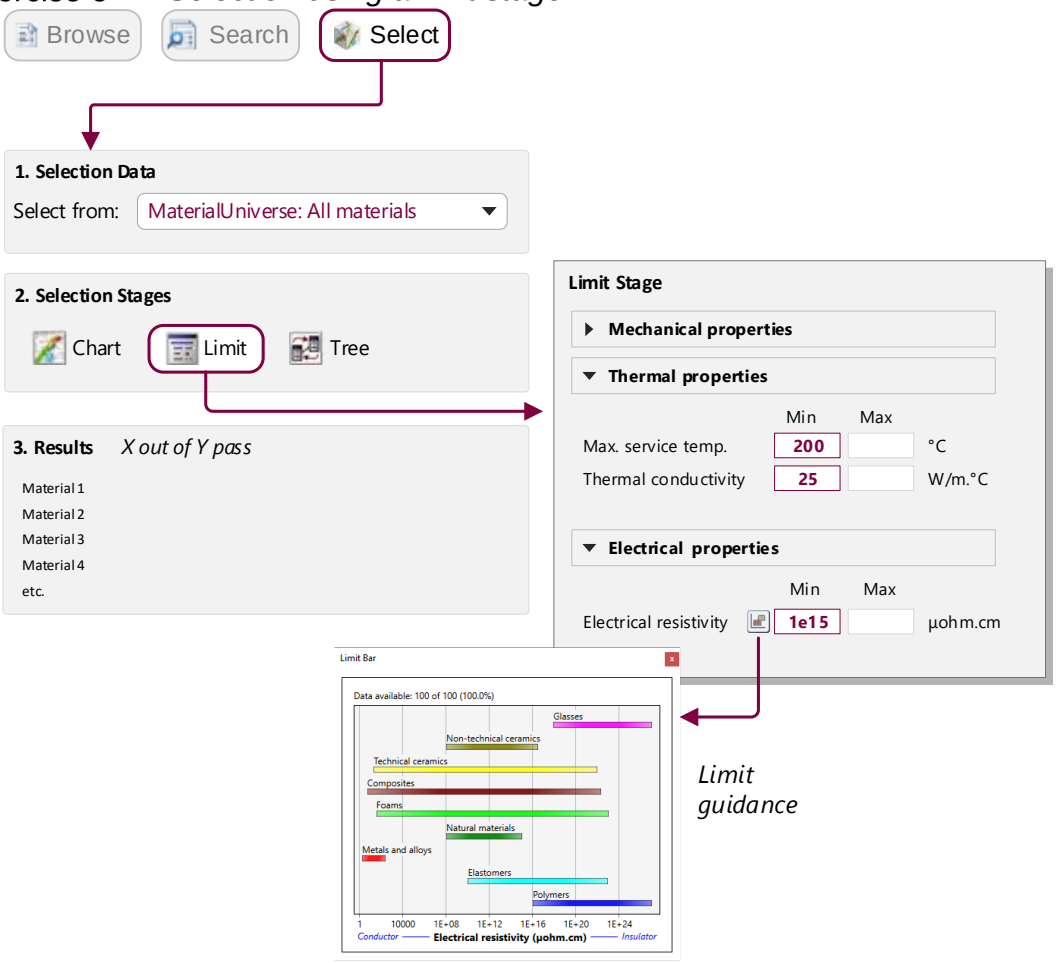
Rank by: Stage 1: Index value.

Example results: Bamboo, Paper, Foam.

❖ Delete this stage

Select the stage in the Selection Stages list and press DELETE.

Exercise 8 — *Selection using a limit stage*



Limit guidance

❖ Select materials with specific thermal and electrical properties.

Create a new Limit Stage with the following criteria:

MAX. SERVICE TEMPERATURE	> 200 °C
THERMAL CONDUCTIVITY	> 25 W/m.°C
ELECTRICAL RESISTIVITY	> 1e15 µohm.cm

Example results: Aluminum nitride, Alumina, Silicon nitride.

Use the limit bars for guidance on suitable values. Enter the limits – minimum or maximum as appropriate – and click **Apply**.

You can change the units on the datasheet by clicking the **Units** tab under **Settings** on the main toolbar.

❖ Filter the results further to select only materials with non-opaque TRANSPARENCY.

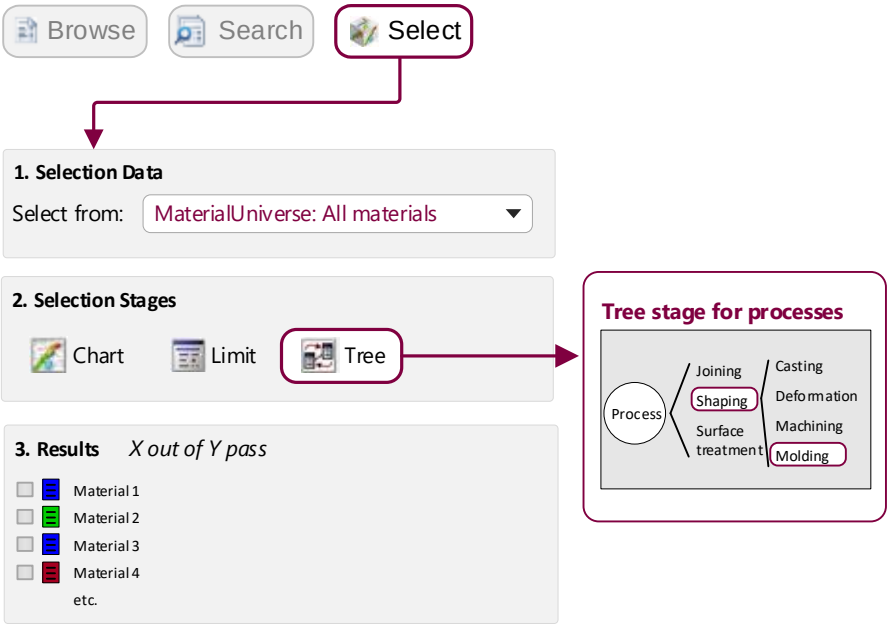
Under Optical Properties, in the Transparency list, select Translucent, Transparent, and Optical quality.

Click **Apply**.

Example results: Alumina and Silicon nitride.

Exercise 9 — *Selection using a tree stage*

Using a Tree Selection Stage, you can filter records based on their links to records in other data tables, or based on the database hierarchy (tree). For example, you can filter records that are linked to specific process record.



❖ Find materials that can be MOLDED

Under Selection Stages, click **Tree**. In the Tree Stage window, select ProcessUniverse and navigate to *Molding*. Select the folder and click **Insert**, then click **OK**.

❖ Click **Show** to view a list of MaterialUniverse records to which this process folder is linked.

Double-click a record name to view its datasheet.

❖ Delete this stage.

❖ Find processes to join FERROUS METALS AND ALLOYS

In the Selection Project panel, under Selection Data, select *ProcessUniverse: Joining*.

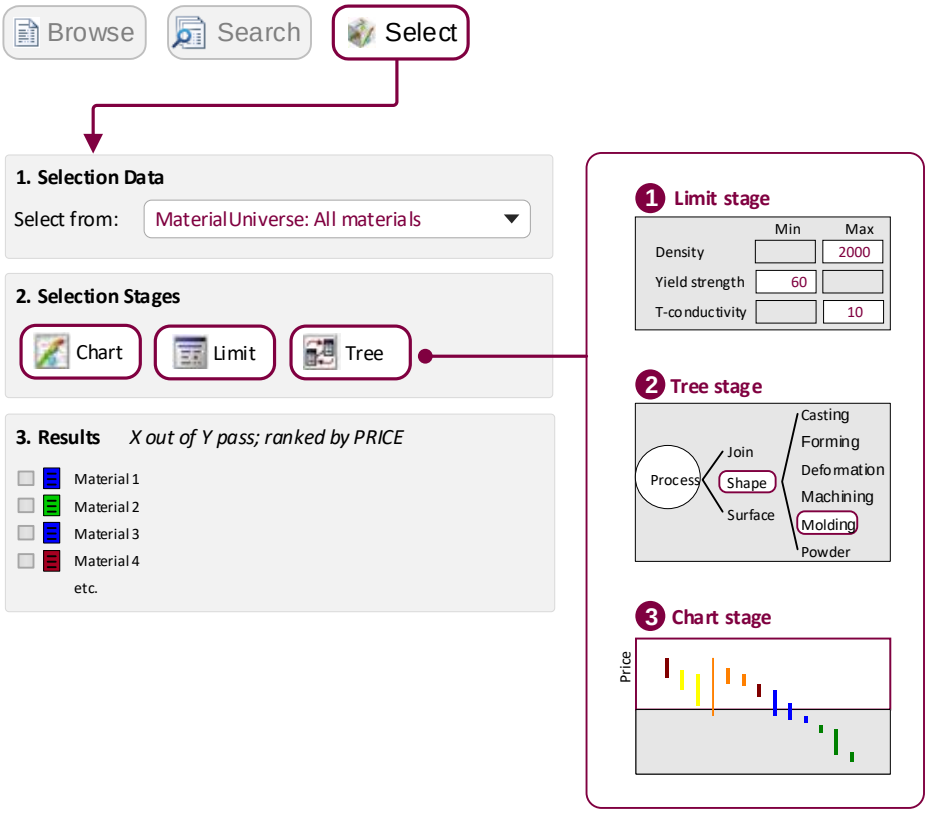
Under Selection Stages, click **Tree**. In the Tree Stage window, select *MaterialUniverse*, expand *Metals and alloys*, select *Ferrous*, and then click **Insert** followed by **OK**.

Click **Show** to view the linked records.

❖ Delete this stage.

2.5 Putting it all together

Exercise 10 — *Combining filtering and charting tools*



❖ Choose the data table

Select from: MaterialUniverse: All materials.

❖ Select materials with specific physical, mechanical, and thermal properties.

Create a Limit Stage with the following criteria:

DENSITY	< 2000 kg/m^3
YIELD STRENGTH (Elastic limit)	> 60 MPa
THERMAL CONDUCTIVITY	< 10 W/m.°C

❖ Filter the results to find those that can be THERMOFORMED

Create a Tree Stage and insert ProcessUniverse > Shaping > Molding > Thermoplastic molding > Thermoforming.

❖ Rank the results by PRICE and find the three cheapest materials

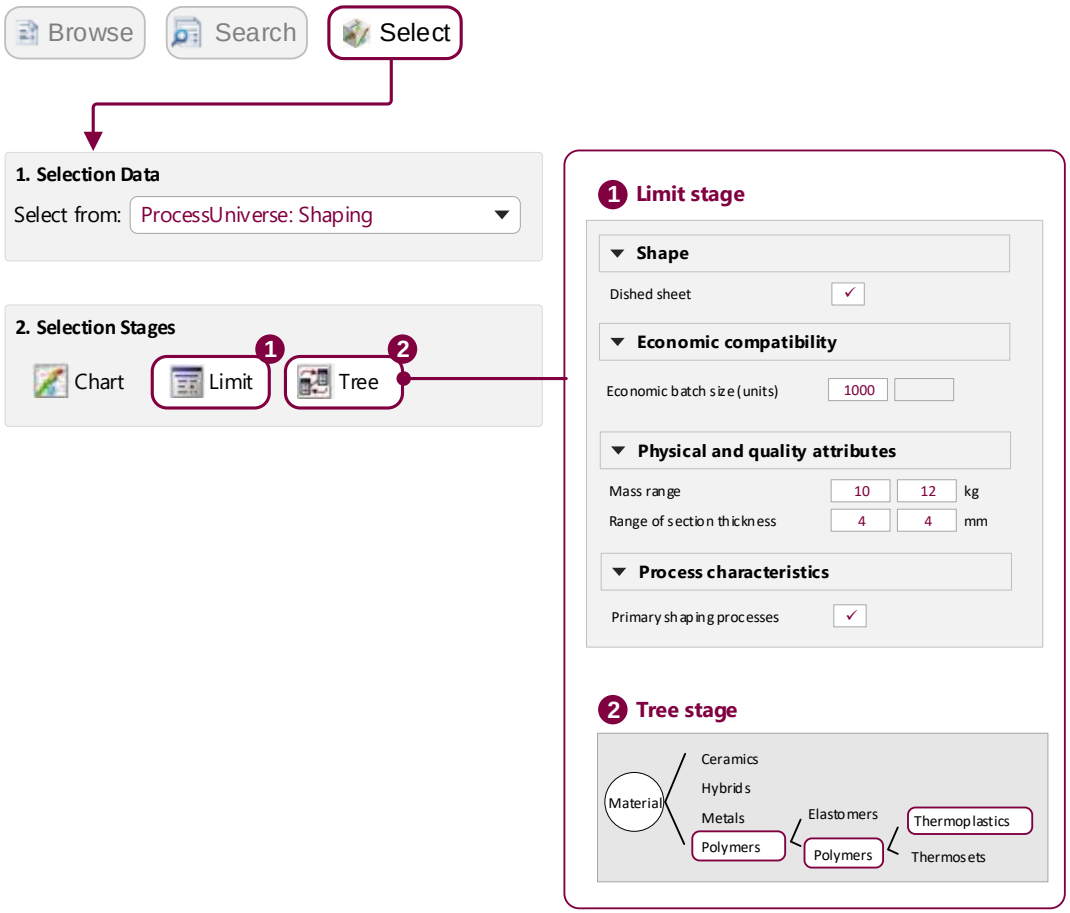
Create a Chart Stage with a bar chart of Price on the y-axis. On the Chart Stage, all materials that fail one or more stages are grayed out. The Results window by default lists the materials that pass all stages.

In the **Rank by** menu, select *Stage 3: Price*.

2.6 Process selection

The chart, limit, and tree selection stages can be used to filter ProcessUniverse records in the same way as with MaterialUniverse.

Exercise 11 — *Select process records*



❖ Select the data table

Select from: ProcessUniverse: Shaping.

❖ Find PRIMARY SHAPING PROCESSES to make a component with specific shape, physical, and economic properties.

Add a Limit Stage with five criteria:

SHAPE	Dished sheet
MASS	10 - 12 kg
SECTION THICKNESS	4 mm
PROCESS CHARACTERISTICS	Primary shaping process
ECONOMIC BATCH SIZE	> 1000

❖ Filter the results to only include THERMOPLASTIC materials

Add a Tree Stage and insert MaterialUniverse > Polymers and Elastomers > Polymers > Thermoplastics.

Example results: Rotational molding, Compression molding, Thermoforming.

2.7 Performance index finder

The Performance index finder is only available in some advanced editions of CES EduPack.

The Performance index finder is a tool to let you plot performance indices on a chart for a given design situation, without having to derive an index from first principles.

Exercise 12 — *Selection using the Performance index finder*

Use the performance index finder to find the materials best suited for a beam loaded in bending, as part of a low cost, low weight, strength-limited design.

Note: You will need to use a Level 3 database for this exercise.

❖ Select the data table

Select MaterialUniverse: All bulk materials

❖ Create a chart using the Performance index finder

Click Chart, then click Performance Index Finder

❖ Set the COMPONENT DEFINITION for the y-axis

FUNCTION AND LOADING	Beam in bending
LIMITING CONSTRAINT	Strength
OPTIMIZE	Mass

Keep the default values for free and fixed variables, and Axis settings.

❖ Set the COMPONENT DEFINITION for the x-axis

Click the x-axis tab, click Performance index finder. Set the following values:

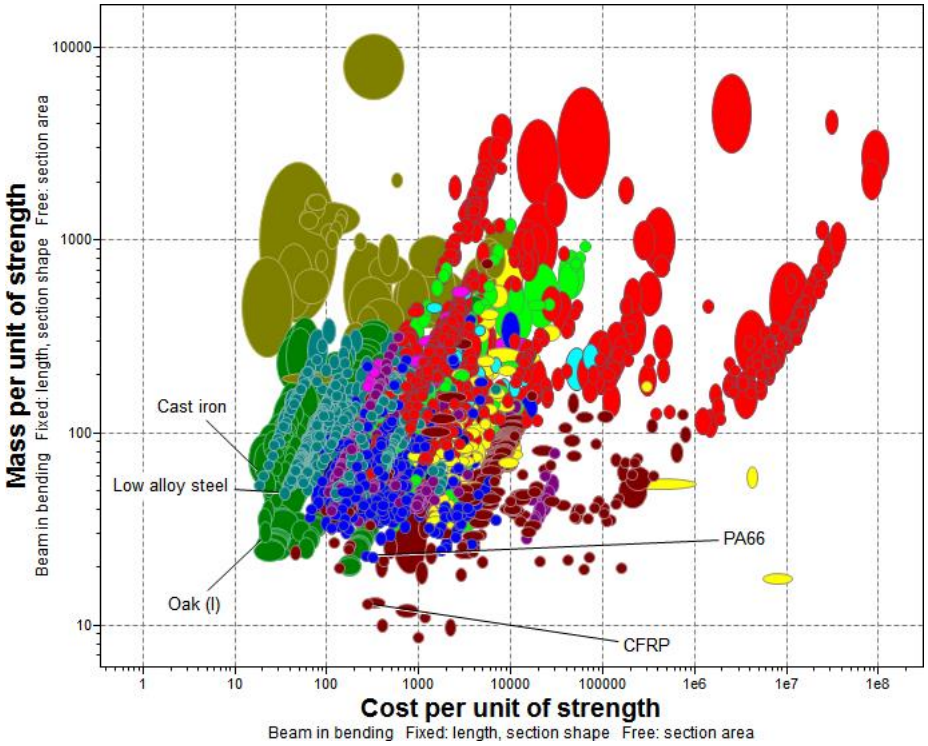
FUNCTION AND LOADING	Beam in bending
LIMITING CONSTRAINT	Strength
OPTIMIZE	Cost

Keep the default values for free and fixed variables, and Axis settings.

❖ View the chart

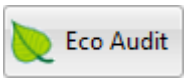
Click **OK** to view the chart.

Materials in the bottom-left corner are best suited to a low weight, low cost, strength-limited design.



2.8 Eco Audit Tool

The Eco Audit Tool is not available in the Bio-Engineering Edition of CES EduPack.



The Eco Audit Tool estimates the energy used and CO_2 produced during five key life phases of a product (material, manufacture, transport, use, and end of life), and identifies which phase has the dominant contribution. This is the starting point for eco-aware product design, as it identifies which parameters need to be targeted to reduce the eco-footprint of the product.

A brand of bottled mineral water is sold in 1 liter PET bottles with polypropylene caps. A bottle weighs 40 grams; the cap 1 gram. Bottles and caps are molded, filled, and transported 550 km from the French Alps to England by 14 tonne truck, refrigerated for 2 days and then sold. The overall life of the bottle is one year.

An example product file for this case study is installed with CES EduPack in the Samples folder, with the filename *Level 2 - Bottle PET.prd*.

Note: The Level 3 Eco Design and Level 3 Sustainability databases contain an enhanced version of the Eco Audit tool that contains warnings about restricted substances, and options to include cost analysis and a secondary process in the audit. Please read the software help, or the online teaching resources for information on how to get started with these advanced features.

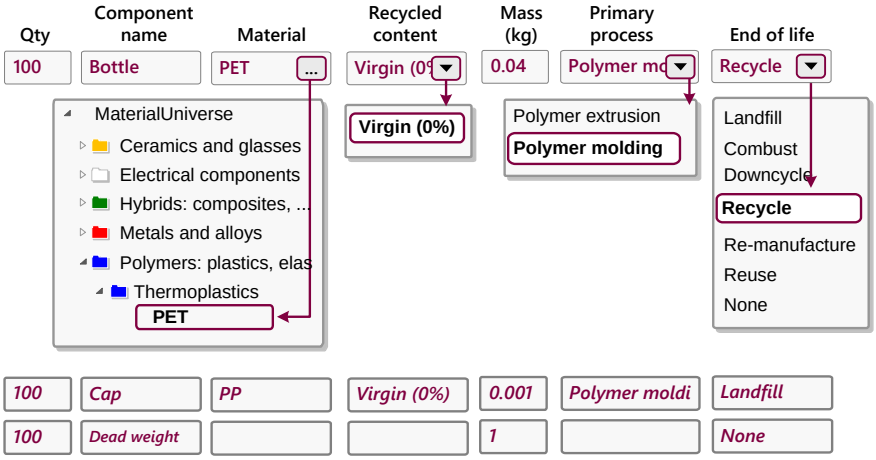
Product definition

The following example shows how the example product file has been created.

To view an explanation of the calculations used at each stage, click Help in the heading.

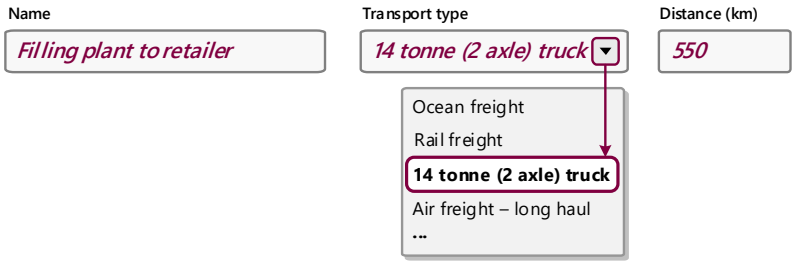
1. Material, manufacture, and end of life

Bill of materials (BoM) and primary processing method.



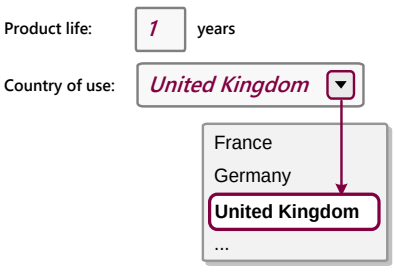
2. Transport

Transportation from site of manufacture to point of sale.



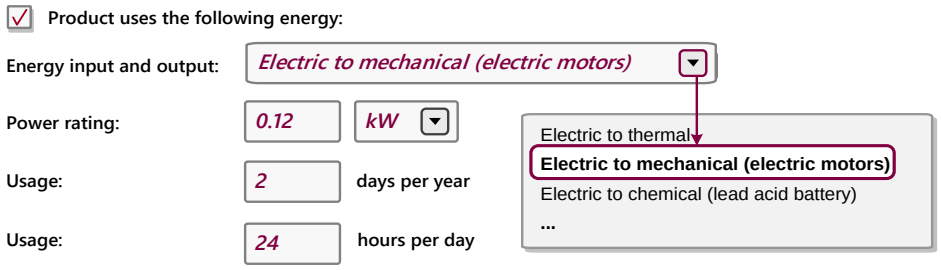
3. Use

Product Life and Location Use



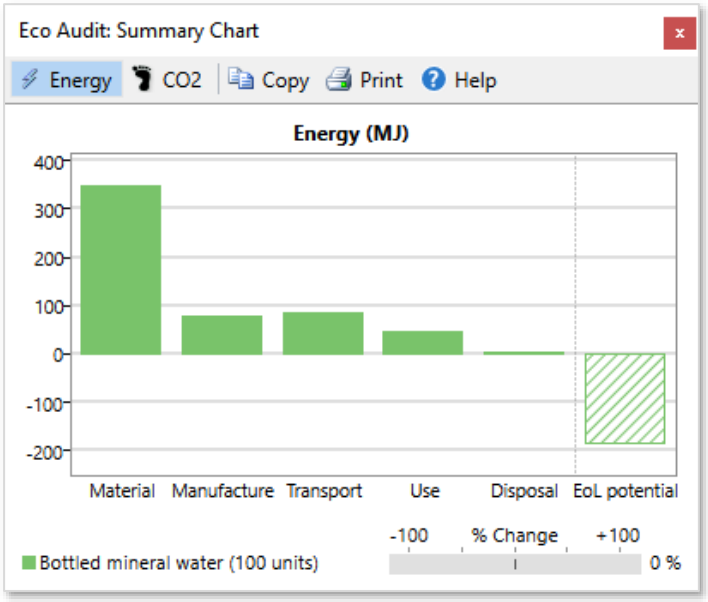
Static Mode

Energy used to refrigerate product at point of sale (average energy required to refrigerate 100 bottles at 4°C = 0.12kW).



4. Report

Summary chart enables rapid identification of the dominant life phase. Toggle between views of energy usage or CO_2 footprint.



The chart shows that, in this project, Material is the dominant life phase. Each life phase can be clicked to show guidance on strategies to reduce its impact.

Detailed report provides a component-by-component breakdown of each life phase, enabling the main contributors to the dominant life phase to be identified.

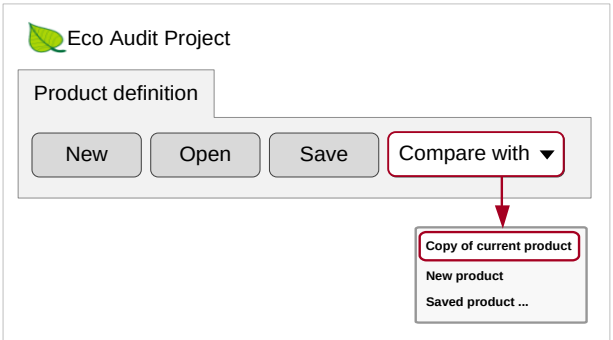
Exercise 13 — *Compare Eco Audit Projects*

❖ Open the *Bottle PET - Level 2* product file.

Click **Eco Audit**, then click **Open** on the Product Definition tab. Locate the sample product file *Bottle PET - Level 2.prd*, located in the Samples folder in your CES EduPack installation folder. For example:
C:\Program files (x86)\CES EduPack 2019\Samples\eco_audit\en\Level 2 - Bottle PET.prd

❖ Create a copy of this product for comparison

Click **Compare with** on the Product Definition tab and select **Copy of current product**.

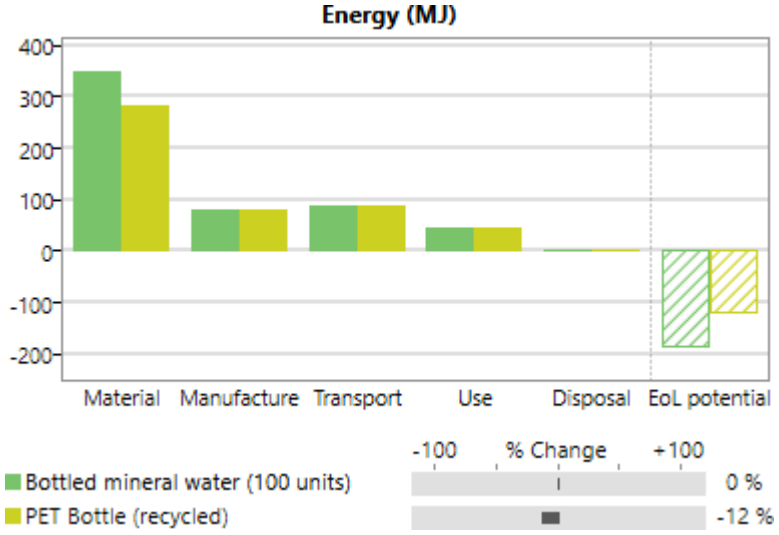


❖ Change the product name to “PET Bottle (Recycled)”

❖ Change the recycled content value for PET to “35%”

Click in the box to manually type in a value.

❖ Generate the SUMMARY CHART



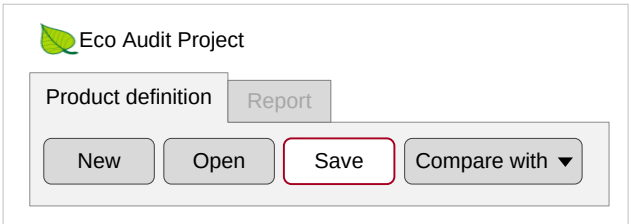
The first life energy (not including EoL potential) is reduced by 12%.

Note: The summary chart can be copied into a document or printed using Copy and Print at the top of the chart window.

Exercise 14 — *Saving and exporting*

Eco Audit projects do not form part of a selection project and therefore need to be saved separately.

❖ SAVE the product definition

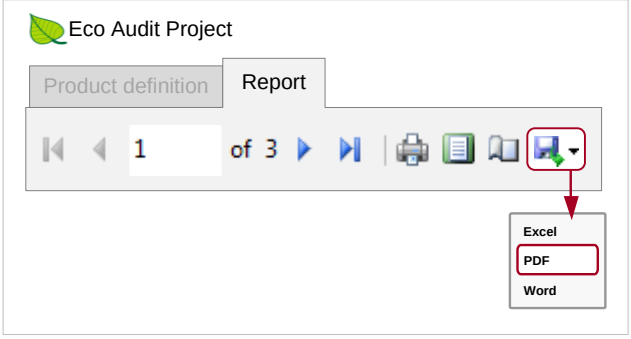


❖ GENERATE the Eco Audit report

Click the **Report** tab (or click **Detailed Report** on the Product definition tab).

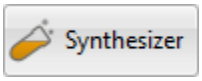
❖ EXPORT the report as a PDF

You will require a PDF reader such as Adobe Reader to view the exported report.



2.9 Synthesizer Tool

The Synthesizer Tool is only available in some advanced editions of CES EduPack.



The Synthesizer Tool is designed for use in the early stage of product development. It consists of two types of models: hybrid models, for estimating the performance of novel materials and structures; and the part cost estimator, for calculating the cost of a component based on the material and process chain.

Synthesized records produced using the Synthesizer Tool can then be compared with existing records in the MaterialUniverse database using selection stages.

Exercise 15 — *Hybrid model: sandwich panels model*

Hybrid materials and structures combine the benefits of two or more materials to produce new materials that exhibit unique combinations of properties. For example, both composite materials and sandwich panels are commonly used to create strong, lightweight structures.

Note: You will need to use a Level 3 database for this exercise.

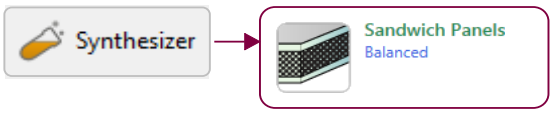
❖ Make a BUBBLE CHART of YOUNG'S MODULUS (E) against DENSITY (ρ) using MaterialUniverse: All bulk materials

As in Example 7.

❖ Use the SANDWICH PANELS MODEL to create synthesized records for a family of hybrid materials

Click **Synthesizer** on the toolbar (or click **Tools > Synthesizer** on the menu bar).

Select the *Sandwich Panels – Balanced* model.



❖ Set the SOURCE RECORD values

FACE-SHEET	Aluminum, 6061, wrought, T6
CORE	Polymethacrylimide foam (rigid, 0.200)

Click **Browse** and locate the records in the browse tree.

❖ Keep the default values for MODEL VARIABLES and MODEL PARAMETERS, and set the following RECORD NAMING values:

FACE-SHEET	Al
CORE	Rohacell

❖ Create the synthesized records

Click **Create** and then **Finish**. The new synthesized records are shown in the Results list and on the Chart Stage.

Note: Click the help icon in the Synthesizer Tool dialog to view further information about the current model type, including details of the calculations used.

❖ Plot an INDEX LINE corresponding to a lightweight, stiff panel in bending $E^{1/3}/\rho$

Click **Index and display lines**, enter a slope value of 3, and select maximize the index.

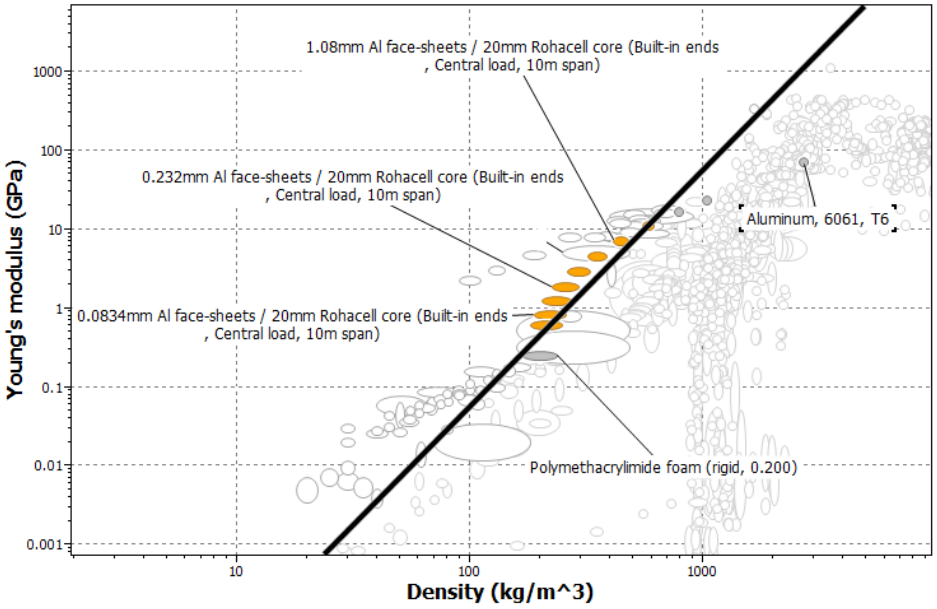
❖ Add labels to the source records and some of the synthesized records

You can select individual records on the chart and drag to place a label.

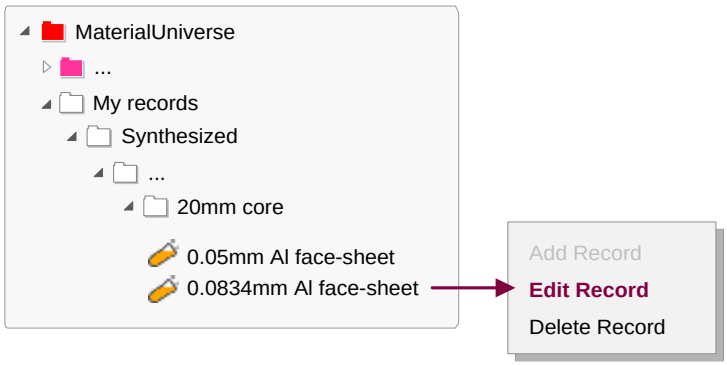
You can also add labels from the Results list: select one or more records in the Results list, right-click and select **Label** on the shortcut menu, then then drag the labels where you want them on the chart.

Click the  **Highlight synthesized records** button to help you identify the synthesized records on the chart.

Use the Zoom controls and to zoom in to the area of interest on the chart.



Synthesized records appear on the Browse tree under **My Records** and may be edited or deleted in a similar way to User Defined records.



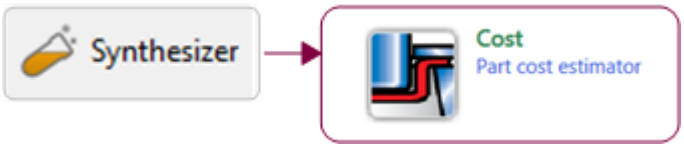
Exercise 16 — *Part cost estimator*

The Part Cost Estimator is a synthesizer model that calculates the total cost of a component based on the material and processing costs.

Note: You will need to use a Level 3 database for this exercise.

❖ Use the Part Cost Estimator to compare the cost of a component manufactured in two different ways: as an injection molded polymer, and as a rolled and pressed metal.

Start Synthesizer Tool by clicking **Synthesizer** on the toolbar and in the dialog, select *Cost – Part cost estimator*.



❖ Set the COMPONENT DETAILS of the first component:

MATERIAL	PP (copolymer, 20% talc)
VALUE OF SCRAP MATERIAL	10%
PART MASS	6.4
PART LENGTH	10
BATCH SIZE	1000 - 1E6
NUMBER OF VALUES	10

Note: For this exercise, the units of part mass and part length do not matter.

❖ Set the PRIMARY SHAPING PROCESS values:

PRIMARY PROCESS	Injection molding (thermoplastics)
AVAILABILITY	Custom form
PART COMPLEXITY	Standard

Use the default values for load factor, overhead rate, and capital write-off time.

❖ Set the RECORD NAMING values:

MATERIAL	PP
PRIMARY PROCESS	molded

❖ Create the new records.

Click **Create**. Keep the Part Cost Estimator window open.

❖ Set the COMPONENT DETAILS of the second component.

In the Part Cost Estimator window, click **Previous** and change the COMPONENT DETAILS for the material process:

MATERIAL	YS170 hot rolled (high strength drawing quality steel)
PART MASS	10

Use the default values for scrap material value, part length, batch size, and number of values (retained from the first material processing chain input).

❖ Set the PRIMARY SHAPING PROCESS values:

PRIMARY PROCESS	Hot shape rolling

Use the default values for the other properties.

❖ Set the SECONDARY SHAPING PROCESS.

Select **Include secondary process**, and enter the following value:

SECONDARY PROCESS	Press forming

Use the default values for part complexity, amount of scrap, and scap recycled.

❖ Set the RECORD NAMING values:

MATERIAL	Steel
PRIMARY PROCESS	rolled
SECONDARY PROCESS	pressed

❖ Click **Create** and then **Finish** to create the synthesized records and close the Part Cost Estimator.

Synthesized records created using Part Cost Estimator are appended to the MaterialUniverse browse tree under My records > Synthesized > Part cost estimator.

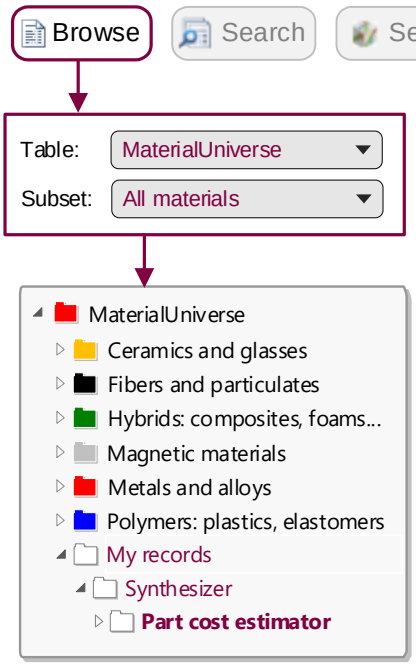
❖ Create a bubble chart to compare the two material processing chains.

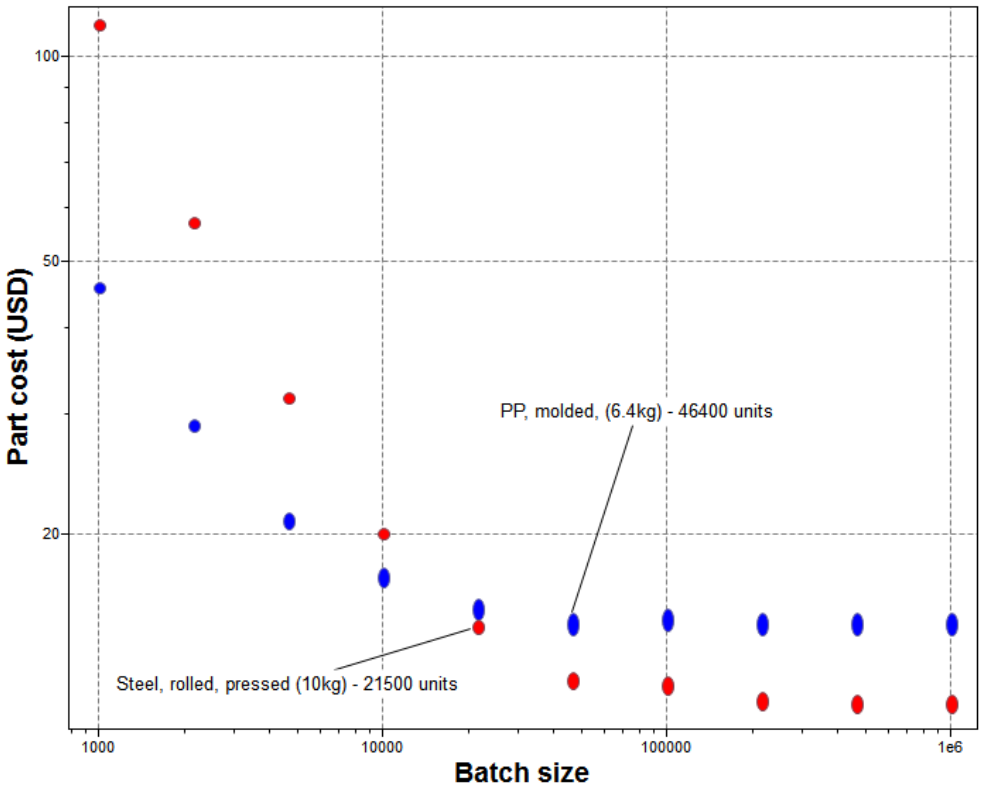
Select MaterialUniverse: All bulk materials, click **Chart**, and set the following x- and y-axis values:

CATEGORY	Part cost estimator
X-AXIS ATTRIBUTE	Batch size
Y-AXIS ATTRIBUTE	Part cost

❖ Change the record color for easy comparison of the two processing chains.

Navigate to My records > Synthesized > Part cost estimator. Right-click the ***PP, molded*** subfolder, click **Record color**, and click a color to change the record color for all records in that folder.



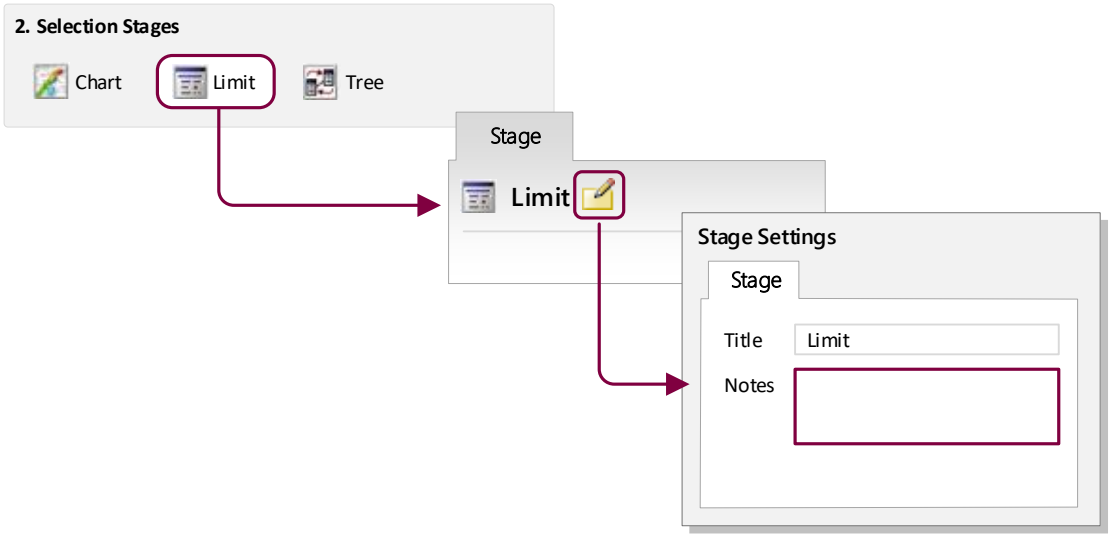


2.10 Saving, copying, and report writing

Exercise 17 — *Adding comments and saving a project*

You can add comments to a selection project as a reminder of why you have applied certain constraints and objectives. Comments are displayed on mouse-over in the selection report, and are saved in the project file.

Comments can be added to all selection stages in a project.



❖ Click **Notes** in the stage window heading to open the Stage Settings dialog, then enter some comments in the Notes box.

❖ Save the project

On the **File** menu, click **Save Project**. Give the project a filename and directory location; the project will be saved with the file extension *.ces*.

Exercise 18 — *Exporting and copying*

Charts, records, and results lists can be copied and pasted into a document in another application such as Microsoft® Word, Microsoft Excel, Microsoft Powerpoint, or Notepad.

❖ Copy a chart into a document.

To copy a chart to the clipboard: in the chart window, right-click the chart and select **Copy** on the shortcut menu, or press CTRL+C.

You can then paste the chart image from your clipboard into the document.

❖ Copy a datasheet into a document.

To copy a datasheet to the clipboard: display the datasheet and then right-click the datasheet and select **Copy** on the shortcut menu, or press CTRL+C.

You can then paste the data from your clipboard into the document.

❖ Copy results into a document.

To copy results to the clipboard, use SHIFT+click or CTRL+click to highlight the records you want, then right-click and select **Copy** on the shortcut menu, or press CTRL+C.

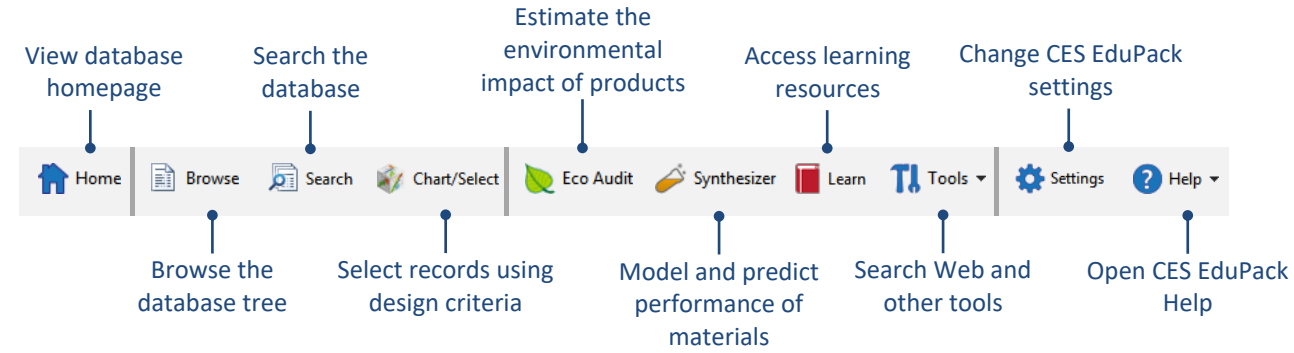
To select all results in the list, right-click and select **Select All** on the shortcut menu, or press CTRL+A.

You can then paste the results from your clipboard into the document.

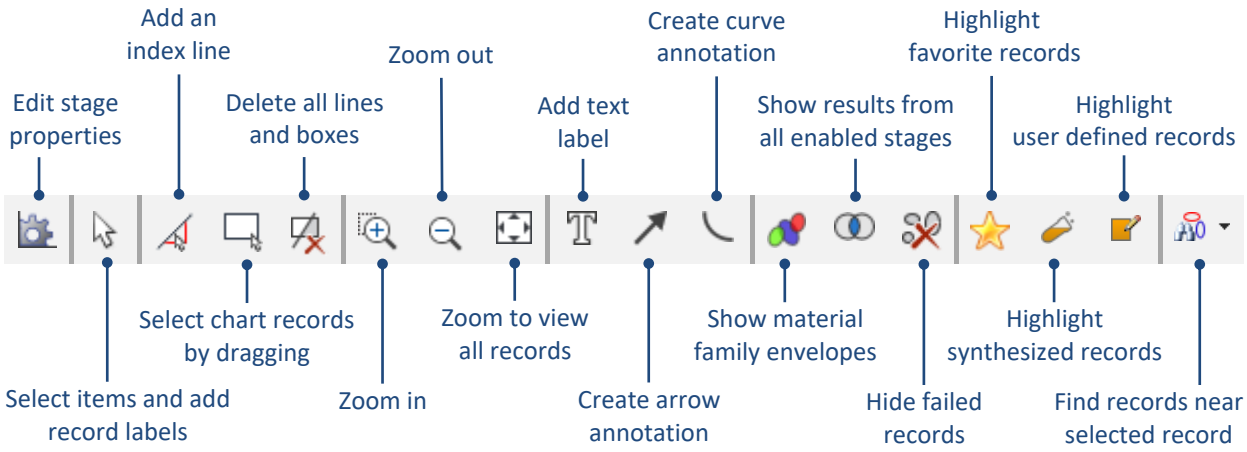
❖ Edit the document you have created.

3 Toolbar guide and general information

3.1 Standard toolbar



3.2 Chart Stage toolbar



3.3 CES EduPack file types

*.gdb	Granta Database file
*.ces	CES Project file
*.cet	Selection Template file
*.frl	Favorites file
*.prd	Eco Audit Product Definition file

4 Contact details

If you have any questions, you can contact us at info@grantadesign.com or at one of the phone numbers below.

International Headquarters:	Tel: +44 (1)1223 518895 Fax: +44 (0)1223 506432
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Germany	Tel: 089 921 315 230 Granta für Lehre: 0800 182 5026 Fax: 08005 89431 5000

For further details, see the contact details page of the Granta Design website, www.grantadesign.com.

We welcome feedback on this documentation. Please let us know if anything is unclear, if you spot an error, or have an idea for new content, by emailing docs@grantadesign.com.

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