



Cambridge-MIT

Institute

Embodied Energy in an Aluminium Can

Title: Conveying the idea of the embodied energy in an aluminium drink can to a lay audiance

Background: Relating complex, technical information to a non-technical lay audience is a crucial skill of modern engineers. For example, as engineers we are comfortable working with units of energy such as MJs but this bears no relevance to an average person. As a result, they cannot judge the relative significance of such figures.

Overview and motivation for this exercise: This example question asks the student to consider a piece of technical information (in this case the embodied energy content of an aluminium drinks can) and to re-express it in a way that would allow a lay audience to appreciate its significance.

General and Specific Resources: The ImpEE resource on the Recycling of Plastics¹ provides data on the embodied energy of various drinks containers. This is included as Table 1. The resource can also provide the general background for setting this problem into a larger context.

The main parameters required for completing the question are given. Optionally, the lecturer can withhold some or all of these to encourage the student to engage in their own independent research.

	Glass	ΡΕ	PET	Alu	Steel
Container Type		1		Content	a way Cocal Ser
Mass ^[g]	325	38	25	20	45
Mass/volume [g/litre]	433	38	62	45	102
Energy/Mass [MJ/kg]	14	80	84	200	23
Energy/Volume [MJ/litre]	8.2	3.2	5.4	9.0	2.4

Table 1: "Embodied Energy of Drink Containers²" from the ImpEE resource on "Recycling of Plastics¹".

Links:

1. "Recycling of Plastics", ImpEE Resource, http://www-g.eng.cam.ac.uk/impee/?section=topics&topic=RecyclePlastics

2. "Embodied Energy of Drink Containers", ImpEE Resource - Source Data, http://www-g.eng.cam.ac.uk/impee/topics/RecyclePlastics/files/Embodied%20Energy%20Drink%20Containers.png

Example Question:

You are an engineer working for a council recycling program. The rate of recycling for aluminium drink cans is below the desired target level. It has been noted that the average person fails to appreciate that, in addition to the raw materials, manufactured products also have a significant embodied energy. Your task is to communicate these issues to the lay audience in a non-technical way.

Example Solution:

There are potentially limitless solutions to this question. One such solution is given here.

The embodied energy in a single 330 ml aluminium drink can is 4 MJ. The energy in a litre of petrol is 34.2 MJ. Thus, the embodied energy of an aluminium drinks can is equivalent to around 0.1169 l of petrol. An information campaign could be developed wherein the public were informed that "discarding an alumnium drinks can wastes the embodied energy that was required for processing the metal in the first place. This is equivalent to filling the can a third full with petrol and throwing it away".

Transferable Skills: (*The numbers after each transferable skill refer to the CDIO Syllabus available on-line at <u>http://www.cdio.org</u>)*

Problem Identification and Formulation (2.1.1) The student needs to identify the key issue involved in the problem. In this case, that the public's awareness of the concept of embodied energy is lacking and needs to be conveyed in a persuasive manner.

Estimation and qualitative analysis (2.1.3) The student needs to estimate the embodied energy in terms of the energy content of petrol.

Communication (3.2) A successful solution will communicate the key issues in an effective manner. The use of petrol in the analogy is an emotive tool that conveys the urgent issue of energy waste. Expressing the embodied energy content in terms of litres of petrol, rather than MJ, makes it easier to relate to.

The Impact of Engineering on Society (4.1.2) The students are made aware of the fact that engineers have a much broader role in the real world than simply designing machines or devices. For example, they can posses the tools to effectively communicate important information to the public.

ESD Skills Developed:

Awareness of ESD Issues. In working through this assignment, students are made aware of the fundamental concept of embodied energy in manufactured goods and eco-function.