

The Four Dimensional Product: *Integration Over Time is the Only Way to Understand Sustainability*

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Executive External Strategy and Communications Fellow
The Dow Chemical Company

13 March 2014



I Waste Time and Money At Home



I Waste Time and Money At Home



I Waste Time and Money At Home



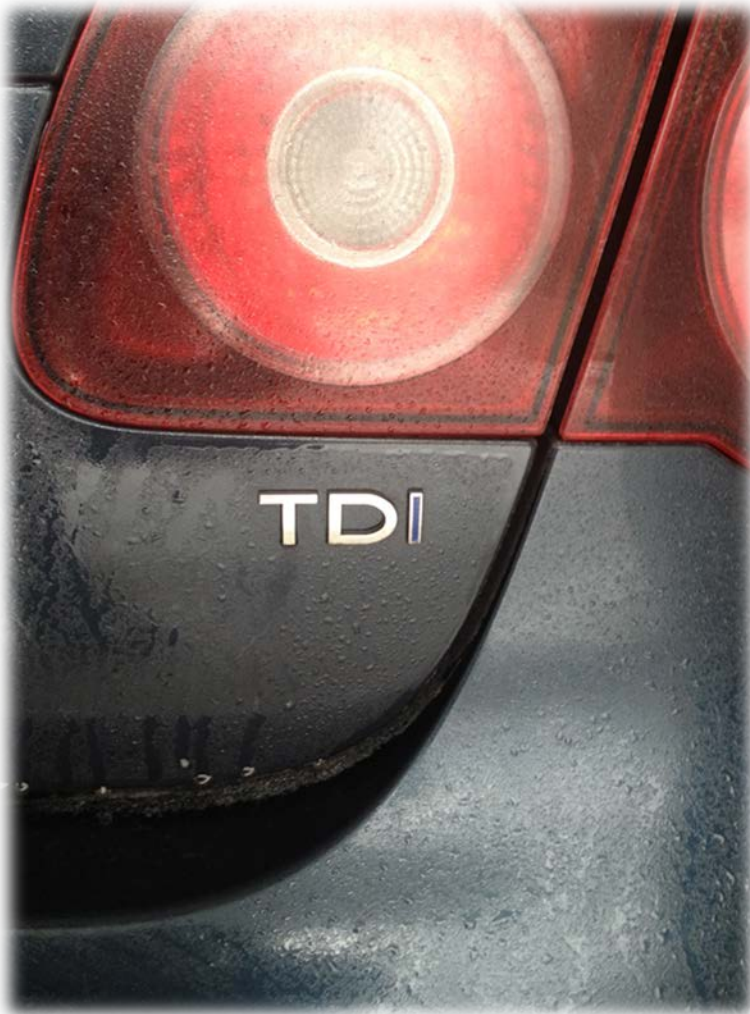
I Waste Time and Money At Home



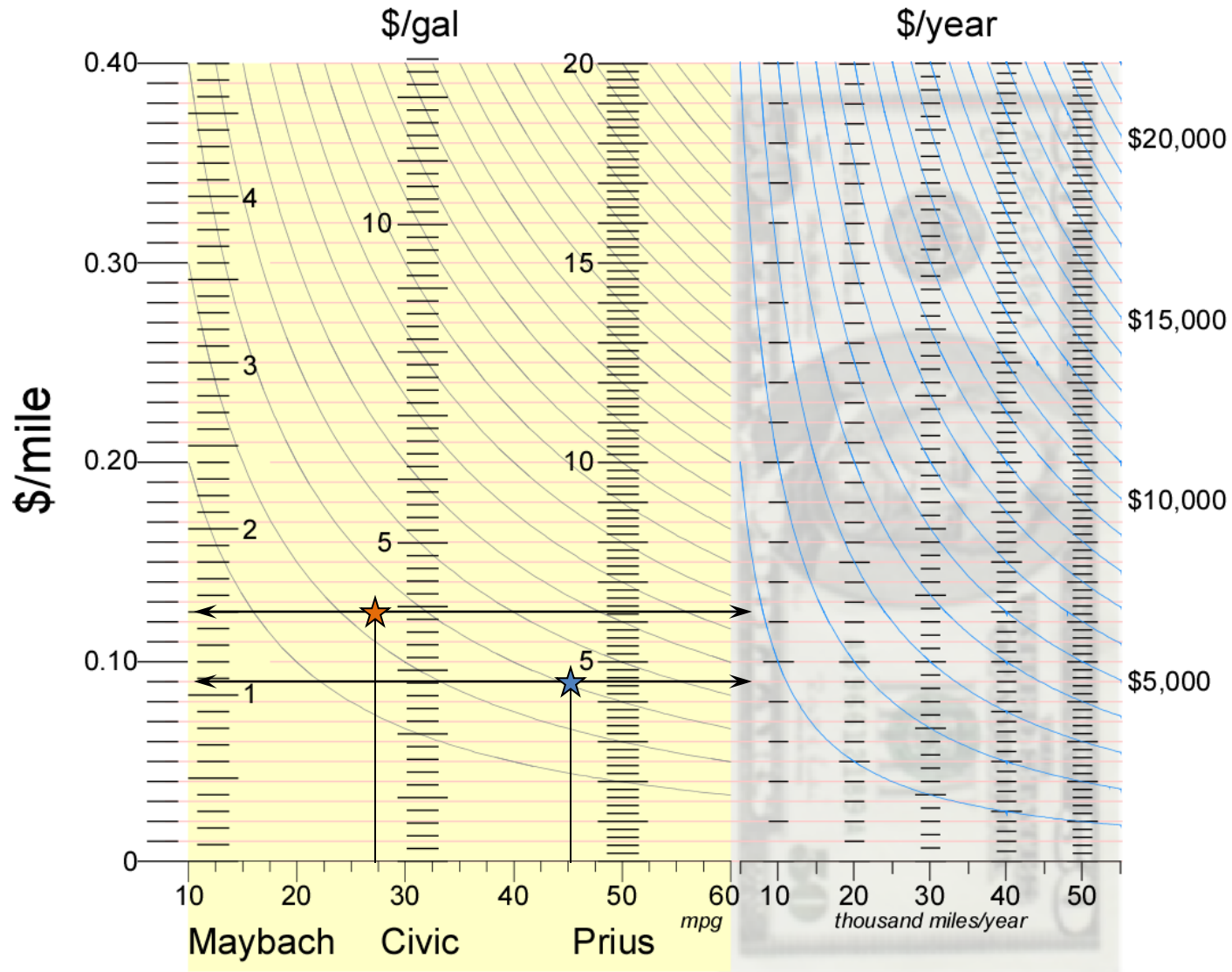
I Waste Time and Money At Home



I Waste Time and Money At Home



I Waste Time and Money At Home



*I'm destroying the planet
slower than you are.*





I Save Time by Using Fossil Fuels



I Repair Things



I Waste Time and Money At Home



I Waste Time and Money At Home



I Waste Time and Money At Home



I Waste Time and Money At Home



Return Shareholder Value

*I can't waste money
and time at work*



Which is more sustainable?

plastic

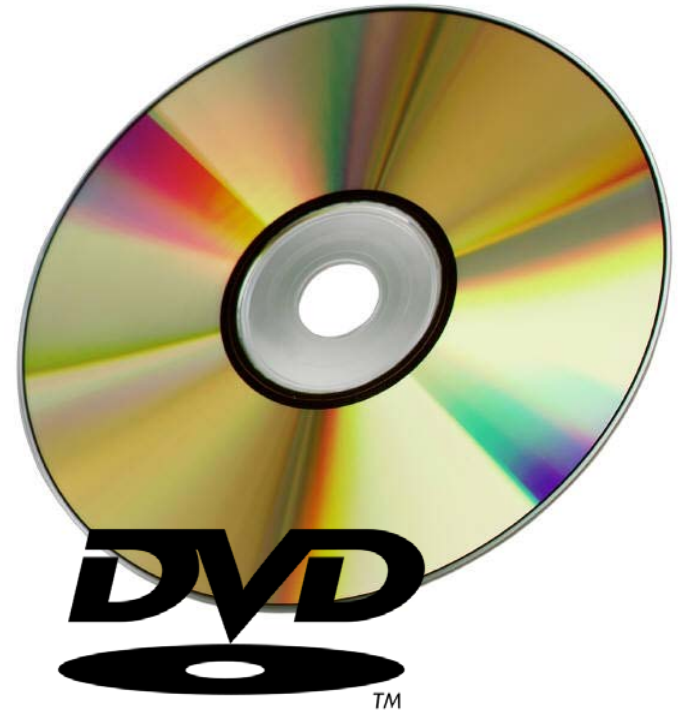


paper



Which is better?

streaming



physical media



Which is more sustainable?

8 hours



1 mile



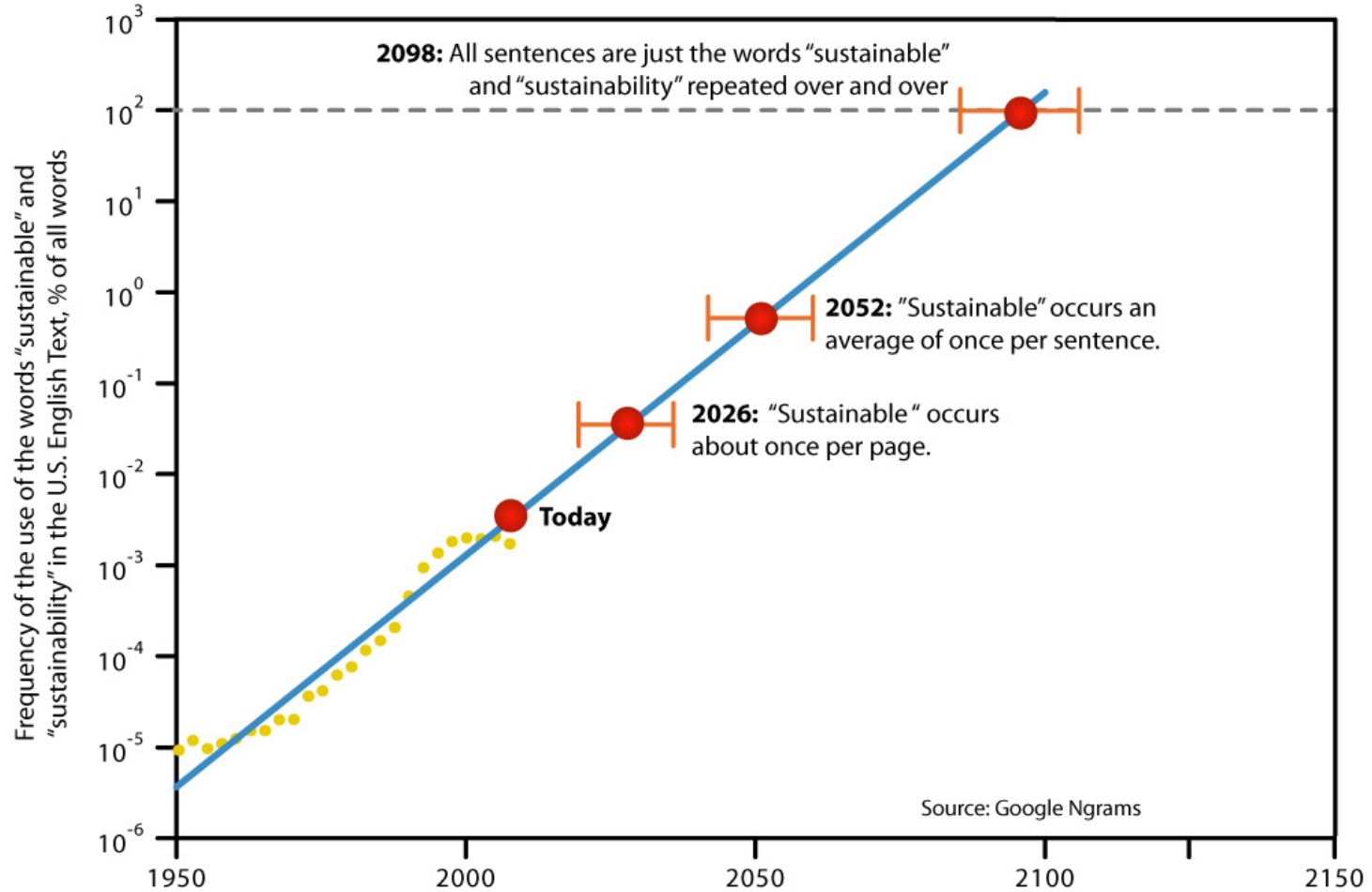
Which is more sustainable?

A meat-eater in a Prius



A vegan in a Hummer

Sustainability is Unsustainable?



<http://imgs.xkcd.com/comics/sustainable.png>

■ Metaphor for Sustainability



Ordered



Disordered

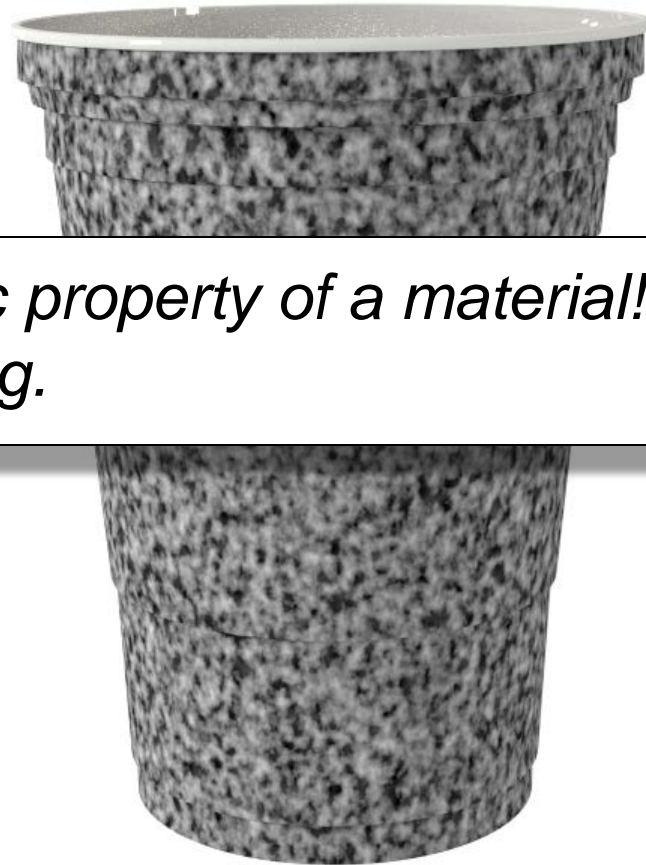


■ Sustainable?





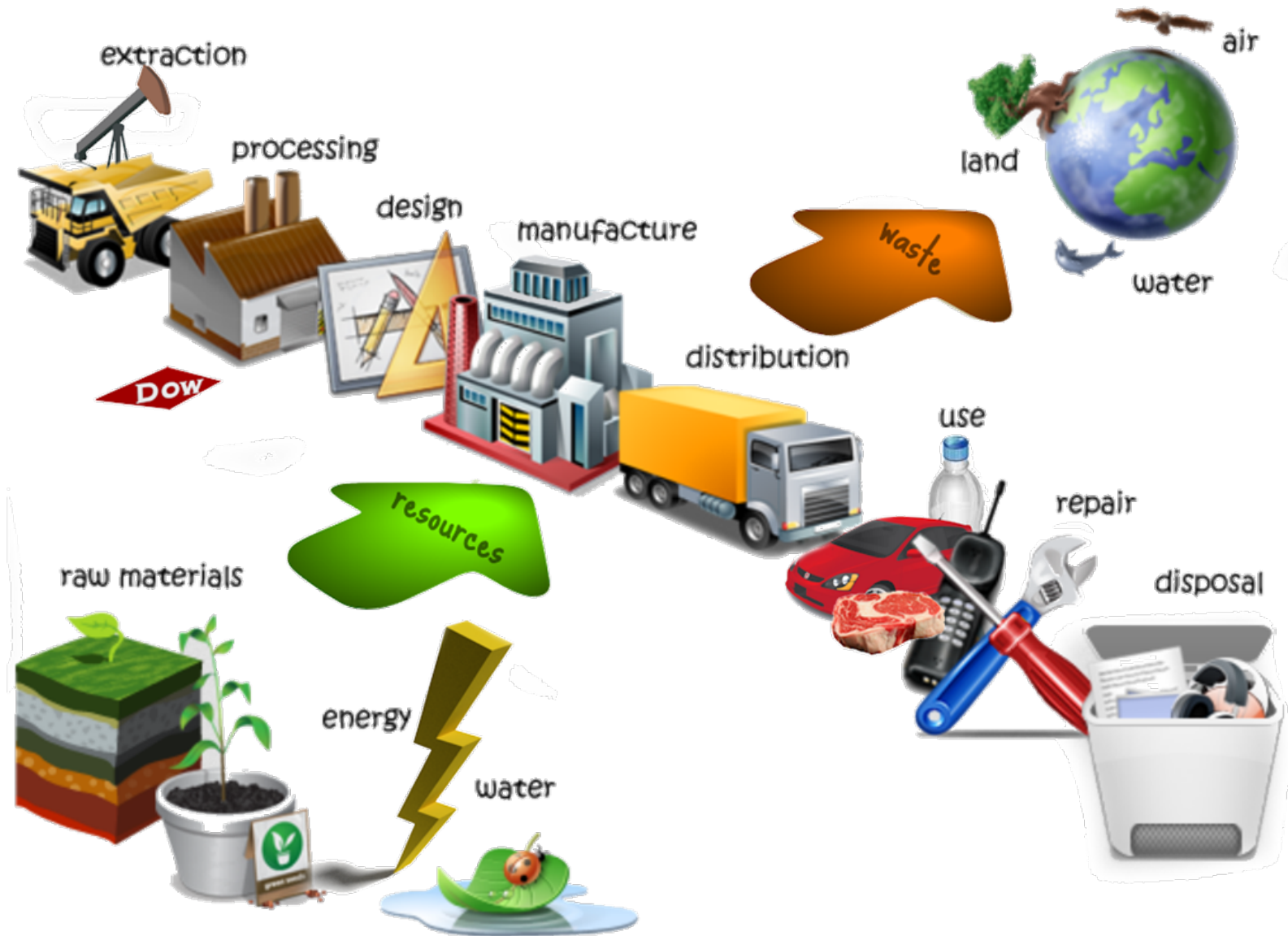
Is this Cup Sustainable?



*Sustainable is not an intrinsic property of a material!
You can't know by just looking.*

How about this one?

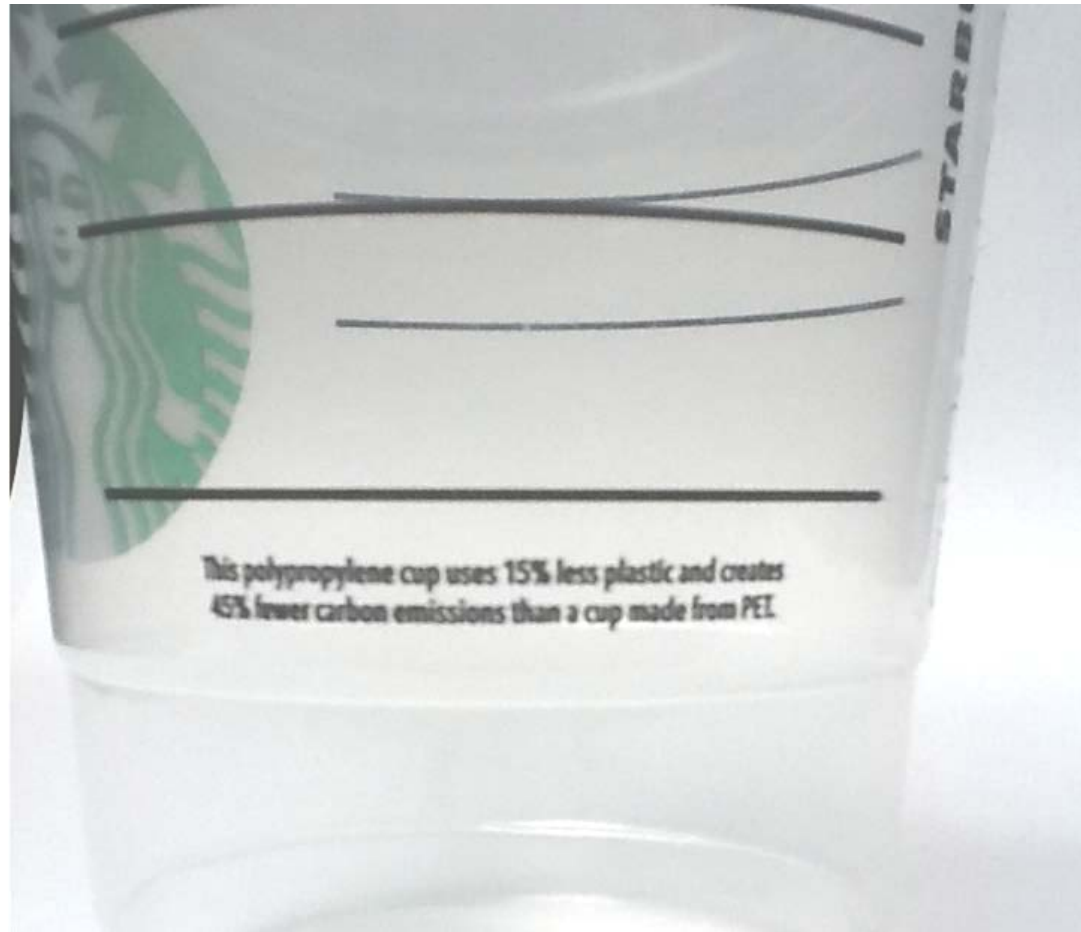
Life Cycle Assessment



adapted from sustainable-graphic-design.blogspot.com



Signs of Hope



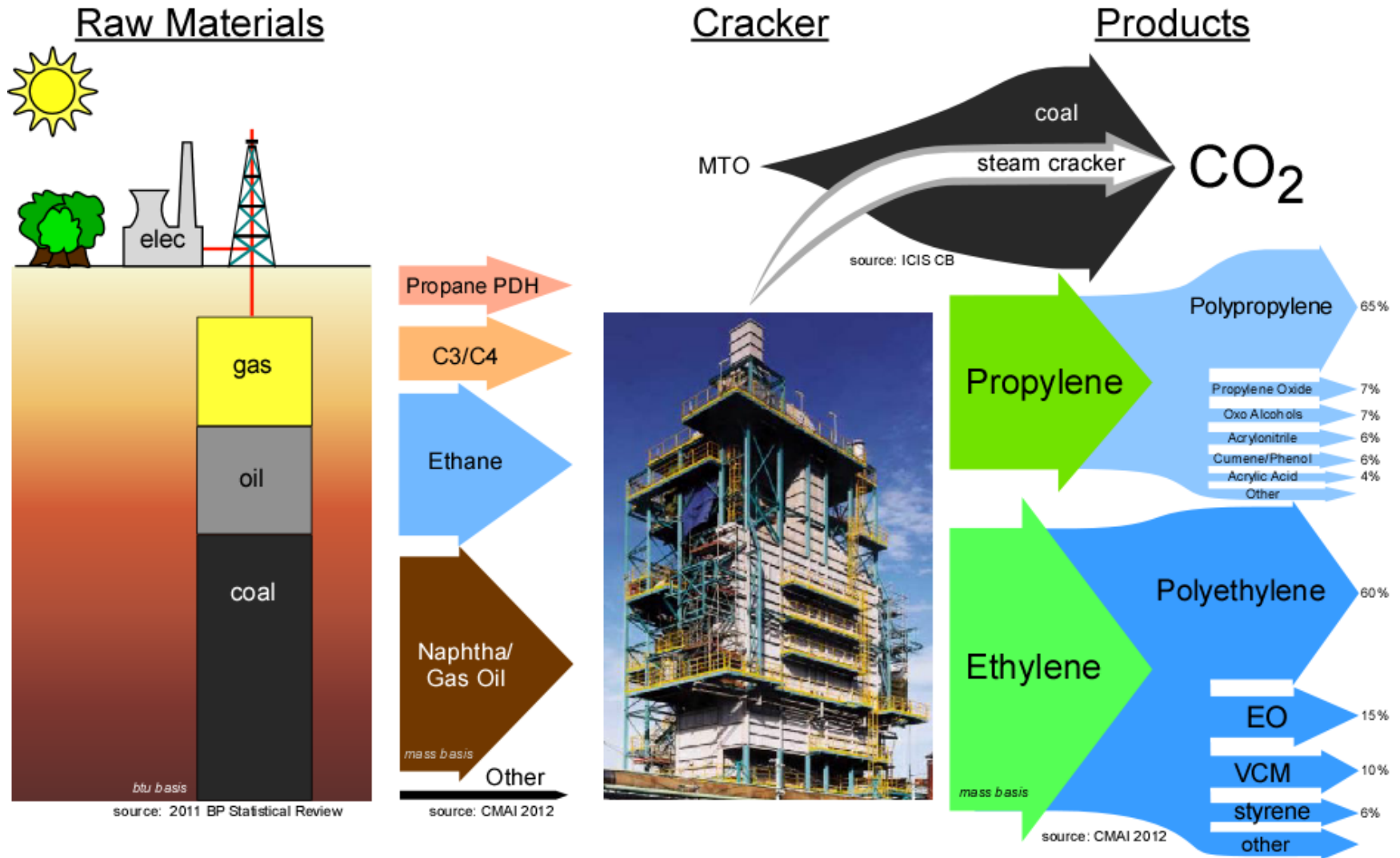




DOW

®

Chemical Industry Snapshot

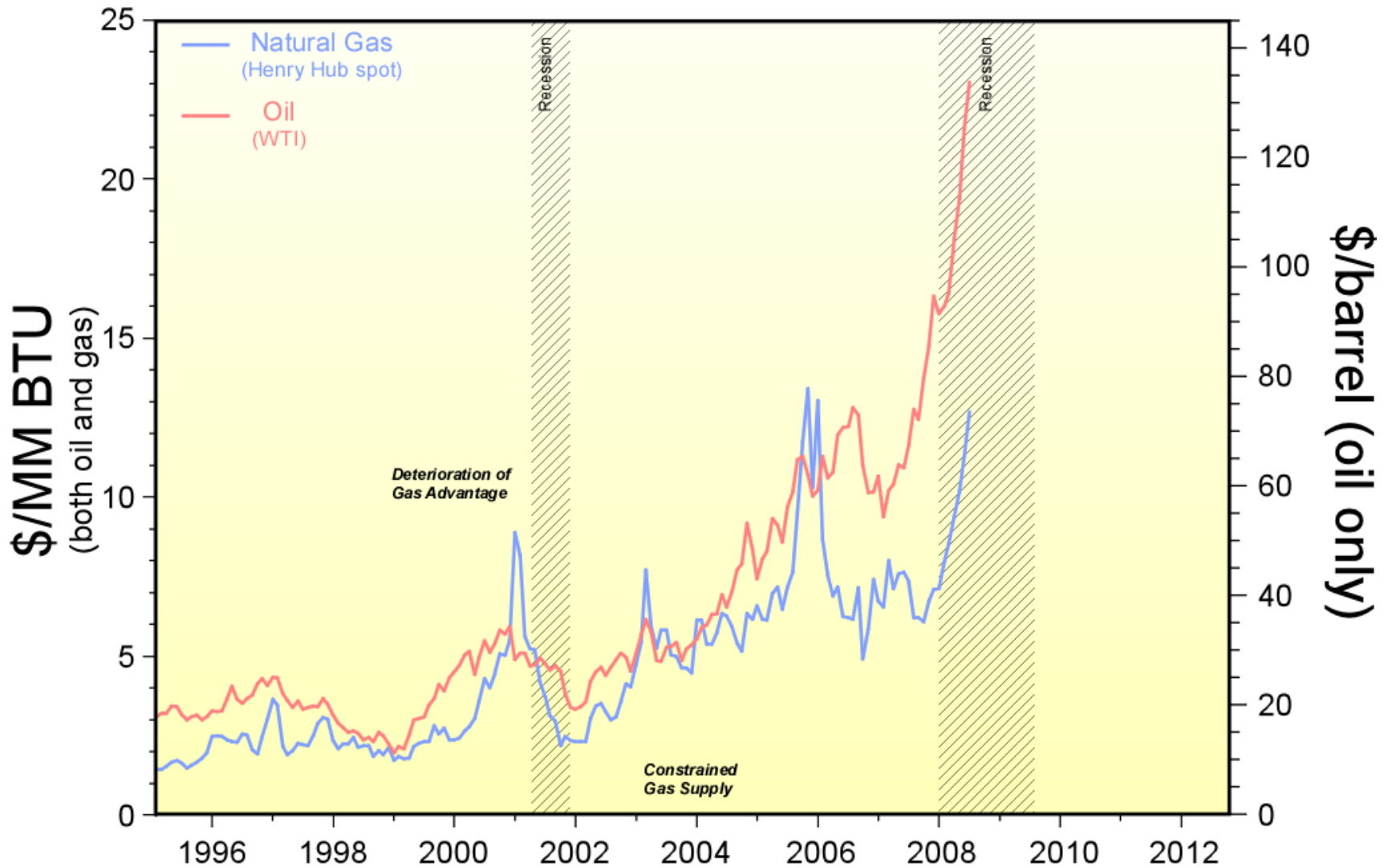




What Unhealthy Looks Like

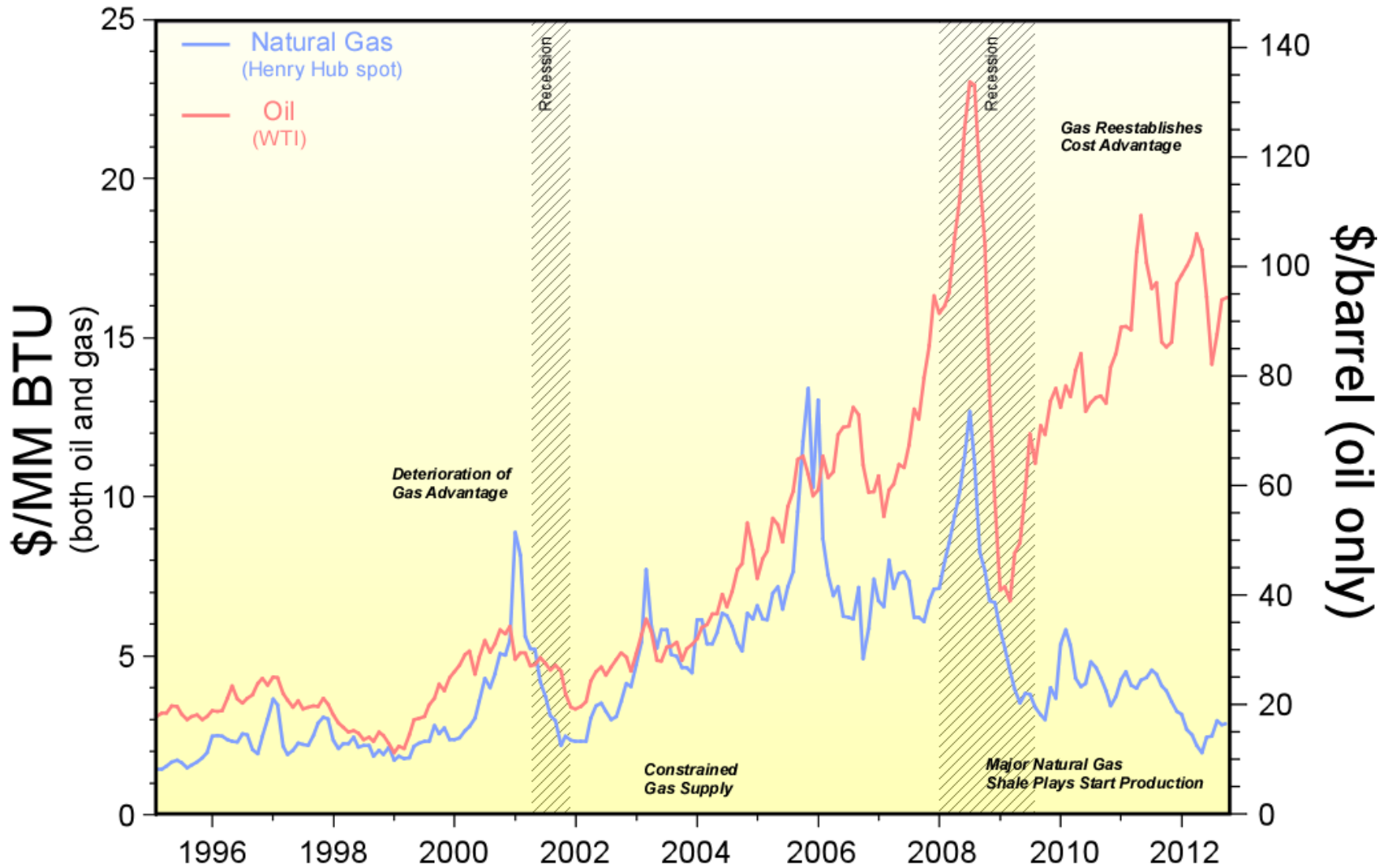


Recent Industry History



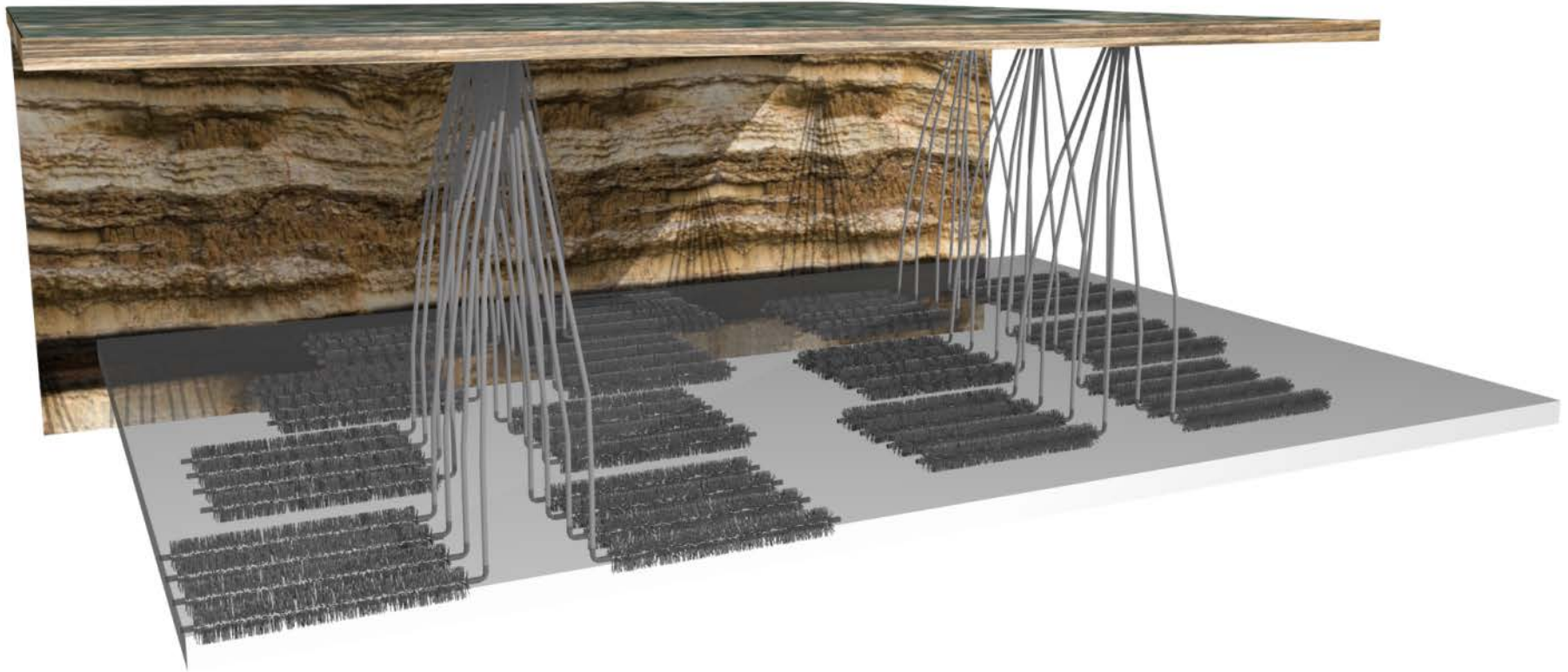
R.I.P.
U.S. CHEMICAL
INDUSTRY
1776-2008

Recent Industry History



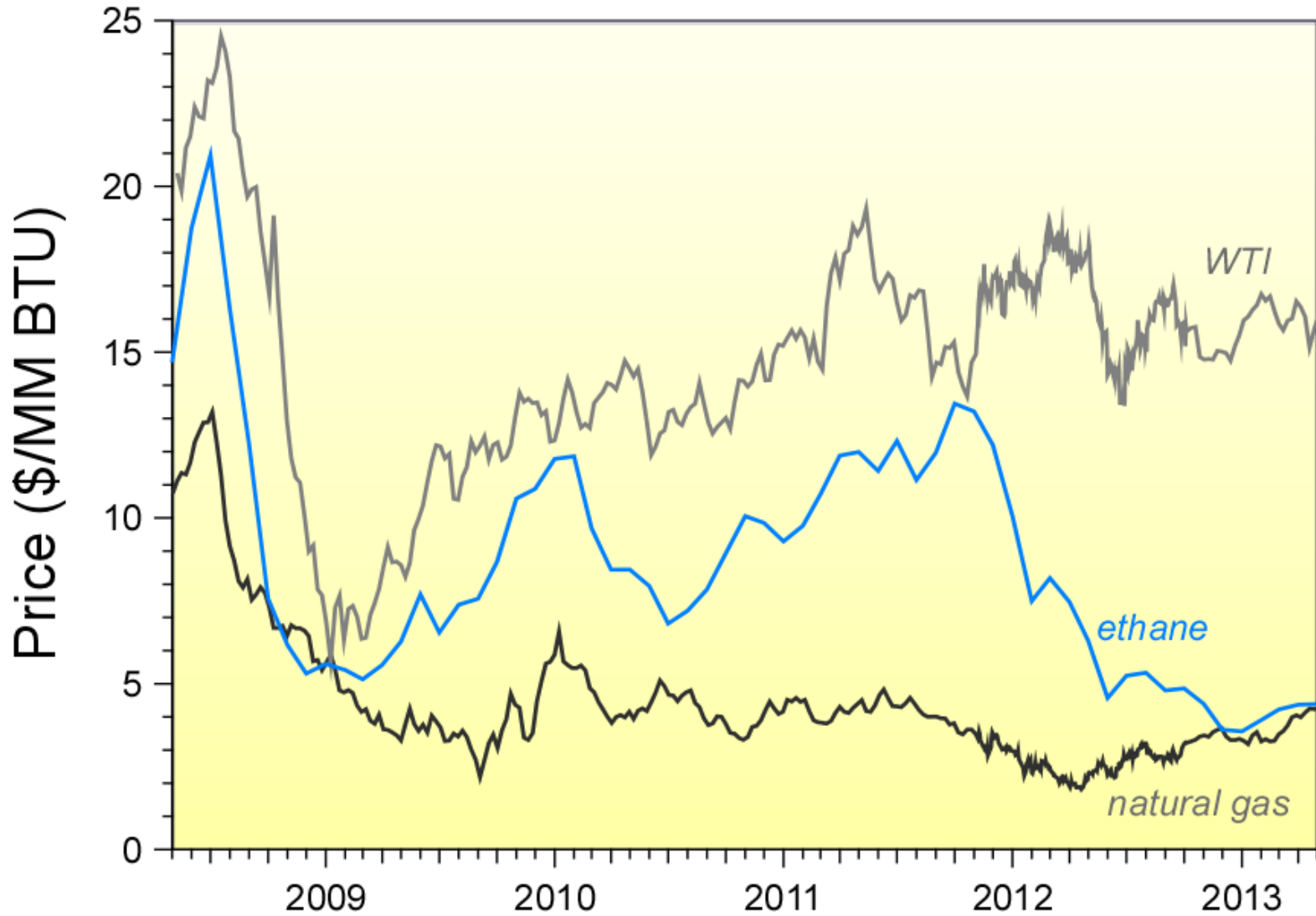
Live Long and Prosper



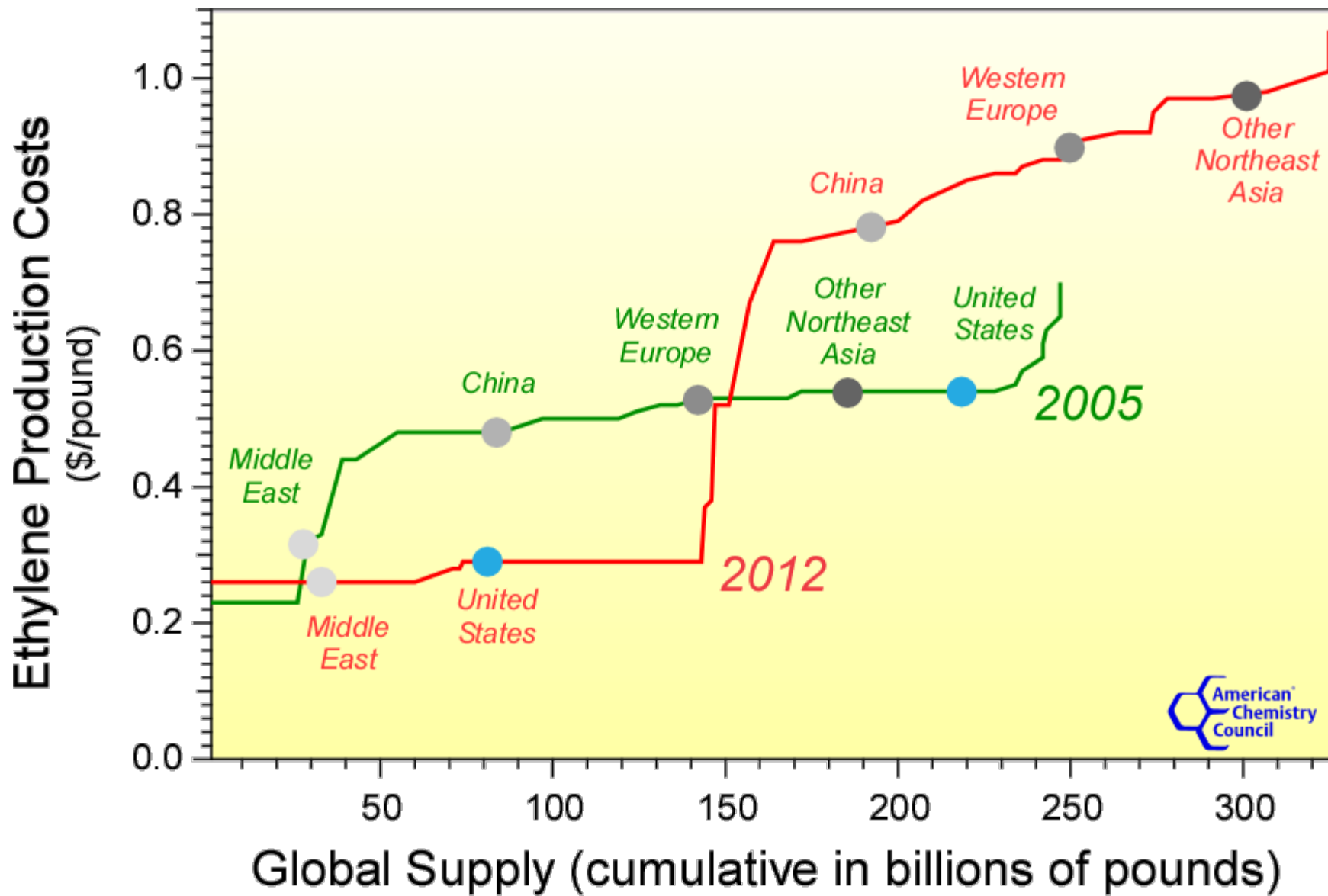




Ethane Price Now Tracks Gas



Impact of Low Gas Prices





Economic Impact of Shale Gas

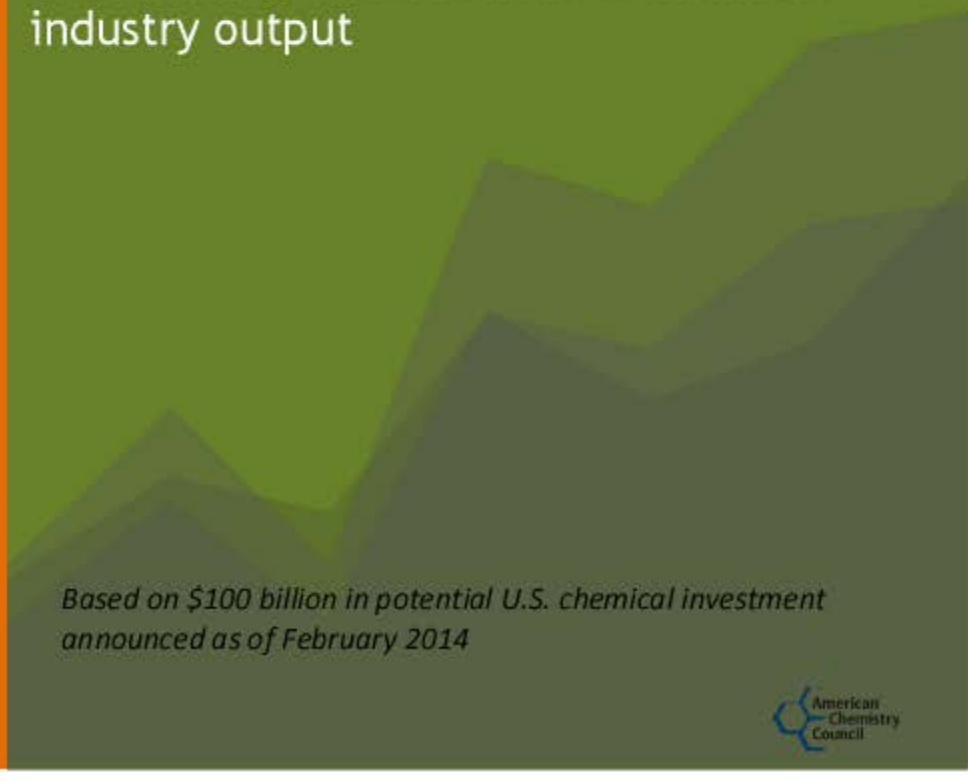
637,000

Permanent NEW jobs by 2023 throughout the U.S. economy from \$81 billion in new chemical industry output



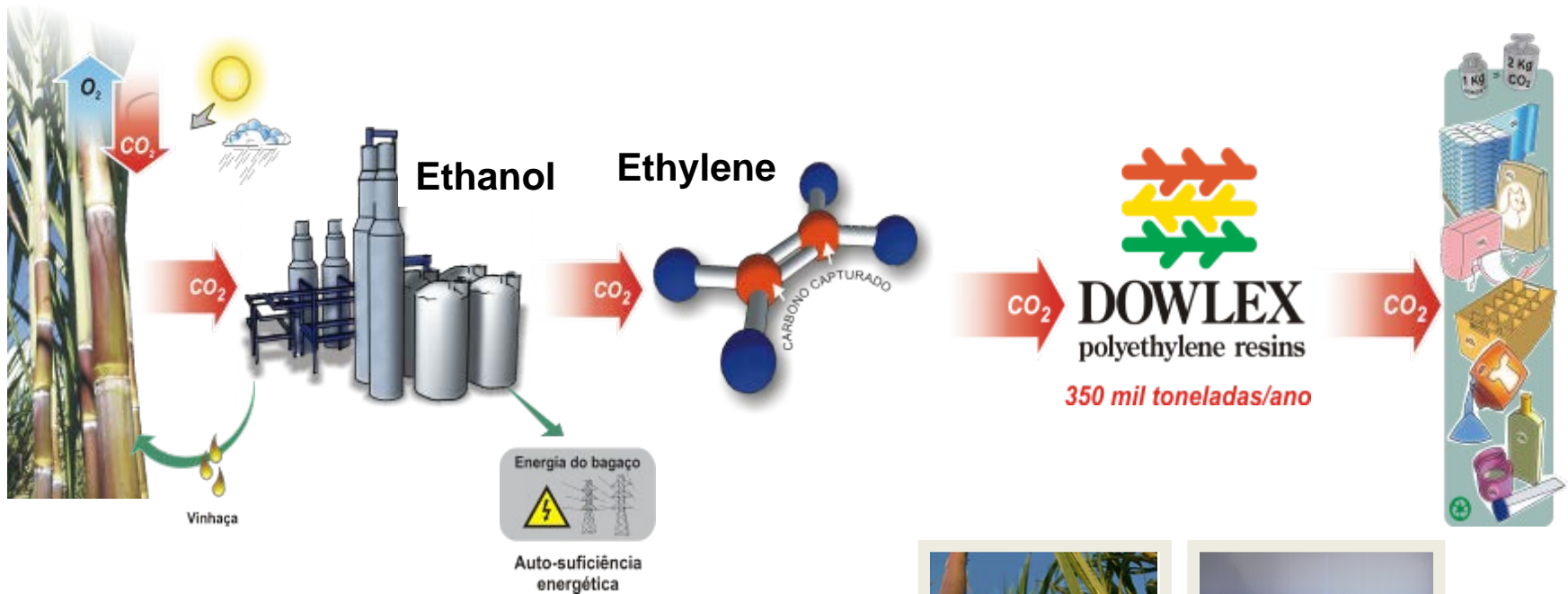
\$243 billion

Permanent NEW U.S. economic output by 2020 from \$81 billion in new chemical industry output



Based on \$100 billion in potential U.S. chemical investment announced as of February 2014

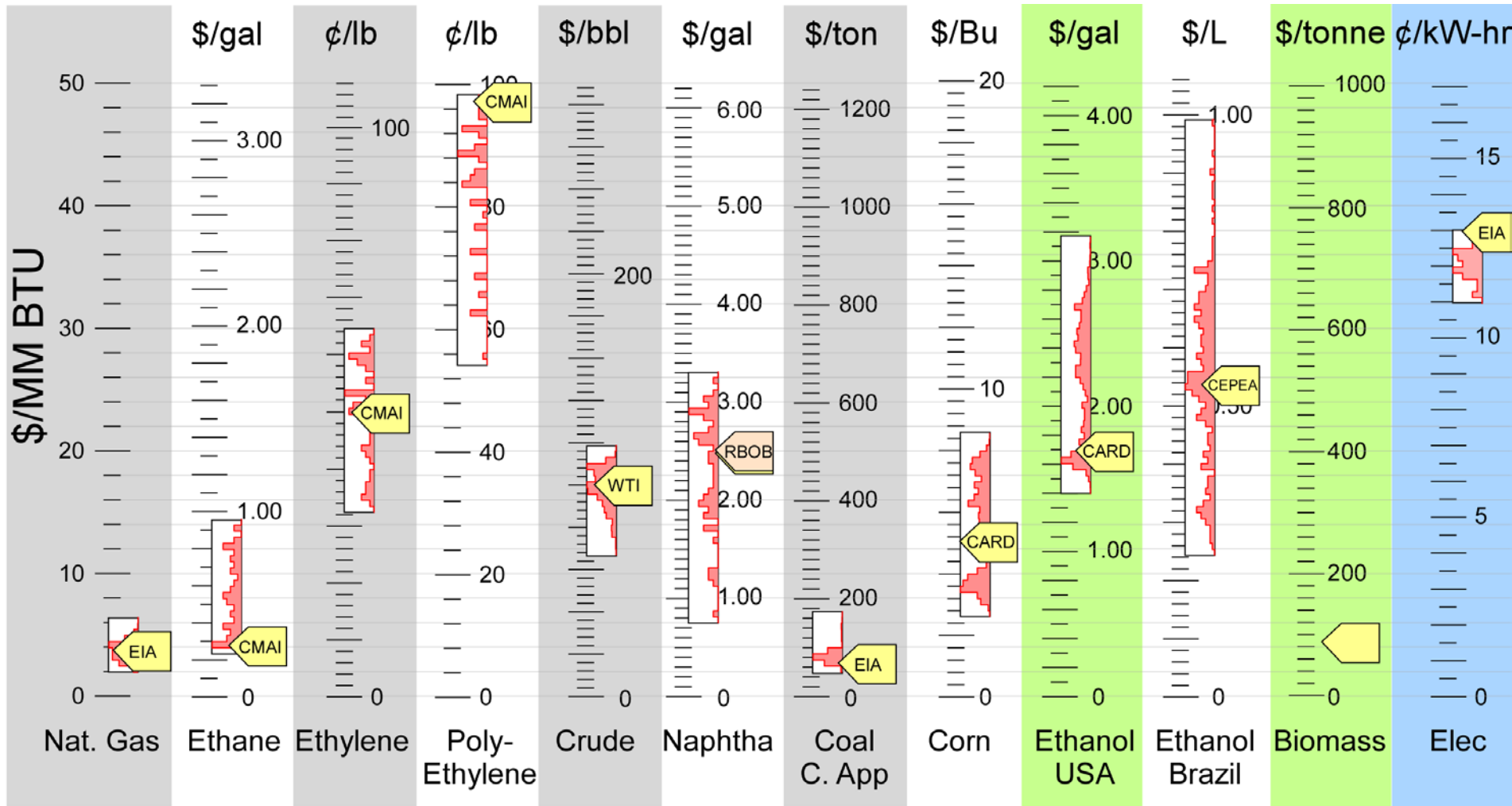
Cane to Polyethylene



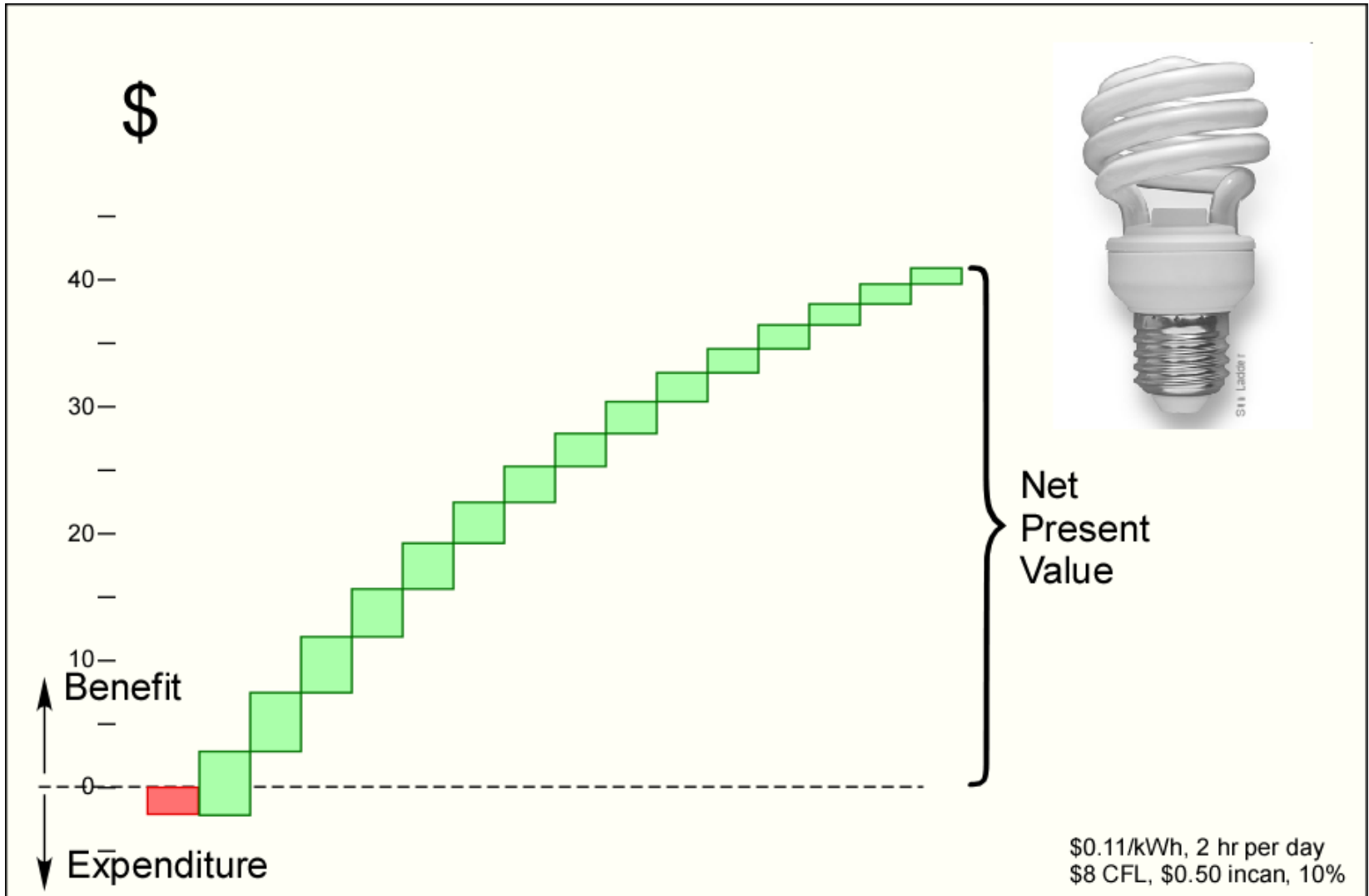
Fully-integrated facility in Brazil
Utilizes state-of-the-art Dow
polymerization catalysis



Chemicals and Energy

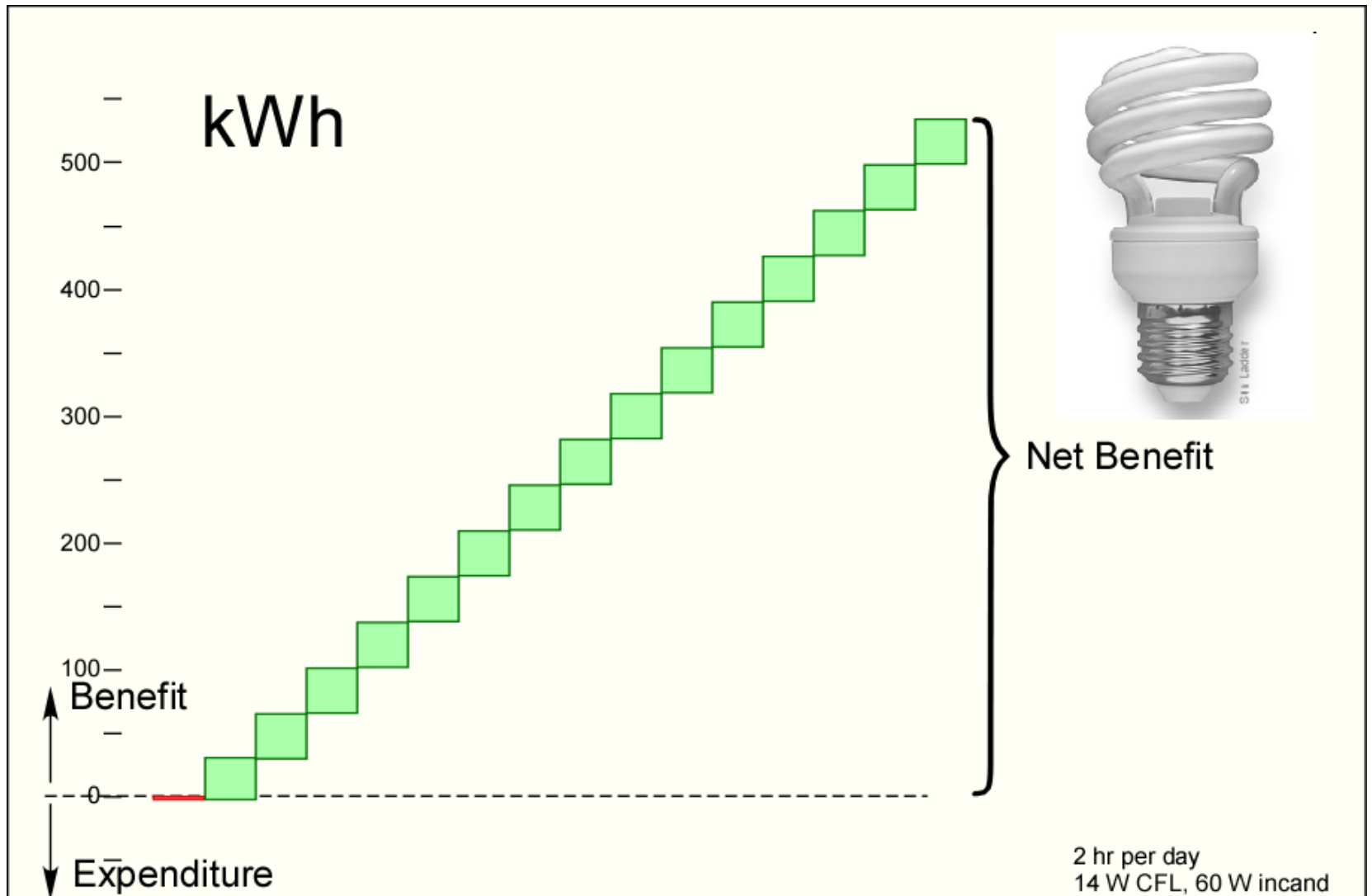


Financial Way of Looking At Benefit

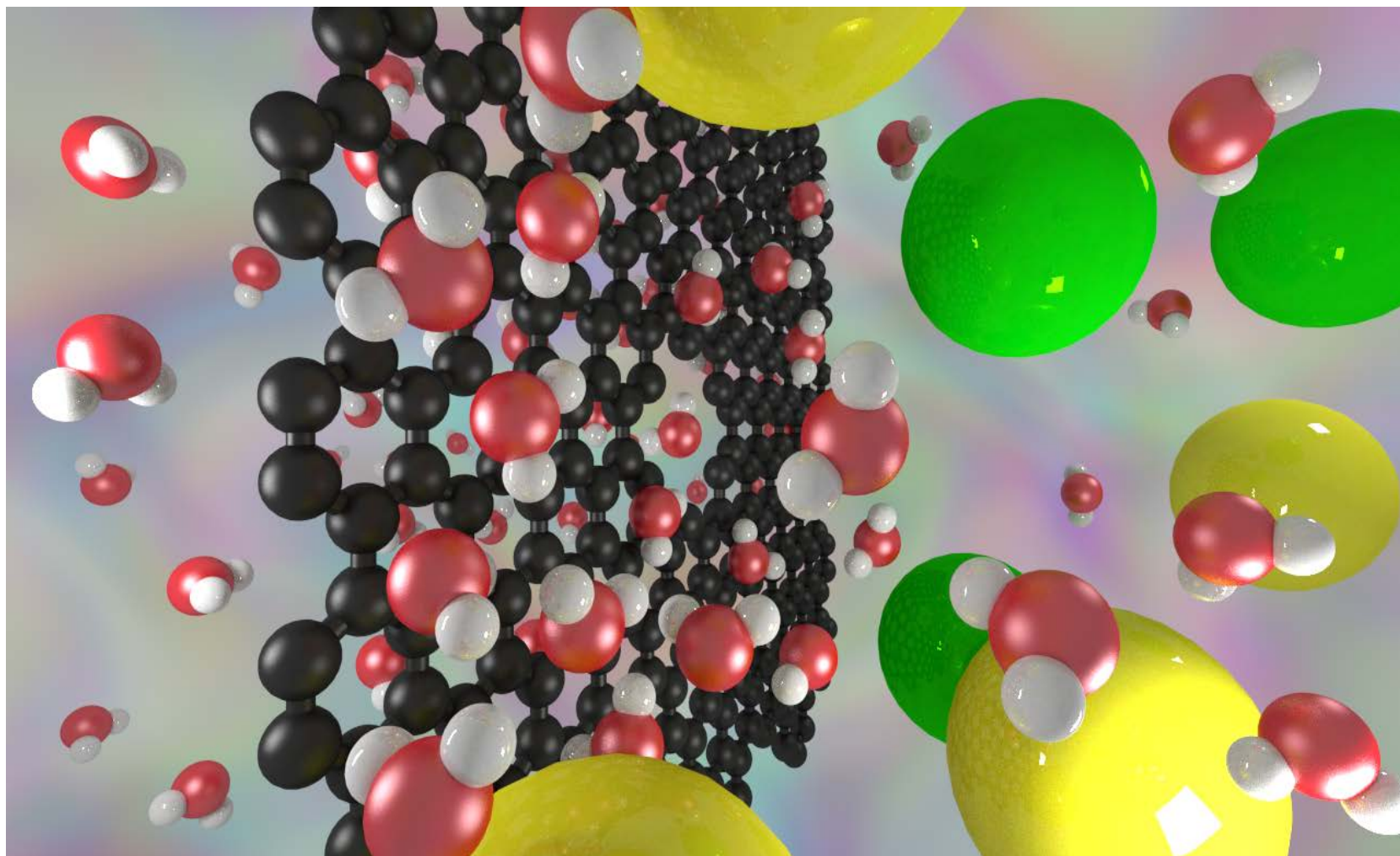




Why Not Sustainability?

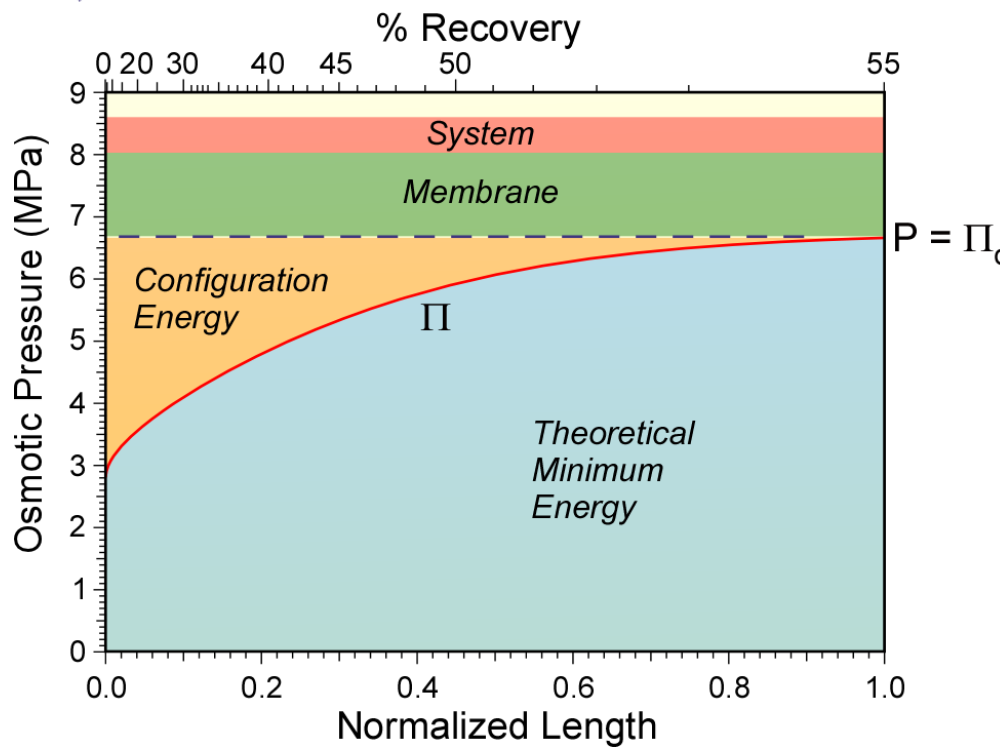
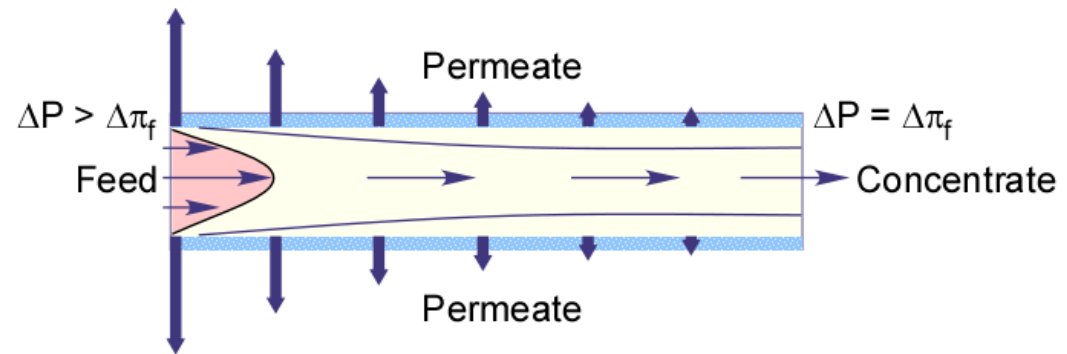
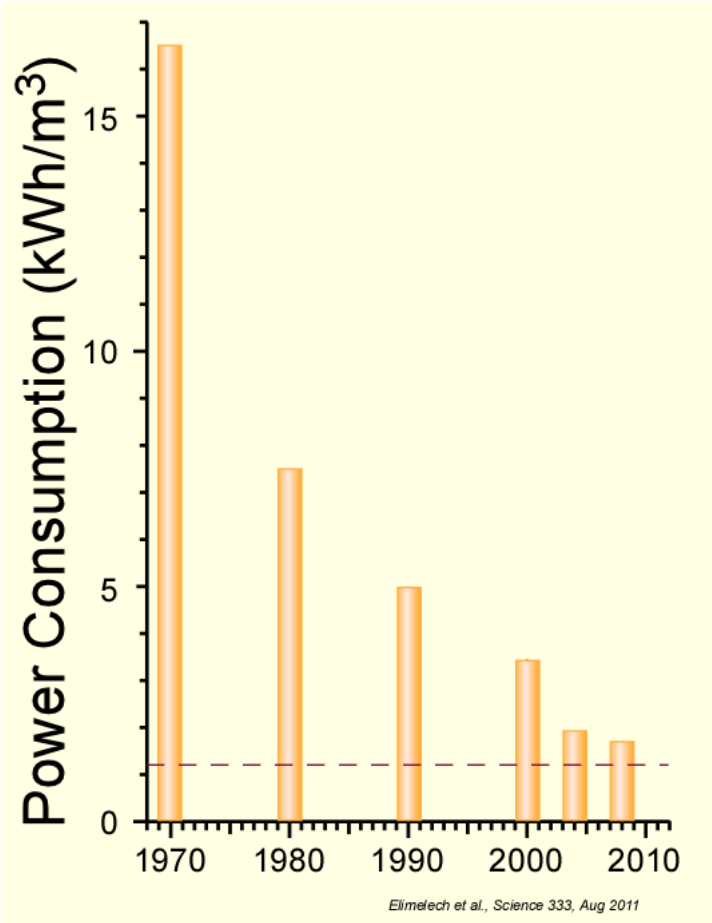


Misconceptions Demean Advances



Fresh Water Production

Simple Distillation $\sim 600 \text{ kWh/m}^3$

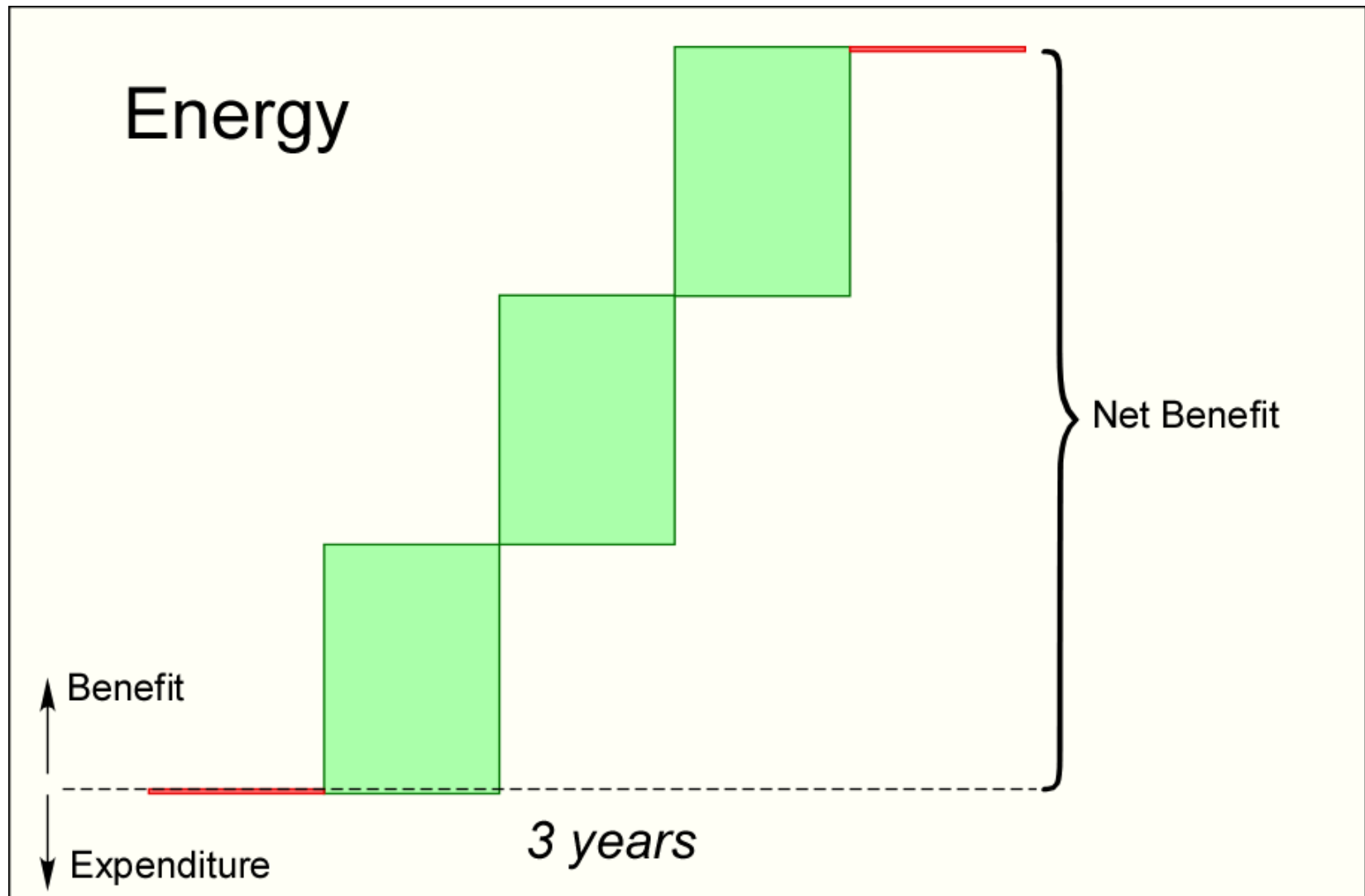


Energy-efficient DOW FILMTEC™ Water Treatment Membranes yield savings on water purification



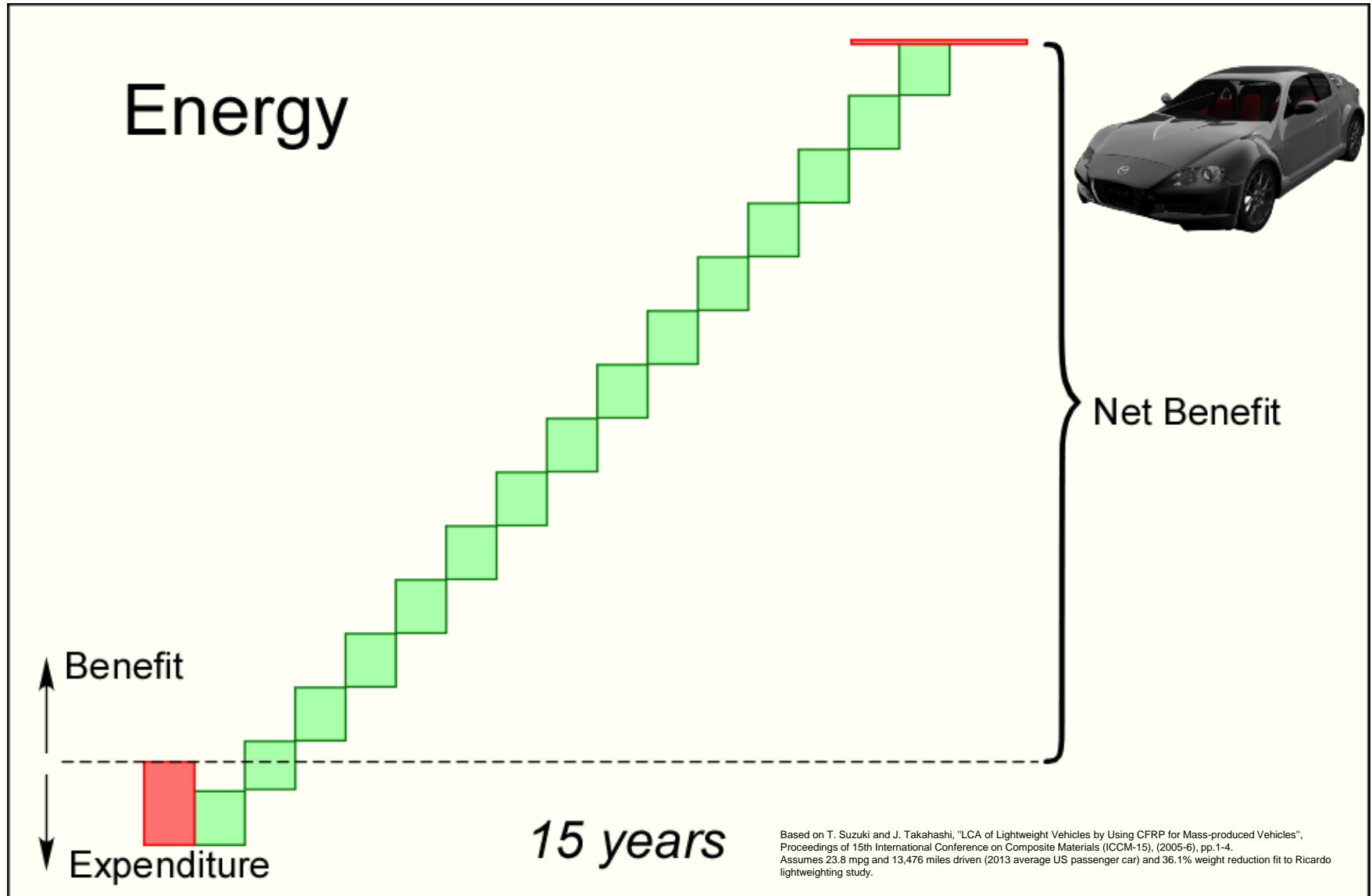
| Process | Operating Energy Consumption (Kwh/m ³) | Customer Energy Savings 2005-2015 (Barrels of Oil-eq) |
|---------------------------------|--|---|
| Multi Stage Flash (MSF) | 13.5 - 25.5 | 242 million |
| Multi Effect Distillation (MED) | 6.5 – 11 | 82 million |
| Reverse Osmosis | 3 - 3.5 | |

RO Cartridge Benefit

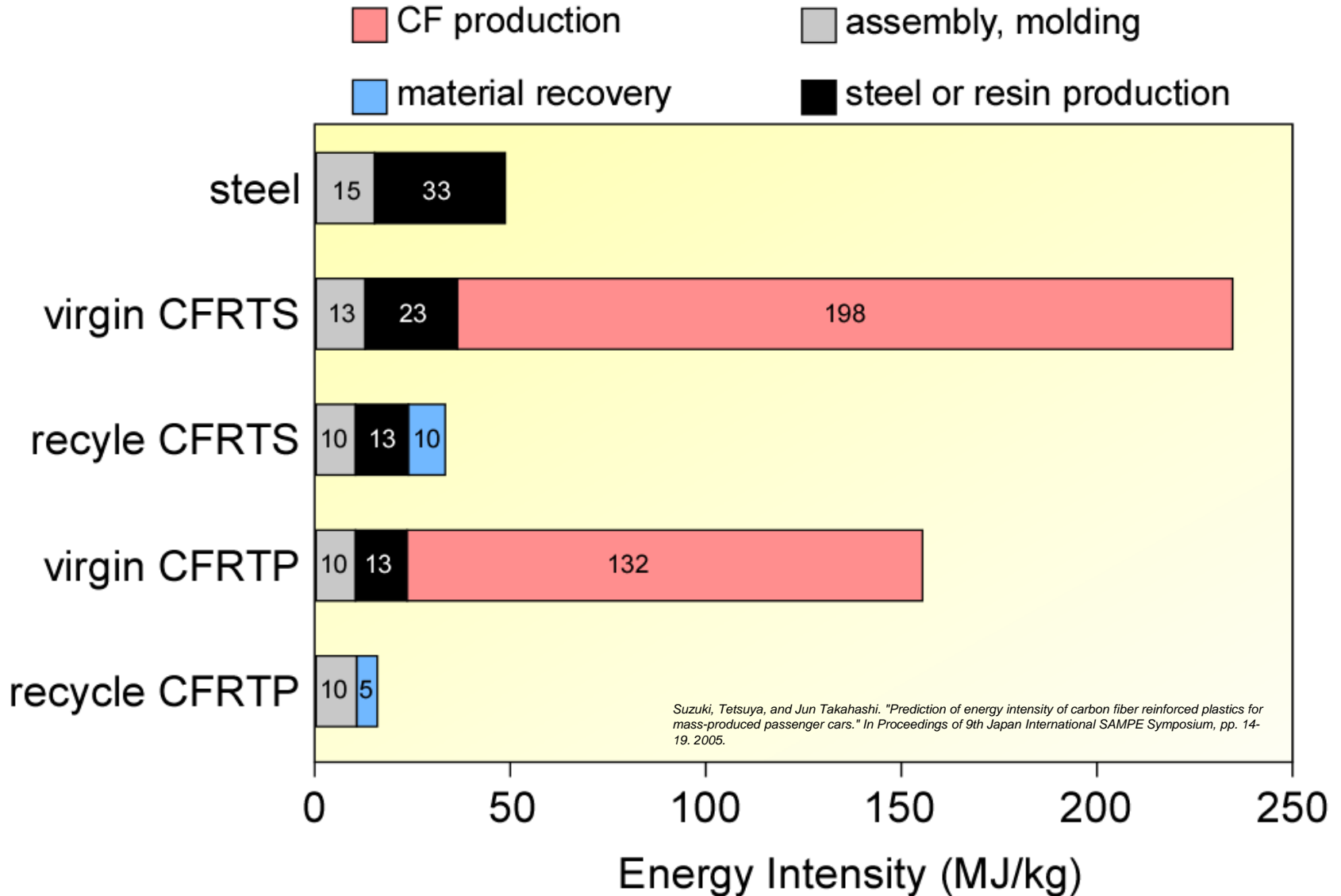


54.5 mpg

Carbon Fiber Benefit



Importance of Recycle

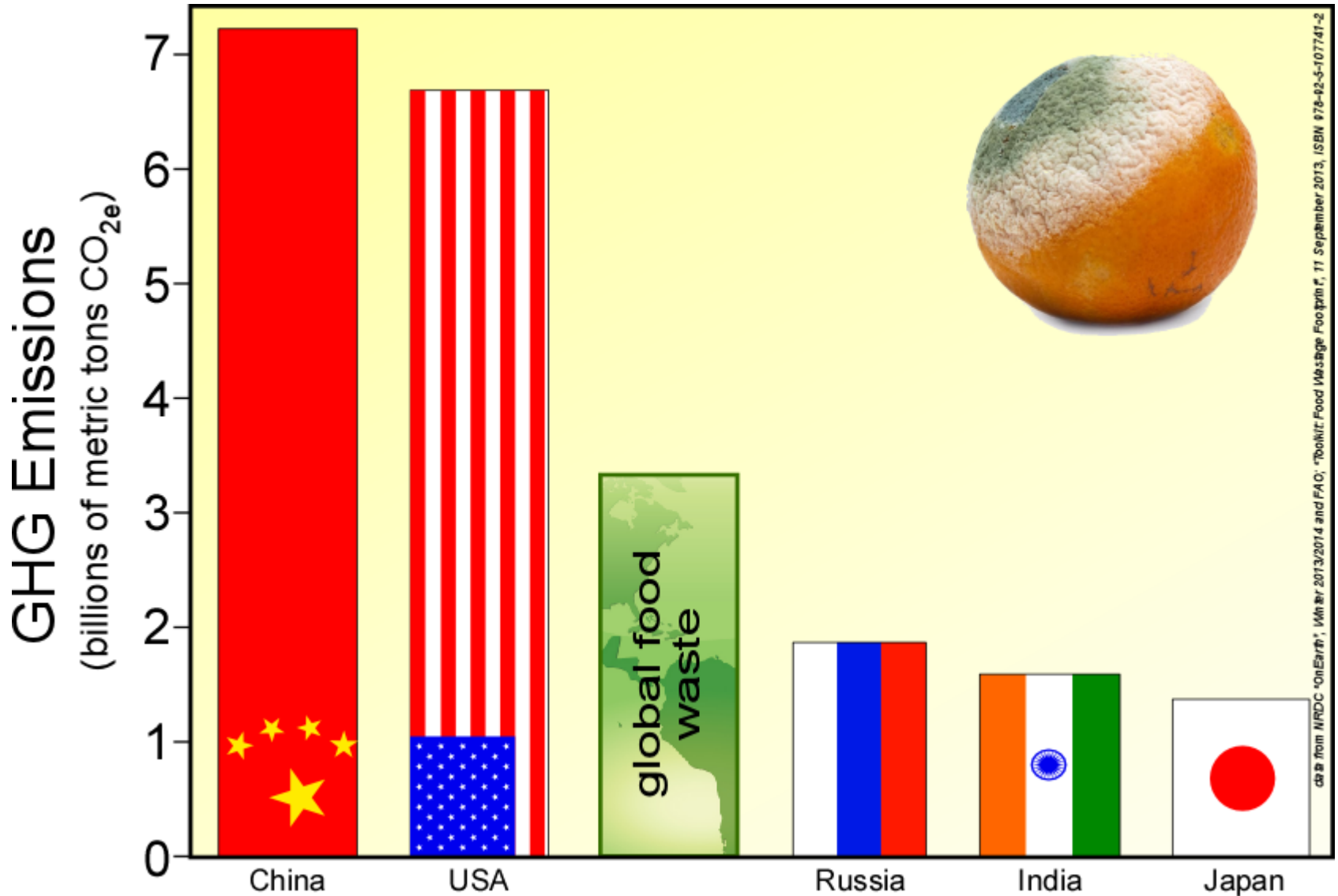


Packaging Addresses Global Challenges



30-40% food grown is wasted. Much of it to spoilage.

Food Waste



data from MIRDC "On Earth", Winter 2013/2014 and FAO, "Toolkit Food Waste Footprint", 11 September 2013, ISBN 978-92-5-107741-2

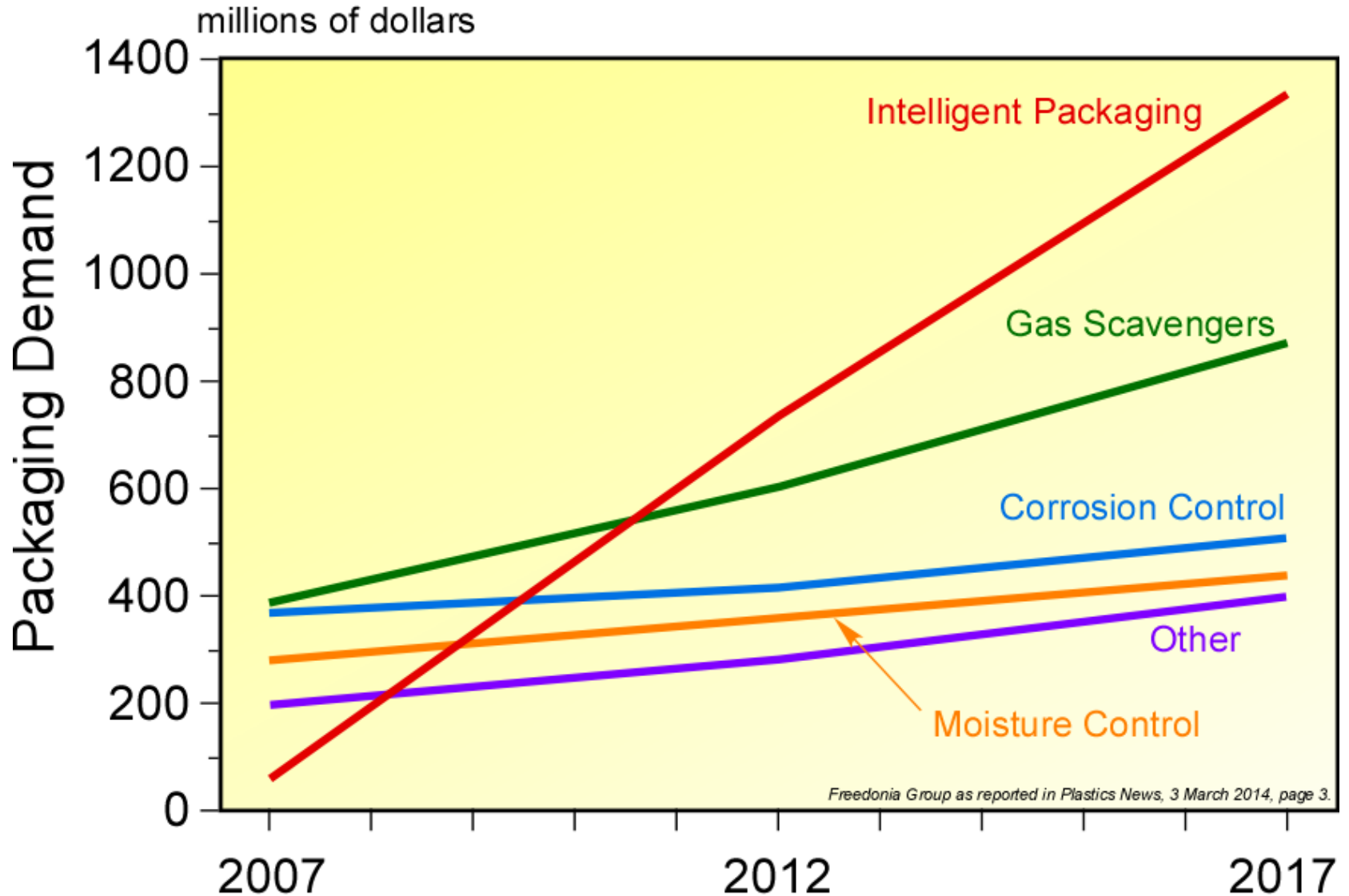
Flexible packaging helps increase shelf life

Using only a few grams of flexible plastic packaging extends the shelf life of a cucumber by more than three times.

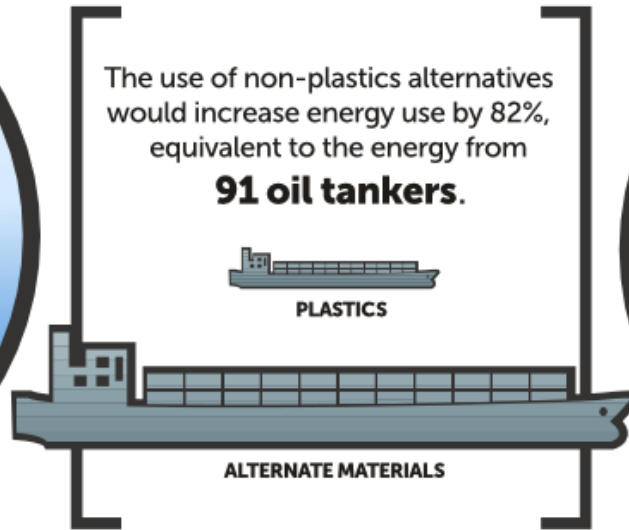


FLEXIBLE PLASTIC PACKAGING
HELPS IN-STORE WASTE
REDUCE
3 percent to under 1 percent
BY **INCREASING**
SHELF LIFE

High-Tech Packaging Growth



LCA Studies on Packaging



Most plastics can be recycled



Stand-up pouch packaging reduces waste and brings energy savings



| Package Type | Contents | Impact per 100 oz Cereal | | |
|---------------------------|----------|--------------------------|---------------------------------------|---------------------|
| | | Landfill Discards* (g) | Process GHG** (kg CO ₂ Eq) | Total Energy** (MJ) |
| Paperboard and HDPE Liner | 11 oz | 380.0 | .861 | 12.1 |
| Stand-Up Pouch | 12 oz | 117.5 | .265 | 9.25 |

| Reduction vs Box | |
|-------------------|------------|
| Landfill Discards | 68% |
| GHG | 69% |
| Energy | 23% |

Beverage Packaging

- The flexible beverage pouch:
 - Consumes ½ the energy of the closest alternative
 - Generates 75% less emissions than the closest alternative
 - Significantly reduces greenhouse gases released and energy consumed in transport of unfilled packages from converter to filling operation



| Beverage Packaging | Product Weight | Package Weight | Product/ Packaging Ratio | Pkg. Weight per 100g Product | MSW Landfill per 100g product | Energy Consumption MJ/8 oz | Emissions Kg CO ₂ e/ 8 oz |
|--------------------------------|--------------------------|----------------|--------------------------|------------------------------|-------------------------------|----------------------------|--------------------------------------|
| Glass Bottle and Metal Cap | 8 ounces (236 g) | 198.4g | 1:1 | 83.9 g | 54.5 g | 3.36 | 0.29 |
| Plastic PET Bottle and Cap | 12 ounces (340 g) | 22.7 g | 10:1 | 9.6 g | 6.0 g | 3.00 | 0.18 |
| Aluminum Can | 8 ounces (236 g) | 11.3 g | 21:1 | 4.7 g | 2.4 g | .99 | 0.08 |
| Stand-up Flexible Pouch | 24 ounces (680 g) | 5.7 g | 35:1 | 2.8 g | 2.8 g | .45 | 0.02 |



Flexible Packaging Examples



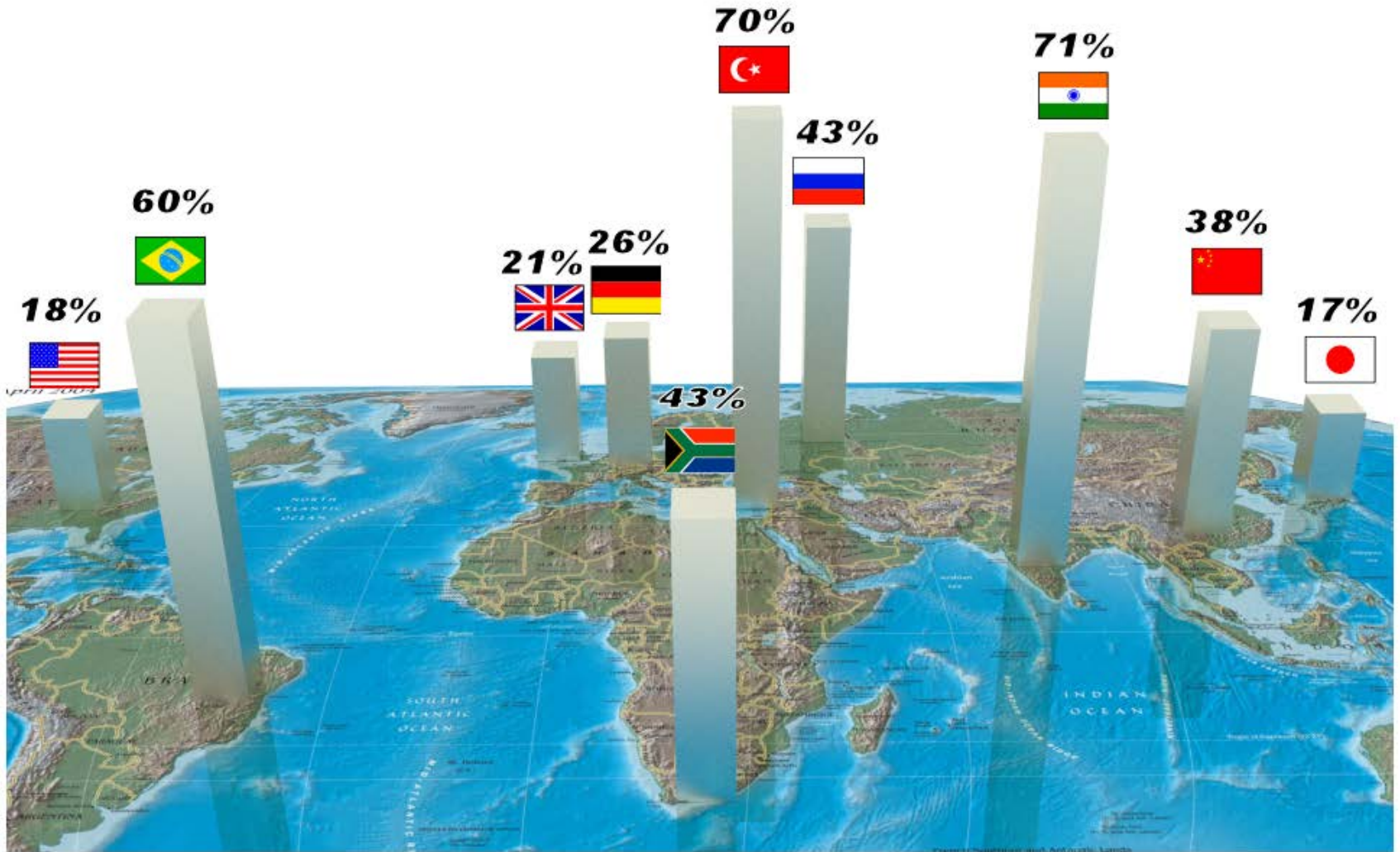
greenerpackage.com



nestle-shop.ch



Packaging Satisfaction



% who say packaging is important to overall product satisfaction



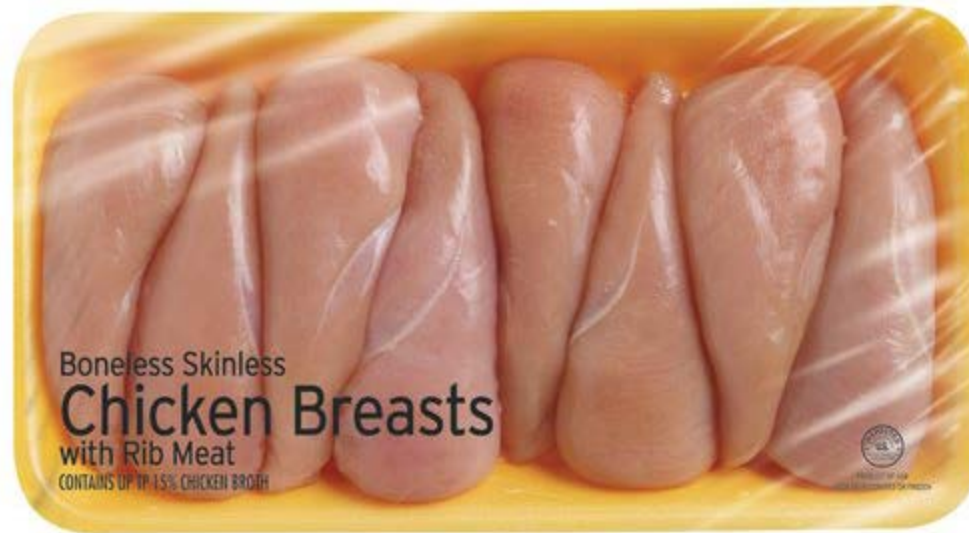
Embodied Fossil Energy







Food Packaging



Modern agriculture is the use of land to convert petroleum into food.

Al Bartlett

**40 kWh/kg
~22% wasted**

Pimentel and Pimentel, 2003

FAO, 2012

CO₂e

13X bigger for beef

chicken

Benefit



Expenditure



} Avoided Waste?



Demand for Bioproducts?

PANTENE PROV [natureFUSION]

UP TO **10X**
STRONGER HAIR*

FUTURE FRIENDLY™
NEW
PLANT-BASED
BOTTLE
(up to 59% excluding cap)

*strength against damage vs. non-conditioning shampoo ©2011 P&G



**NEW
PLANT-BASED
BOTTLE**

(up to 59% excluding cap)

*strength against damage vs. non-conditioning shampoo ©2011 P&G

The pure, crisp taste of DASANI now comes in a better bottle. A bottle up to 30% made from plants that is still 100% recyclable.

DASANI.

Pure Taste in a Better Bottle

DASANI.

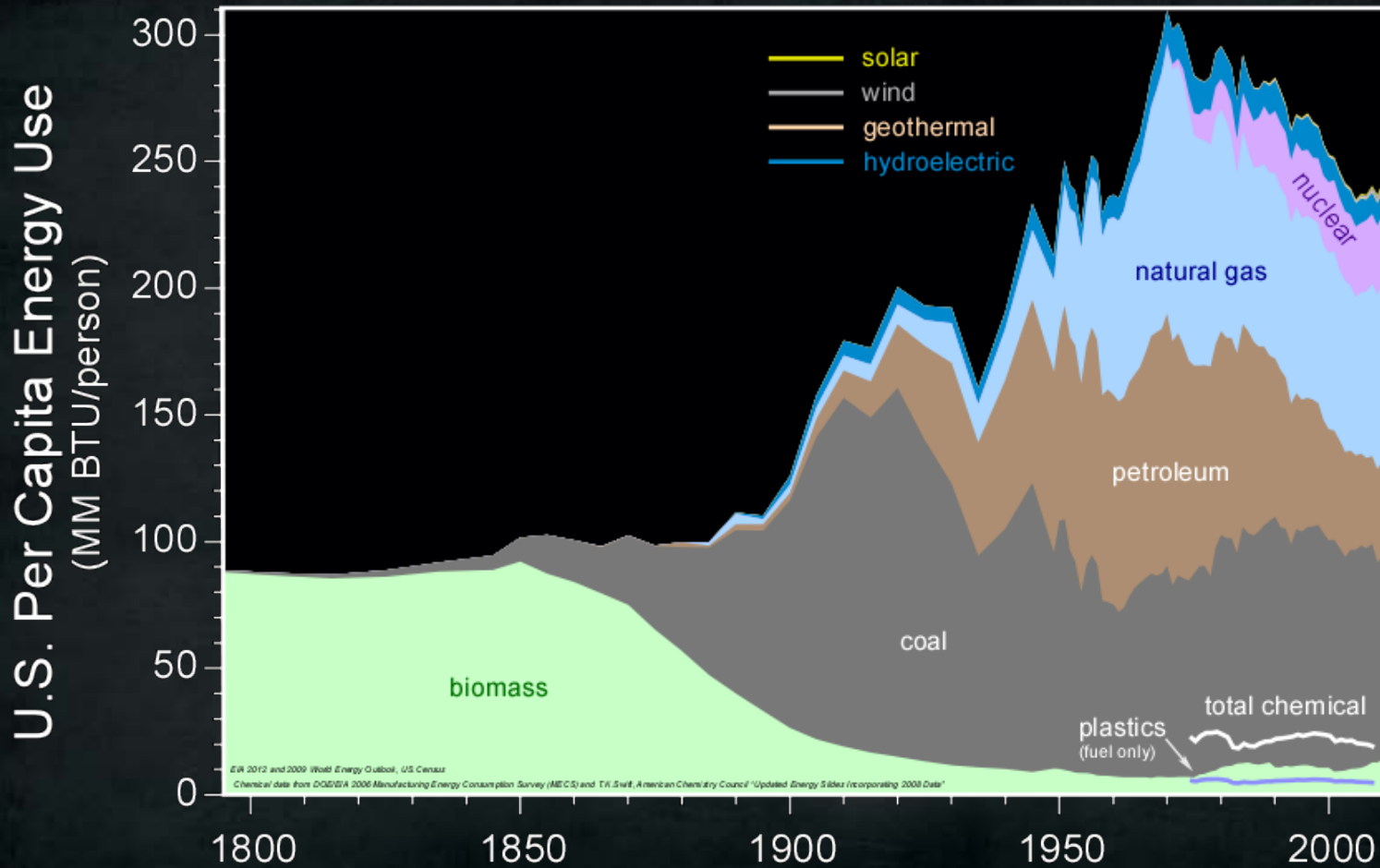
plantbottle®
Up to 30% made from plants
100% recyclable plastic bottle

*Delta Airlines Napkin
April 2012*

*Midland Daily News
1 January 2012*



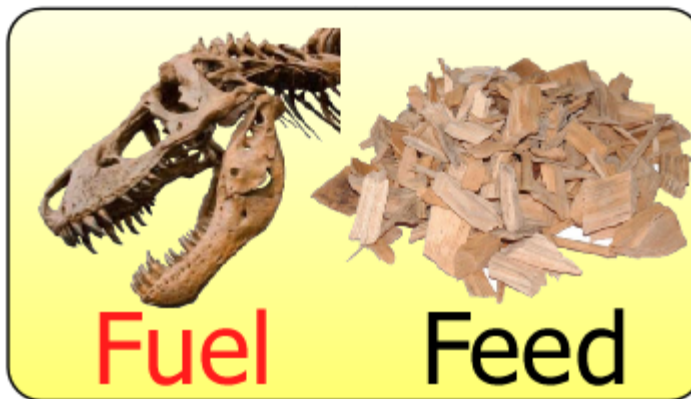
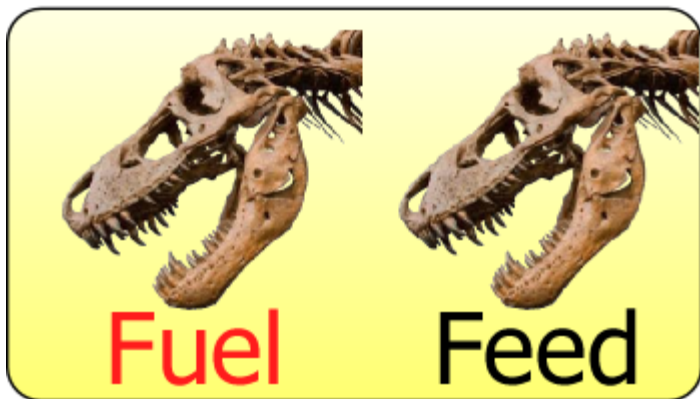
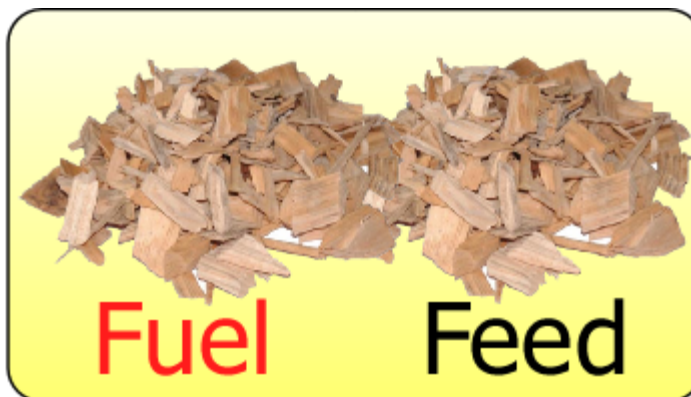
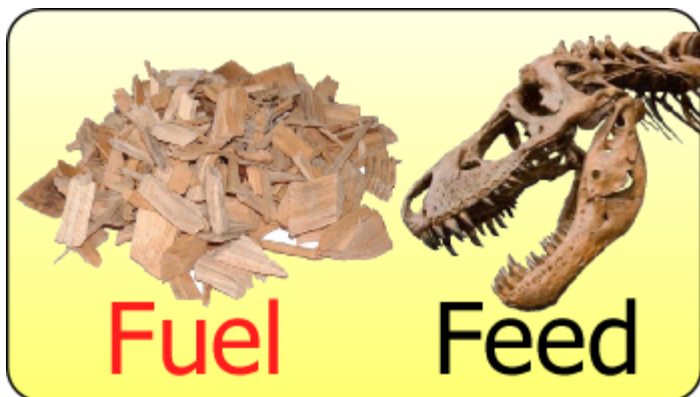
Per Capita Energy Use







Two Carbon Flavors





The End

Questions?