



Can LCA support both  
ends of the recycling  
stream?

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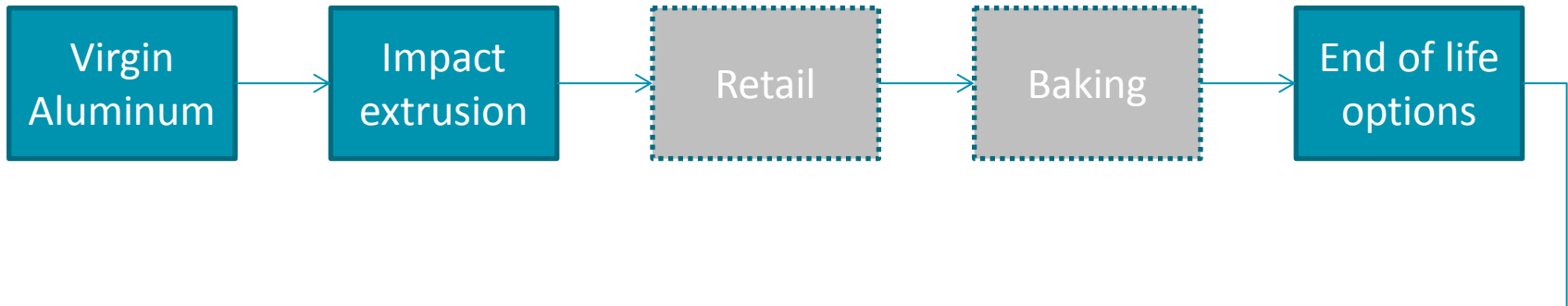
# What did our grandmothers (and the EPA) teach us?

*Waste not, want not.*



# Aluminum pie plate

## First Life



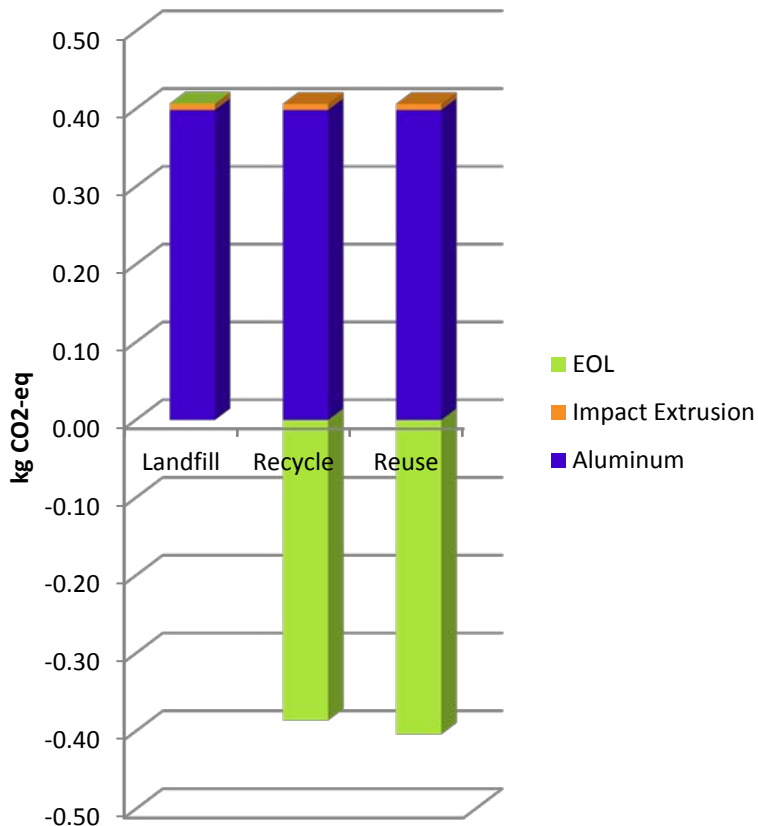
## Second Life



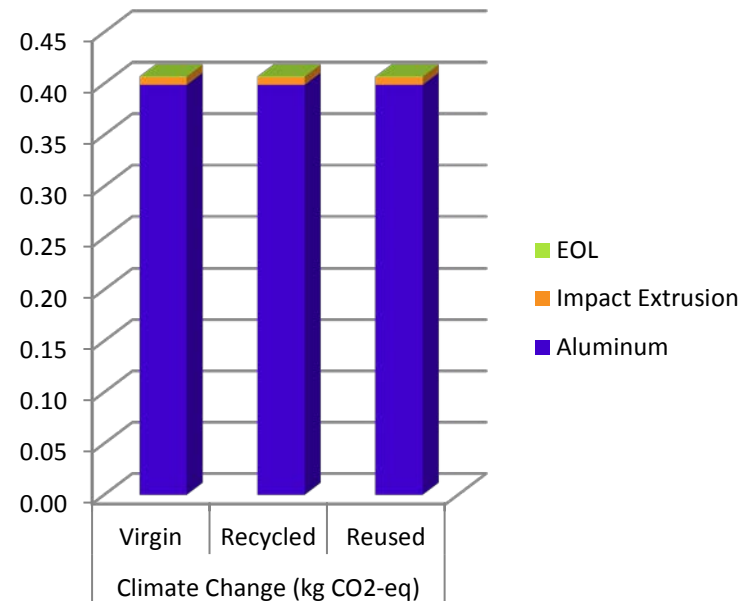
# What does LCA teach us?

(Avoided burden method)

**Aluminum Pie Plate**  
Climate Change - Avoided Burden

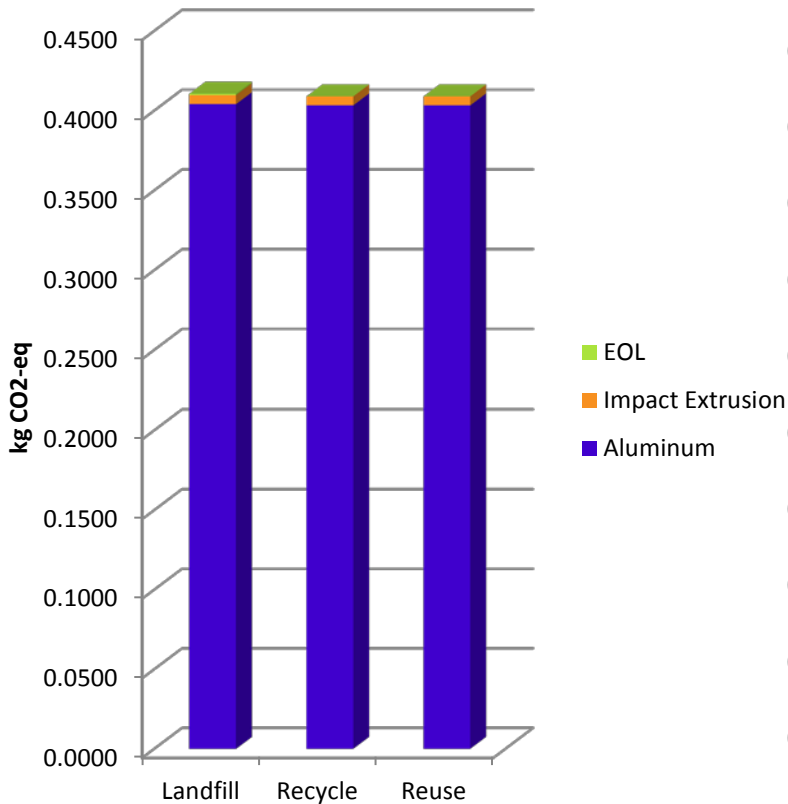


**Aluminum Pie Plate, second life**  
(all landfilled)  
Climate Change - Avoided burden

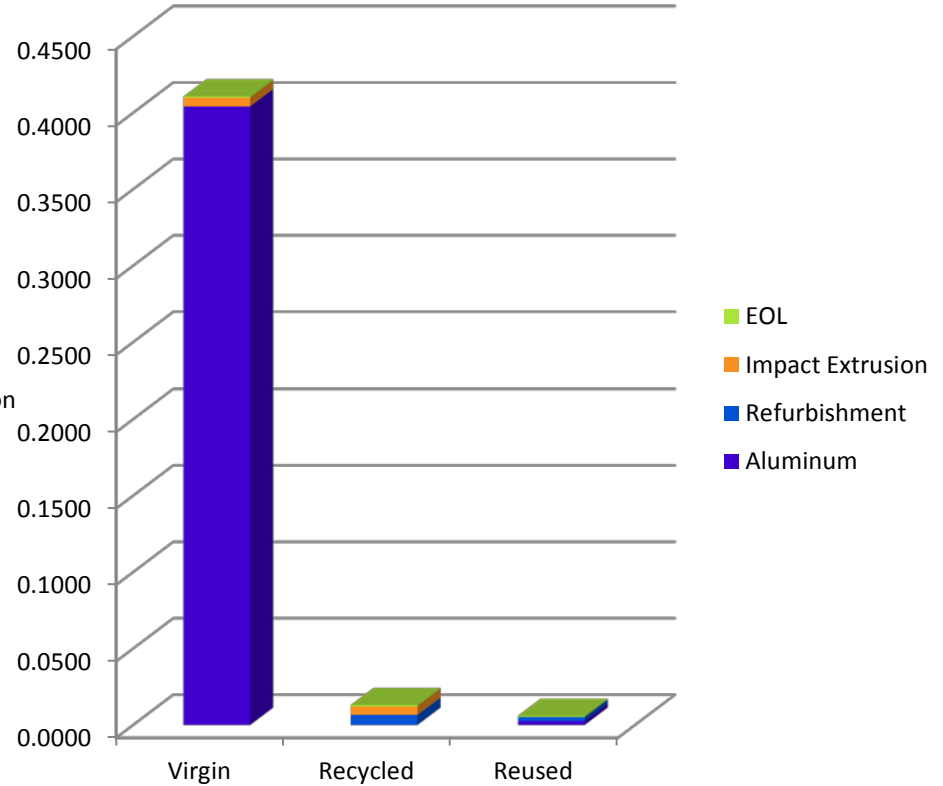


# What does LCA Teach Us? (Cut-Off Method)

**Aluminum Pie Plate  
Climate Change - Cut off**

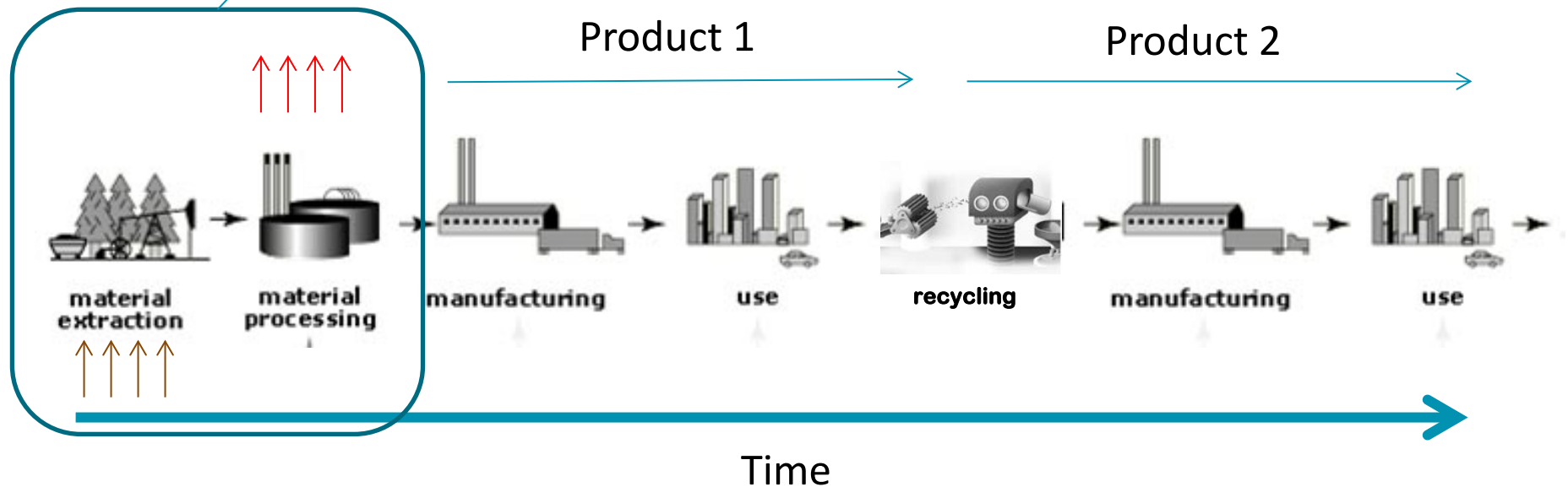


**Aluminum Pie Plate, second life  
Climate Change - Cut Off**

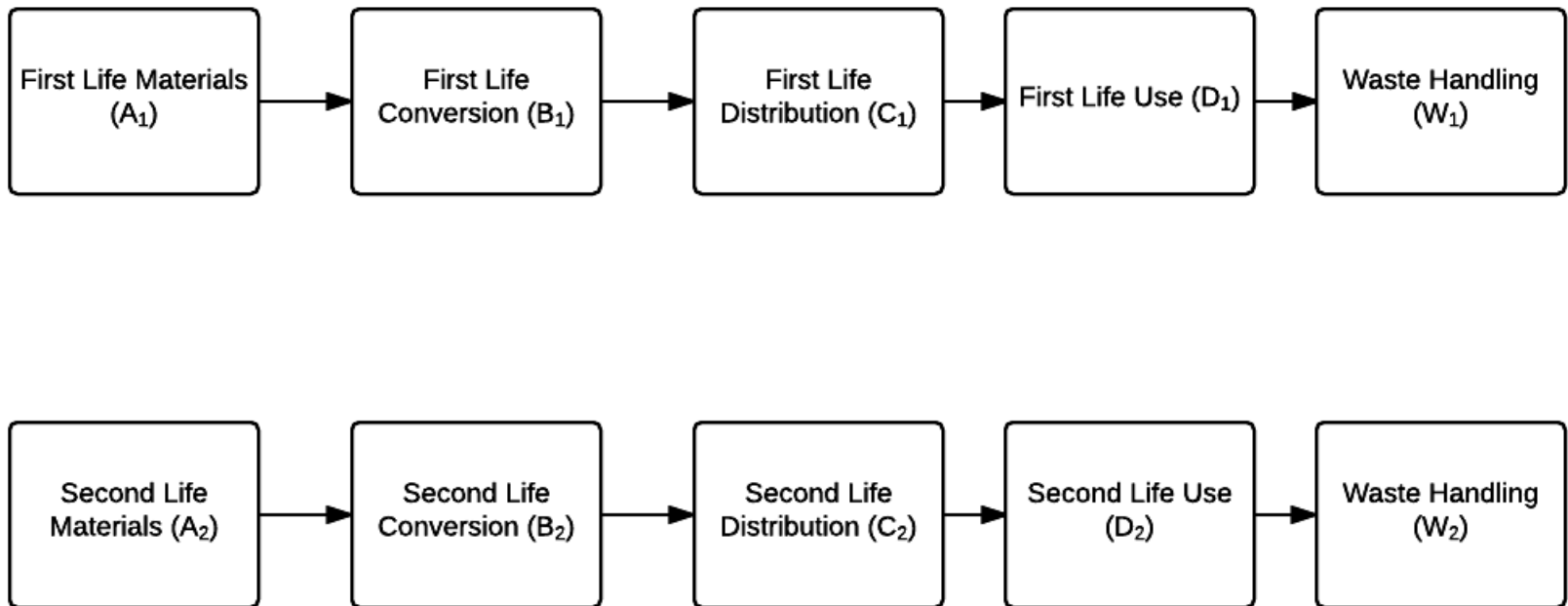


# It's a question of allocation (or where you draw your boundaries)

How do you allocate these flows between product 1 and product 2?

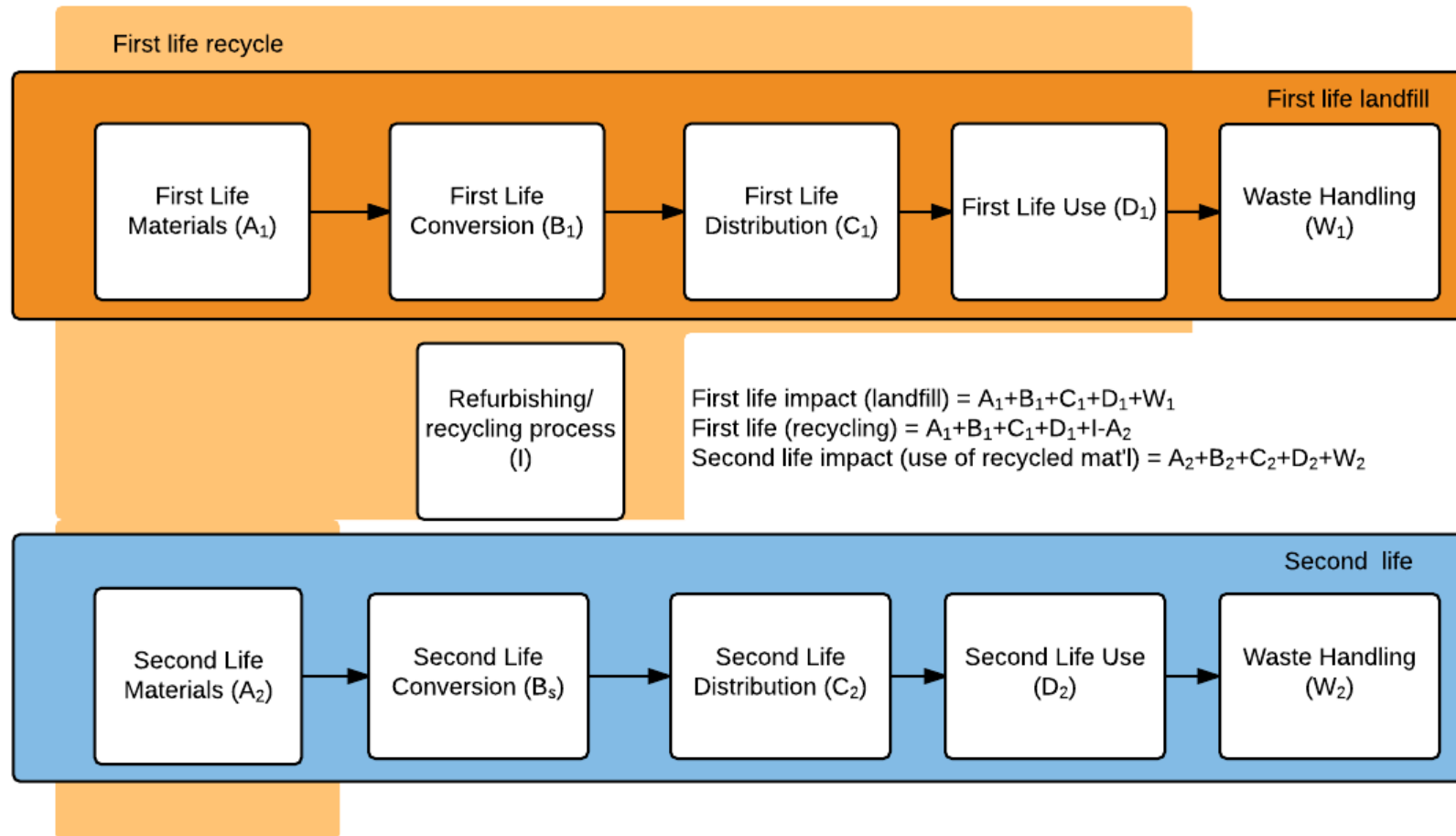


# Flow diagram of two lives



# Boundary Diagram, Avoided Burden

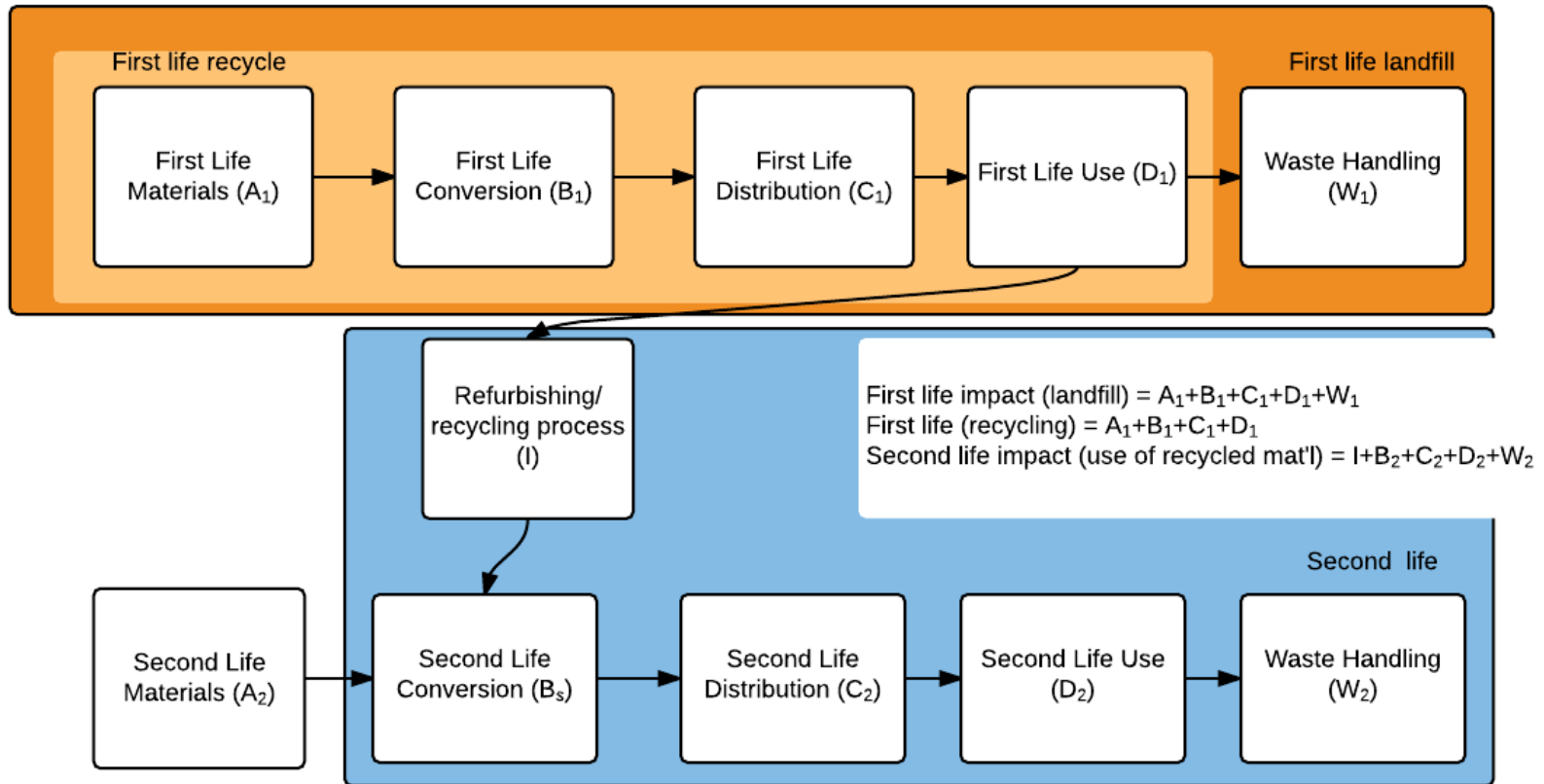
## Avoided Burden





# Boundary Diagram, Cut-Off

## Cut off



# Other methods?



- Market-based or economic approach
  - Essentially flips between avoided burden and cut-off, depending upon market conditions
  - What is sustainable changes based on the market
- 50/50 approach
  - Arbitrarily assigns 50% of the avoided burden to each life
  - Still has pesky negatives

*Shouldn't throwing something valuable in the recycle bin always be better?*

*Shouldn't using a recycled material that takes less energy to refurbish always be the better option?*

# CAN WE REDRAW THE BOUNDARIES TO SUPPORT BOTH THE RECYCLER AND THE USER OF RECYCLED MATERIAL?

(And not have those pesky negatives?)

# Rethinking the paradigm



# Rethinking landfilling



Steel Commodity Market

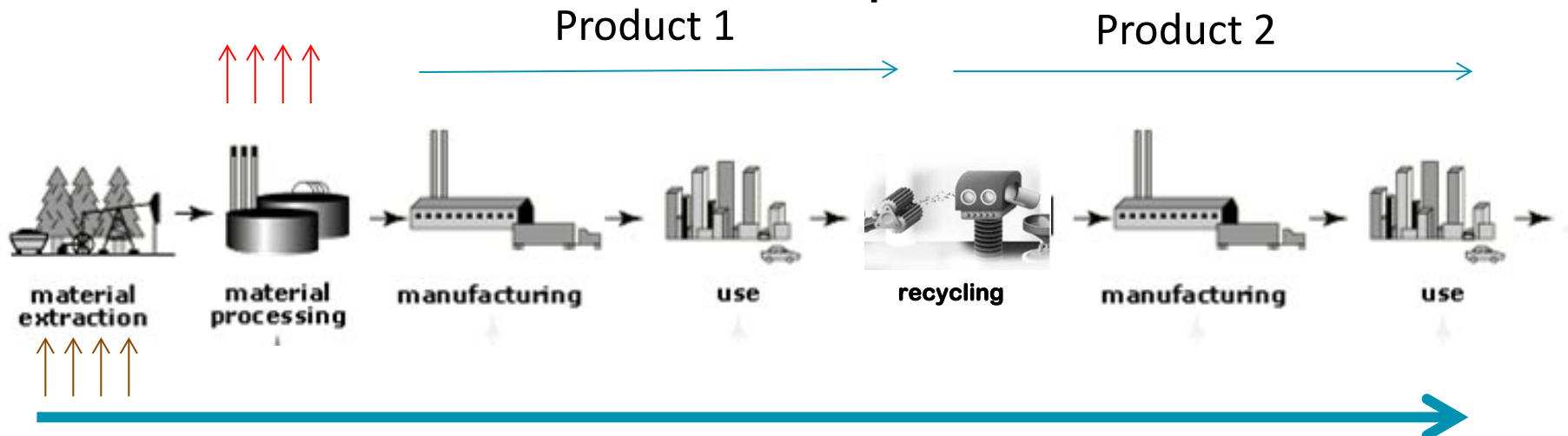


Landfilling results in the need for additional virgin material

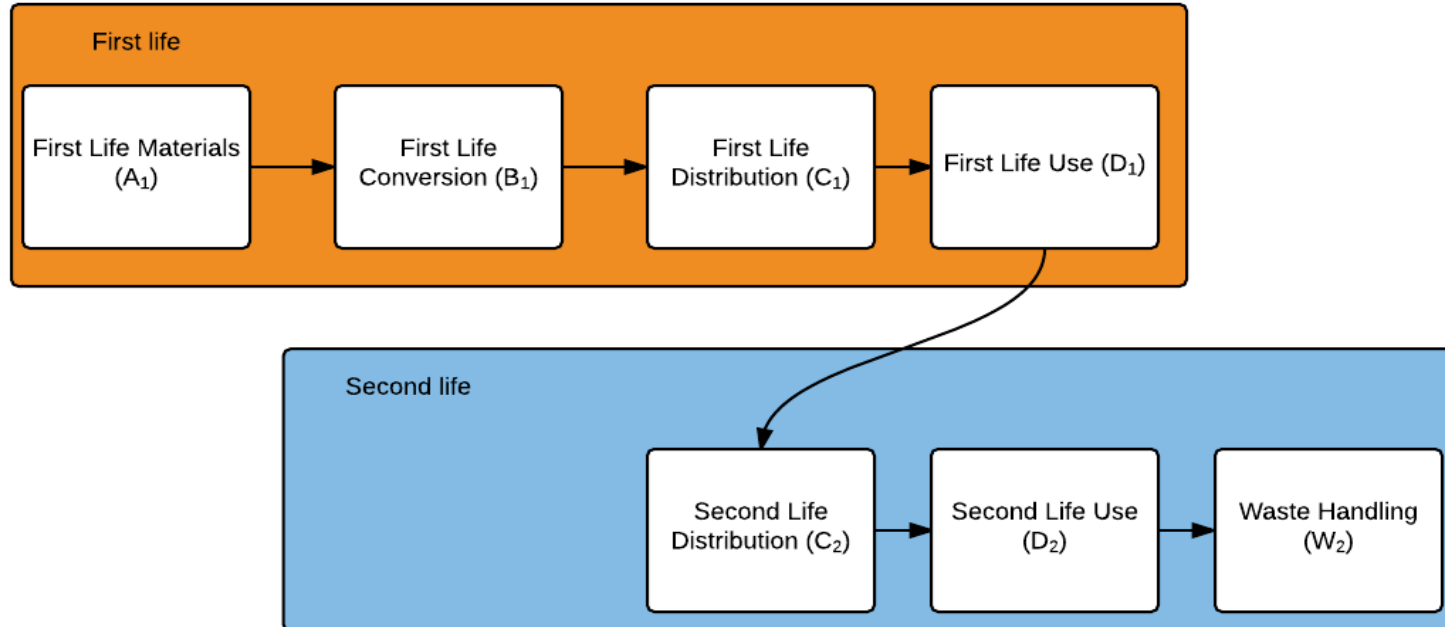
All images courtesy pixabay

# If reuse is the benchmark . . .

- Landfilling gets the burden all the way through manufacturing.
- Incineration takes the same burden of taking a product out of the system.
- Emissions and land use impacts for landfilling and incineration are added on top

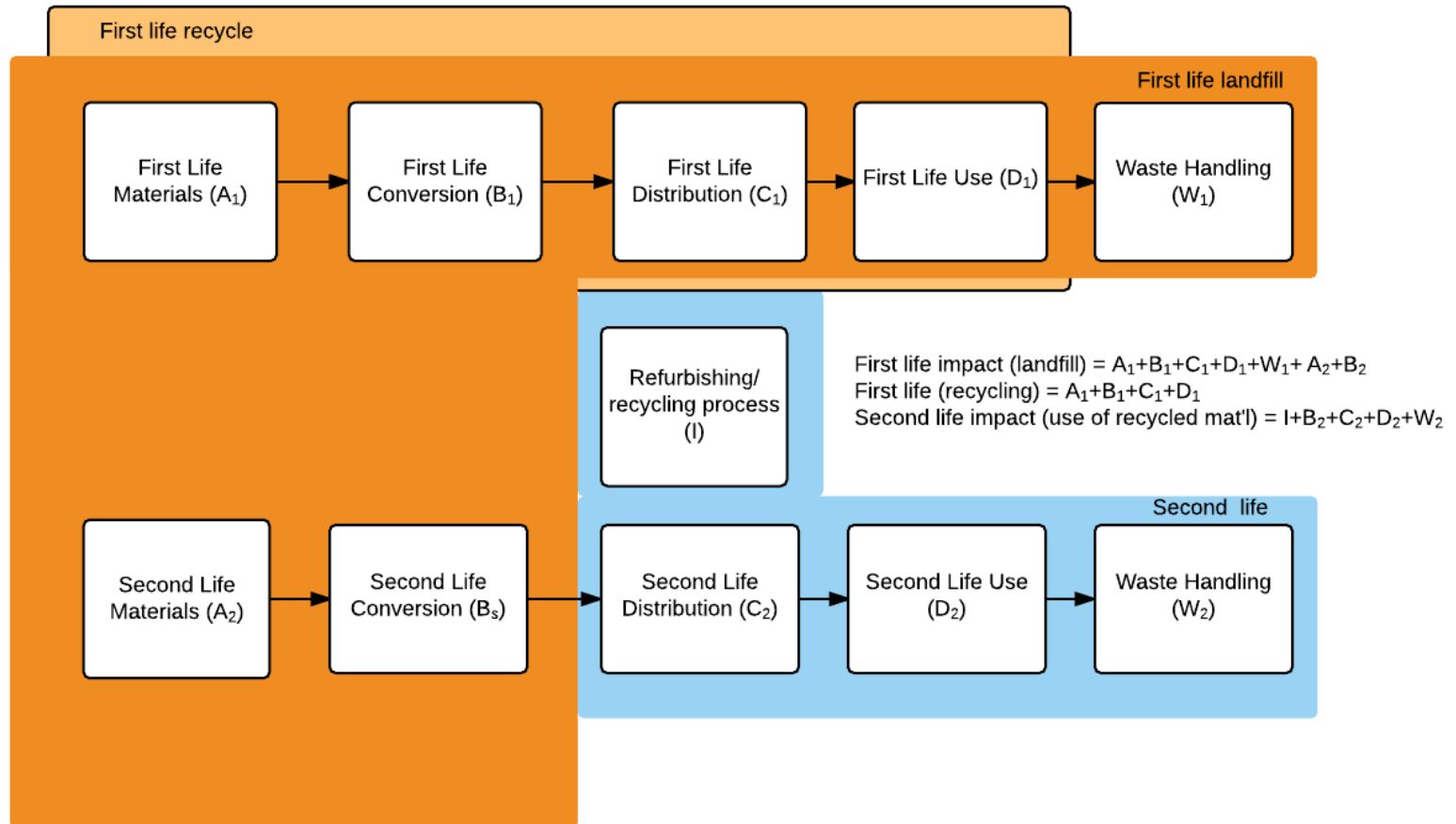


# System Boundaries for Reuse, Ideal



# System Boundary Diagram, Ideal

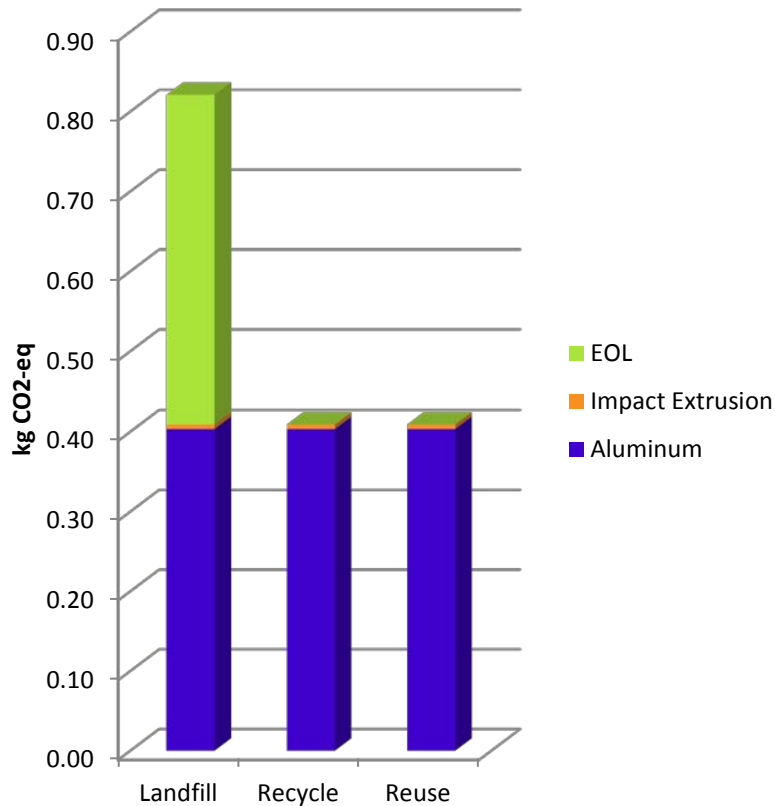
## Ideal



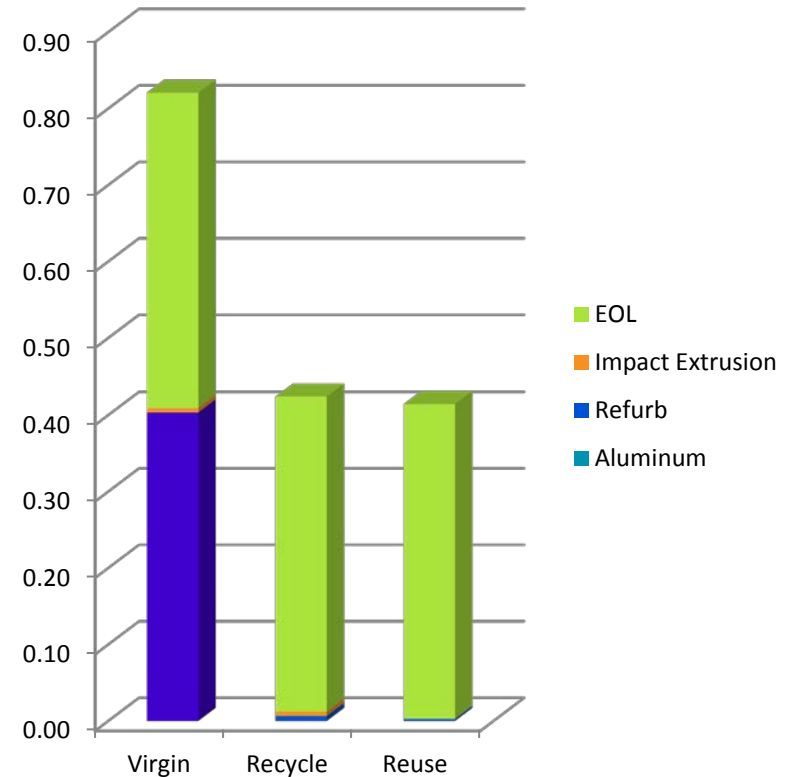


# What does LCA teach us using this method?

## Aluminum Pie Plate Climate Change - Ideal



## Aluminum Pie Plate, second life (all landfilled) Climate Change - Ideal



Impact difference similar to Avoided Burden

Impact difference similar to cut-off

# Philosophical questions



- Is the circular economy or cradle-to-cradle concept really better?
- Can we really emulate nature in our life cycles?
- If those are truly better ways of working, can LCA reflect it?
- Should LCA be used to drive better behavior?



Thank you!

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