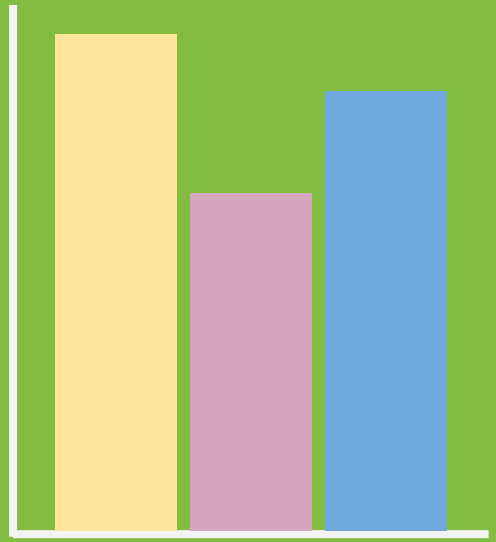
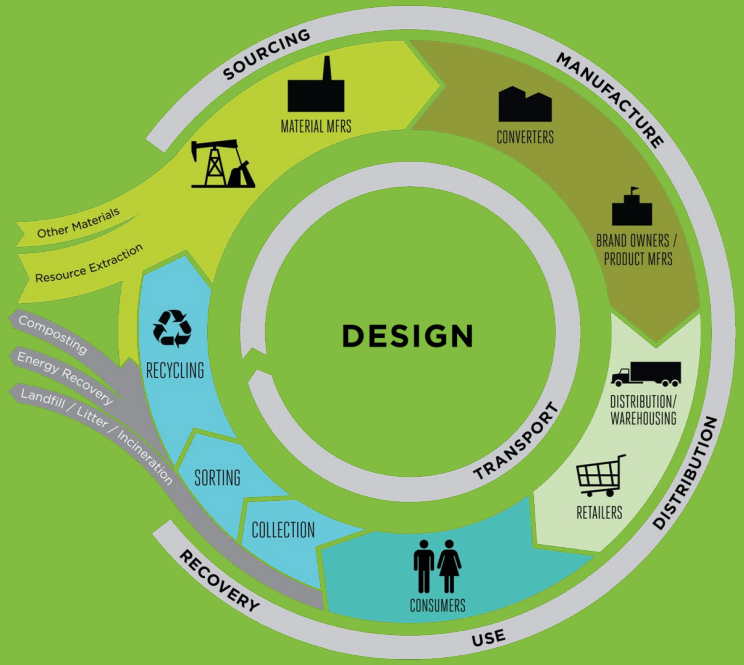
Life Cycle Assessment

Sustainable Packaging and Recycling Decisions





“This option is best because it’s made from plants.”

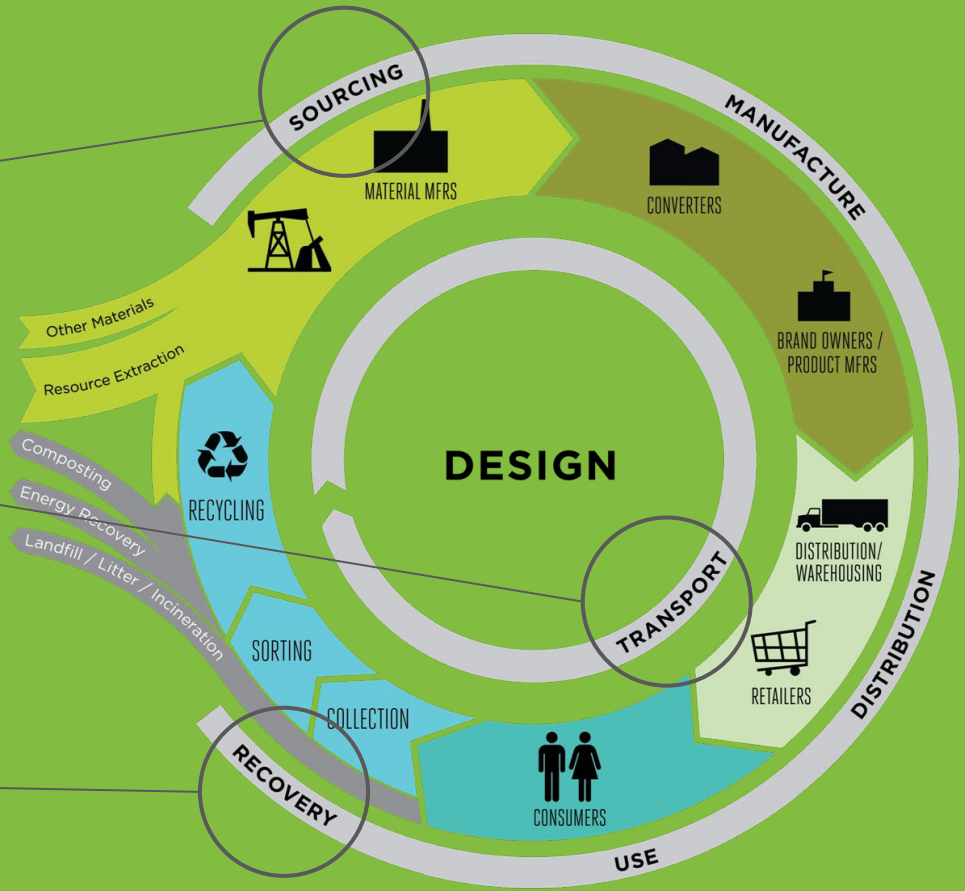
“This option is best because it’s lightweight.”

“This option is best because it’s reusable.”

Made from plants

Lightweight

Reusable



“This option is best because it’s made from plants.”

...but it’s not recyclable!

“This option is best because it’s lightweight.”

...but it’s made of fossil-based materials!

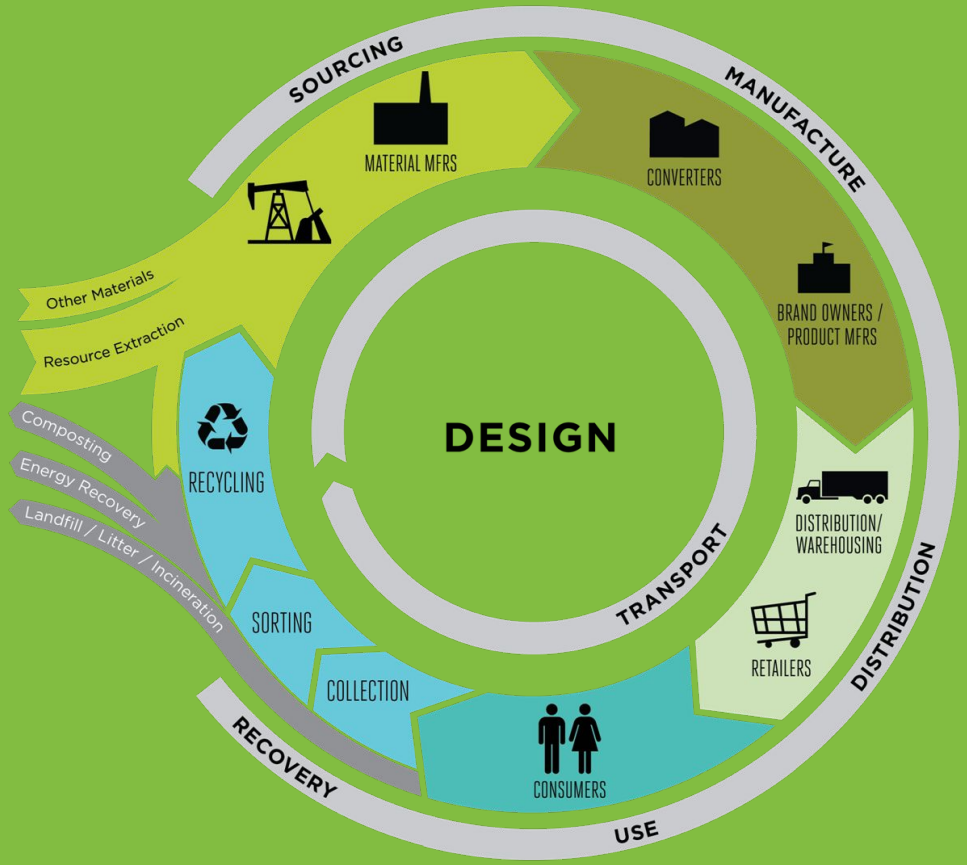
“This option is best because it’s reusable.”

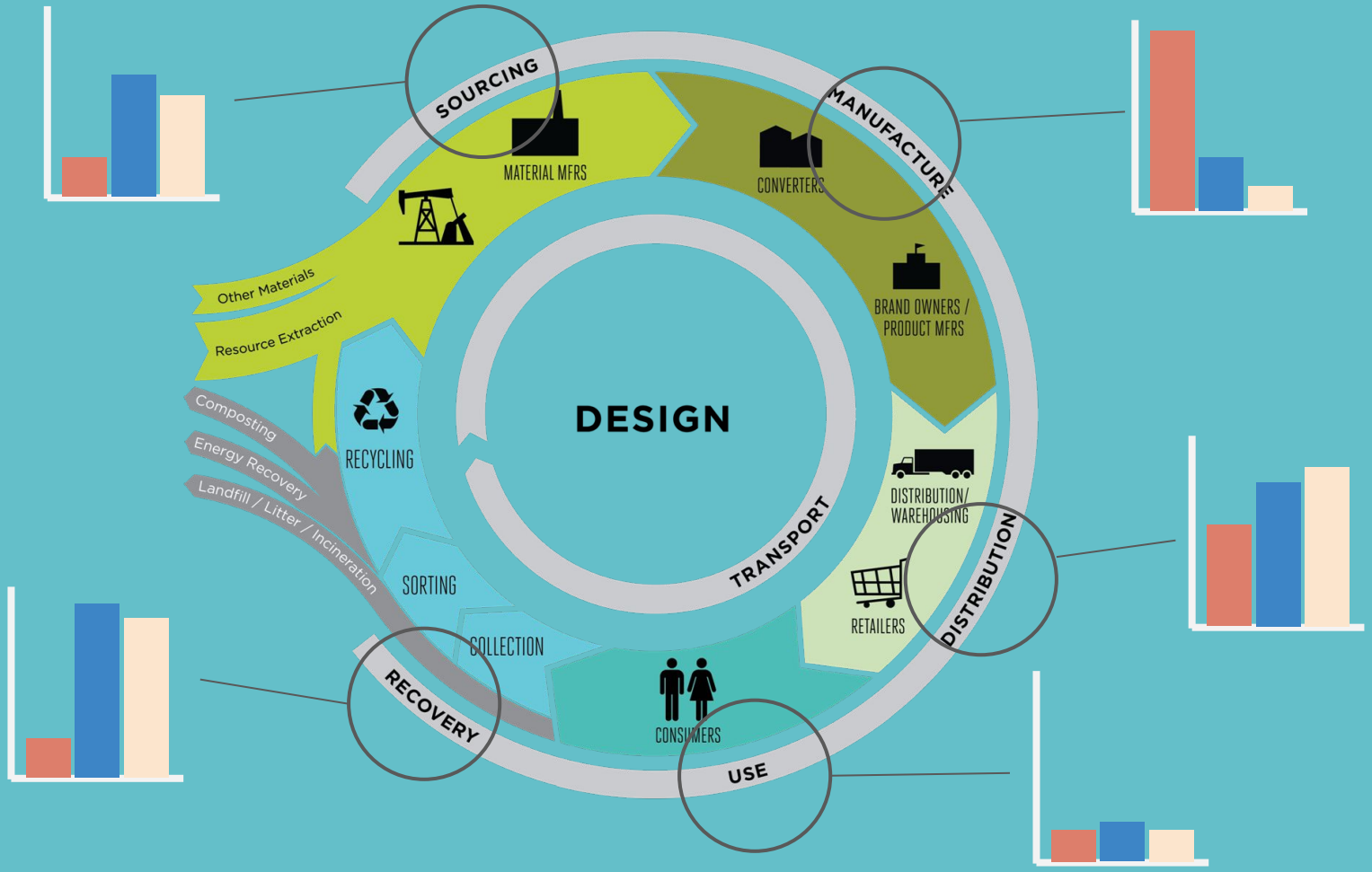
...but it uses a lot of material!

How can we evaluate those trade-offs?

What has the least net environmental impact?

How can we take a holistic view?

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MATERIAL MFRS
MANUFACTURE
CONVERTERS
BRAND OWNERS / PRODUCT MFRS
DISTRIBUTION/ WAREHOUSING
DISTRIBUTION
RETAILERS
TRANSPORT
USE
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RECOVERY
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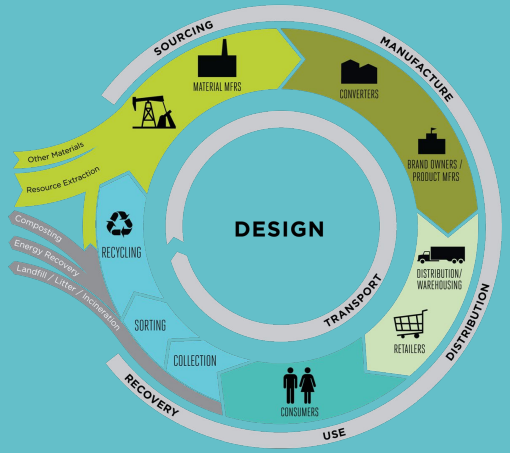
SORTING
RECYCLING
Other Materials
Resource Extraction
Composting
Energy Recovery
Landfill / Litter / Incineration
DESIGN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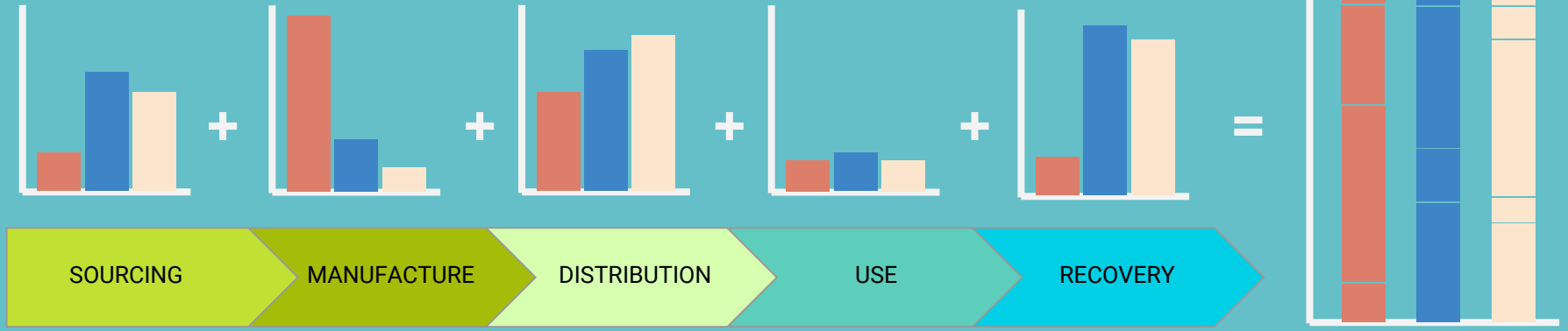
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MANUFACTURE
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USE
RECOVERY

Particulate emissions

Acidification potential

Water consumption

Solid waste generation

Carbon footprint

Fossil fuel consumption

Aquatic toxicity

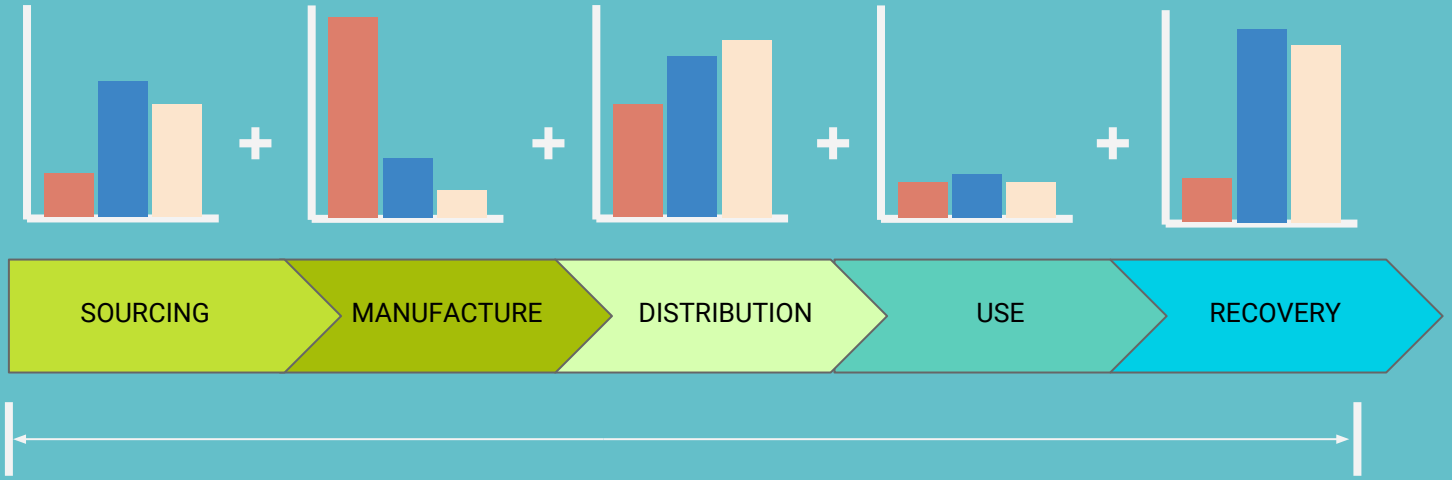
Eutrophication potential

Human toxicity

Cumulative energy demand

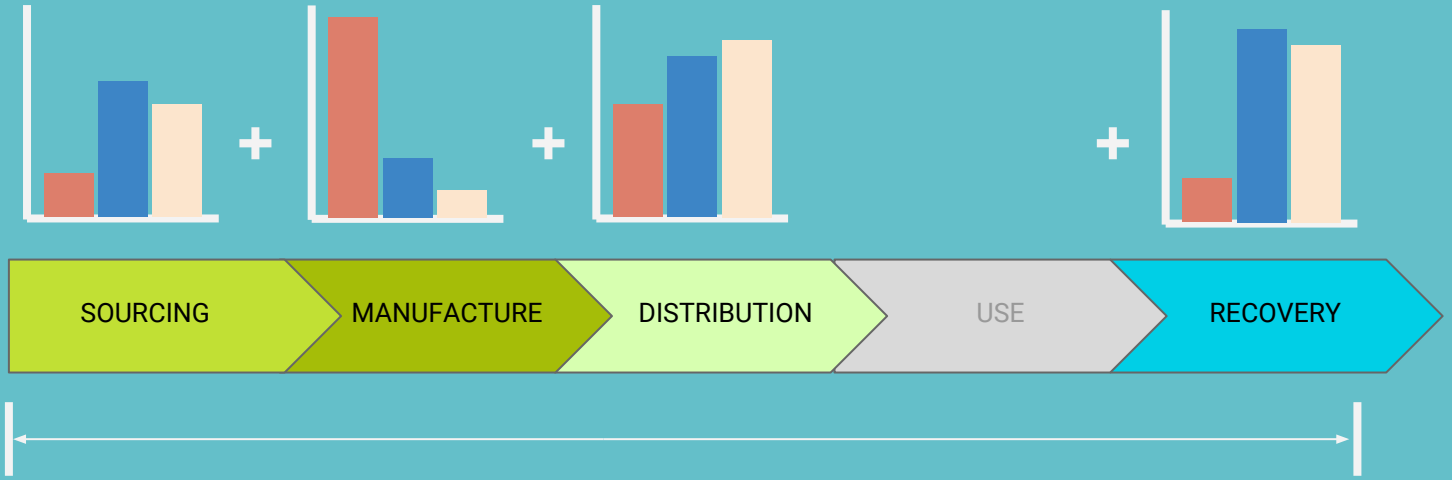
Non-fossil resource consumption

Boundaries depend on the question being asked



cradle-to-grave

Boundaries depend on the question being asked



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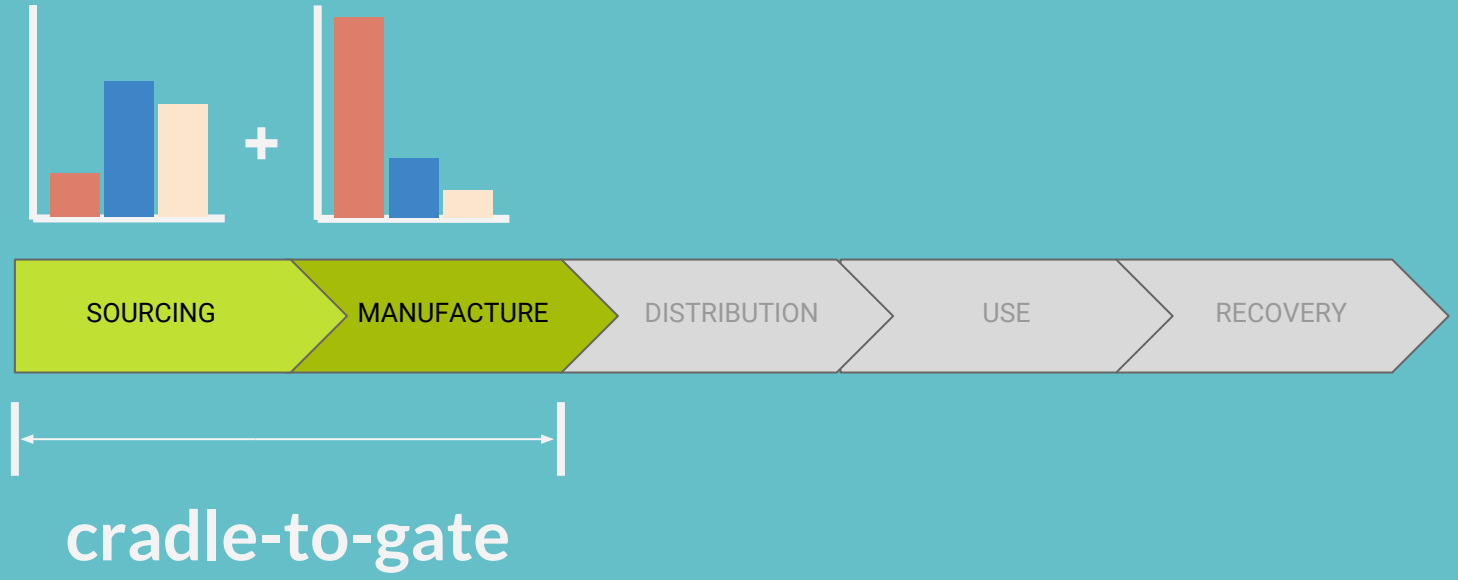


You’re in charge of packaging for a brand of coffee.

You have two options.

Option A

Uses 25%
recycled content

Has a recycling
rate of 73%

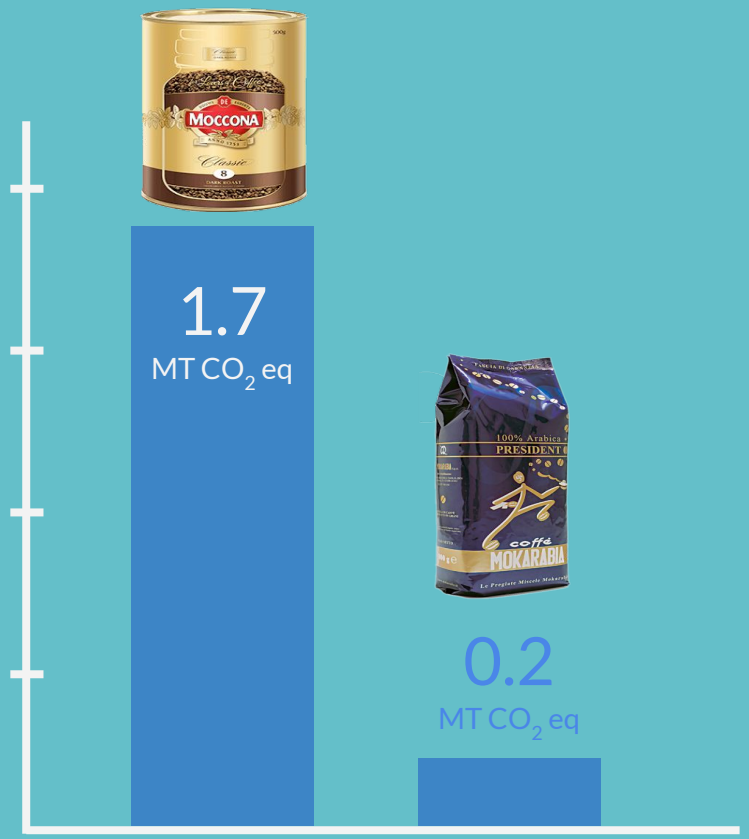
Option B

Uses 0%
recycled content

Has a recycling
rate of 0%

Option A

Option B



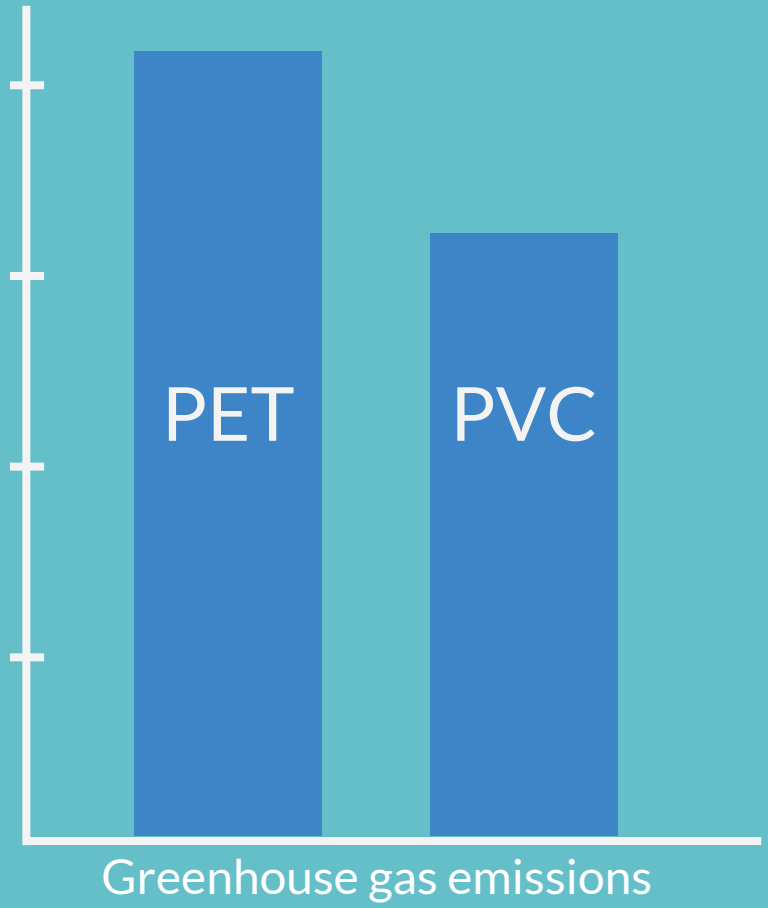
The steel can has more *circular economy* characteristics, but it is significantly more GHG intensive.

You're in charge of packaging for a new product.

You have two options for the type of plastic.

This time, we don't want to blindly follow circular economy ideals. Let's base the decision on a comparative life cycle assessment.

Option B has a markedly lower carbon footprint.



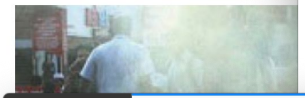
If you chose option B, you've chosen PVC !

PVC flex affects reproduction, growth of foetus: Suchitwa Mission

Dioxin also damages functionality of hor

Preshanth Kalanjoor

Jan 12, 2019, 02:59 PM IST



Why You Should Avoid PVC Products

Nicole D'Alessandro | Jun. 18, 2014 02:15PM EST

Tesco to ban non-recyclable plastic packaging by 2019

Target 'raises the bar' for fight against pollution, but campaigners say there is a need for the supermarket t on reducing its volume of packaging

@josh_gabbatiss | Wednesday 23 May 2018 17:30 | 12.5K shares |

Waste-to-Energy plants that use solid waste as feedstock pose threat to environment

WtE plants in India burn mixed waste. The presence of chlorinated hydrocarbons like PVC results in the release of dioxins and furans when the waste is burnt at less than 850 degree C. Appropriate filtering mechanisms need to be installed to control such dangerous emissions.

Written by Isher Judge Ahluwalia, Almitra Patel |
Updated: January 30, 2019 8:38:02 am

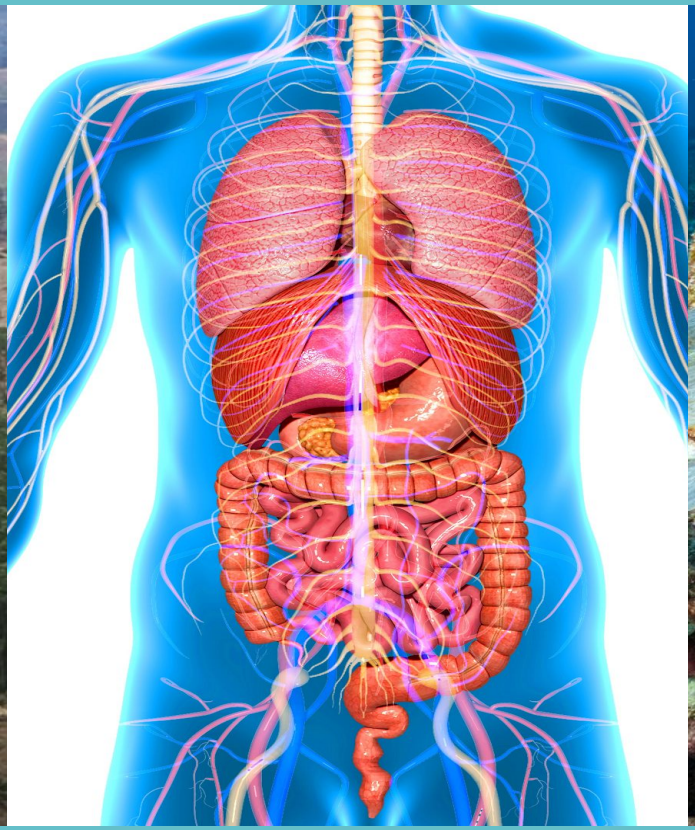
367 Shares

New Report Looks At The Adverse Health And Safety Impacts Of Plastic PVC Pipes

Center for Environmental Health Publishes "Our Health, PVC, and Critical Infrastructure"

News | November 6, 2018

Can subjects like land use, toxicity, and marine plastic pollution be described by singular metrics?



LCA's biggest limitation?

time

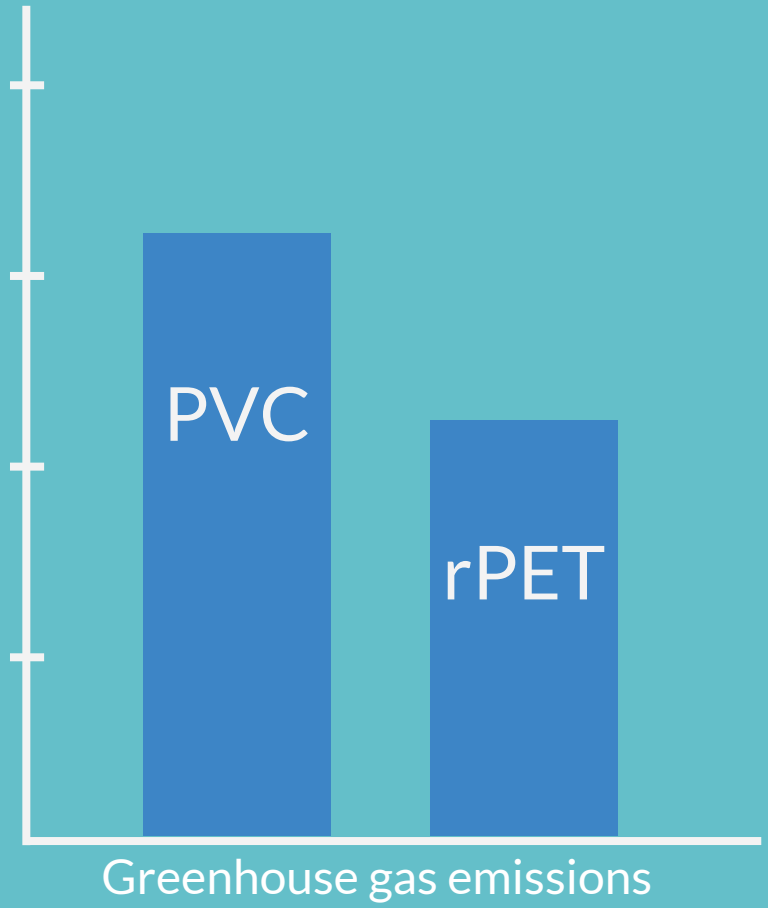
LCA estimates *some* indicators of environmental preferability within the current system *at the current time*.

It *cannot* tell us if we're creating a system that can be indefinitely sustained in the future.

A system that can
be indefinitely sustained
requires low life cycle impacts
and circularity.

The good news?

Circularity *almost always* decreases life cycle impacts like carbon footprint



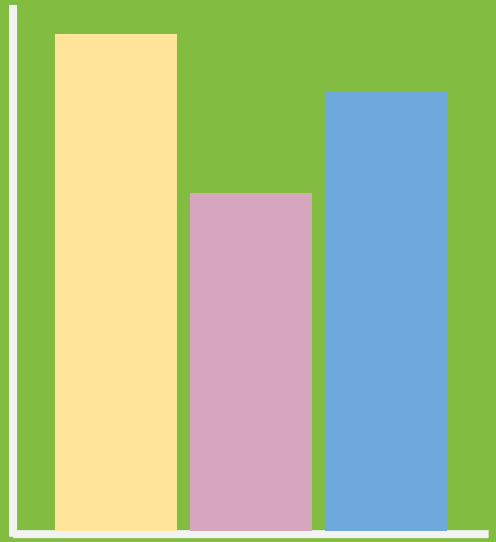
Now if you choose option B, you've chosen 100% recycled PET !

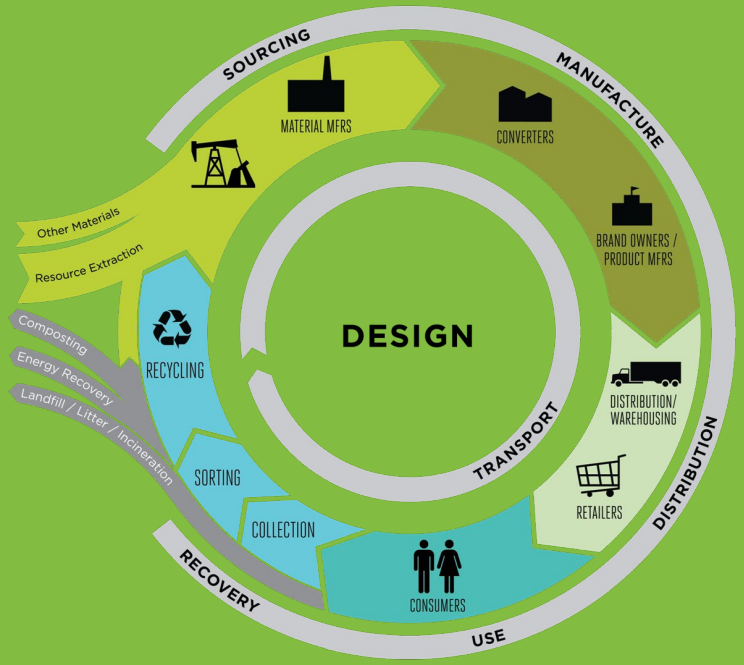
From the Oregon DEQ's publication *The Significance of Environmental Attributes as Indicators of the Life Cycle Environmental Impacts of Packaging and Food Service Ware:*

"**materials with recycled content generally have lower environmental impacts than producing the same materials from primary feedstocks.**"

i.e. *don't* switch from material A to material B just because material B has more recycled content, but *do* use as much recycled content as possible once a material has been chosen.

RECYCLING

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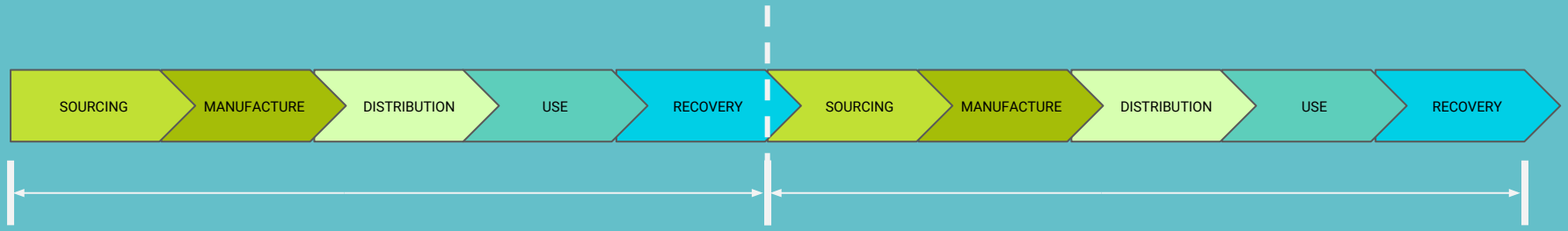
Recycling has two major effects on life cycle impacts

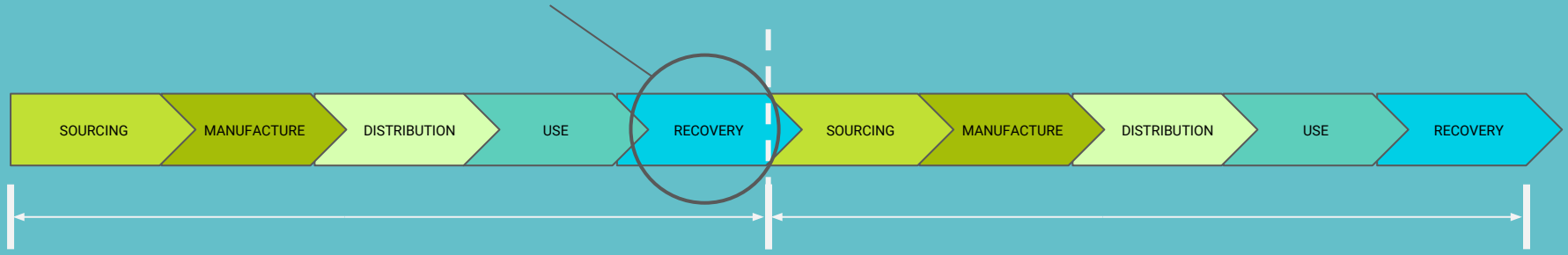


“current” life cycle

“next” life cycle

Recycling has two major effects on life cycle impacts

Impacts (and benefits) from landfilling and incineration are avoided.



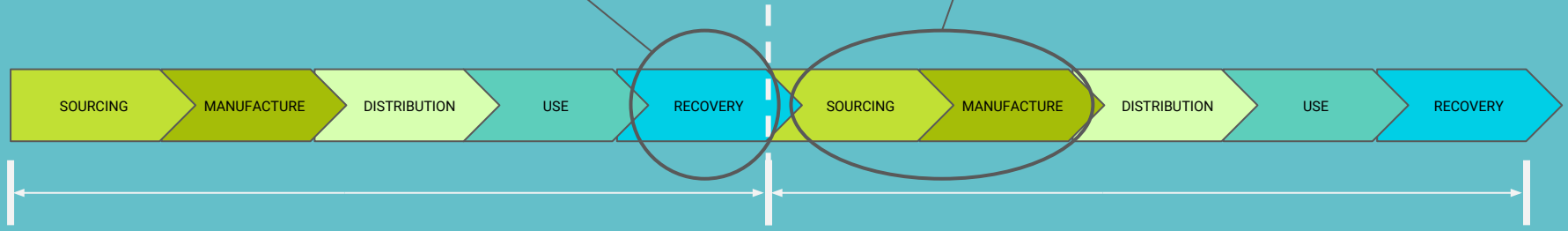
“current” life cycle

“next” life cycle

Recycling has two major effects on life cycle impacts

Impacts (and benefits) from landfilling and incineration are avoided.

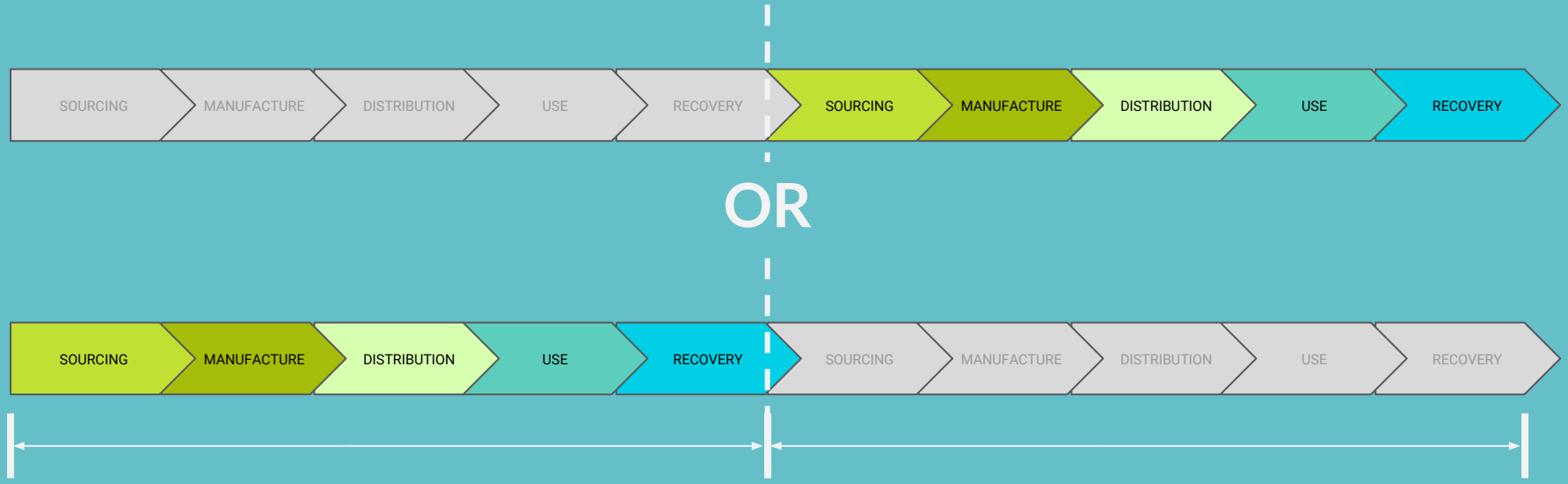
Impacts (and benefits) from extracting and manufacturing with virgin feedstocks are avoided.



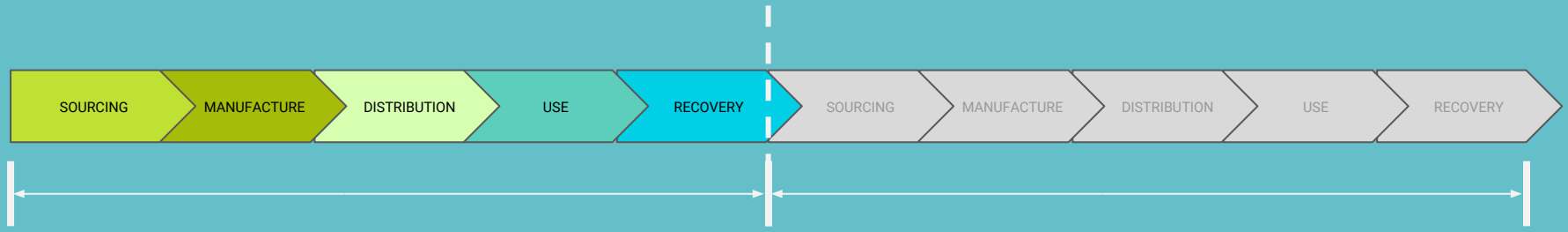
“current” life cycle

“next” life cycle

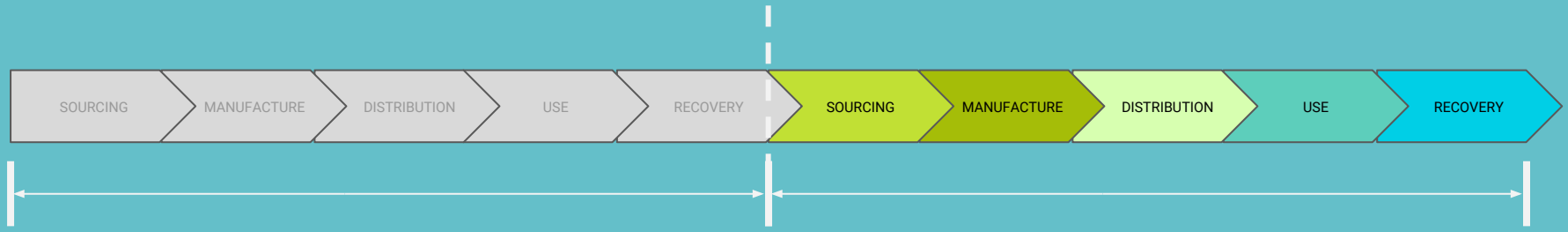
Conventional LCA boundaries exclude one of the “two” life cycles impacted by recycling.



Recycling enables the “next” product to be manufactured with recycled content, but those impact reductions don’t get attributed to the item being recycled.



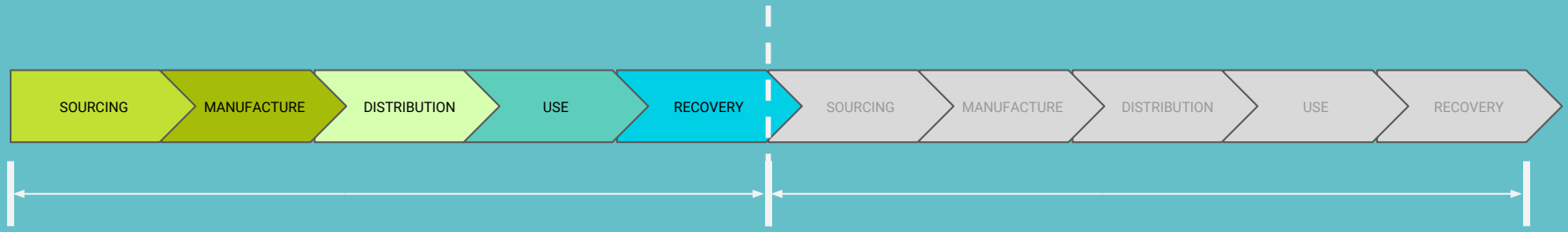
Manufacturing with recycled content enables the "previous" product to be recycled, but those impact reductions don't get attributed to the item manufactured with recycled content.



"current" life cycle

"next" life cycle

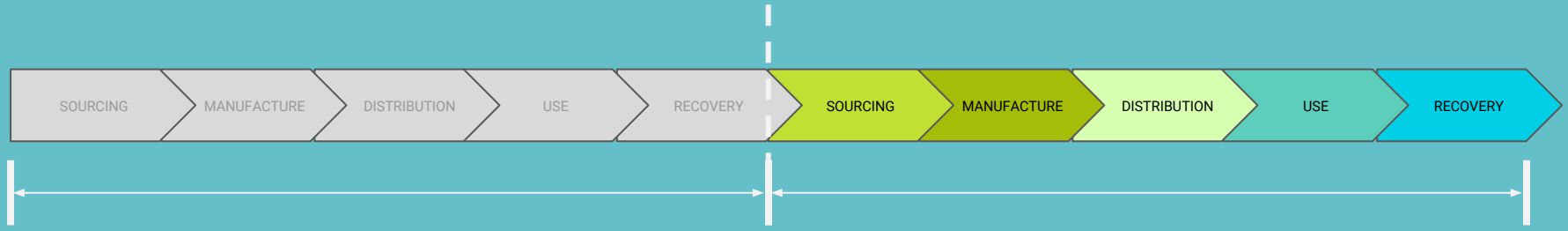
How to make plastic recycling look bad



“current” life cycle

“next” life cycle

How to make paper recycling look bad

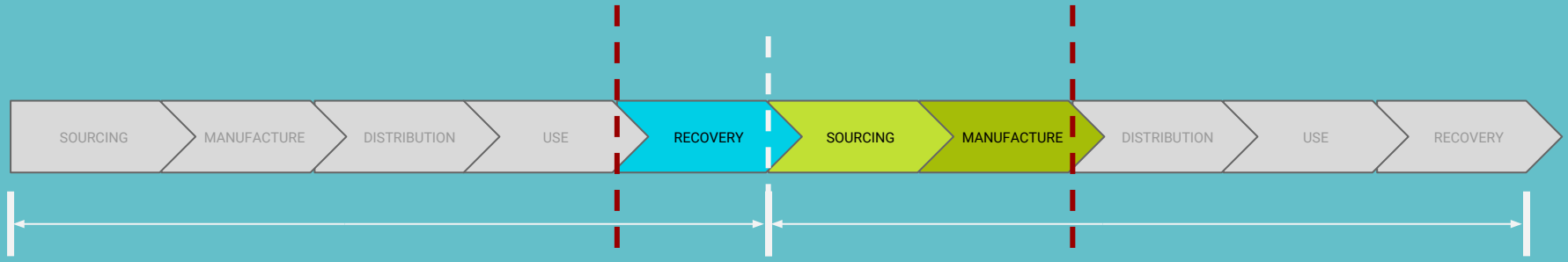


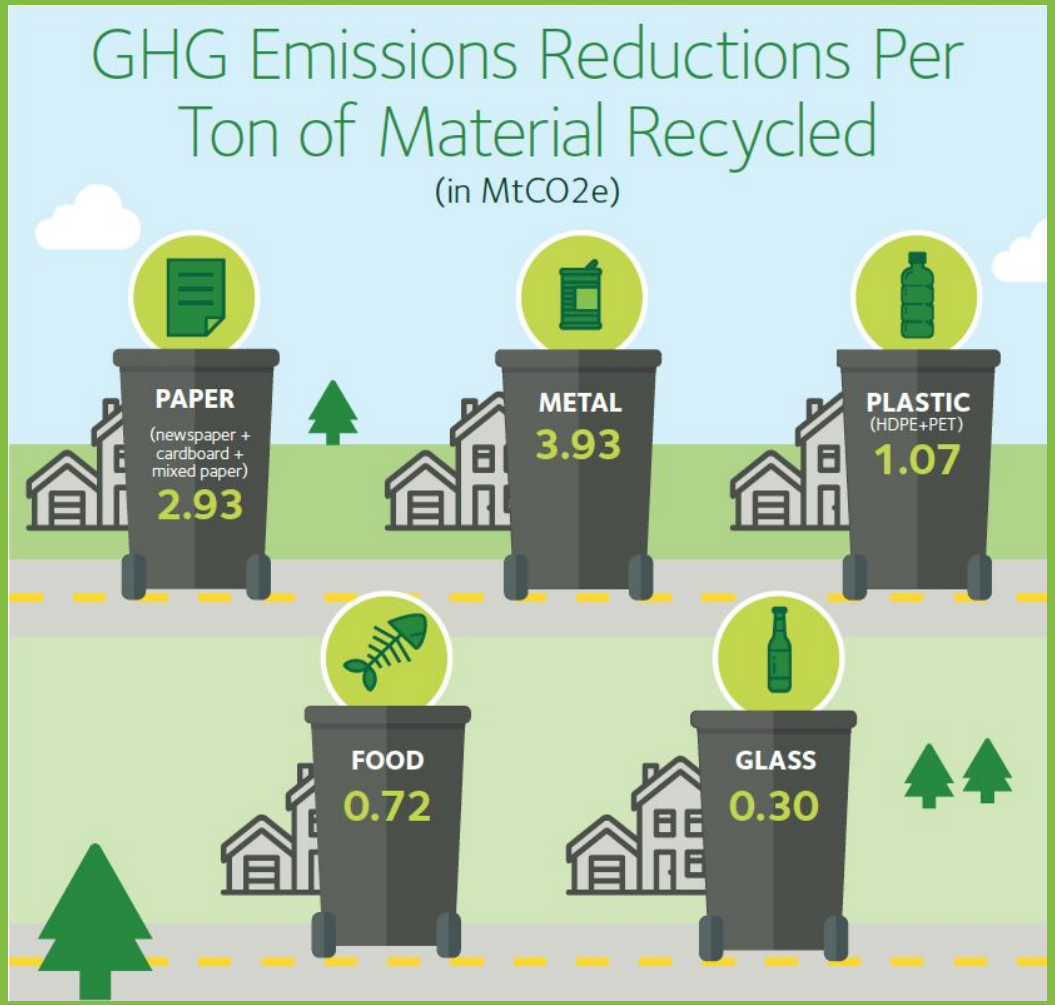
“current” life cycle

“next” life cycle

The EPA WARM tool uses boundaries that are appropriate for the question “what happens if we change an end-of-life pathway?”

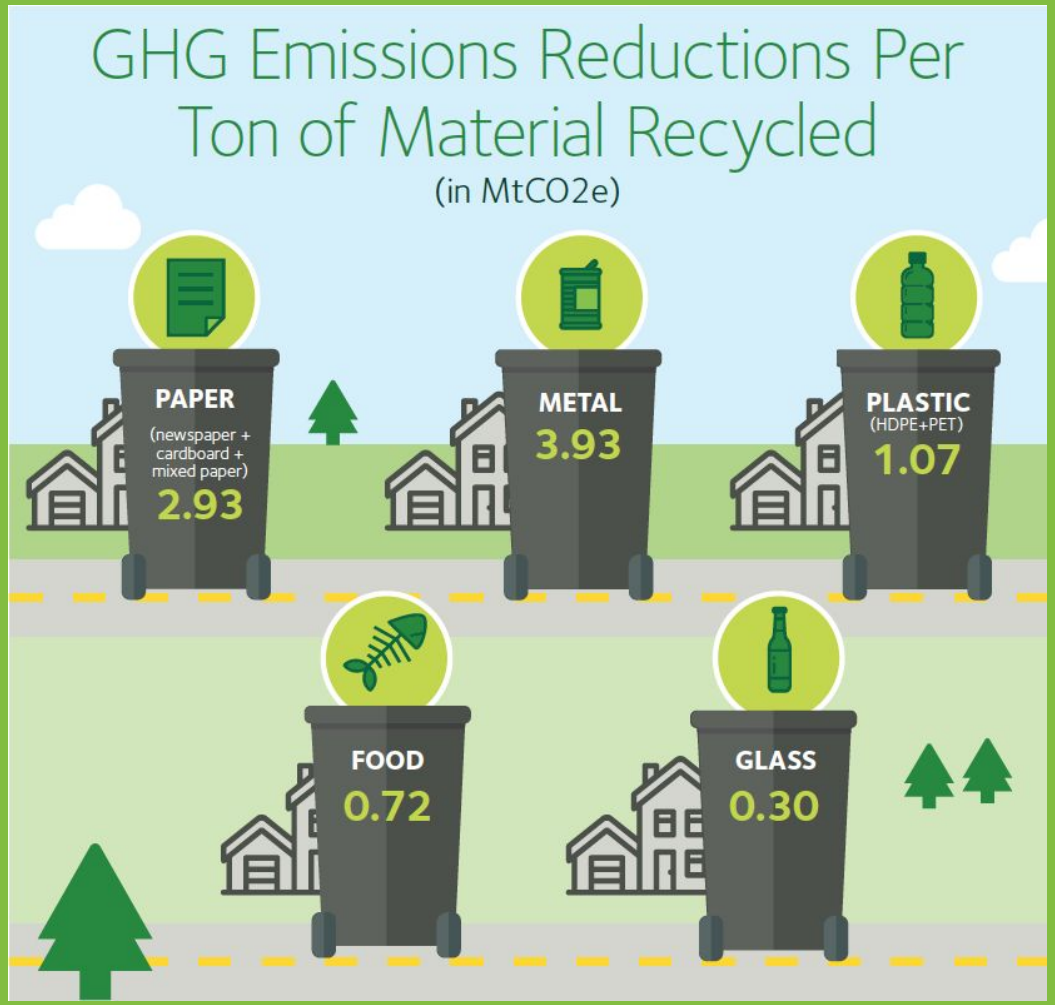
(e.g. “what happens if this gets recycled?”)





Waste Management, 2016 Sustainability Report

WARM can be used to get a common sense view of the greenhouse gas emission reductions from recycling different materials.



Waste Management, 2016 Sustainability Report

WARM can be used to get a common sense view of the greenhouse gas emission reductions from recycling different materials.

But should recycling decisions be based solely on LCA?

WARM tells us that *recycling **ANY** material results in a reduction of greenhouse gas emissions.*

So while this type of thinking may be useful to *prioritize* recycling of certain materials, it should not be used to justify recycling less.

More tons recycled = more GHG emissions avoided

From HB 1795:

"Washington should reset its recycling agenda and move away from arbitrary waste diversion and recycling goals and emphasize quality recycling that prioritizes recycling that offers significant economic and environmental benefits over the quantity of waste diverted"

Are weight-based diversion and recycling goals truly "arbitrary"?

Does translating tons of waste to tons of GHG emissions truly tell us about "environmental benefits"?

What are the “environmental benefits” of recycling?

Reducing the use of landfills?

Conserving resources?

Enabling a more circular economy for its own sake?

Reducing greenhouse gas emissions?

What about reducing water consumption, toxicity, particulate emissions, energy usage, etc?

All of the above?

Key Takeaways

- LCA is the only way we can learn about “invisible” environmental characteristics like GHG emissions.
- LCA can show us a plethora of different environmental indicators - it can’t tell us which one is most important.
- The analysis boundaries matter!
- LCA is temporally limited. It gives us a snapshot in time.

Key Takeaways

- LCA can help avoid unintended consequences of decisions.
- LCA can introduce unintended consequences when relied on too heavily.
- LCA is extraordinarily sophisticated, and still an imperfect science.
- Sustainability is science + art + philosophy.
- Don’t feel bad for liking circular economy principles because they’re easier to understand!