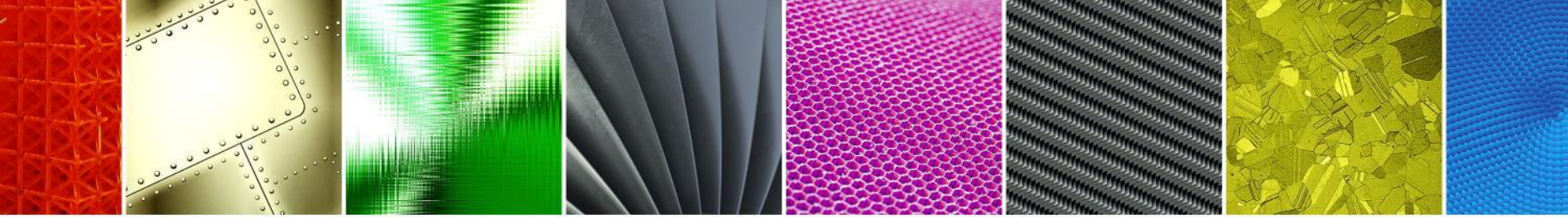


Workshop on Policy Design for a Climate-Friendly Materials Sector

Granta Design Ltd.

Dr Tatiana Vakhitova

Brussels 16th of September 2016

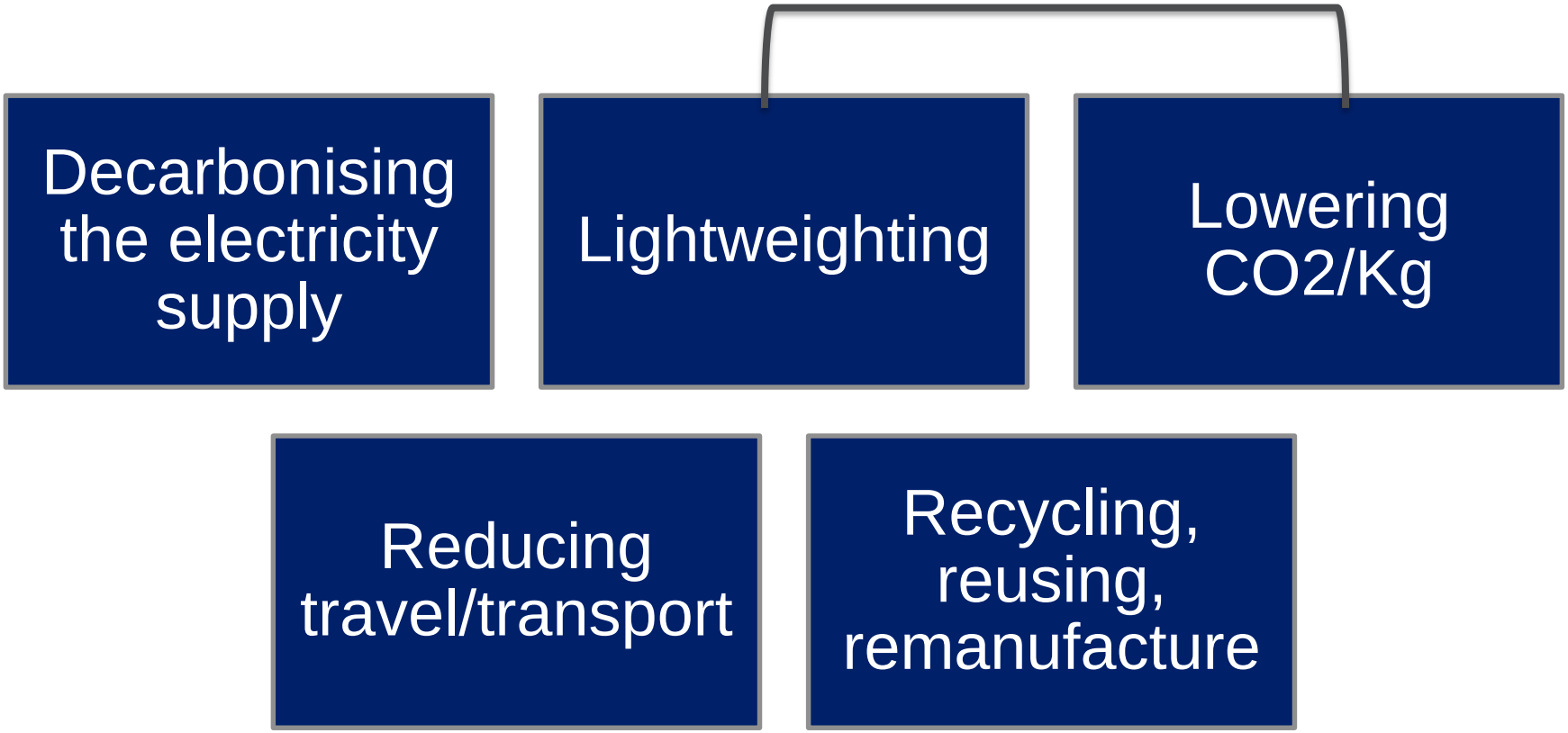
GRANTA
MATERIAL INSPIRATION

www.grantadesign.com

Agenda

- Substitution Case Study
- Trade-offs
- Barriers to change

Ways to reduce Carbon Footprint



Automotive transmission cross beam

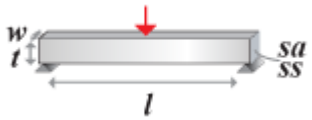
Materials

- Cast aluminium alloy
- ~2kg

Design Requirements

Function:

Automotive transmission cross beam



- Beam loaded in bending
- Strength-limited design
- Length, section shape specified
- Section area free

Current material:

Al 357-T6

Constraints:

- Adequate stiffness (>12GPa)
- Temperature resistance -40°C to +100°C
- Resistant to: salt water, oil, fuel
- 3D complex shape

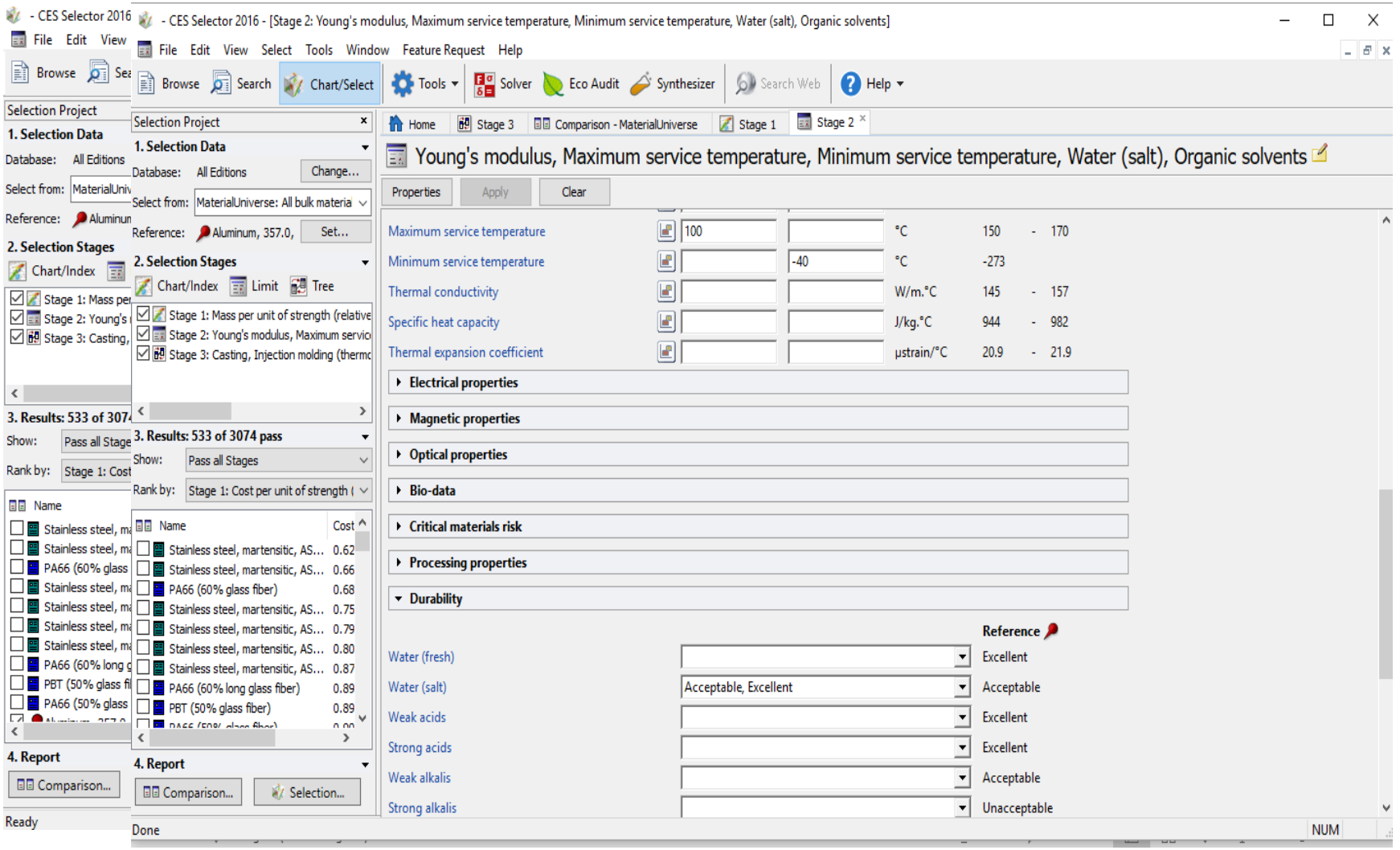
Objectives:

- Minimize mass
- Minimize cost
- Minimize Carbon Footprint

How we are going about it?

- Data on the properties of Materials and Processes
  - Our largest database has 88,000 different materials
- Software Selection Tools
  - CES Selector has been used in industry since 1994
- A methodology
  - Granta's co-founder Professor Michael F. Ashby wrote books on the topic of material selection and more
- Industrial consortia
  - Inputs on real life case studies, data and industrial challenges

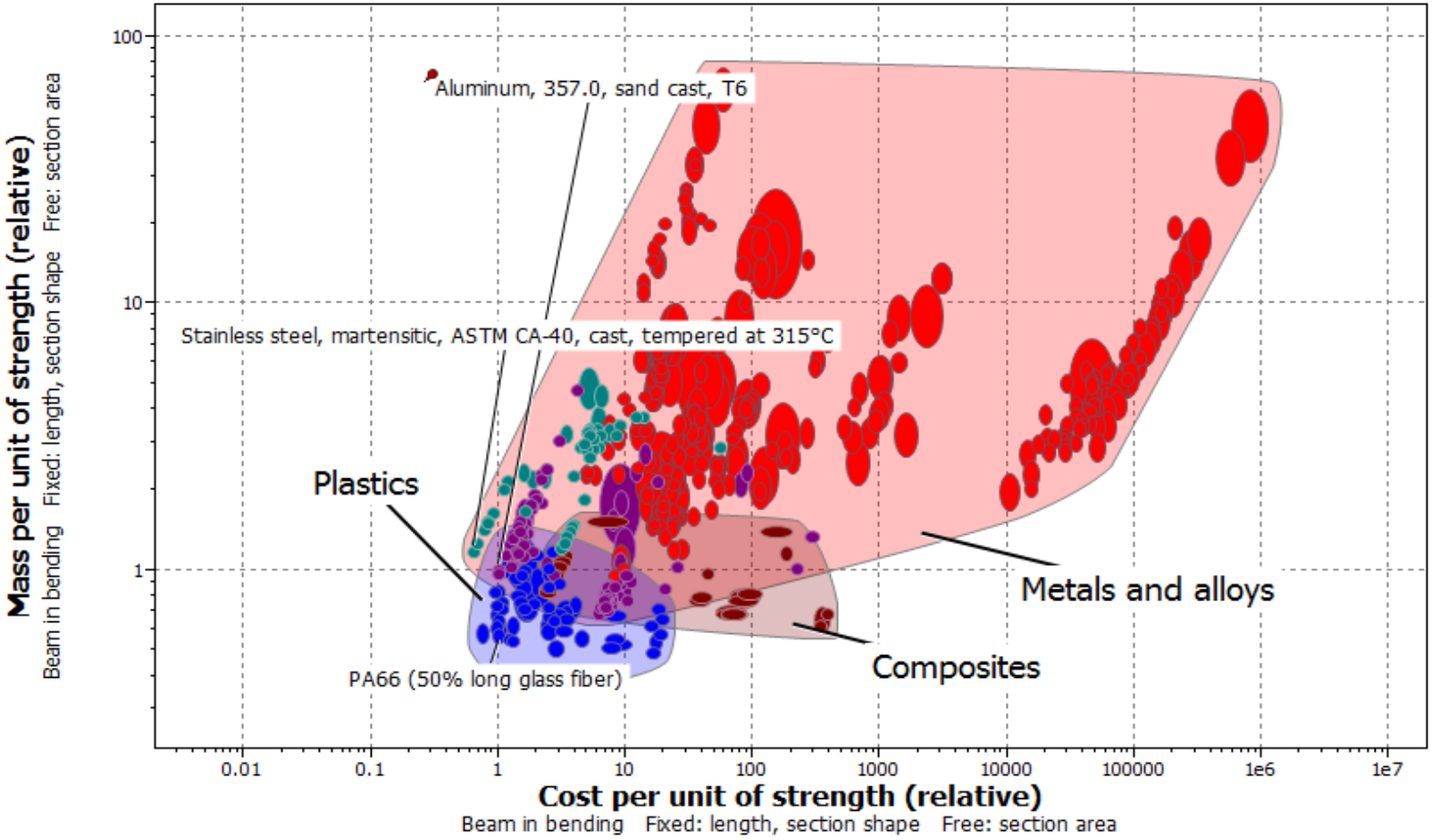
Step 1. Apply Constraints



Step 2. Work out the Performance Indices

- Relative performance of materials for:
  - Weight $\sigma_f^{2/3} / \rho$
  - CO2 $\sigma_f^{2/3} / CO_2 \rho$
  - Cost $\sigma_f^{2/3} / C_m \rho$

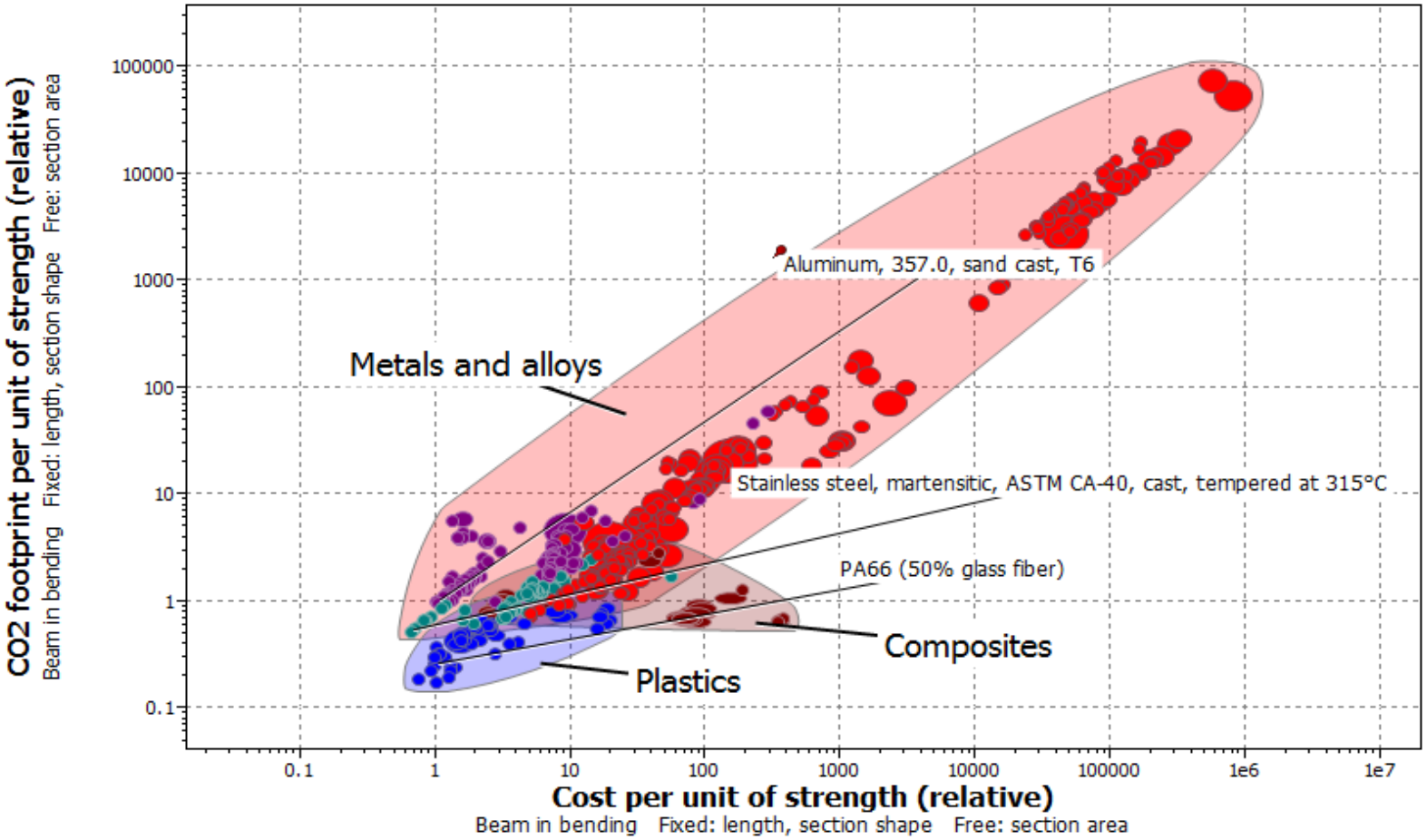
Step 3. Look at the trade-offs



We can work out the penalty per unit of function

There are methods for multi-objective optimization

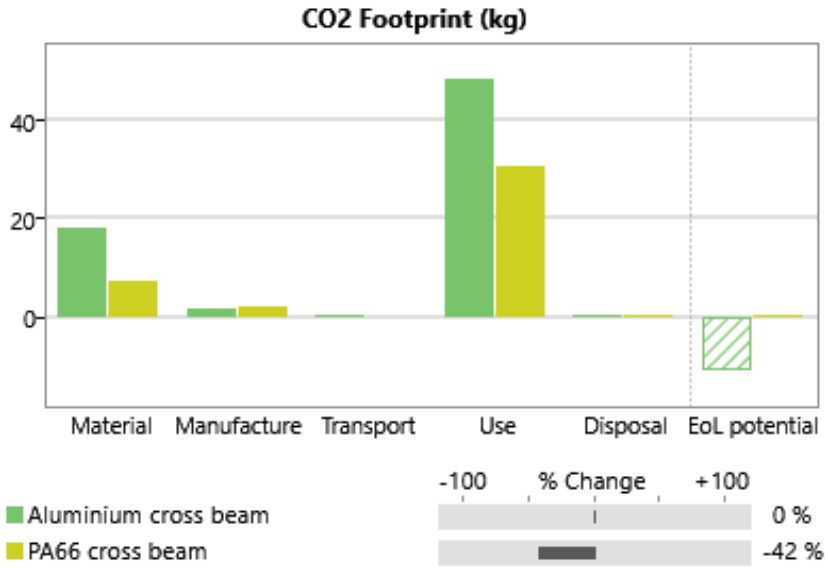
Step 3. Look at the trade-offs

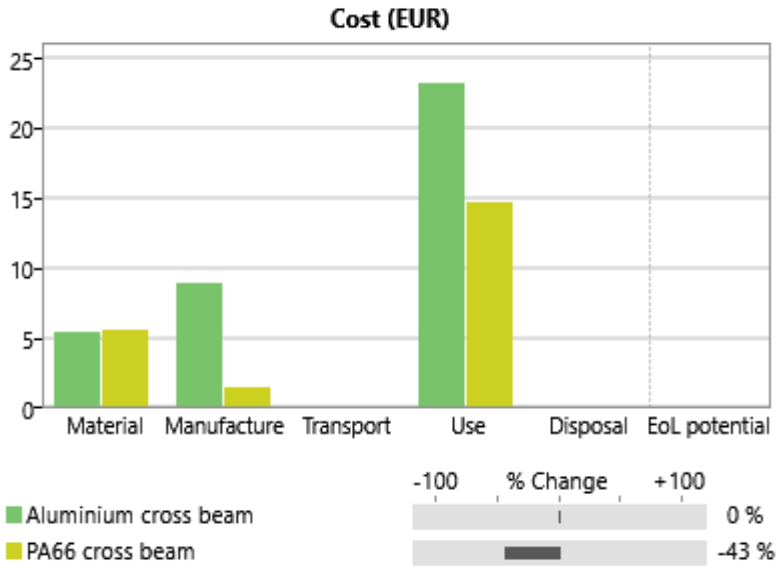


We can work out the penalty per unit of function

There are methods for multi-objective optimization

Step 4. But what about the whole life cycle of the product?





A higher carbon price will make the trade off look better

CES Eco Audit Tool estimates Energy, CO2 and Cost at the design stage

Step 5. But what other barriers are there to change?

Internal inertia

- No experience of manufacturing with new material
- Bulk purchasing arrangements
- Industry standards

Supply chain risk

- Critical materials
- Restricted Substances

Social acceptability & Legislation

- Social anxiety e.g. driverless cars
- Regulations
- Social, Environmental and Economic impact in materials producing countries

Infrastructure

- Electricity Supply
- Trade agreements
- Transport links

Solving one problem and creating another

- The use of composite materials has an impact on recycling
- The use of biopolymers has an impact on land and water

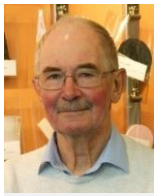
Granta Design

- Helps members of industry and engineering students to understand wider impact and trade-offs of their decisions

Through:

- Data
- Tools & Educational resources
- Methodologies
- Industrial Consortia & Academic Networks Interactions

Granta Design Cambridge (UK) since 1994



Mike Ashby

David Cebon

UNIVERSITY OF CAMBRIDGE

ASM INTERNATIONAL

Management of knowledge about materials and processes

Our network: example partners and collaborations

Owners

University of Cambridge

ASM International

Software

Altair

ANSYS

Autodesk

Dassault Systèmes

PTC

Siemens

Data

ASME – Setting the Standard

Campus

Global Powder Metallurgy Property Database

IHS

M-Base Engineering + Software

MI-21 Metals Information For the 21st Century

MMPDS

NCAMP

NIMS

Stahl

UL

Computatio

CMDNetwork

Collaboration

ADS

AMAZE

Ac Ce Le Ra Te D
Me Ta L Lu Rg Y

Ellen MacArthur Foundation – The Circular Economy 100

Education

SEFI

FEMS

Questions / Comments

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