Bio-Plastics

A Unilever Perspective

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Unilever

Multinational fast moving consumer goods company

Increasing focus on developing markets, particularly S. and SE. Asia

Annual turnover ~ €40b, R%D spend ~ €1b

Unilever

end 2009

Unilever Sustainable Living Plan

HELP
1 BILLION
PEOPLE IMPROVE THEIR HEALTH &WELL-BEING

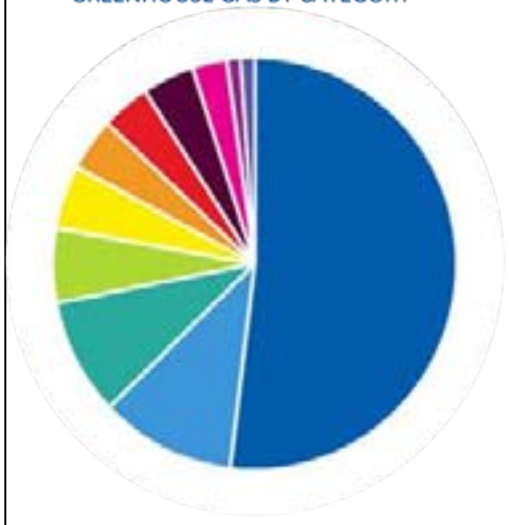
HALVE
ENVIRONMENTAL FOOTPRINT OF OUR PRODUCTS

SOURCE
100%
OF AGRICULTURAL RAW MATERIALS SUSTAINABLY

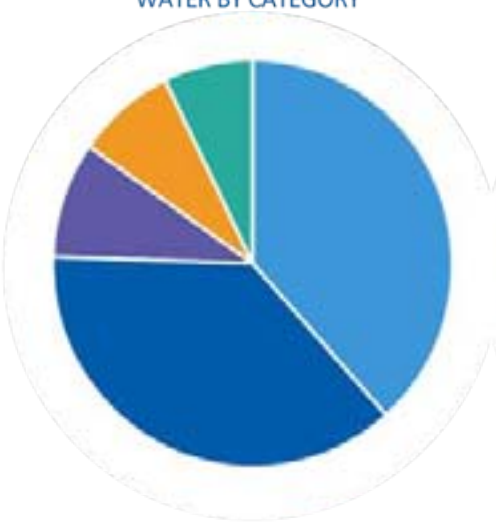
approach is cradle to cradle. taking responsibility across the whole value chain

Unilever Environmental Footprint

GREENHOUSE GAS BY CATEGORY



WATER BY CATEGORY



WASTE BY CATEGORY

- Soap, shower gel & skin care
- Laundry detergents & fabric conditioners
- Shampoo & conditioners
- Soups, sauces & stock cubes
- Tea & beverages
- Household cleaners
- Ice cream
- Margarine & spreads
- Mayonnaise, mustard & dressings
- Deodorants
- Toothpaste

Primary packaging 54%

\+

Secondary packaging 13%

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Leftovers 34%

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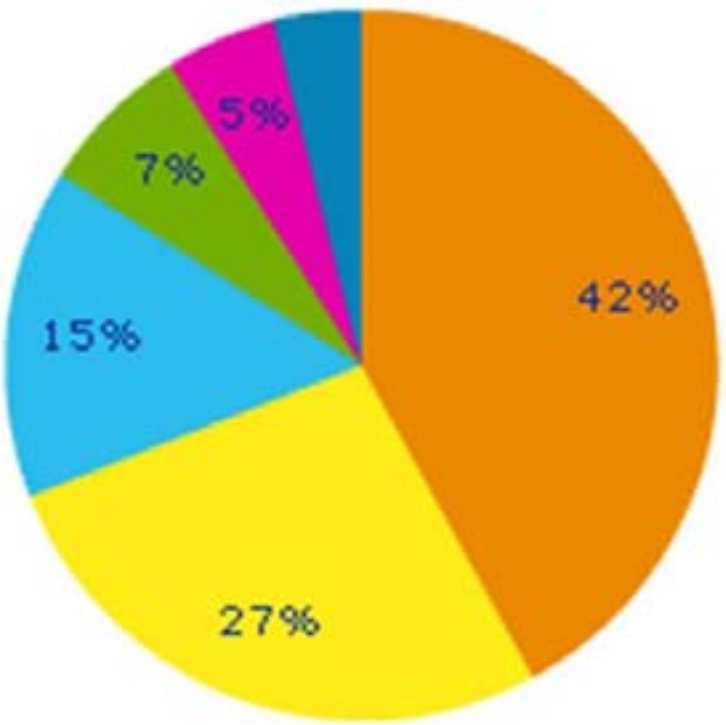
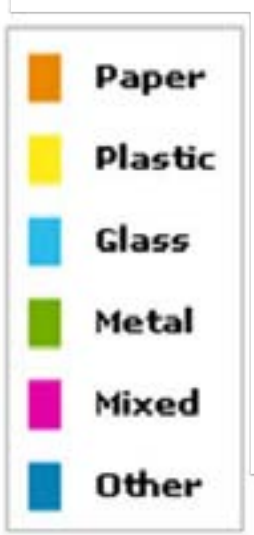
Est. national index of materials recycled, reused or recovered X%

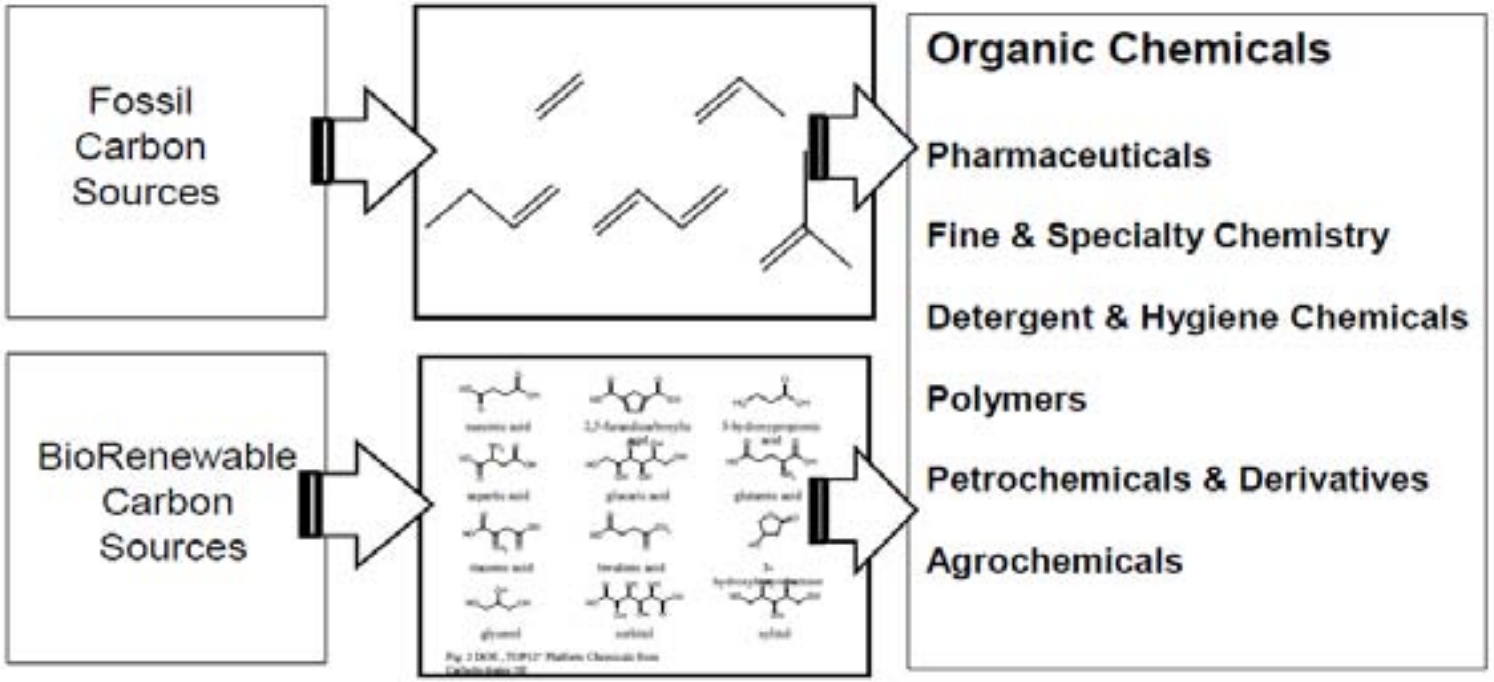
Unilever Packaging Usage





overall (2009): 2.4 million tonnes

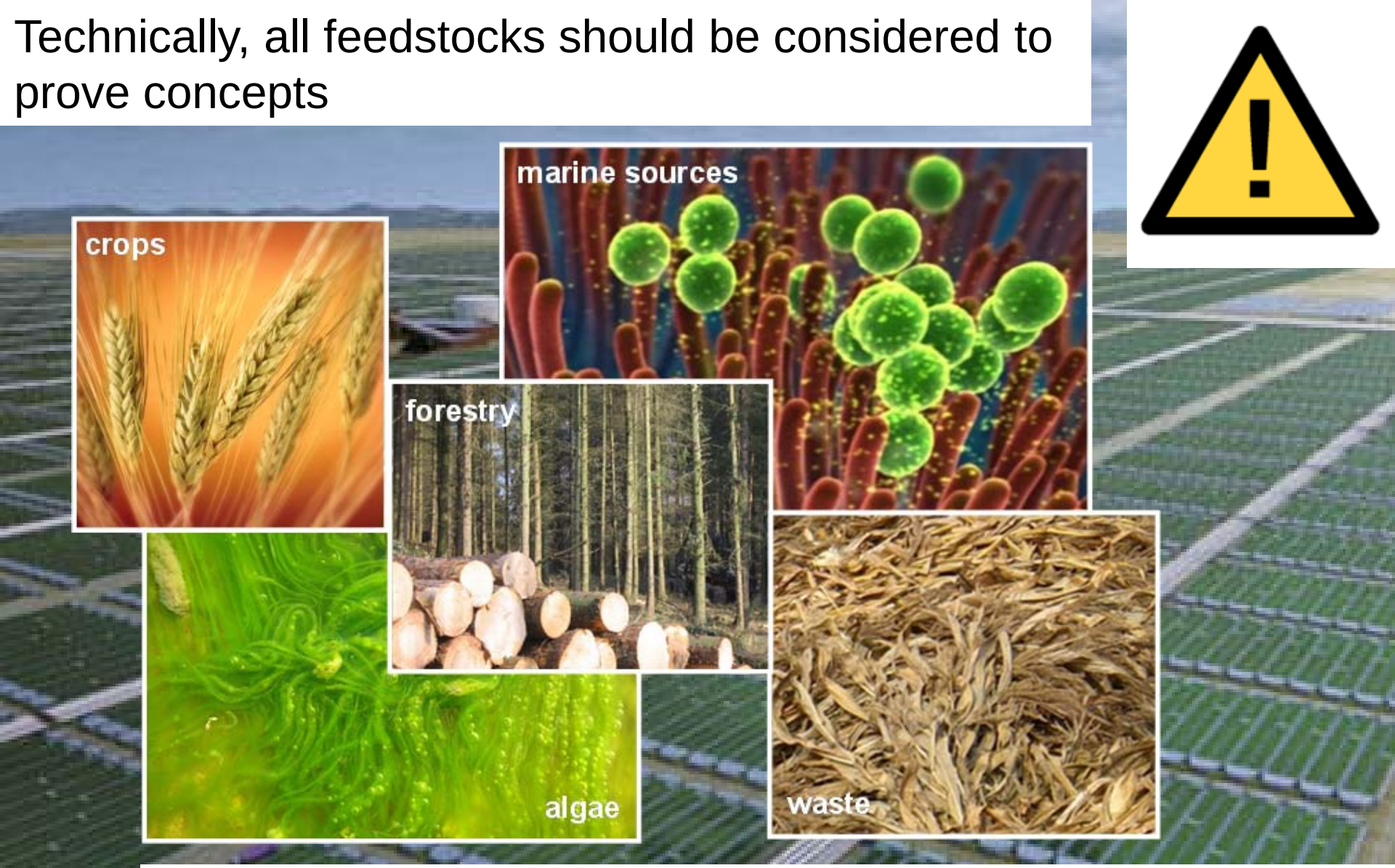
The Role of Bioplastics



Long term: Part of the transition to a society much less dependent on fossil fuel sources → sustainability and supply security

Short term: Where competitive they can be part of a hedging strategy against fossil derived materials → supply diversification

Technically, all feedstocks should be considered to prove concepts



Commercially, Unilever will not use feedstocks for plastics where there are negative consequences for food availability and prices

Bioplastics: Key Considerations

technical performance

cradle-to-cradle LCA approach

volume available

cost and margin/premium

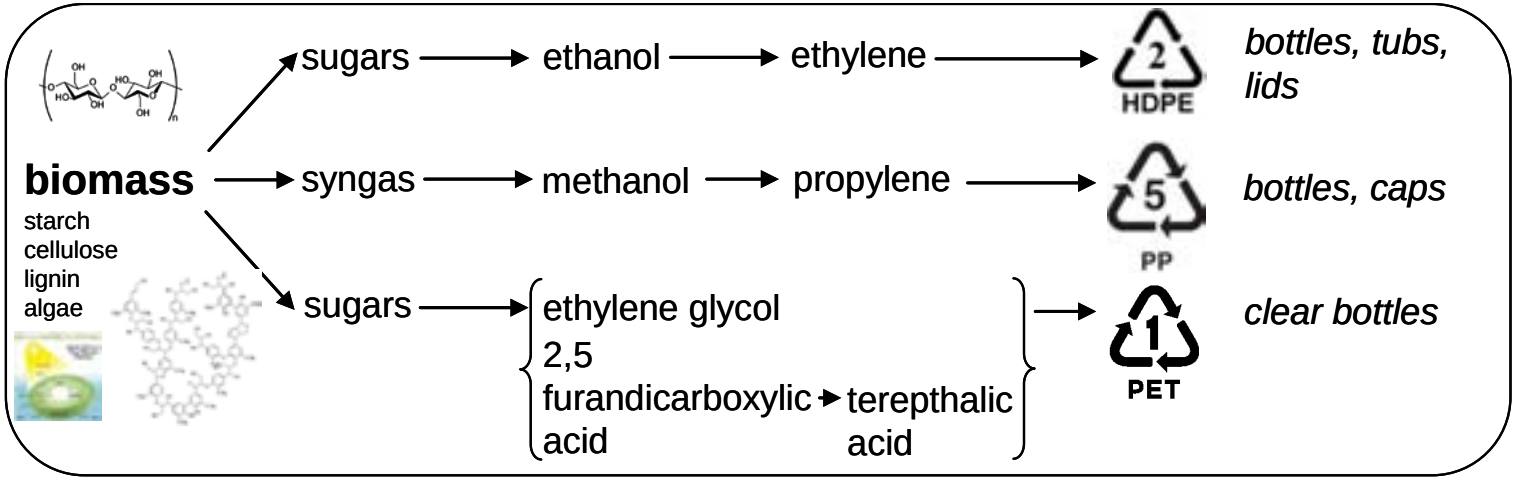
global or local supply

appropriate brand and CSR message

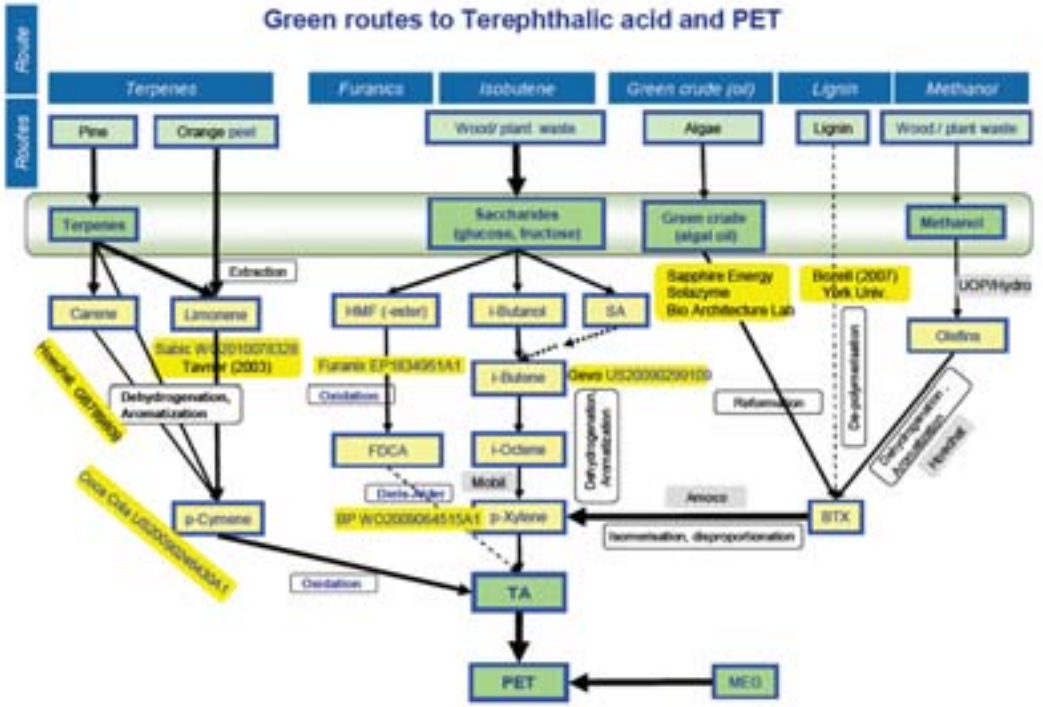
end-of-life scenarios

key opinion formers

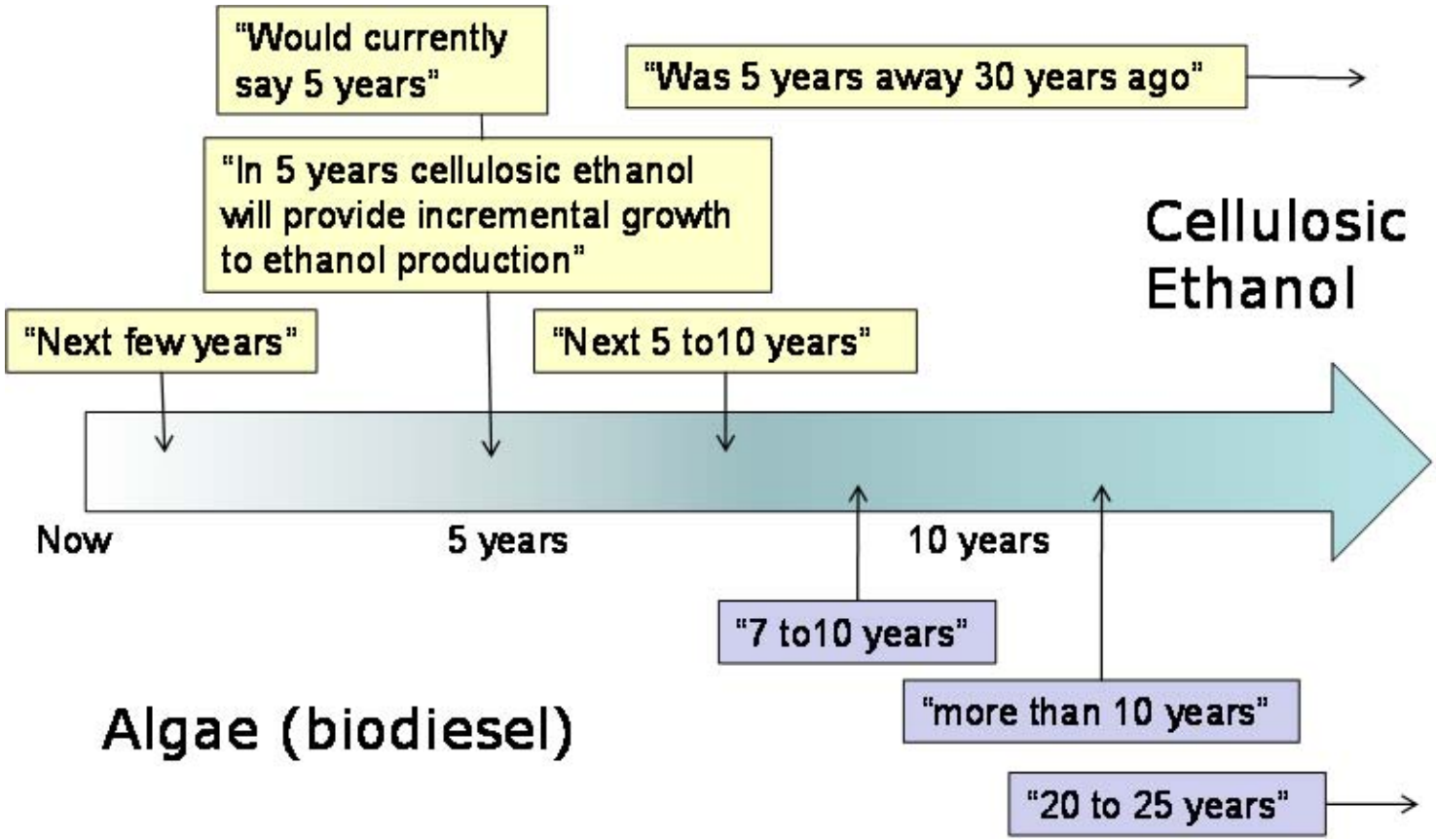
Materials



Companies like Unilever are well aware of, and in some cases actively developing, bio-based solutions for packaging (and formulation) materials

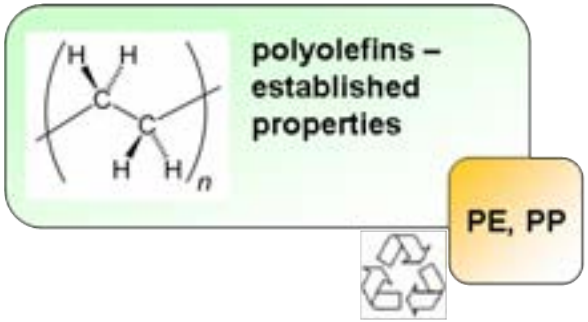


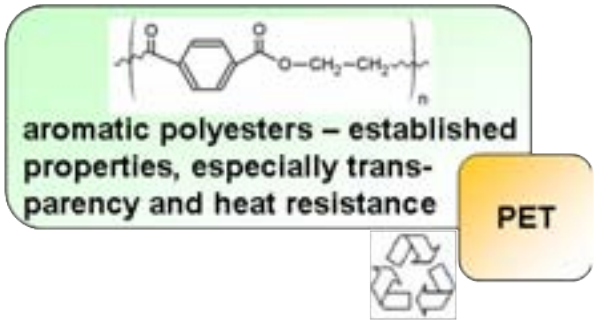
Materials Development

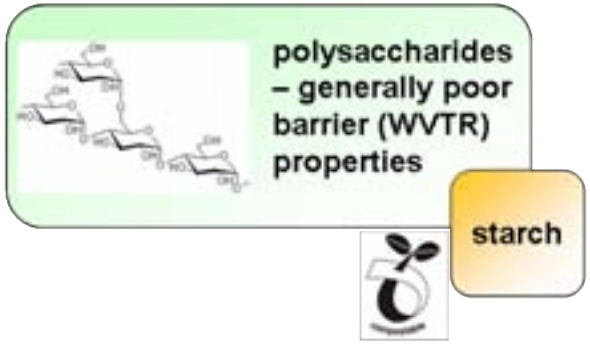


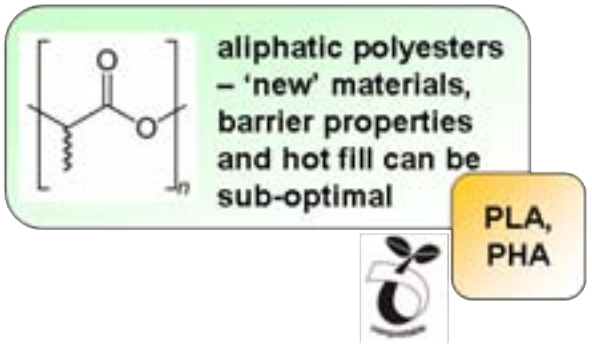
Development is needed – existing materials may be a short-term bridging solution but not a long-term choice

Technical Performance









Bottles: mechanical, hot fill and barrier → PE, PP, PET preferred

Sachets, pouches, mixed materials: barrier → PE, PP, PET preferred for monomaterial packaging, other plastics possible for multilayer packaging

Specialty applications, e.g. teabags: heat sealability → PP preferred, PLA possible in some cases

Materials Replacement

	PE	PP	PET	PBT	PS	PVC	PA	PLA
Bio PE	✓✓	✗	✓	✓	✗	✗	✗	✓
Bio PP	✗	✓✓	✓	✓	✗	✗	✗	✓
Bio PET	✓	✓	✓✓	✓	✗	✗	✗	✓
Bio PBT	✗	✓	✓	✓✓	✗	✗	✓	✓
Bio PTT	✗	✓	✓✓	✓✓	✗	✗	✓✓	✓
Bio PA	✗	✗	✗	✗	✗	✗	✓✓	✗
PBS	✗	✓	✓	✓	✗	✗	✗	✓
PHA	✓	✓	✓	✗	✓	✓	✗	✗
PLA	✓	✓	✓	✗	✗	✗	✓	-

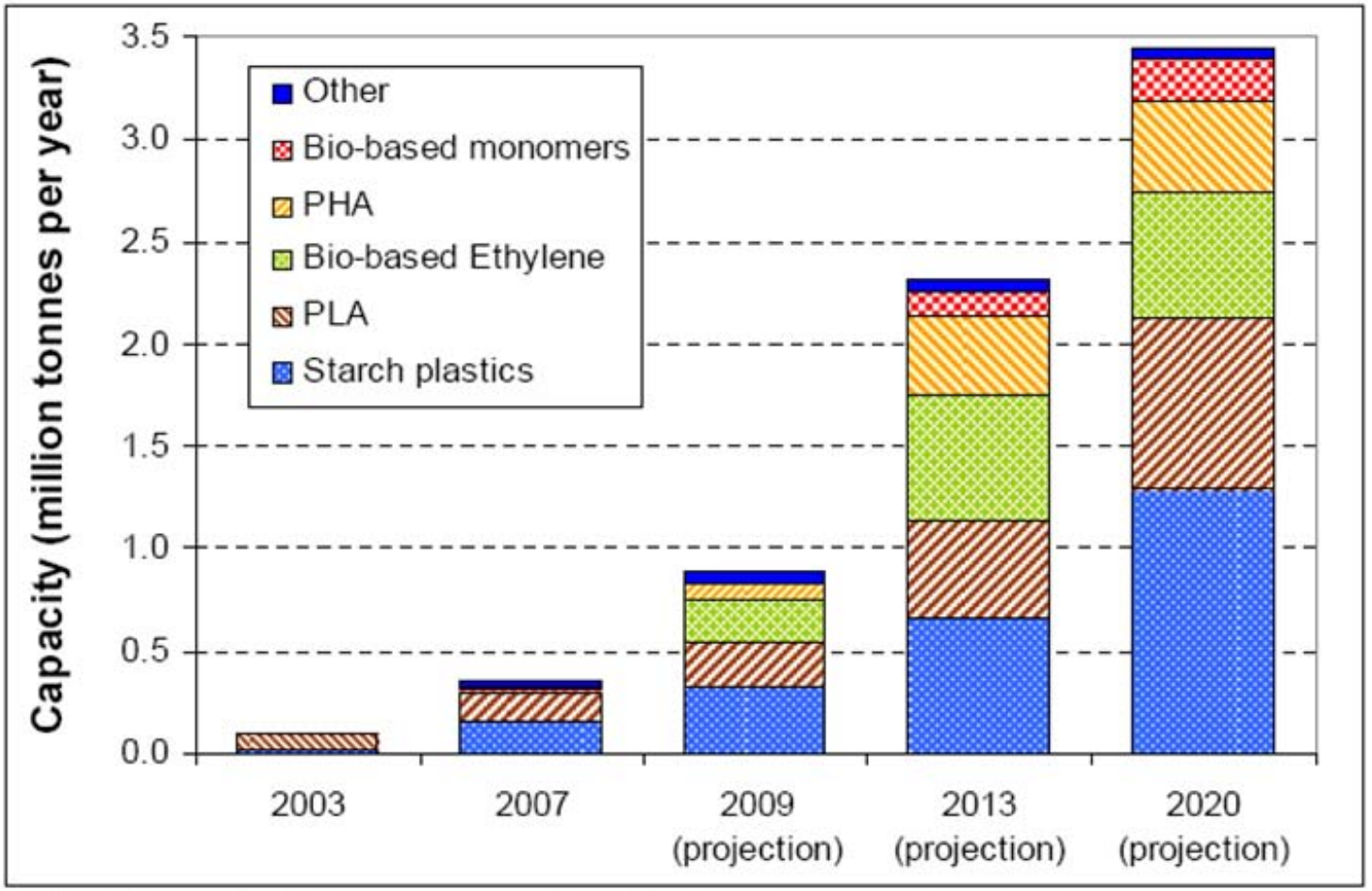
Realistic scope for substitution is limited when considering all aspects of performance: e.g. barrier properties, hot-fill, top-load etc.





Volumes Available

PROBIP 2009



Note: Category "other" includes cellulose films, PTT from bio-based 1,3-PDO, bio-based polyamide and PUR from bio-based polyols; category "Bio-based monomers" includes primarily bio-based epichlorohydrin.

Rapid growth in capacity but volumes still small within a 10 year timescale

Volumes Available

If any bioplastics were to replace bottles, tubs, lids and film Unilever would need

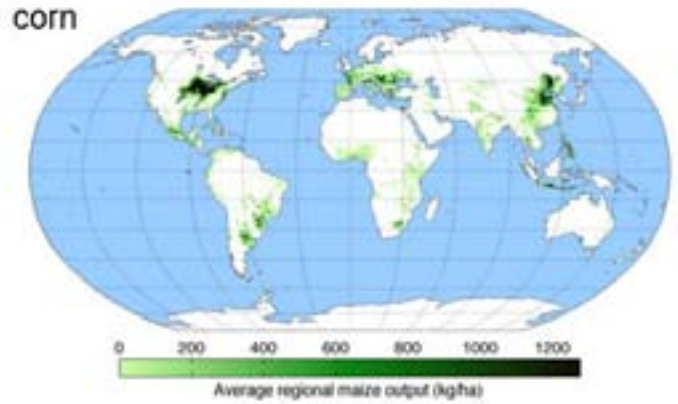
~ 500,000 tonnes per annum

If degradable bioplastics were to replace heat seal paper for tea bags Unilever would need

~ 10,000 tonnes per annum

Compare with supply projections → rapid saturation of niche applications, long-term growth possible for bulk replacement

Global Supply

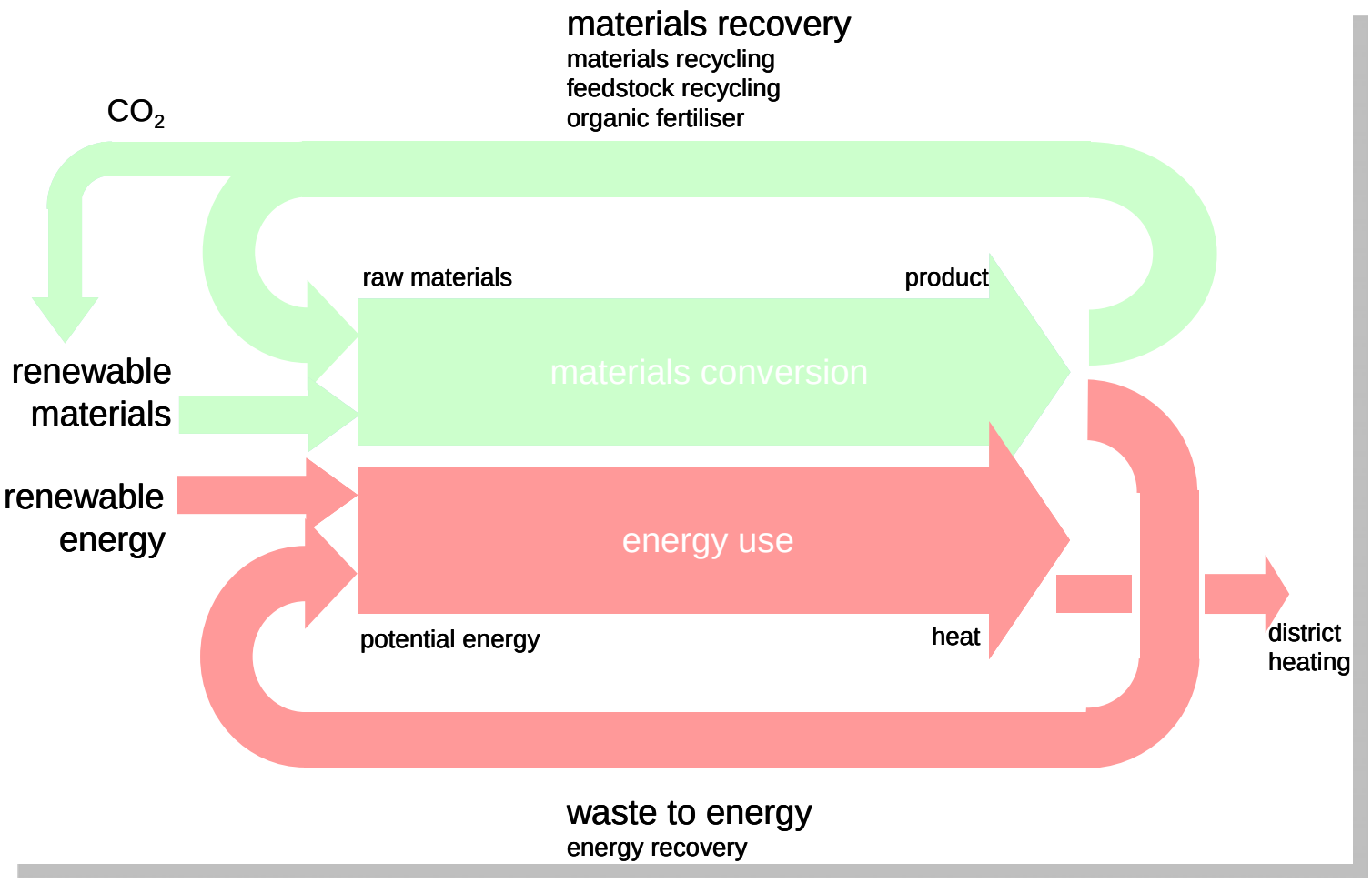


Economics dictate that bioplastics will most probably be made regionally for regional markets: extended relavant biomass supply chains do not exist

Feedstock availability and cost, combined with acceptability, will be a key determining factor for Unilever

A combination of factors suggests that plastics made from Brazilian sugar are likely to be the dominant bulk materials for some time

Life Cycle Analysis



Life Cycle Analysis

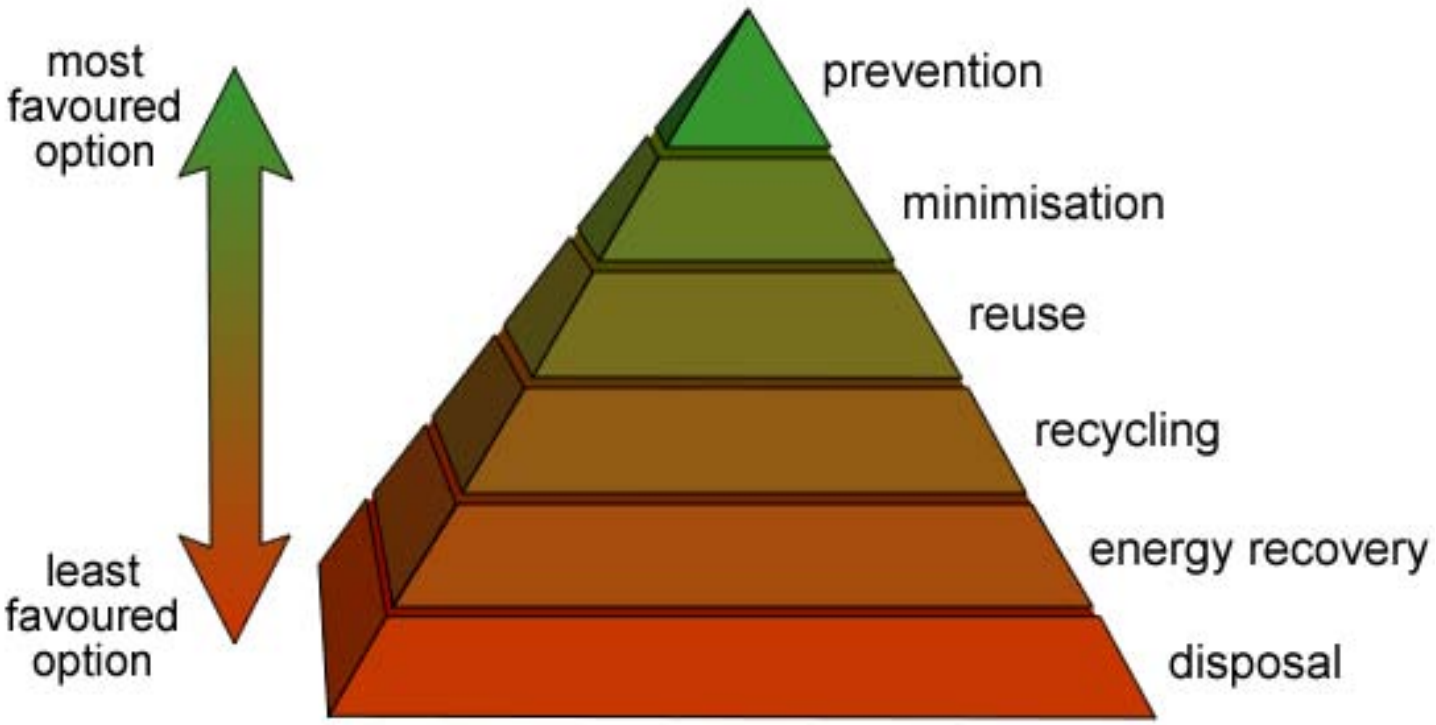
Detailed analysis necessary for all new materials

Bioplastics don’t always come out more favourably than fossil derived materials

Renewable is not the same as sustainable

it all depends on the agricultural practices

Waste Hierarchy



The primary concern for packaging materials is their fate at the end of life

End of Life Considerations

where anaerobic digestion exists, disposing of food waste and packaging in one stream is attractive

in countries with no municipal waste collection infrastructure, private collection can drive very high recycling rates of heavy items, e.g. bottles: bottle recycling is very much a preferred option in all geographies

pyrolysis and gasification are emerging as potential technologies for generating value from mixed waste

End of Life Considerations

mechanical recycling

collection limited to PET, PE, PP but best overall for environmental impact

energy/feedstock recovery

suitable for mixed plastics; chemical recycling and pyrolysis environmentally favourable

anaerobic digestion

suitable for biodegradable plastics; biogas recovery gives superiority to composting

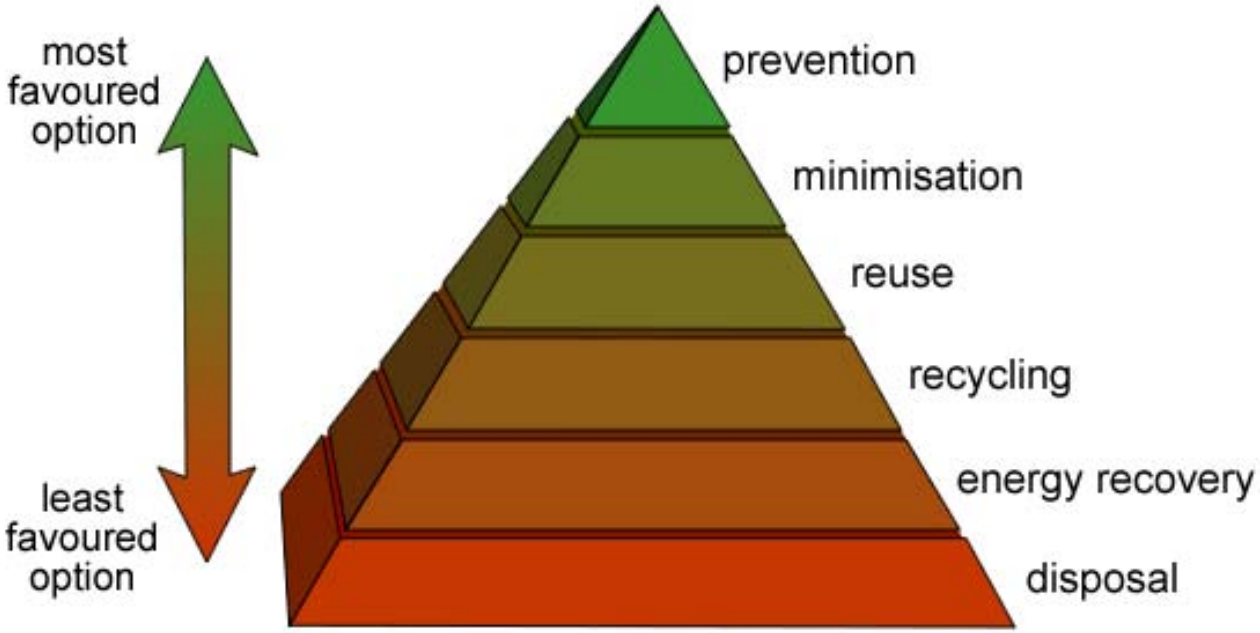
industrial composting

composting generally not advantageous regarding energy demand, resource depletion and release of gases

landfill

landfill has the worst environmental outcome in almost all cases

Bioplastics and the Waste Hierarchy

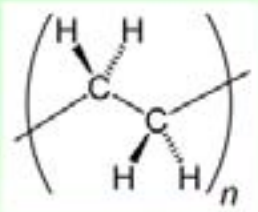


Bottles: can be materially recycled → PE, PP, PET preferred

Sachets, pouches, mixed materials: cannot be recycled → materials choice dependent on recovery infrastructure (WtE versus composting)

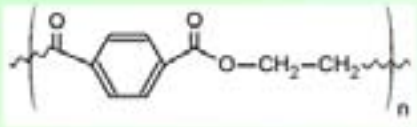
Specialty applications, e.g. teabags: home compostable materials needed

Material Costs



green PE ~ 1.4 x conventional PE

PE, PP

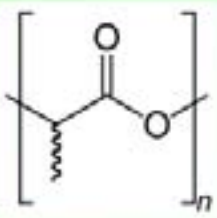


100% green PET not yet commercial

PET

starch bioplastics ~ 1.5-3 x conventional PE/PP

starch



starch bioplastics ~ 1.2-2 x conventional PET

PLA, PHA

Bioplastics are all significantly more expensive that conventional materials

Increased competition and volume must be encouraged

Feedstock Costs

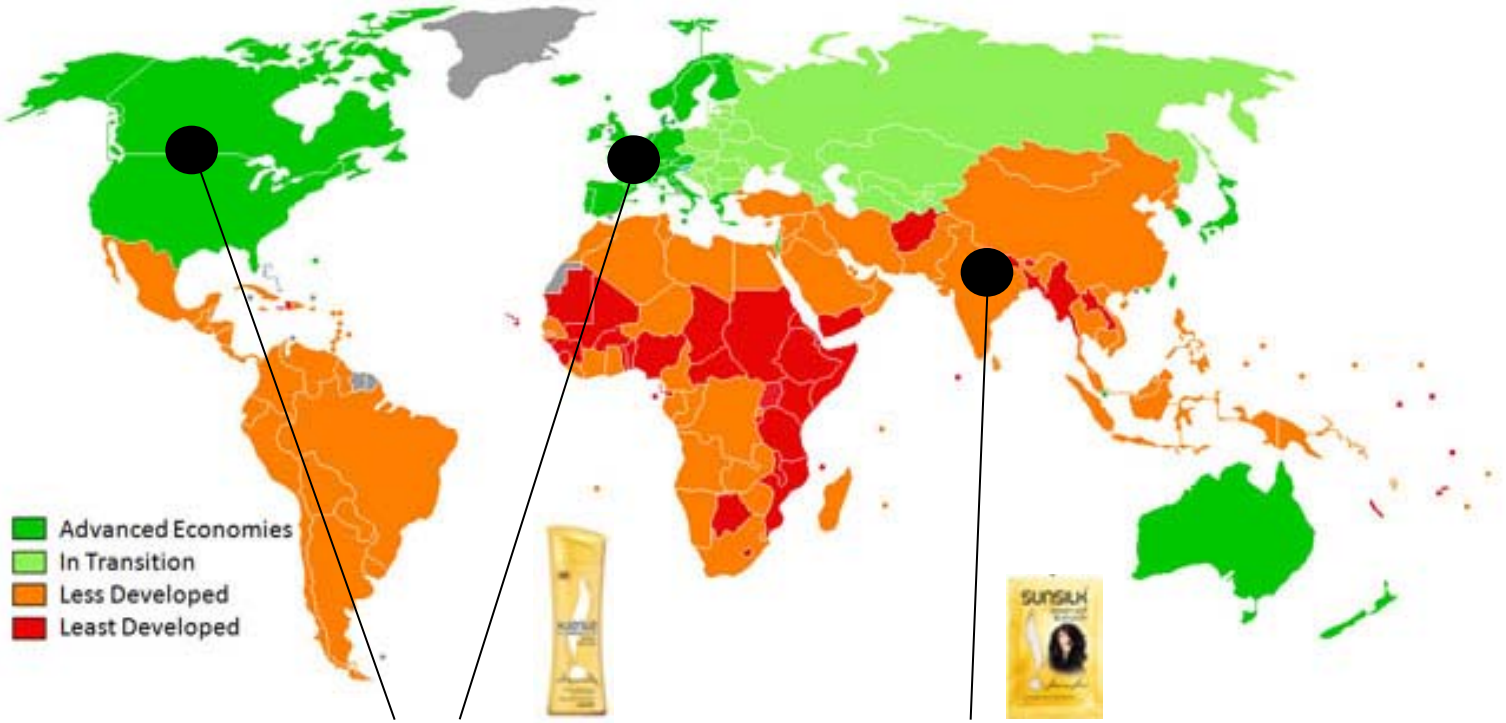
	bio-ethanol from sugar cane – predominantly from cane juice and molasses, possible from bagasse	$7.7/GJ biofuel (Brazil)
	bio-ethanol from corn – predominantly corn starch, possible from stover	$29.4/GJ biofuel (USA)
	bio-ethanol from wheat – predominantly from grain, possible from straw	$36/GJ biofuel (UK)

- Significant variation between sources of biomass
- Significant influence of tariffs and subsidies, particularly for biofuels market
- Price (and price volatility) not decoupled from fossil fuels
- Cellulosic prices likely to rise significantly upon large scale commercalisation





Brands and Markets



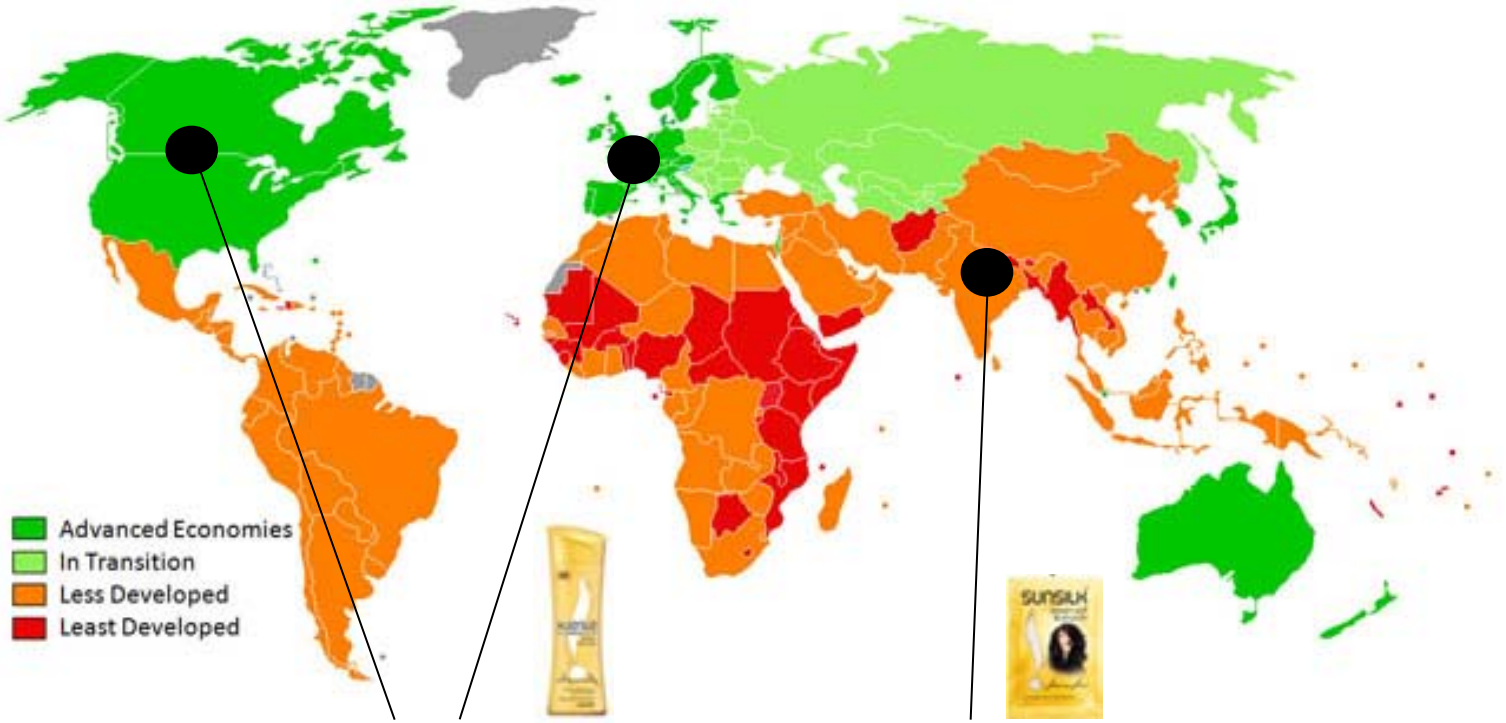
Developed markets

- Dominant form: rigid
- Recycling important
- Affordability increasingly important, some scope for premium

Developing markets

- Dominant form: flexible
- Recovery important for flexibles, simplicity required for recycled rigid materials (little municipal infrastructure)
- Affordability vital

Brands and Markets



Developed markets

Developing markets

There is little evidence that consumers will pay more for bio-based packaging for everyday, familiar products

However, there is an increasing expectation that companies will make efforts to make their packaging more sustainable. Amount of packaging is the primary concern, materials type is less important

Bioplastics versus Recyclate

Use of recycled plastics is a good way to reduce the waste footprint of packaging. Bioplastics have no impact.

The GHG footprint of packaging is low compared to the GHG footprint of the product formulation

The first priority of a waste-reduction programme will not be bioplastics unless it is for products where the formulation and packaging waste are likely to occur together in significant amounts

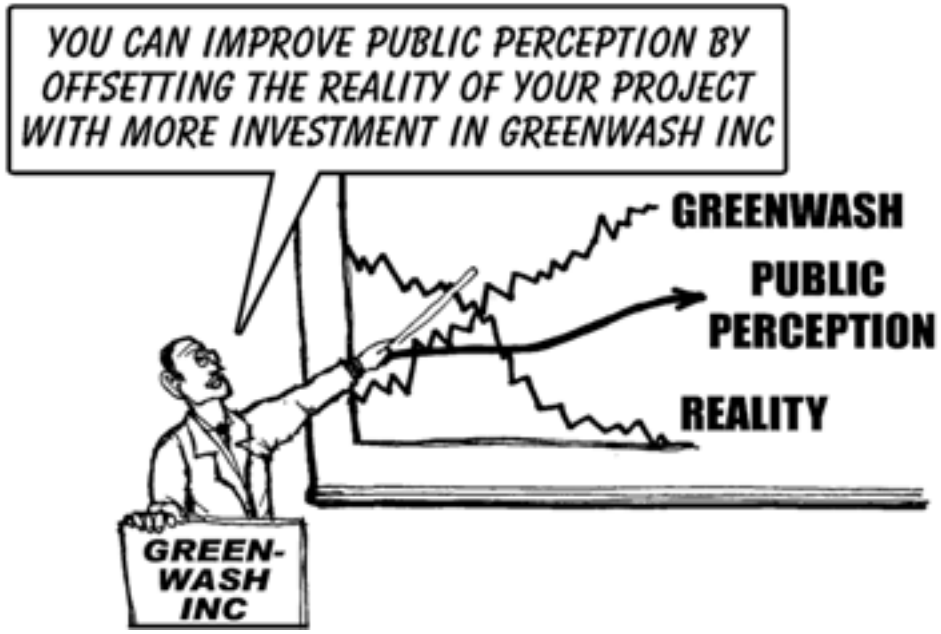
Recycled plastics will be a more immediate option if:

a) *Recycled materials are better understood by consumers than bioplastics (possible confusion between 'bioplastic', 'green plastic', 'biodegradable' etc. claims) and brand owners*

b) *Recycled materials are cheaper than bioplastics*

c) *Recycled materials have a greater overall contribution to environmental metrics*

Bioplastics: Public and NGO understanding



Information on all aspects of products is more available, more analysed and more discussed than ever before – all parts of the value chain are under scrutiny

It is best to make the right choice, with high standards, than to make a hasty choice

Bioplastics still have some way to go for consumer packaged goods

Final Comments

- Recyclable plastics are generally preferable
- Aim towards bulk applications
- Bioplastics cannot always be premium
- The value chain must work together
- Appropriate product claims essential
- Verified environmen-tal claims essential
- Sustainable agriculture is vital
- End of life technologies must be developed

The use of bioplastics is just one weapon in the sustainability arsenal. The biggest impact will be had when bioplastics are used in conjunction with materials reduction and use of recyclate





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Acknowledgments
Unilever packaging community, esp. Jay Gouliard
Laurence Hogg