



# Environmental Performance of Recycling based on Life Cycle Assessment approaches

Joep Meijer

President of theRightenvironment

Chemical Engineer

10 year LCA Expert in EU

2 years in Austin



## Are you interested in ...

- the environmental benefits of products, services and policies
- finding most sustainable option where choices can be made
- Optimized environmental performance looking at different life cycle phases
- Optimized performance looking at different aspects of Sustainability
- Make informed choices with the best footprint?



# Life Cycle Assessment can...

- Determine the environmental benefits of products, services and policies
- Help find the most sustainable option where choices can be made
- Show synergy or trade-offs in different life cycle phases
- Show synergy or trade-offs in different aspects of Sustainability
- Can compare different solutions



# Life Cycle Thinking =

Making informed decisions

About the environmental performance

Looking at the entire life cycle



## What if the city/county/state

...would have a landfill ban on anything that can be reused, recycled, composted or incinerated?



My believe is that governments can create the conditions for a new segment of economy that will bring jobs, economic growth and creativity to the field of waste treatment



## What if the city/county/state

What would be the environmental condition that should go along with a landfill ban?

What about the following paradigm:

'Any plan for treatment of a waste should have an comparable or better environmental footprint than current ways to deal with it'





# What if the city/county/state

How would we measure this?  
What framework do we need?





# What is better?

## Primary

Depletion of resources

Land transformation

Processing

...

## Secondary materials

Collection

Logistics

Processing

...



# What is better?

It is a balancing act

What balance do we need?





# What is better?

We all know that:

- Recycling aluminum takes 10% of the energy to produce primary aluminum: 20 MJ/t vs. 200 MJ/t
- Recycling of many products is easy, but keeping the same quality is a challenge



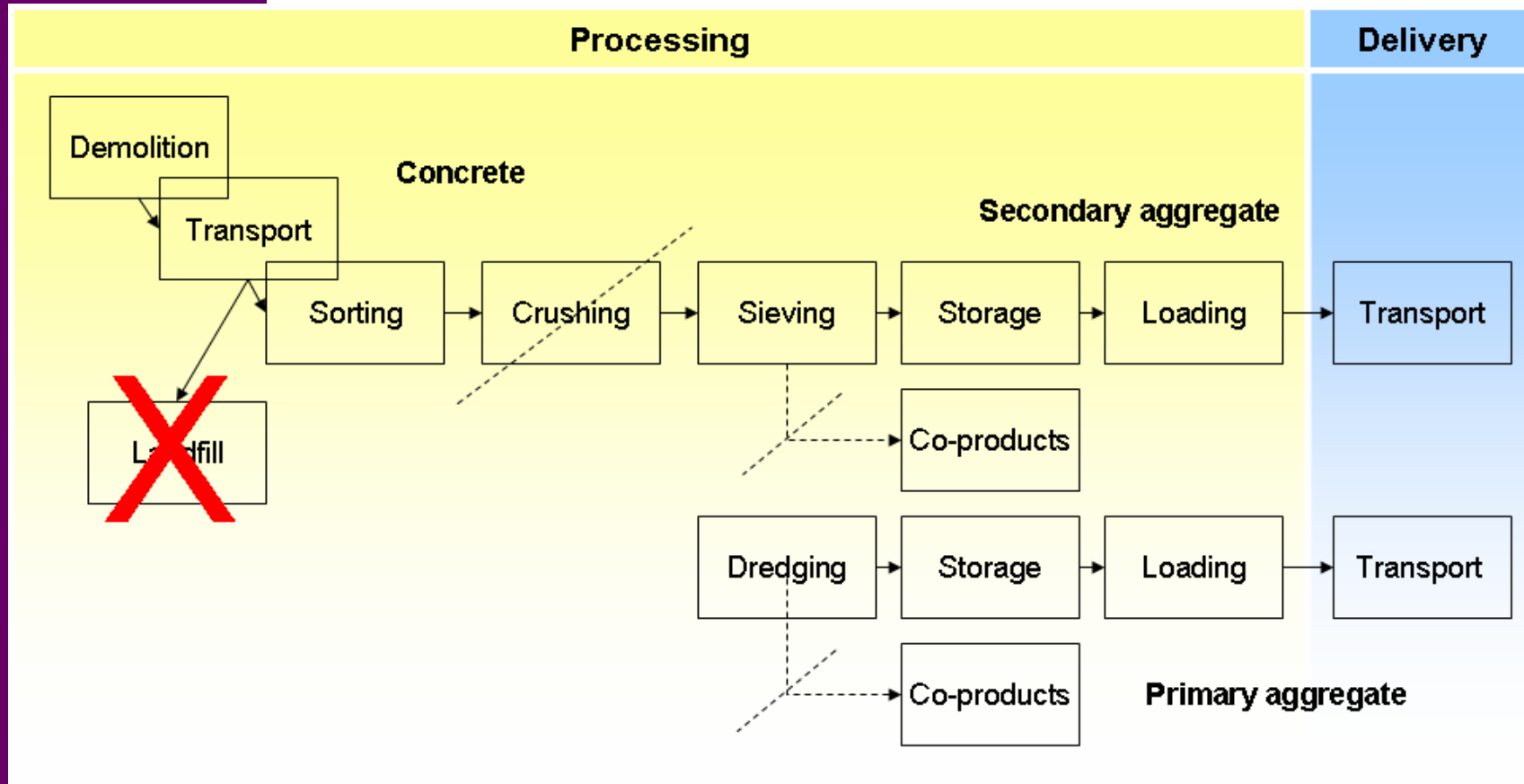
# What is better?

Points of attention from my experience

- The energy balance is not always positive
- A return and/or recycling system for each individual product does usually not make sense
- With pre-consumer waste recycling it is much easier to up-cycle in stead of down-cycle



# Example





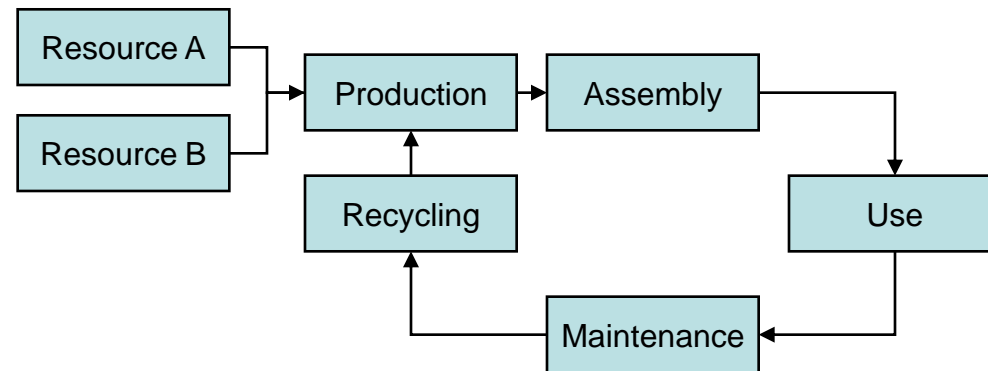
# How to assign “Sustainability value” to a recycling solution?



# Life cycle assessment (LCA)

LCA is a powerful tool for assessing the environmental performance of products, services or scenarios

It is based on material and energy flows for processes and materials that together form a life cycle





# Sustainability indicators

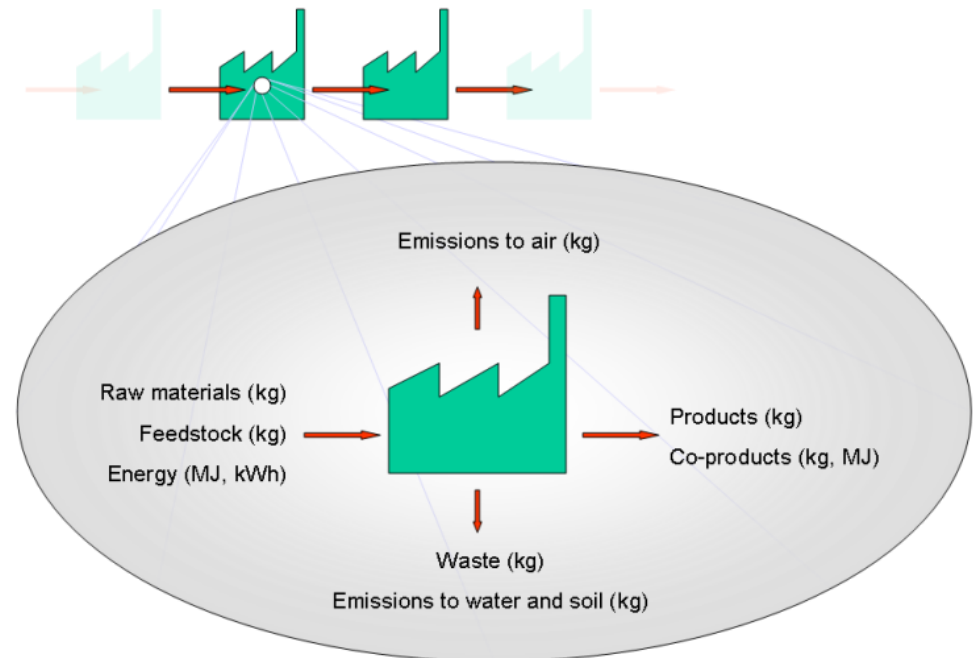
A range of impact categories can be distinguished

- Global warming
- Acidification
- Eutrophication
- Aquatic ecotoxicity
- Human toxicity
- Non-hazardous waste
- Water
- Depletion of non-renewables
- Depletion of the ozone layer
- Summersmog
- Terrestrial ecotoxicity
- Energy
- Hazardous waste



# Inventory

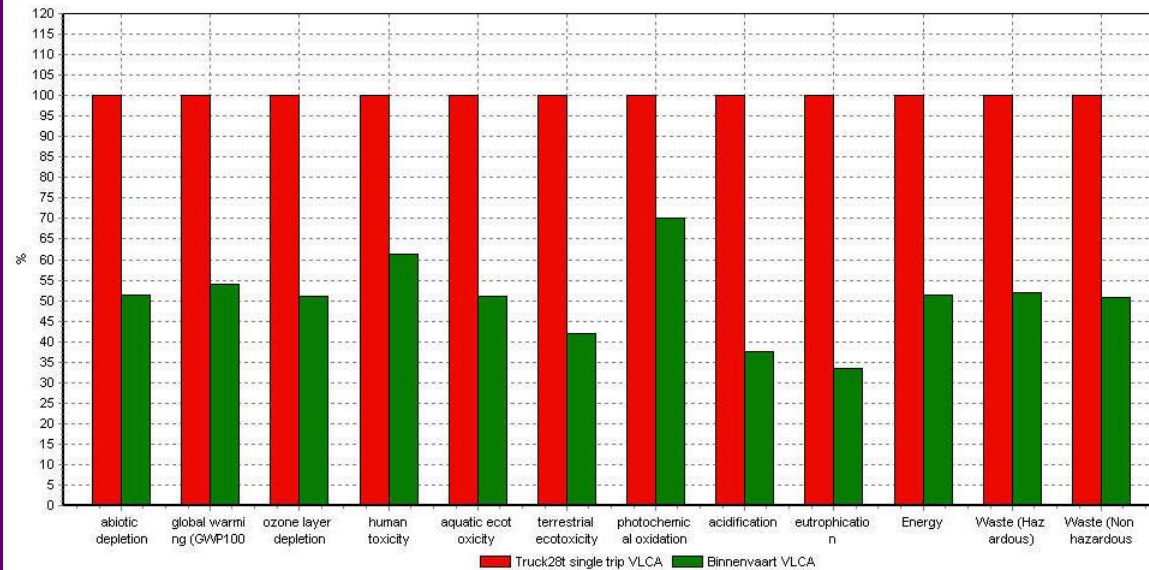
Incoming and outgoing material and energy flows for every process and material





# Impact Assessment

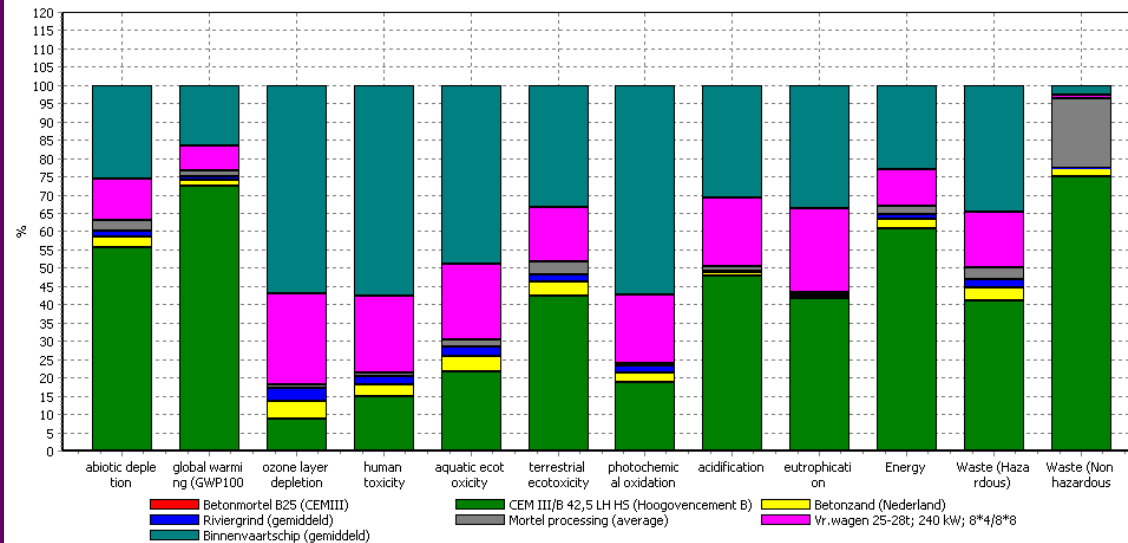
The result is an Environmental profile





# Interpretation

Major contributions give options for improvements





## A common framework

If we need to create a level playing field to make the right **decisions**, choose the right technology and define the right scale...

If we need to develop a methodology that goes with that, that will enable people to judge and **communicate**?

What **language** do we need to develop?

LCA takes us as far as science takes us



# Lessons

1. A framework to evaluate the sustainability of waste recycling options is useful. LCA can provide just that.
2. Not every waste stream needs to have its own waste recycling option. A certain scale (or pooling) is needed to beat logistical inefficiencies



# Environmental Performance of Recycling based on Life Cycle Assessment approaches

Joep Meijer

President of theRightenvironment

[joepmeijer@therightenvironment.net](mailto:joepmeijer@therightenvironment.net)

[www.therightenvironment.net](http://www.therightenvironment.net)