ACTIVITY 02

MATERIALS FLOWS, THE BIG PICTURE

COULD ALUMINIUM USE BE 'CLOSED-LOOP'?

CONTEXT FOR THE ACTIVITY

This activity is based around interrogating five stimuli: a photograph of an aluminium smelter; various datasets on global aluminium stocks and flows; and a graphic used by Walter Stahel to illustrate what happens to resources used in an aluminium can over several cycles. The theme of the activity is 'big picture' flows and the consequences of feedback in different contexts. Can aluminium use be 'closed-loop'? When, if at all? How? Does it matter?

The main stimulus for this activity is a Sankey diagram that visualises the stocks and flows of aluminium internationally. Aluminium is a very significant metal in the global economy and in the discussion, participants are encouraged to reflect on ways to improve the prospects for aluminium in relation to creating more 'circularity'.

RESOURCES AVAILABLE

- 2:R1a Intro PPT slide
- 2:R1 Photo of an aluminium smelter
- 2:R2 A Sankey diagram of aluminium flows
- 2:R3 A graphic to illustrate what happens to resources used in an aluminium can over several cycles
- 2:R4 Aluminium prices
- 2:R5 Aluminium flows - cars

ORGANISATION

- Small group (2-3) discussion around aluminium datasets
- Larger group (4-6) discussion on aluminium and 'circularity'

TASK(S) AND RUNNING ORDER

1) In small groups develop dialogue around the aluminium smelter photograph and Sankey diagram.
2) Consider in groups the graph about recycling and aluminium cans.
3) Reflection: where would *your* emphasis go in improving the prospects for aluminium in relation to creating more 'circularity'?

TIMINGS

Overall approximately 60 minutes.
Task 1 /2: 40 mins. Task 3: 20 mins.

AIM OF THE ACTIVITY

This activity emphasises the importance of 'big picture' flows and the consequences of feedback in different contexts. Through a focus on aluminium stocks and flows globally, participants consider whether aluminium use could be 'closed loop' and the prospects for aluminium in relation to creating more 'circularity'.

TASK 1

Invite participants to work in small groups (of 2-3) and introduce this activity with the photograph of the aluminium smelter R1. Invite participants to comment on what's happening in the photograph before introducing the aluminium context. Using copies of the Sankey diagram about aluminium flows (R2), ask groups to comment on what they see. What is happening? What is puzzling? Is the flow of aluminium a promising example of 'circularity'? Gather ideas and comments. P.S. The answer to the last question is probably "it depends!"

Some points which might be discerned from the diagram and elaborated on in a debriefing:

a) A great deal of aluminium goes into long lasting infrastructure, infrastructure which is still expanding globally so any notion of reaching a point where new aluminium is not required in quantity is a long way off. Many other uses of aluminium are long term e.g. aircraft bodies.

b) Most recycling is pre-consumer which distorts our understanding if claims are made for high levels of aluminium recycling. The post-consumer loops are really of a different order.

c) There appear to be two quality paths for aluminium - wrought and cast. These are materials with different properties and uses and most post-consumer flows are of the less valuable cast aluminium.

For background detail relating to the aluminium flows Sankey diagram, facilitators can refer to pages 3-7 in Julian Allwood's report *Going on a metal diet*. (Allwood et al., 2011). This report (see References for weblink) details how producing aluminium is extremely energy intensive and that most of this energy is required at the early stages of the process - to create liquid metal from ore or recycled scrap. This report details evidence showing that for current uses of aluminium we could reduce metal production by up to a third, through better product design, and then by a further quarter by reducing losses in manufacturing.

TASK 2

Introduce the groups to the Walter Stahel diagram (R3) that considers recycling and aluminium cans. What is this about? What does it add to our understanding?

In a debrief with groups note that, in the context of the first task, it seems that with short cycle aluminium products even very high rates indeed of recycling still means rapid depletion of the original stock. This brings out the issue, again of cycles and time periods. It is not much use having a snapshot when effects are so dependent on feedback over different time periods. There is the decades-long cycles for infrastructure and the weeks-long cycles for aluminium cans. Ask participants:

But does it matter that this is so obviously a linear system just now? I mean if we could get renewables to dominate aluminium smelting (add a fact here) and found another perhaps bio-benign material for the drinks containers that should be fine? Do we care so much when we could wait a few decades for demand to meet supply from existing infrastructure? Aluminium is a pretty benign material, isn't it?

Some objections: what about the 'overburden' and bauxite mining waste? What about transport and other costs, social and environmental? Context matters?

Why are we just talking about it as a raw material, and not about products and extended product life etc? What about stock maintenance? (Walter Stahel addresses this in his work).

What about the need to experiment with design for recovery e.g. tagging significant items like structural supports? The digital revolution now makes this possible, surely? What about more effort to approve or standardise big aluminium components to aid reuse or extended use?

TASKS 3

Set up larger groups (4-6) and ask participants: "Where would your emphasis go in improving the prospects for aluminium in relation to creating more 'circularity'?"

In this task invite groups to look at the role of raw materials and materials businesses. Consider:
-End product design/use
-Policy matters/taxes/incentives
-Potential of ICT and/or new business models

Useful background information on these themes can be found in Walter Stahel's circular economy overview paper recently published in *Nature* (Stahel, 2016). See References for a link to this paper.

"The ultimate goal is to recycle atoms……. To close the recovery loop we will need new technologies to de-polymerize, de-alloy, de-laminate, de-vulcanize and de-coat materials"
Walter Stahel

Some data on aluminium prices on the international market is provided in R4. If you would like groups to focus their aluminium circularity discussion on a particular sector, you could perhaps introduce R5 that considers material flow analysis for automotive aluminium.

REFERENCES AND FURTHER READING

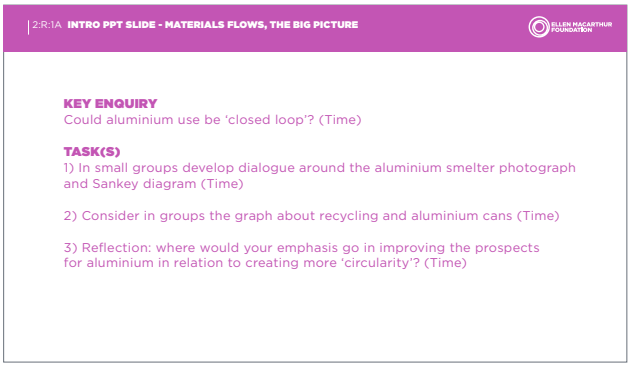
Allwood, J., Cullen, J., and Carruth, M. (2011) *Going on a metal diet - using less liquid metal to deliver the same services in order to save energy and carbon* Cambridge University/EPSRC. Available at: http://www.uselessgroup.org/publications/reports/wellmet-2050-going-metal-diet

Stahel, W. (2016) Circular economy. *Nature* 531, p435-438 Macmillan. Available at: https://www.nature.com/articles/531435a

THUMBNAIL RESOURCES

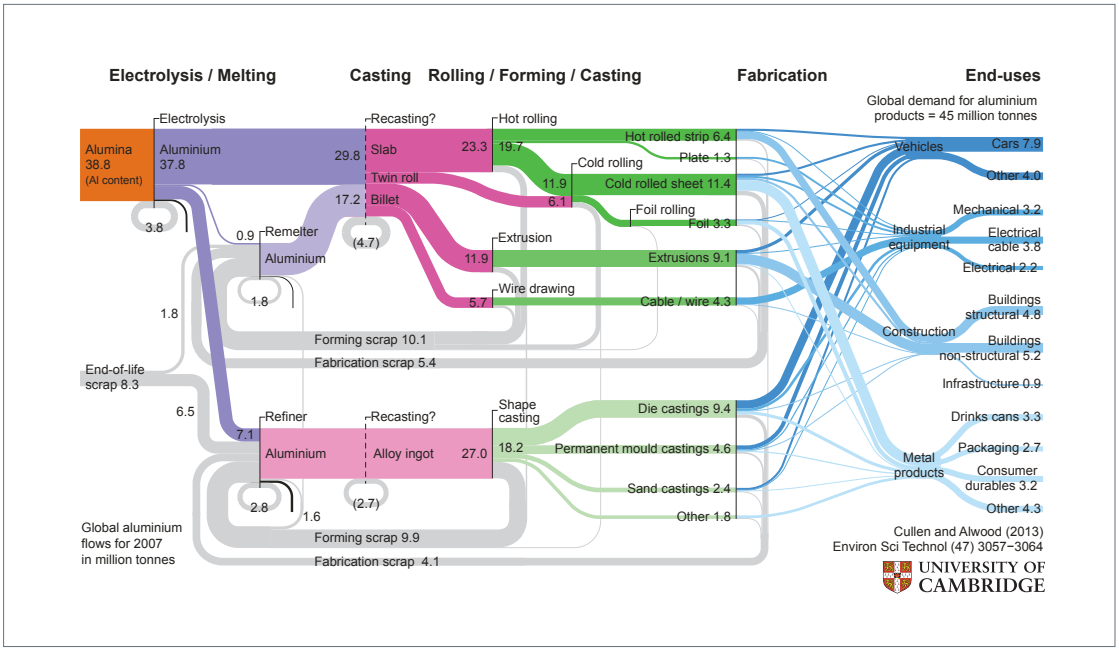
CLICK TO DOWNLOAD HIGH RESOLUTION VERSIONS FROM BELOW

2:R1a INTRO PPT SLIDE

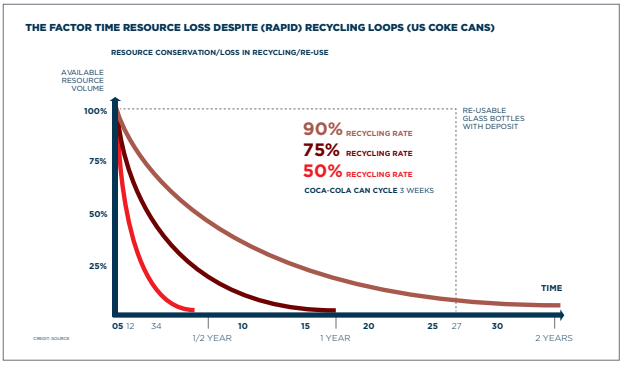


2:R1

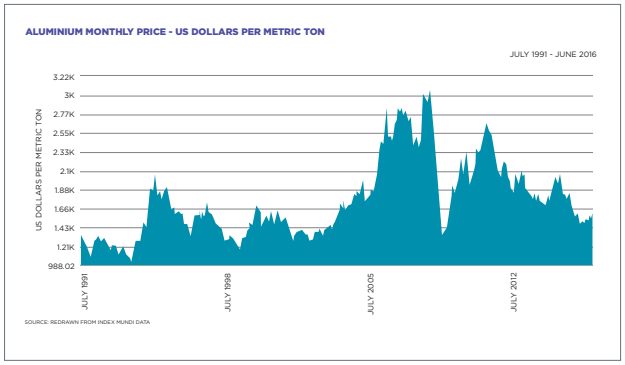
2: R2



2:R3



2: R4



2: R5