



Example applications:

- Build consideration of eco factors into early phase product design - where changes cost least and have most impact
- Minimize 'eco-cost', e.g., embedded energy or carbon footprint, of a product
- Identify issues with end-of-life or regulatory restrictions
- Account for full life cycle impact of a product

Industrial relevance

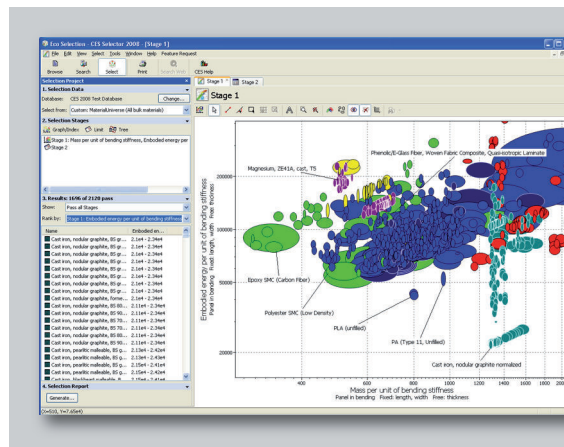
Aerospace, energy, defense, medical devices, manufacturing, materials production, and other engineering enterprises



CES Eco Selector

Environmental objectives are increasingly important in engineering and design. You may wish to limit the carbon footprint of your product, reduce its energy usage, limit wastes and emissions, or specify the manner of its disposal at the end of its life.

CES Eco Selector is a practical tool that helps you to address such objectives. It is a specialist edition of Granta's CES Selector™, combining CES Selector's powerful materials and process selection capabilities with a unique Eco Audit Tool and comprehensive data on materials and process properties of environmental relevance.



A materials eco selection study. A designer is investigating materials for a design application that uses a panel in bending. The graph shows the trade-off between embodied energy and mass for this application. Such plots enable a designer to quantify and visualize engineering, economic, and environmental properties.

Core tools and data

The CES Selector Basic Edition provides tools to browse, search, and interact with materials data, plus powerful analysis capabilities. It comes with the MaterialUniverse data module, providing engineering, price, and limited eco data for 3,700 engineering materials. You can select suitable materials for your application - for example by ranking them according to 'cost per unit of function' for a specific engineering application. This provides a rational process identifying the best materials to consider for your design objectives and for making materials substitutions.

More information is provided in the CES Selector Basic Edition product overview.

CES Eco Selector components

The CES Eco Selector edition augments the core software with:

The Eco Audit Tool - A quick and easy tool for estimating the energy usage and CO₂ footprint of a product design at each phase in the product life cycle.

Eco MaterialUniverse data module - extends the standard MaterialUniverse data module with additional data covering properties of interest in eco design - enables eco auditing and eco selection.

CES Eco Selector enables a two-stage approach to eco design (described overleaf).

Eco Material Universe data module

Standard Material Universe data on 3,700 materials is augmented with additional data covering properties of interest in eco-design:

Material production

- Production energy
- CO₂, NO_x, SO_x creation

End of Life

- Recycle
- Down-cycle
- Disposal - biodegrade, incinerate, landfill
- Recycling energy
- Recycle as % of current supply
- Heat of combustion
- Combustion CO₂

Sustainability

- Sustainable
- Possible substitutes

Indicators for principal component

- Eco-indicator, EPS value

Material processing energy

- Minimum energy to melt
- Minimum energy to vaporize
- Minimum energy to deform 90%

Bio-data

- Toxicity rating
- Approved for skin and food contact
- WEEE prohibited

Geo-economic data

- Annual world production
- Reserves
- Typical exploited ore grade
- Minimum economic ore grade
- Abundance in earth's crust

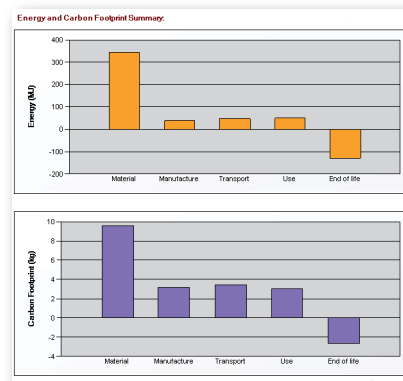
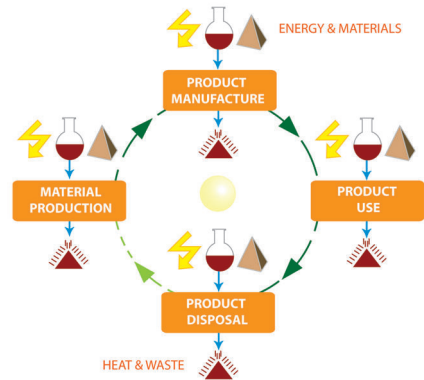
Further Information

The latest on CES Selector is at:

www.grantadesign.com/products/ces/

Stage 1. Eco auditing

Materials have a life cycle (right). They are produced, manufactured into a product, used, and - at the end of their life - recycled or discarded. Environmental damage occurs at all four phases of the cycle. Eco design demands consideration of the full life cycle impact. Before product designers can minimize this damage, they need an effective means to estimate it, and to focus their design efforts on the most significant life phases. But most approaches to such quantitative assessment (for example, LCA methods) are not designed for use as quick and practical design tools.



The **Eco Audit Tool** provides this capability. Via a simple input form within the CES Selector user interface, you enter information about product composition, processing, usage, transportation, and disposal. The tool then combines this with eco property data on the materials and processes used to estimate the energy usage and CO₂ output resulting from each stage in the product life cycle.

Results are reported as graphs (left) and in tabular form, enabling further quantitative analysis. Generating this information early in design helps to guide materials and process decisions when those decisions cost least and have the most impact, and enables quick analysis of 'what if' scenarios.

Stage 2. Optimizing eco impact

Knowing which phases in the life cycle of a product design will make the most significant contribution to its environmental impact helps to guide the design strategy by which that impact is minimized. For example, if the materials production phase dominates, you might seek to identify materials that fulfil the same engineering function but have a lower embodied energy. If the use phase dominates in a product that moves, you may aim to select materials with a lower mass.

Whatever your objective, **CES Selector** is the ideal tool for analyzing materials alternatives. You can plot engineering, economic, and environmental properties - or combinations of them (see picture overleaf) and you can rank materials against a specific design objective. CES Selector aids selection decisions - for example, find the material that represents the best trade-off between a mechanical property, like stiffness, and an eco property, like embodied energy. It helps with materials substitution - for example, find materials that have a similar engineering performance to a material in current use, but a lower environmental footprint.

As well as plotting properties that are expressed numerically, you can browse, search, and perform selection on properties stored as text or 'yes'/no' values. For example, you might use the software to find materials that can be recycled or that are not prohibited by WEEE regulations. Available eco properties include all of those listed in the sidebar (left).

Having identified a possible material or process, designers can quickly apply the Eco Audit Tool again to ensure that changes made to reduce environmental impact in one part of the life cycle are not outweighed by negative effects elsewhere. The Eco Audit Tool and CES Selector, drawing on the Eco Material Universe data module, thus provide a practical eco design solution that works easily within the design process.