Sustainability and Its Impact on the Chemical Industry

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Executive External Strategy and Communications Fellow
The Dow Chemical Company.

25 January 2021

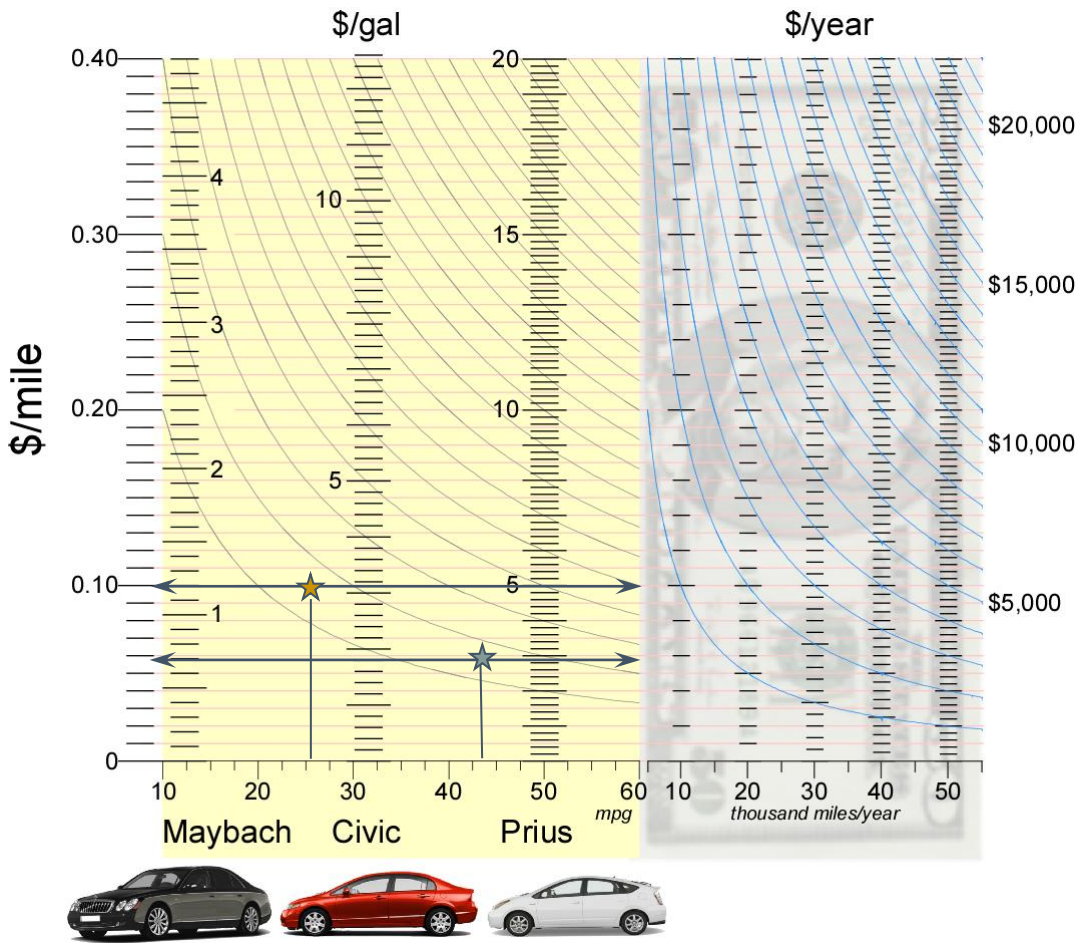

Green-e
Energy
CERTIFIED


TDI


XLE
HYBRID
SYNERGY
DRIVE

saved 6 tons CO2
at $917/ton

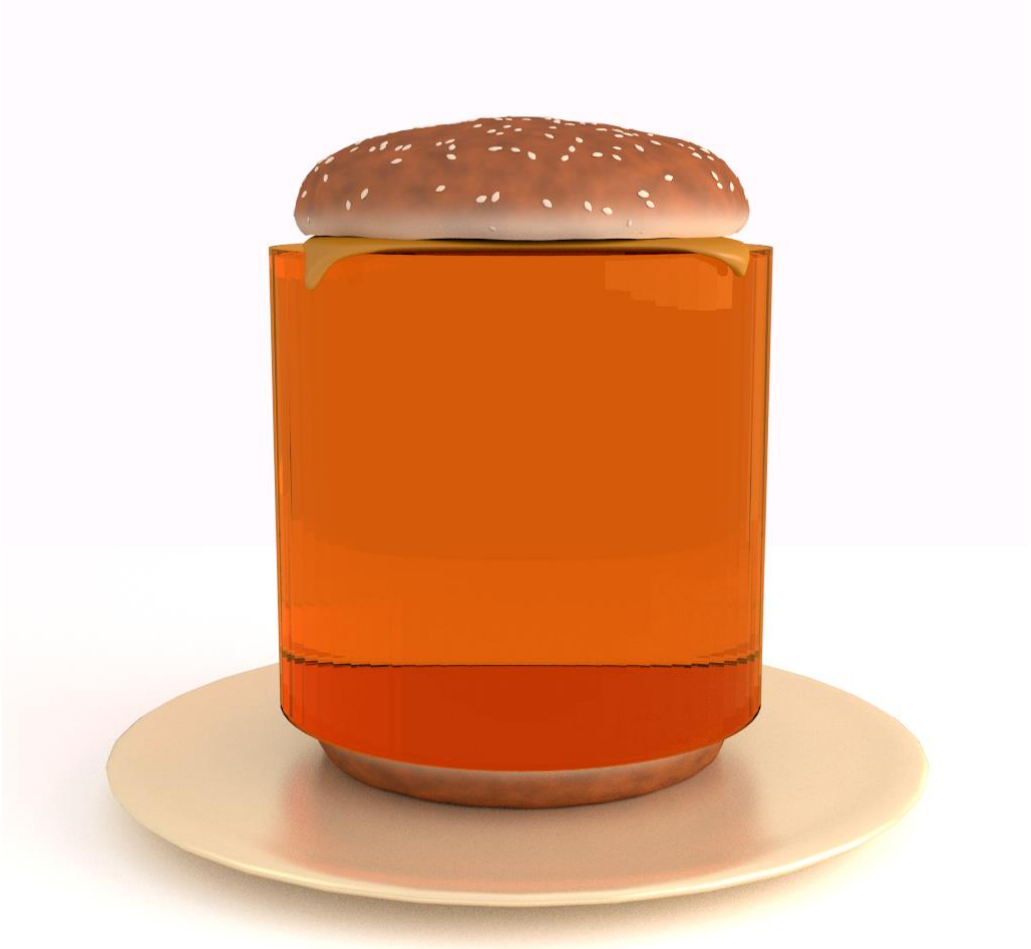
offsets are~$10/ton



min wage is $32,600/MM BTU

gasoline at $2/gal ~$15/MM BTU

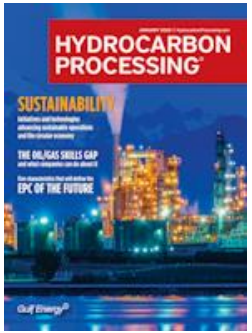
Cabot CEO in 2019 is
$1.9 million/MM BTU assuming
24/7 work at high output




ORGANIC
NASOYA
EXTRA FIRM
TOFU
Nutrition Facts
ORGANIC
NASOYA
FIRM
TOFU
Great for Grilling, Stir-Frying & Sautéing
Nutrition Facts

Sustainability Definition

The process of managing available resources, investments and technologies to maintain and optimize operations for greater safety, reliability, efficiency, and environmental and social awareness.



SUSTAINABILITY DEFINITION

Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs.

Brundtland Commission

Sustainability Definition

> Sustainability is the ability to continue a defined behavior indefinitely. Environmental sustainability is the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely.

thwink.org

Sustainability Definition

> Sustainability is wondrously complicated. Every person will give you a slightly different definition of sustainability. That's because sustainability really can be applied to almost anything in life.

Arizona State University School of Sustainability

What is the Best Definition?

1. The process of managing available resources, investments and technologies to maintain and optimize operations for greater safety, reliability, efficiency, and environmental and social awareness.
2. Meeting our own needs without compromising the ability of future generations to meet their own needs.
3. The ability to continue a defined behavior indefinitely.
4. Wondrously complicated.

SUSTAINABILITY DEFINITION

Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs.

Brundtland Commission

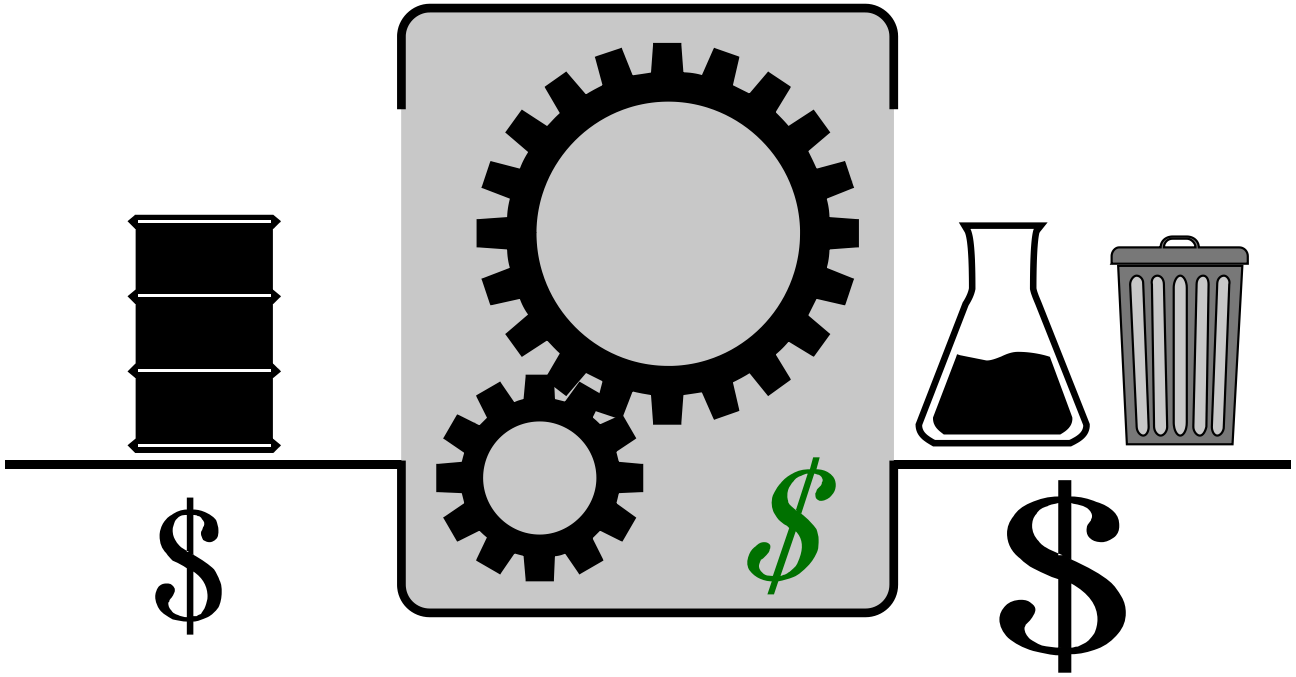
Three Pillars of Sustainability

UN Sustainable Development Goals

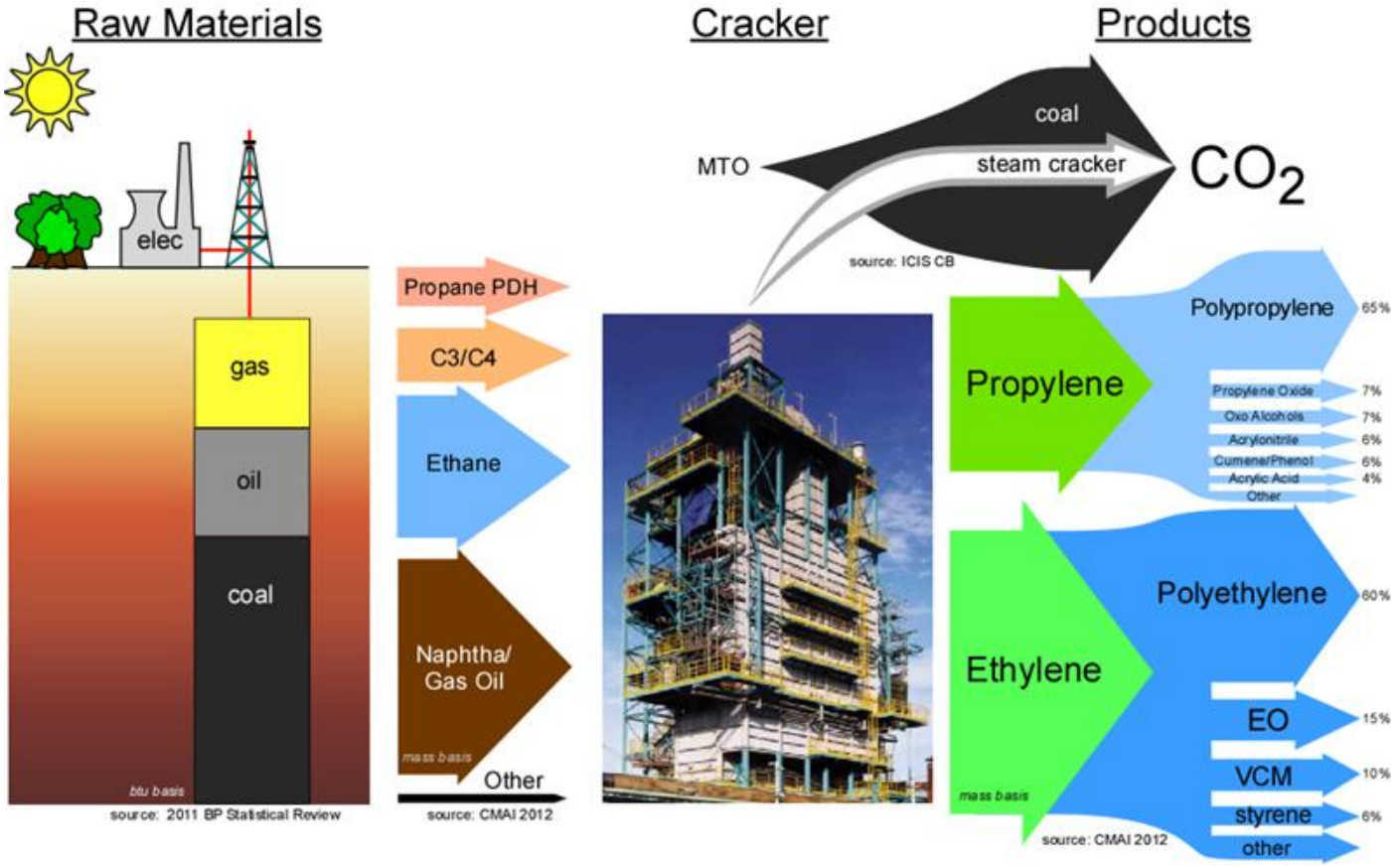
Dow Sustainability Journey

Main Focus Areas-2020 update

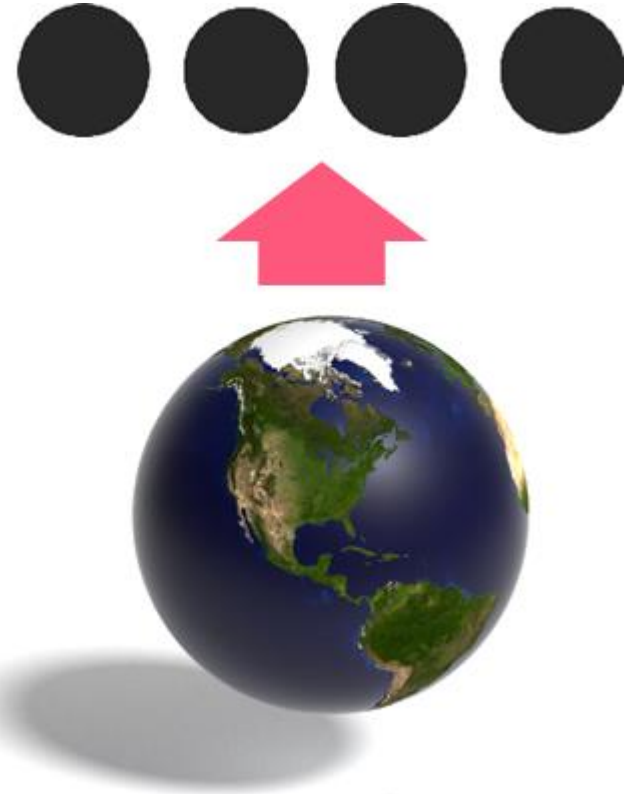
Simplified Chemical Industry



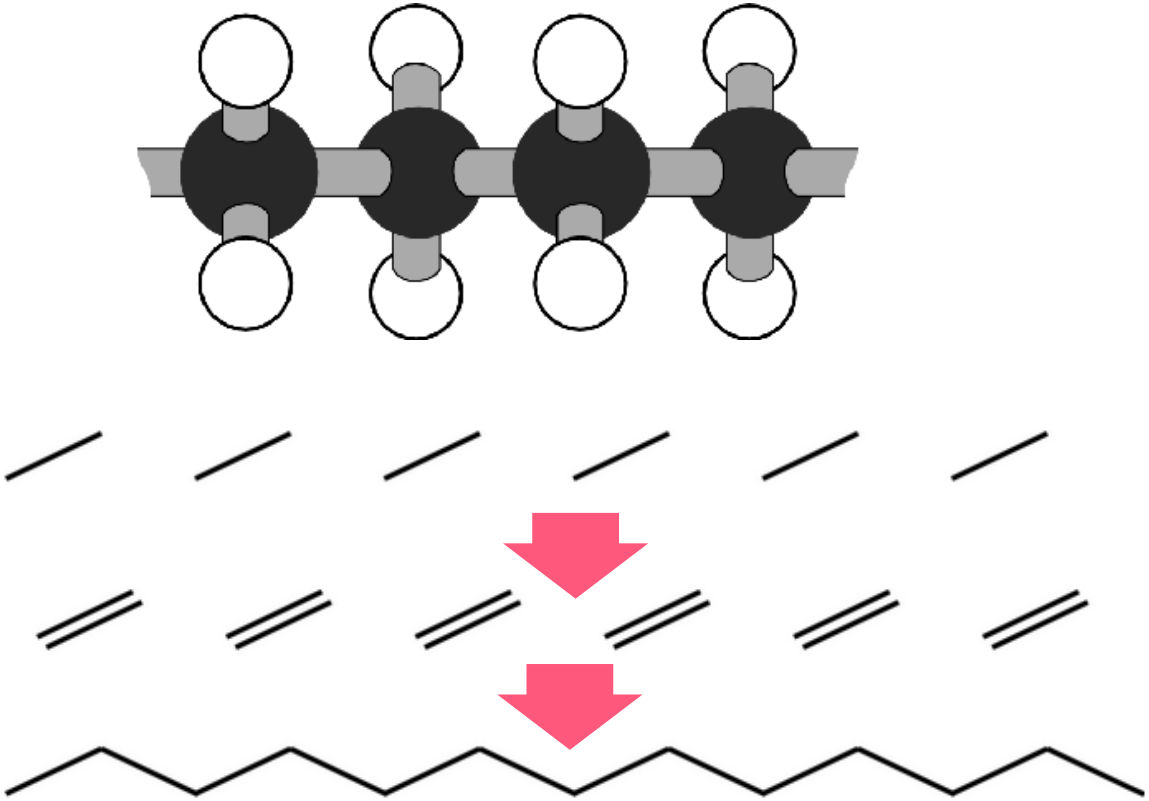
MODERN CHEMICAL INDUSTRY



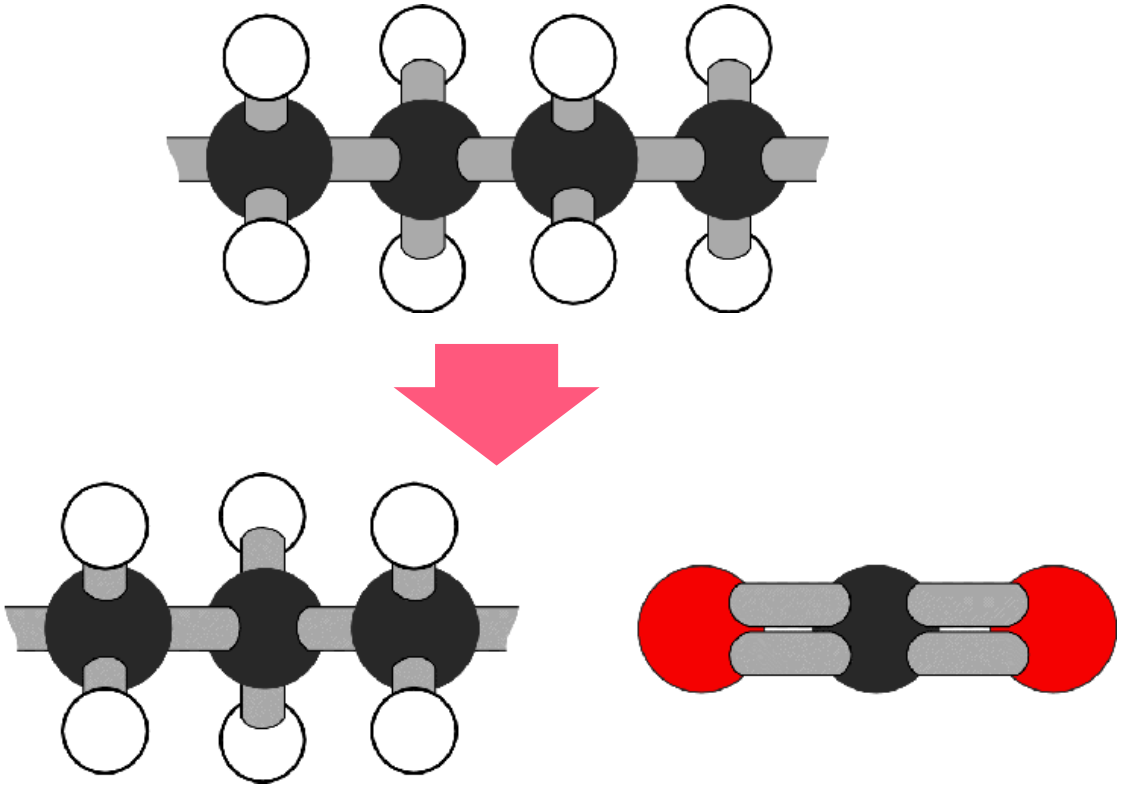
Rough Industry Mass Balance



CHEMICAL TRANSFORMATION



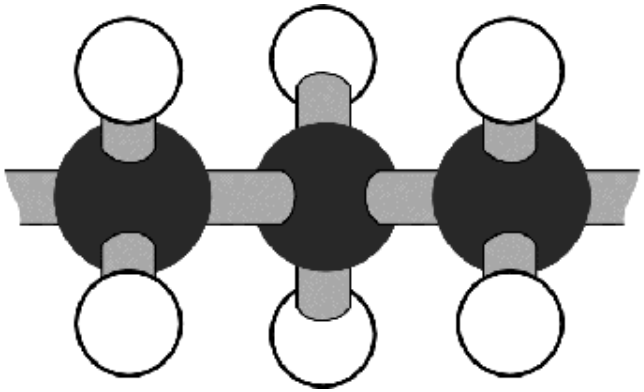
Rough Mass Balance

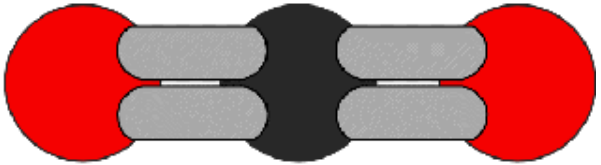


IMPLICATIONS

EPA 2.59 lb CO2/lb black

~5 carbons out of ground
2 go to CO2
3 go to CB
(12 out, 5 burned, 7 product is closer)





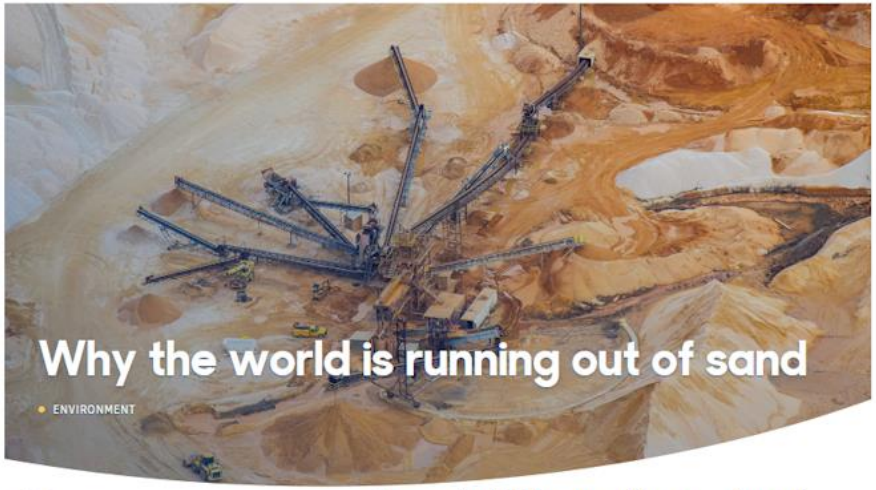
FOOTPRINTS

SAND FOOTPRINT

The World is Running Out of Sand

The little-known exploitation of this seemingly infinite resource could wreak political and environmental havoc

BBC FUTURE



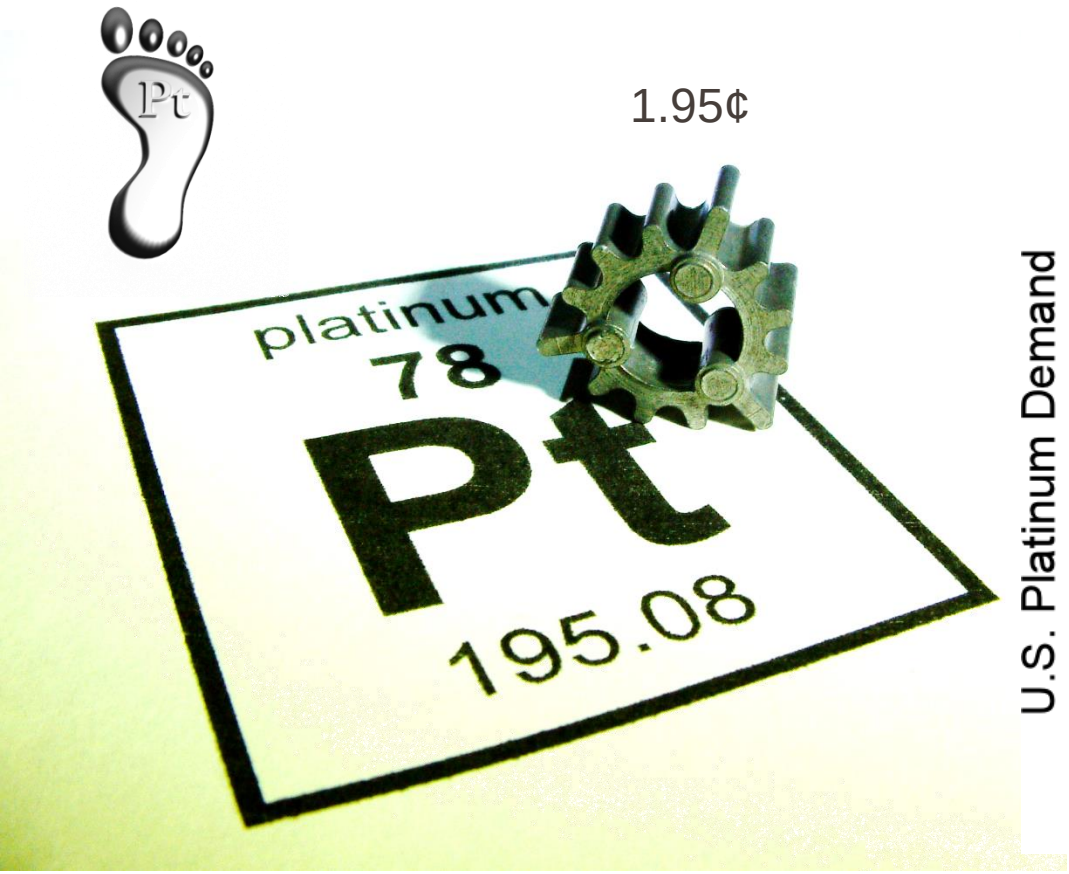
By Vince Beiser
17th November 2019

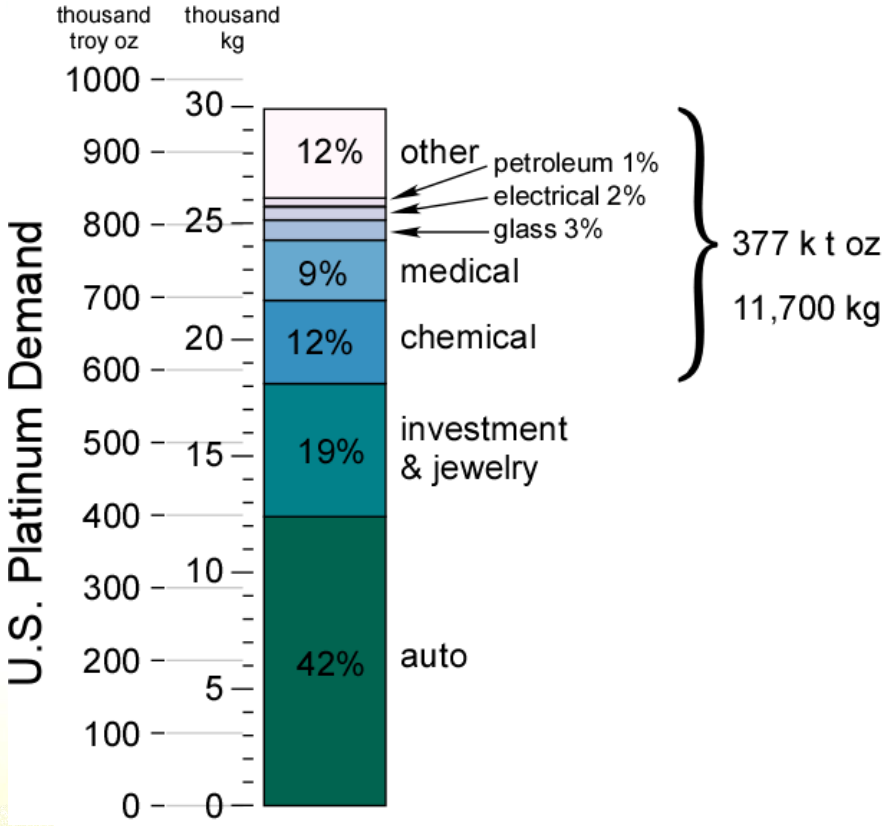
It may be little more than grains of weathered rock, and can be found in deserts and on beaches around the world, but sand is also the world's second most consumed natural resource.

Granite Footprint

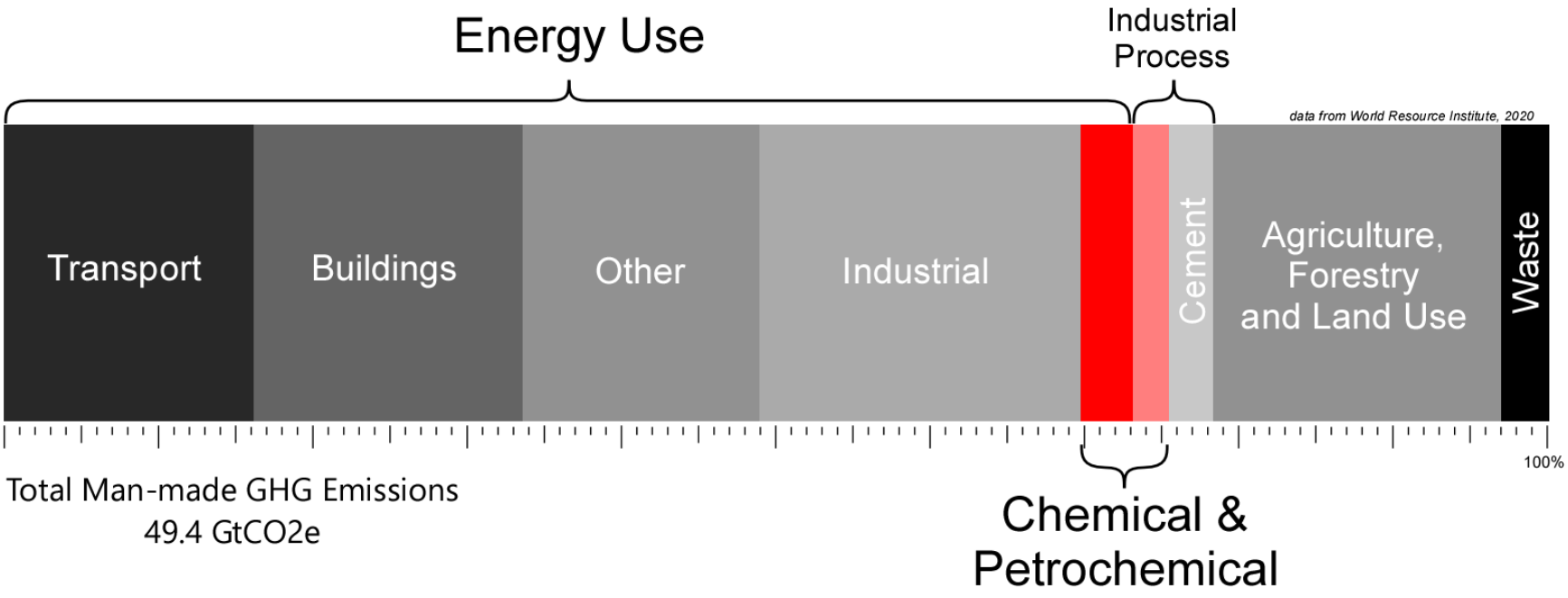
Elemental Footprint

Platinum Footprint

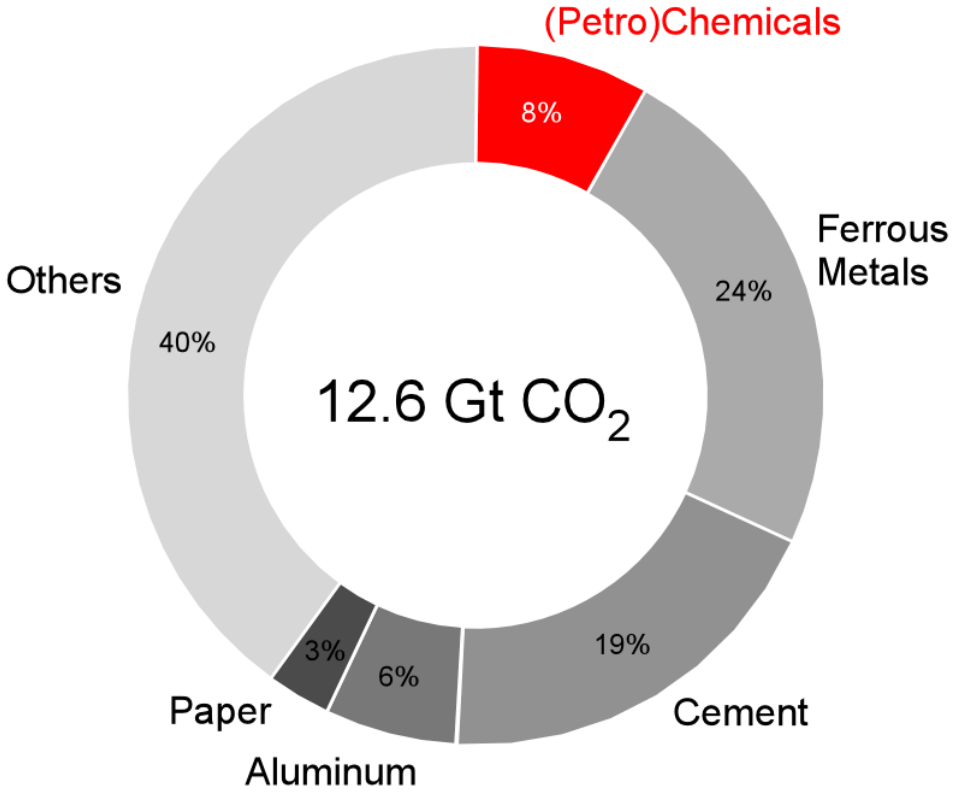




Carbon Footprint of Industry

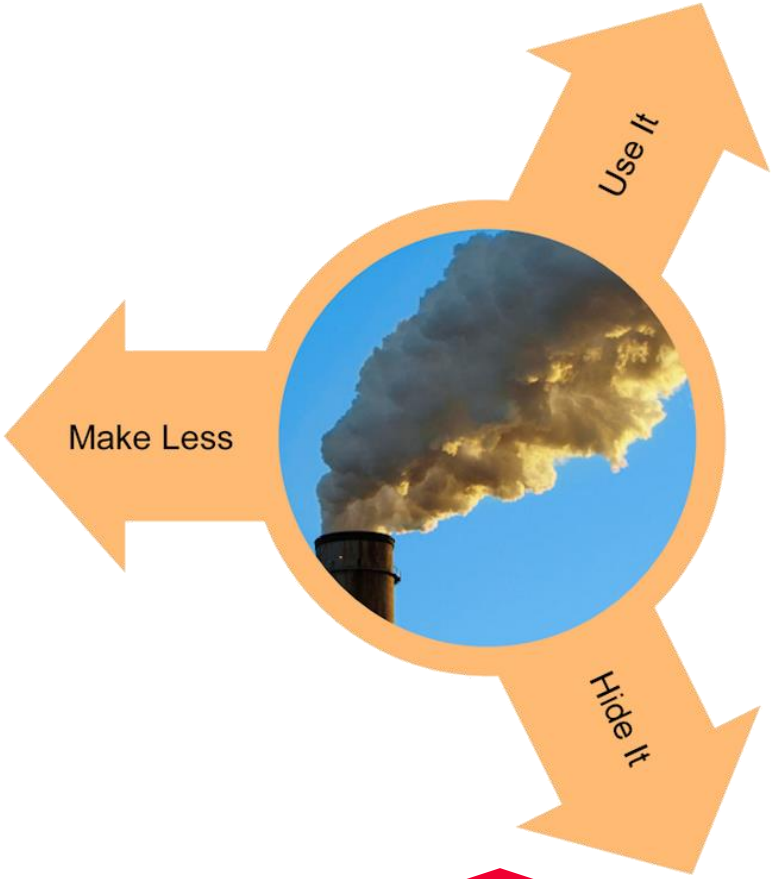


GLOBAL CO2 EMISSIONS FROM INDUSTRY

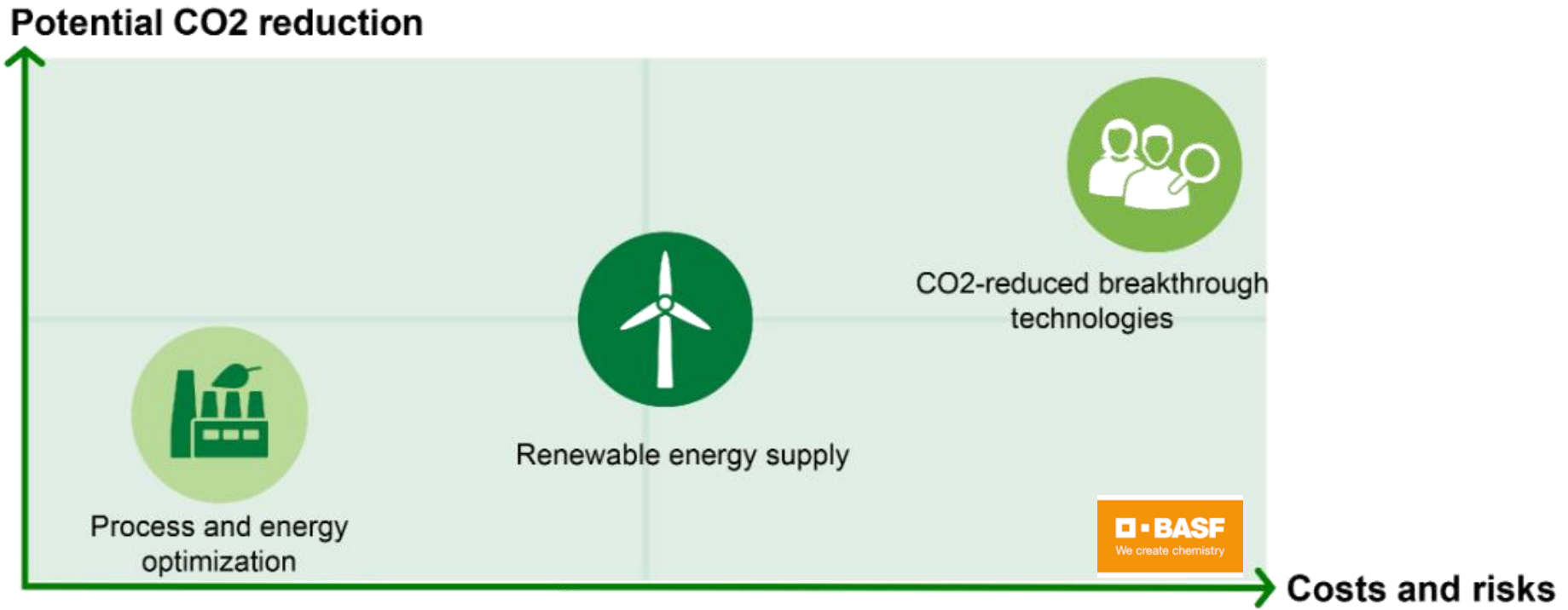


Martin Brudemuller, BASF at the World Economic Forum, 21 Jan 2020

Options For CO_2



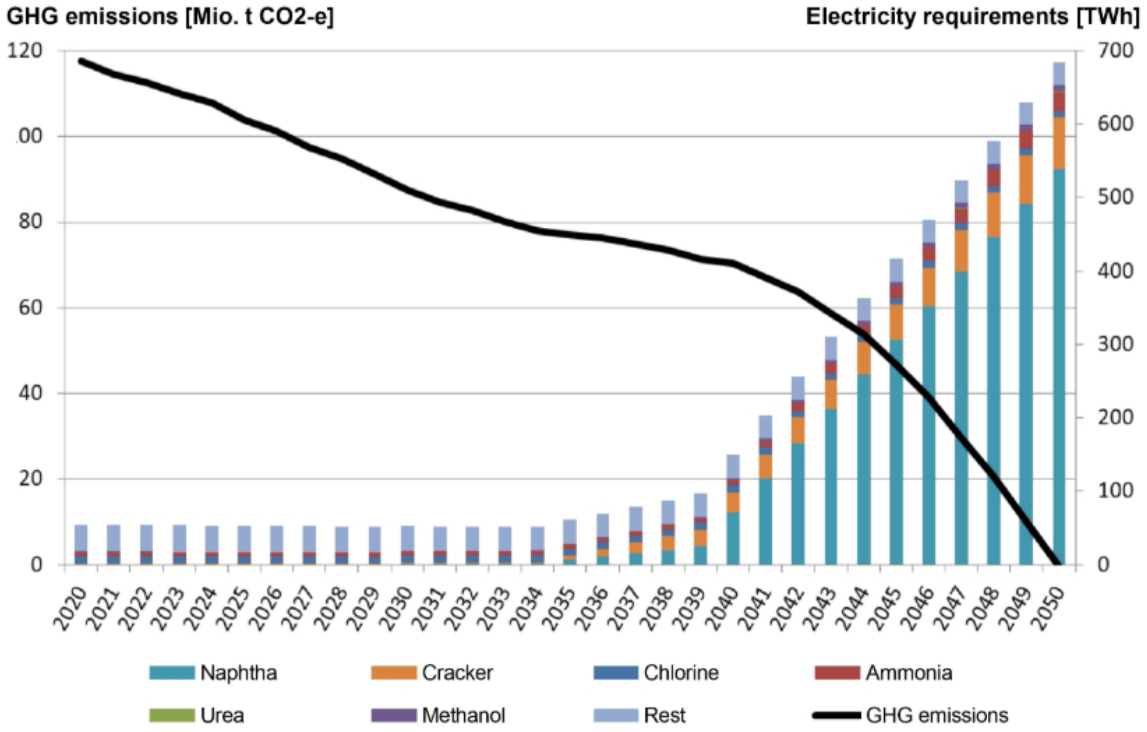
Potential Solutions For Direct Emissions



Martin Brudermüller, BASF at the World Economic Forum, 21 Jan 2020

Plan For Zero Emissions

Electricity requirements to achieve greenhouse gas neutrality in the German chemical industry

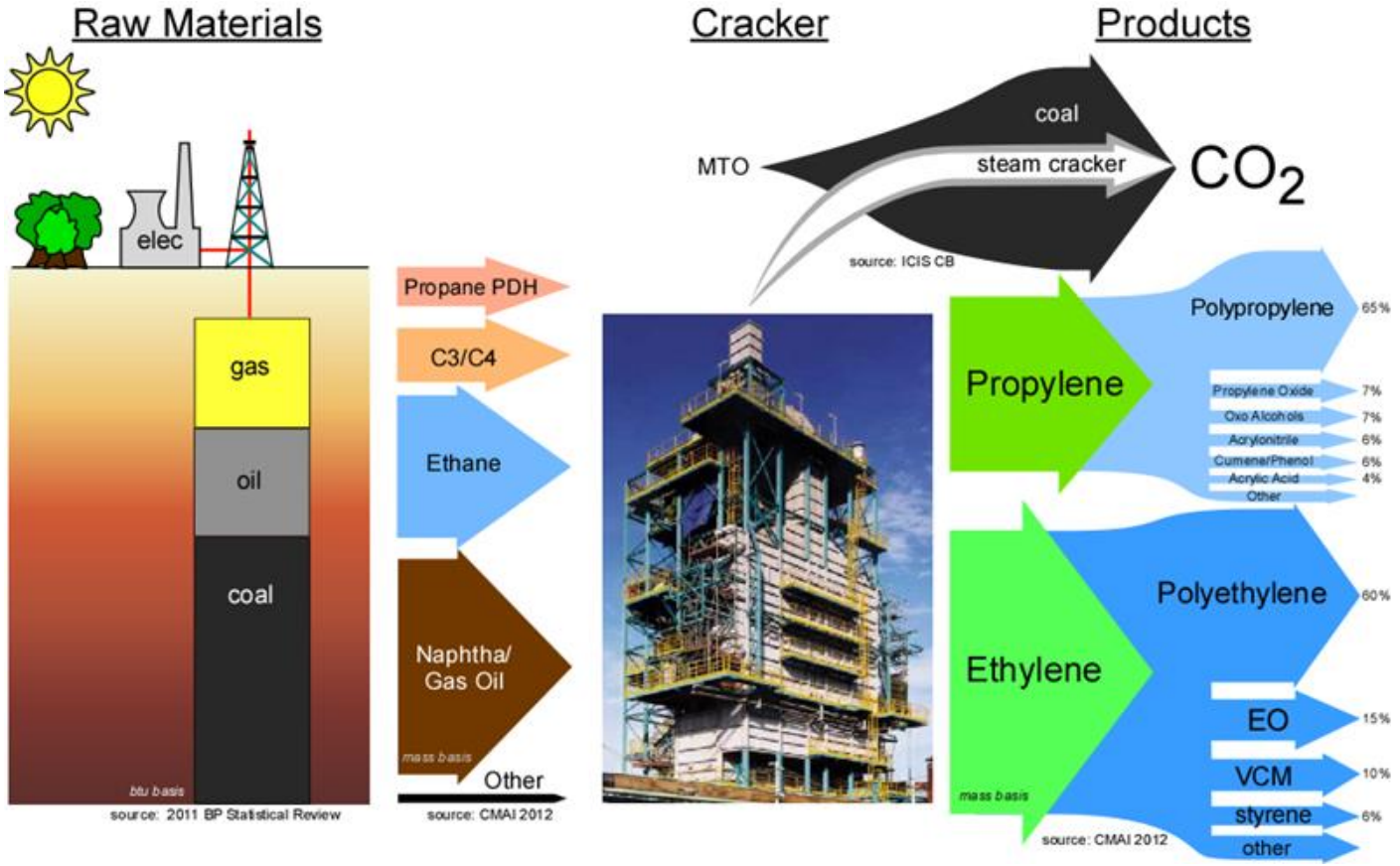


490 for all Germany today

270 for all industry

Martin Brudermüller, BASF at the World Economic Forum, 21 Jan 2020

MODERN CHEMICAL INDUSTRY



Bad Omen

THE COLLINS WORD OF THE YEAR 2018 IS...

SINGLE-USE

'Single-use', a term that describes items whose unchecked proliferation are blamed for damaging the environment and affecting the food chain, has been named Collins' Word of the Year 2018.

Single-use refers to products – often plastic – that are 'made to be used once only' before disposal. Images of plastic adrift in the most distant oceans, such as straws, bottles, and bags have led to a global campaign to reduce their use.

The word has seen a four-fold increase since 2013, with news stories and images such as those seen in the BBC's Blue Planet II steeply raising public awareness of the issue.

Collins
Pioneers in dictionary publishing since 1819

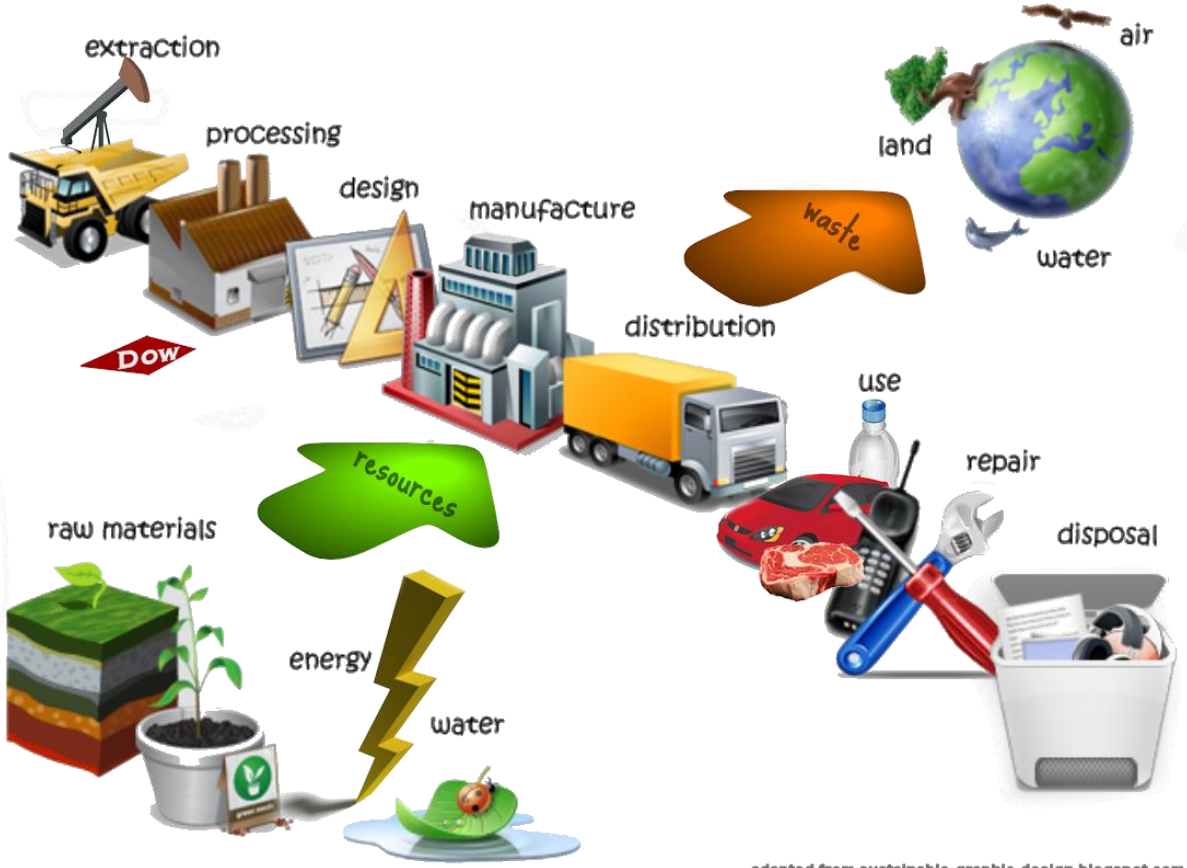
DOW

SINGLE USE

More Sustainable?

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

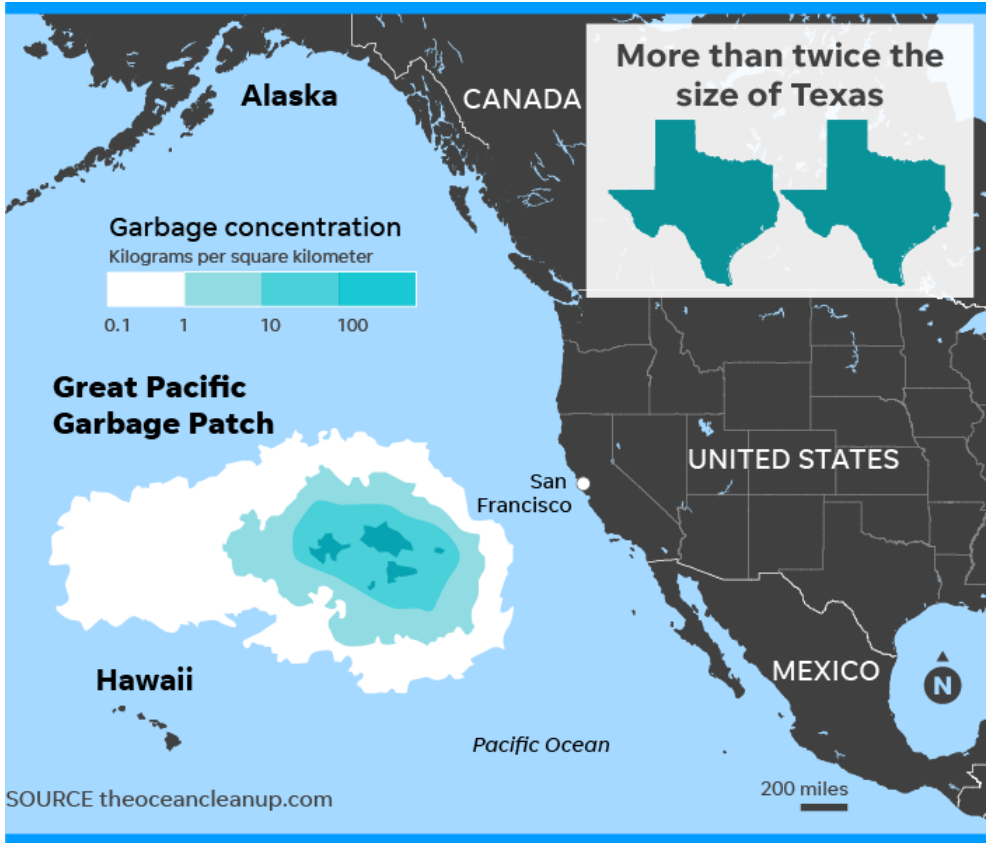
How about this one?

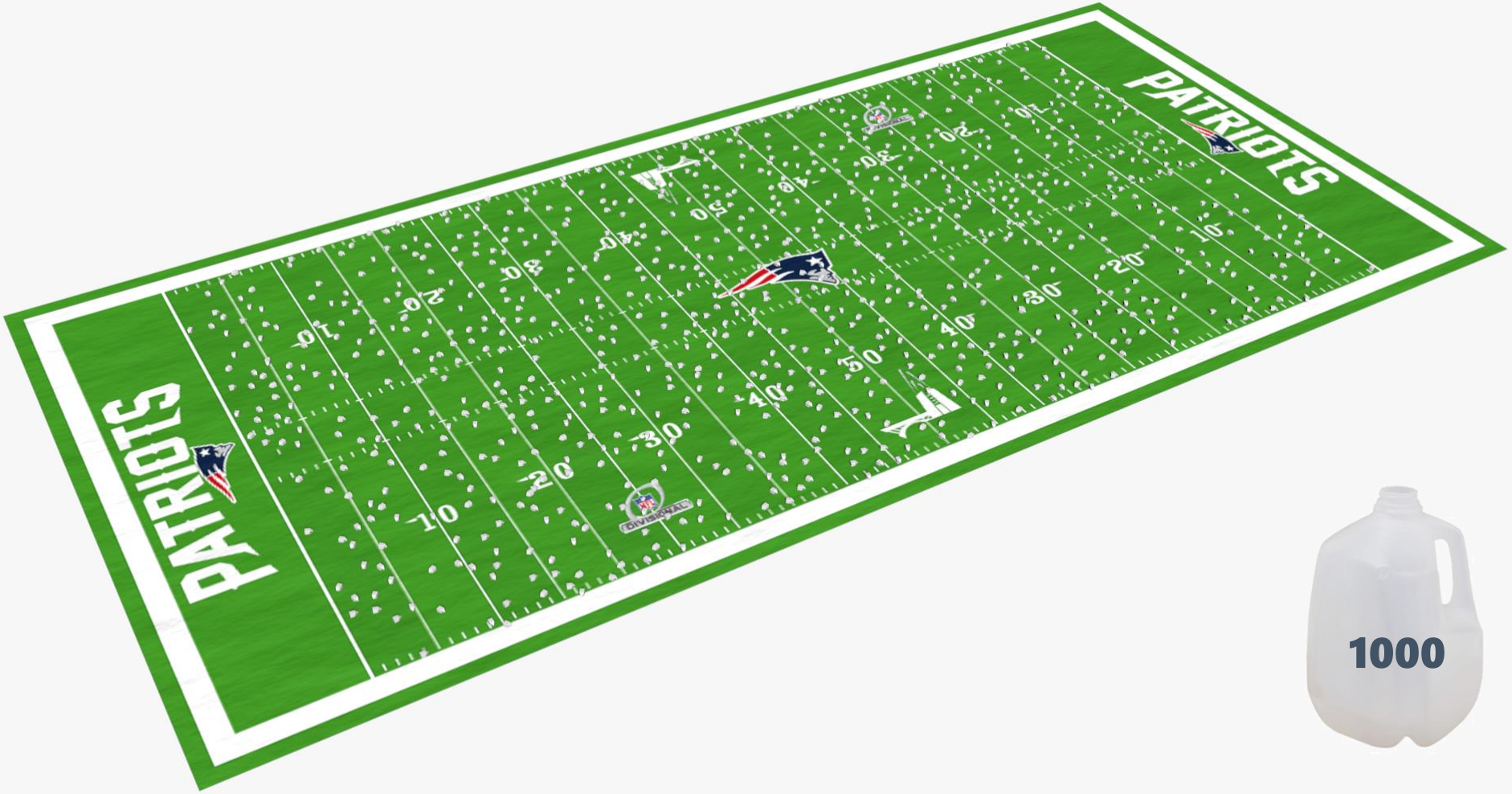


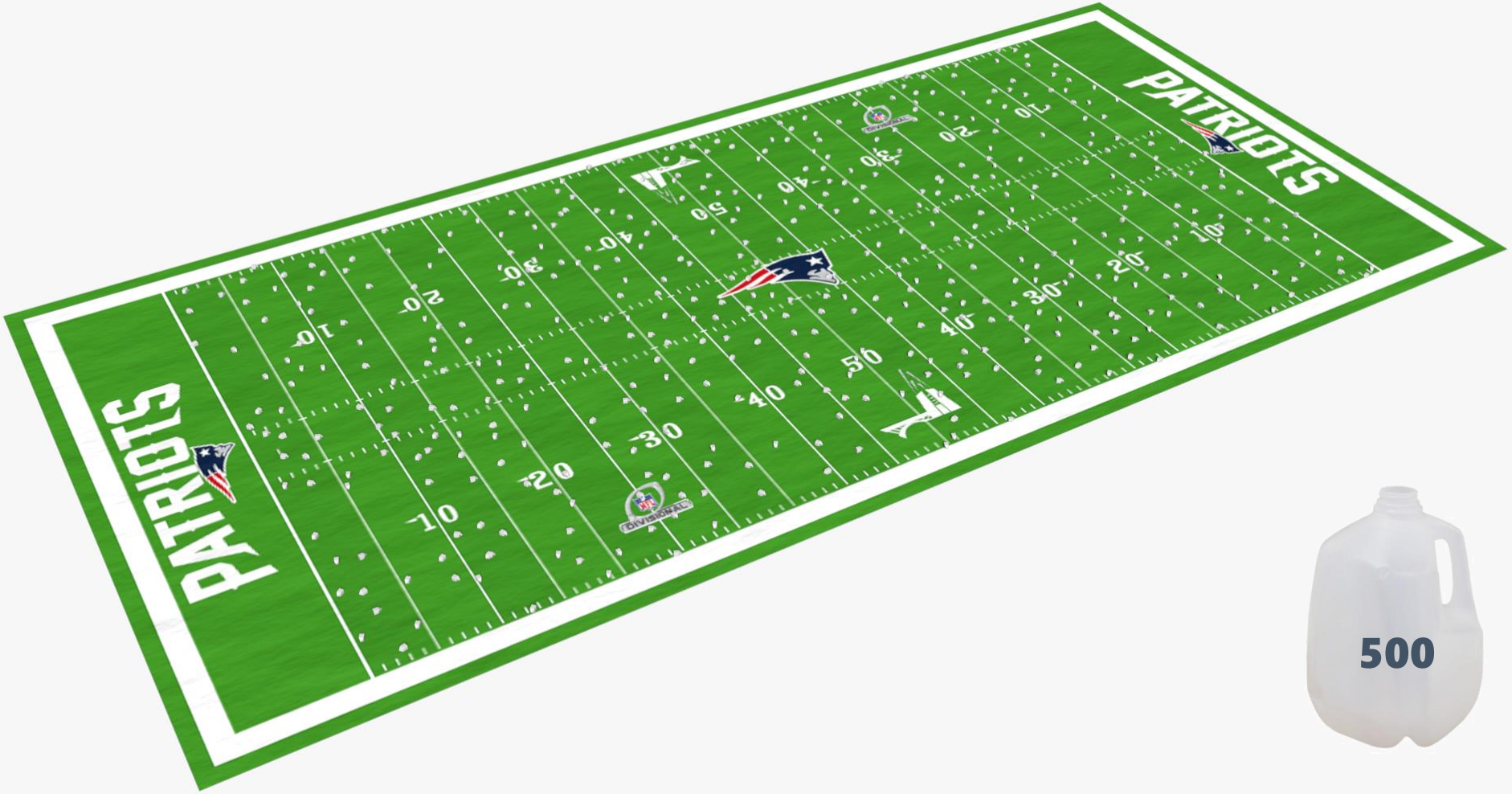
adapted from sustainable-graphic-design.blogspot.com

Ocean Plastic

The Pacific Gyre




PATRIOTS
PATRIOTS
1000


PATRIOTS
PATRIOTS
500


PATRIOTS
PATRIOTS
200


PATRIOTS
PATRIOTS
100


PATRIOTS
PATRIOTS
50


PATRIOTS
PATRIOTS
20


PATRIOTS
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PATRIOTS
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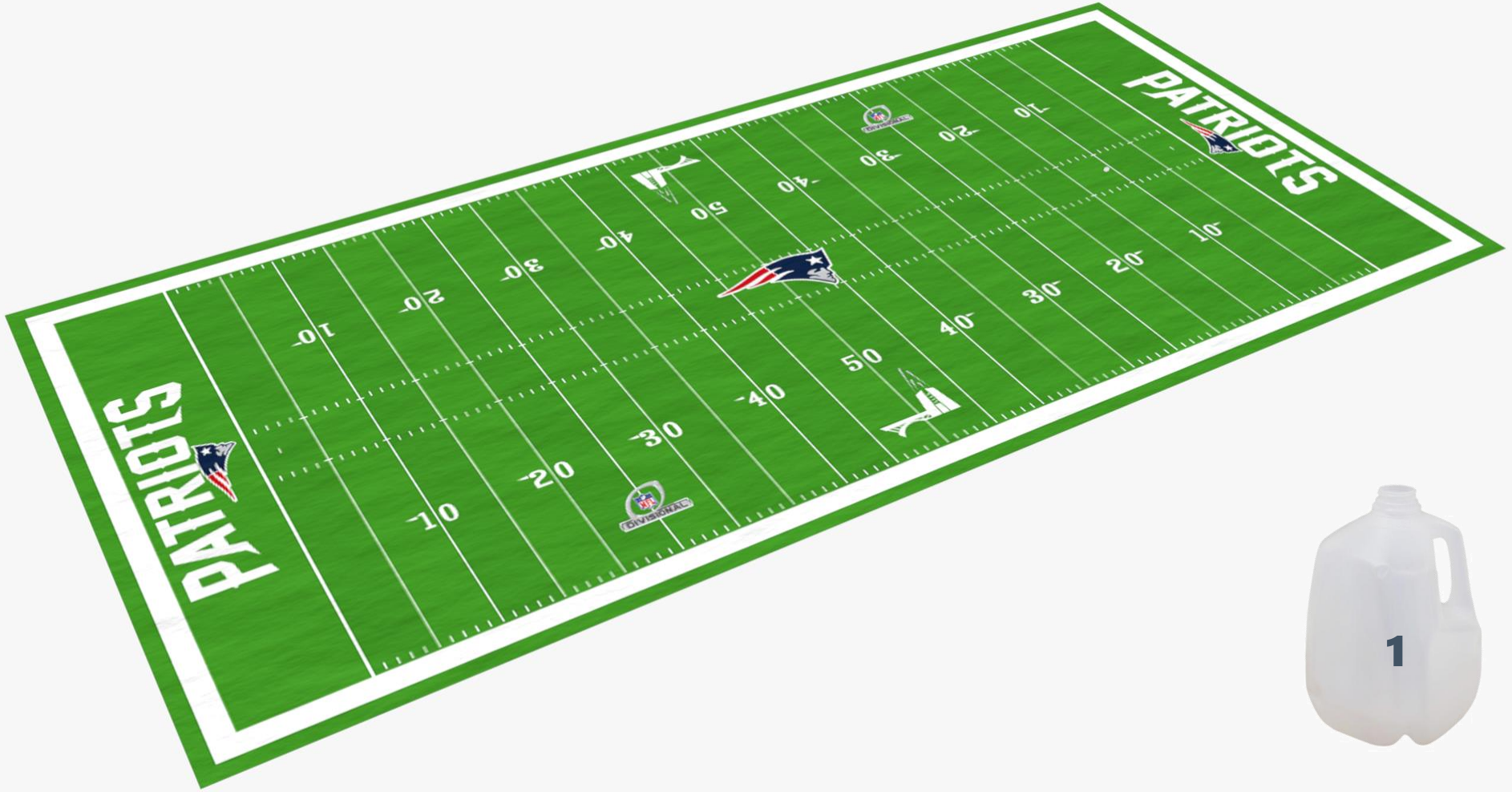
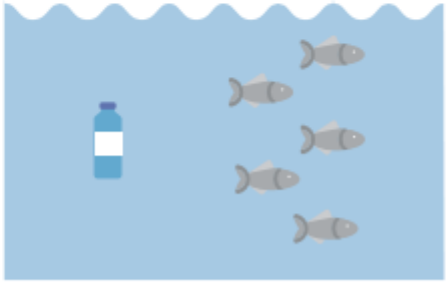
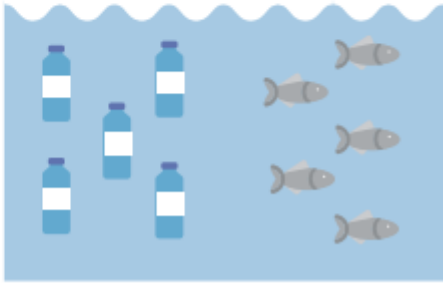
10
2


PATRIOTS
PATRIOTS
1

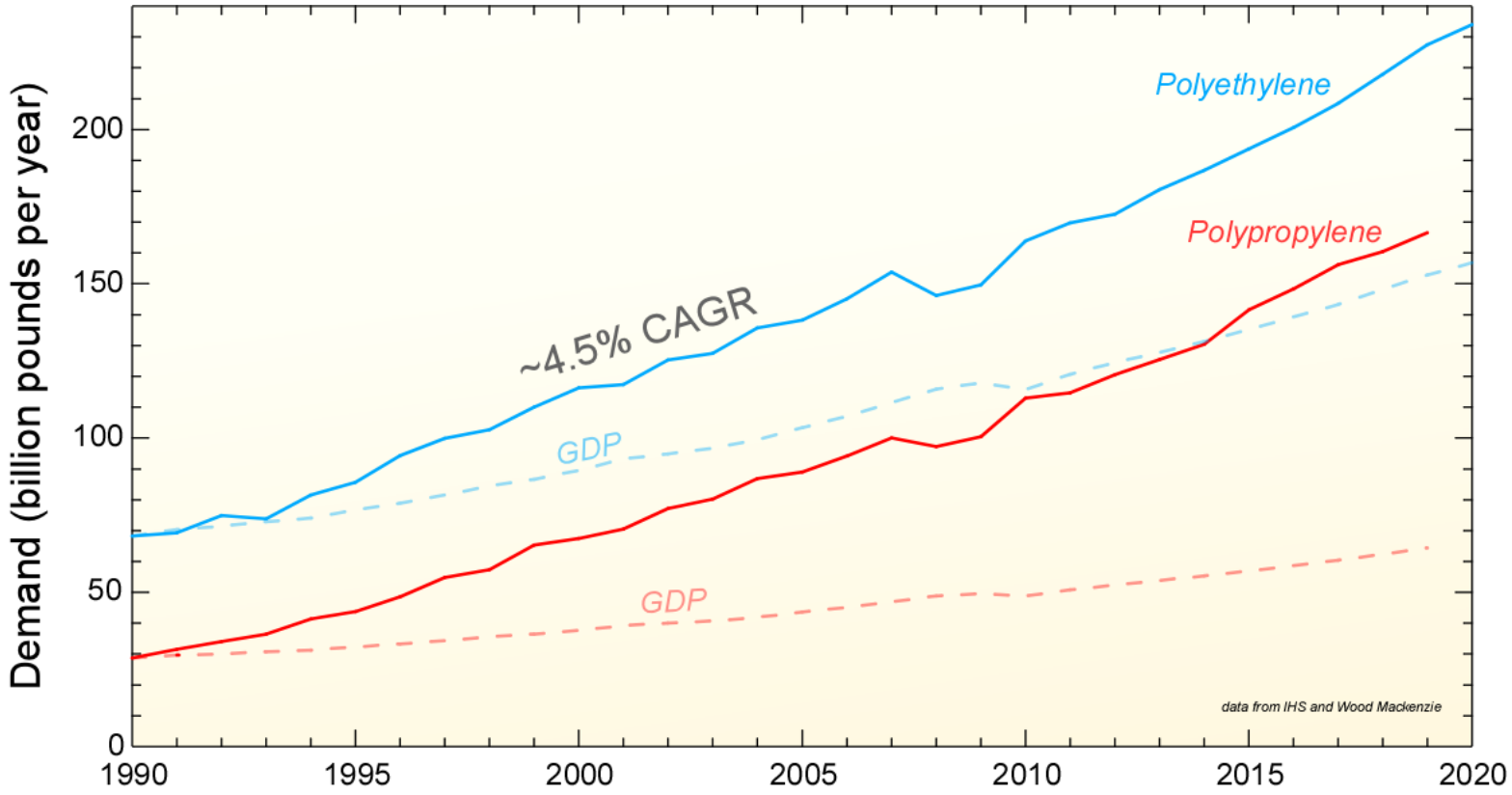
In The Pacific Gyre At Point of Highest Plastic Concentration

5

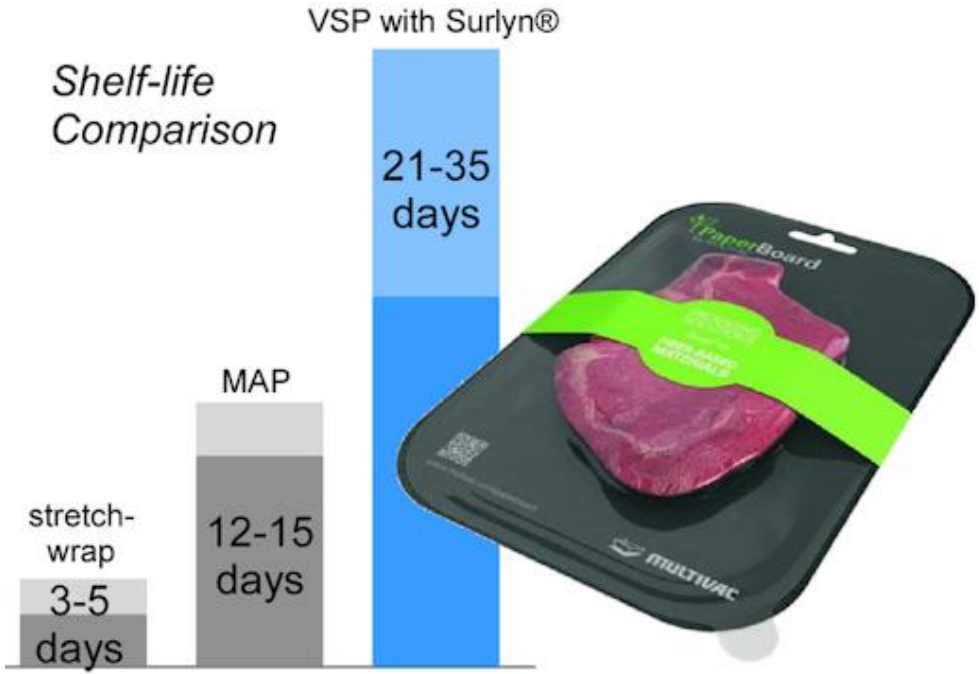

5

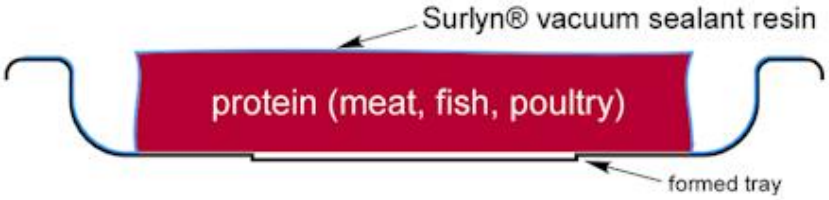
	2014	2050
PLASTICS PRODUCTION	 311 MT	 1,124 MT
RATIO OF PLASTICS TO FISH IN THE OCEAN (BY WEIGHT)	 1:5	 >1:1

GROWING >GDP


Demand (billion pounds per year)
0
50
100
150
200
1990
1995
2000
2005
2010
2015
2020
Polyethylene
Polypropylene
~4.5% CAGR
GDP
GDP
data from IHS and Wood Mackenzie

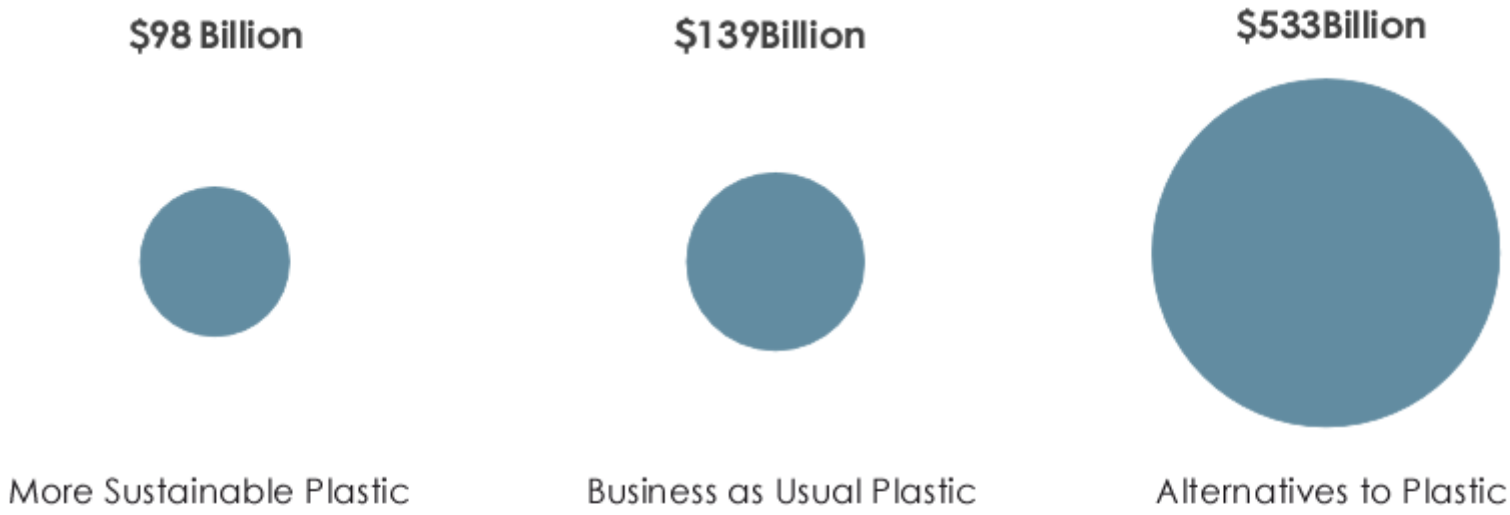
PLASTIC PROVIDES BENEFITS





Plastic Provides Benefits

ALTERNATIVES COST MORE



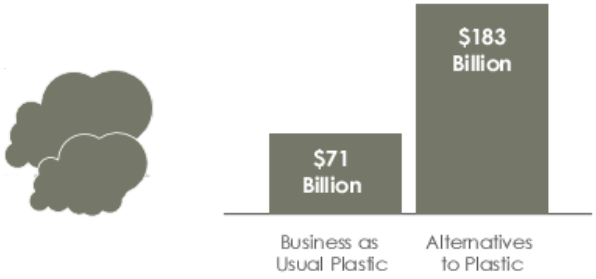
The cost of using alternative materials is approximately four times that of using plastic (in a business as usual scenario). We're producing more and more consumer goods, so choosing the material that creates the least impact is important.

Source: Trucost

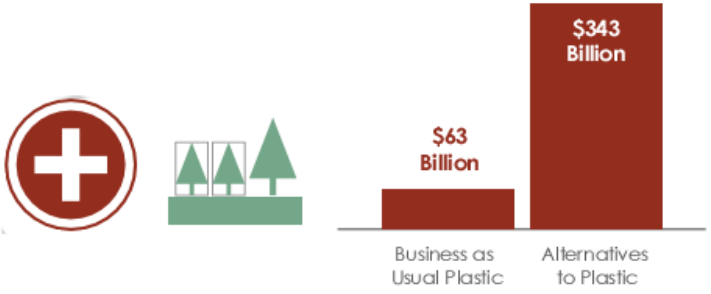
Source: American Chemistry Council TRUCOST report

ALTERNATIVES HAVE HIGHER ENVIRONMENTAL COSTS

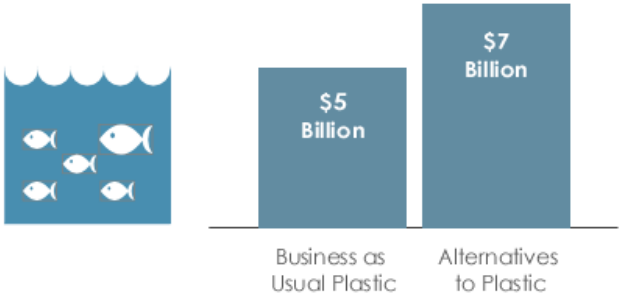
Climate change



Damage to the health of humans and ecosystems



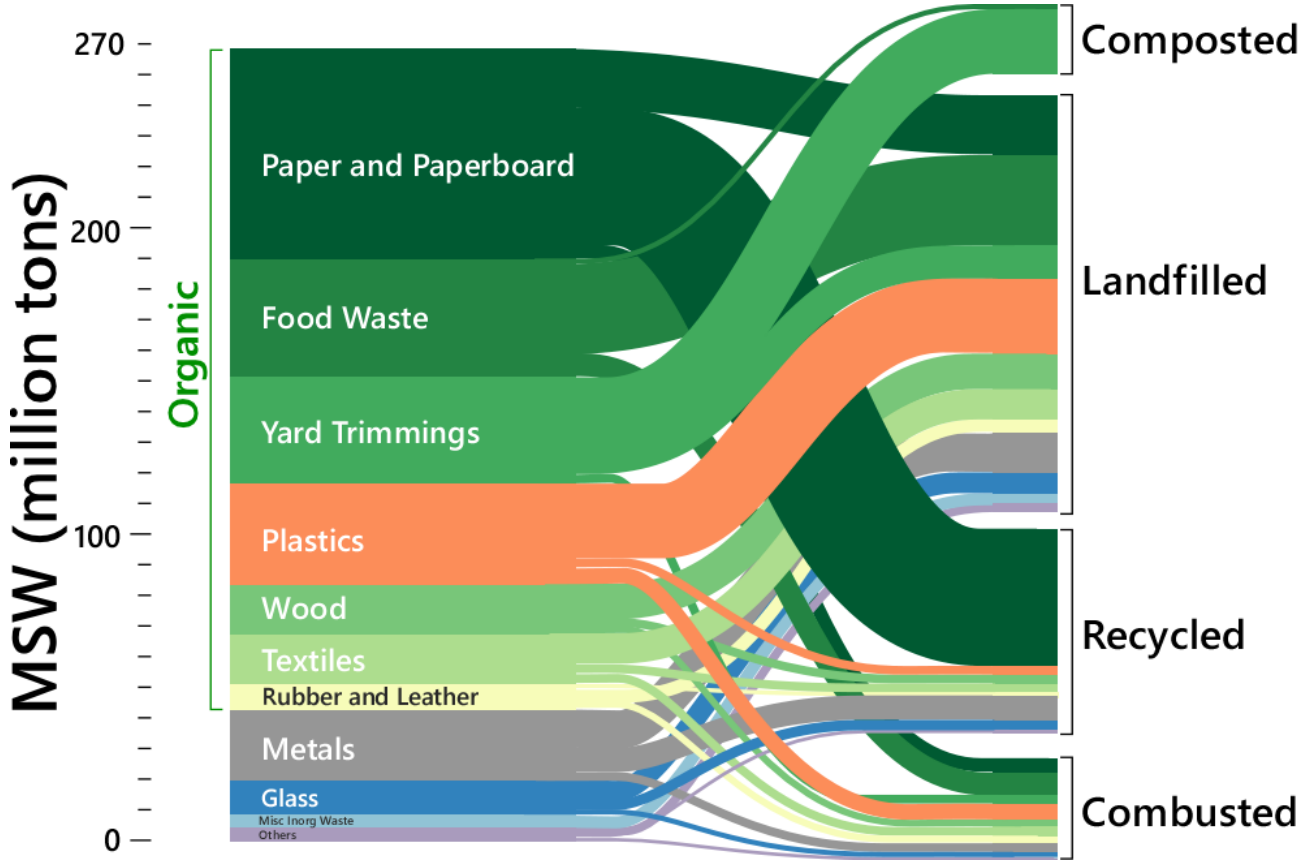
Damage to the oceans



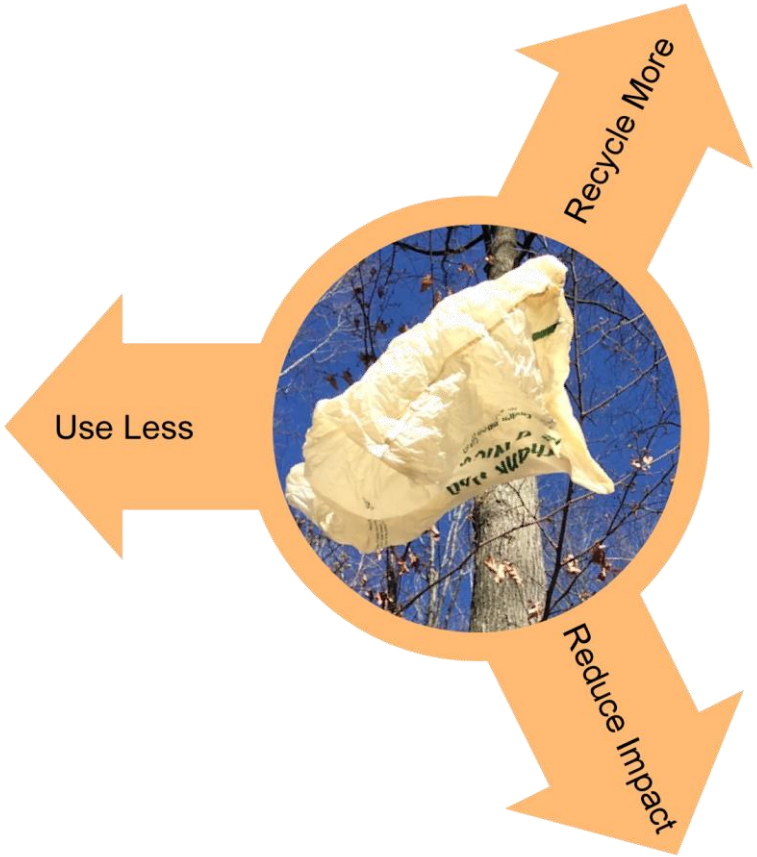
All dollar values are in USD
Source: Trucost

Source: American Chemistry Council TRUCOST report

U.S. TRASH


MSW (million tons)
270
200
100
0
Organic
Paper and Paperboard
Food Waste
Yard Trimmings
Plastics
Wood
Textiles
Rubber and Leather
Metals
Glass
Misc Inorg Waste
Others
Composted
Landfilled
Recycled
Combusted

Possible Solutions



USE LESS WITH MORE EFFICIENT PACKAGING

EDIBLES		NON-EDIBLES
Edible Oils	Rice & Grains	Paint & Coatings
Ketchup & Other Condiments	Breakfast Cereal	Detergents & Cleaning Products
Sauces	Dry Baking Products (flour, sugar, etc.)	Motor Oil & Fuel Additives
Soups	Ground Coffee	Seeds
Honey & Syrups	Snack foods	Cat Litter
Water & Juices		De-icer Pellets
Dry Pet Food or Treats		Fine Aggregates (filter sand, etc.)

EDISON AWARDS
2015

R&D 100
2015
R&D 100 Winner

Re-Closable Cap
- Precision pouring
- Maximum filling content utilization

Flexible Design
- Four Print Surfaces
- Superior drop resistance
- Reduce excess head space
- Improved dispensing
- Collapses easily

Top and Bottom Handles
- Easy handling

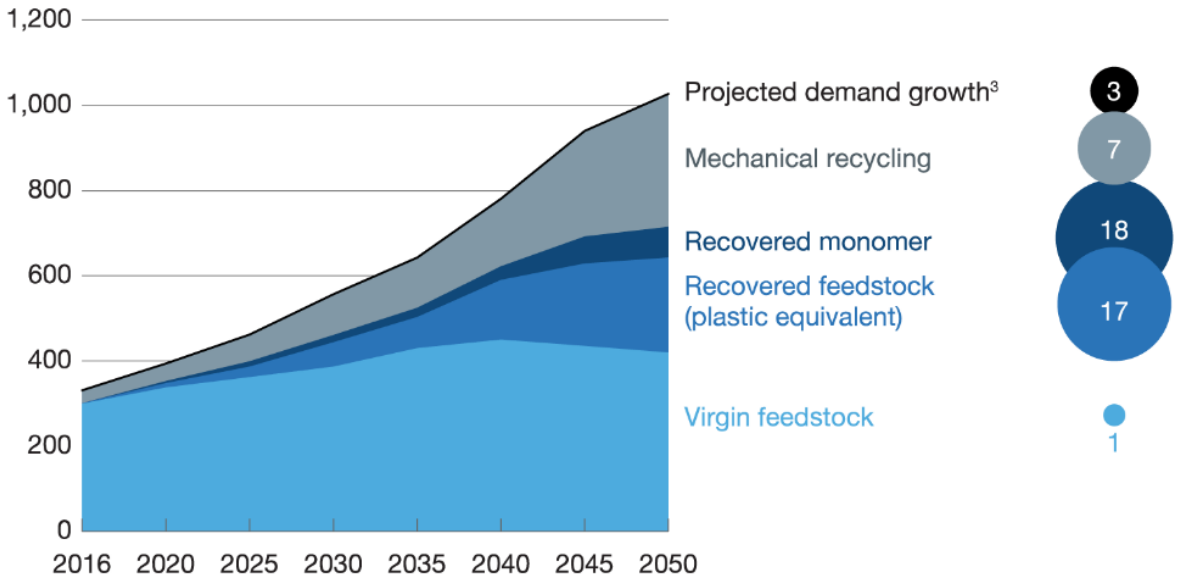
Cubic Shape
- Shelf Stable & Maximizes Shipping Efficiency

Space Saving
- Ships and Stores Flat when Unfilled

ENABLE RECYCLING

By 2050, nearly 60 percent of plastics production could be based on plastics reuse and recycling.

Global polymer demand 2016–50 and how it could be covered, millions of metric tons[1]

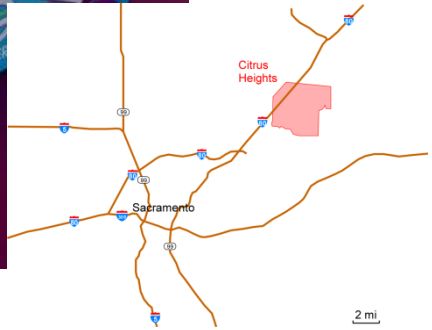


[1]Scenario based on a multi-stakeholder push to boost recycling, regulatory measures to encourage recycling, consistent progress on technologies, and $75-per-barrel oil price.
[2]Compound annual growth rate. Mechanical recycling limited by downcycling and applicable materials, monomerization limited by applicability to condensation polymers only, pyrolysis limited by likely rise in input costs.
[3]After demand reduction, assuming annual global GDP growth of 3.1%.

Provide Alternatives

RECOVER


ENERGYBAG
THE PLACE FOR YOUR PLASTIC LEFTOVERS
IF YOU DON'T BIN IT, BAG IT
3-MONTH PILOT PROGRAM TO RECOVER NON-RECYCLED PLASTICS
ENERGYBAG
THE PLACE FOR YOUR PLASTIC LEFTOVERS

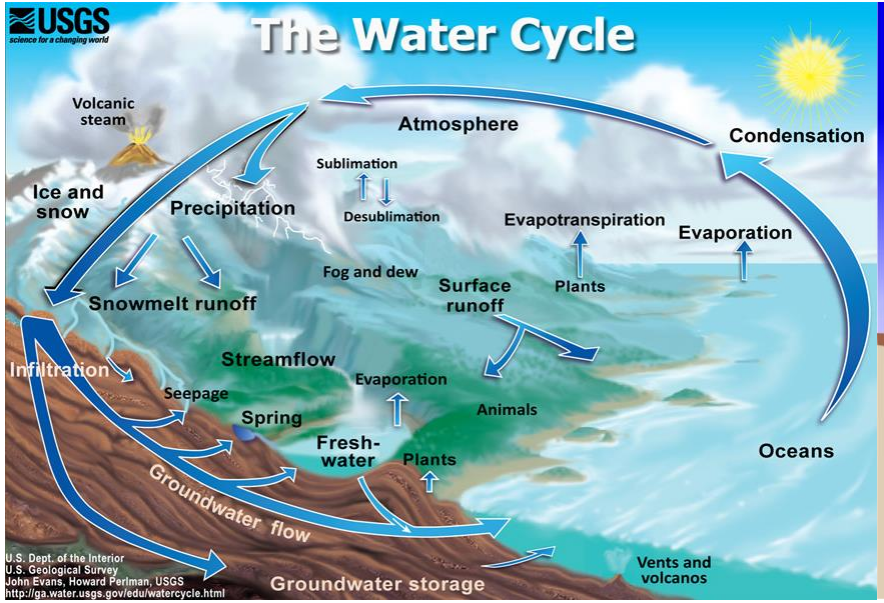

Citrus Heights
Sacramento
2 mi

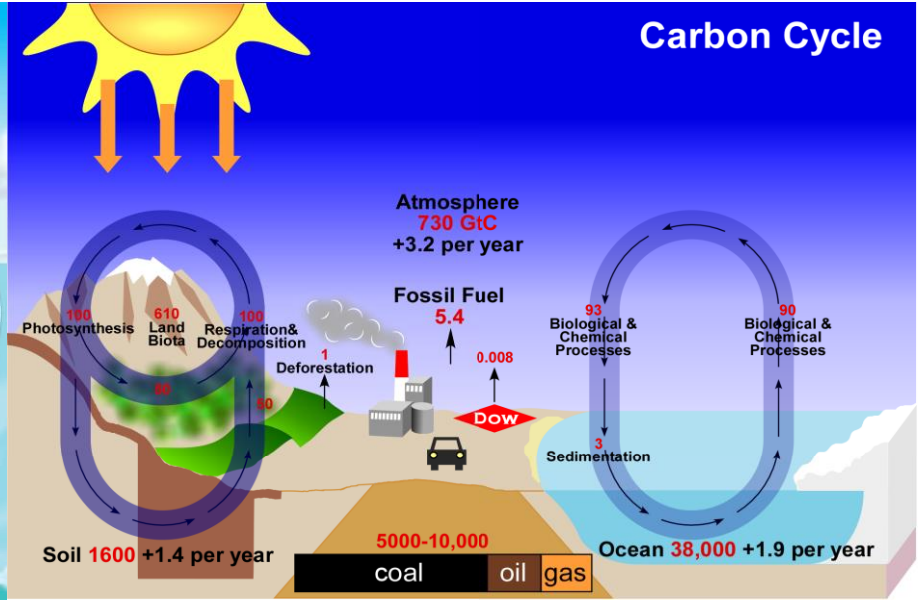

Hefty
ENERGYBAG
NON-RECYCLED PLASTICS
COLLECTION PROGRAM
20

DISAPPEAR

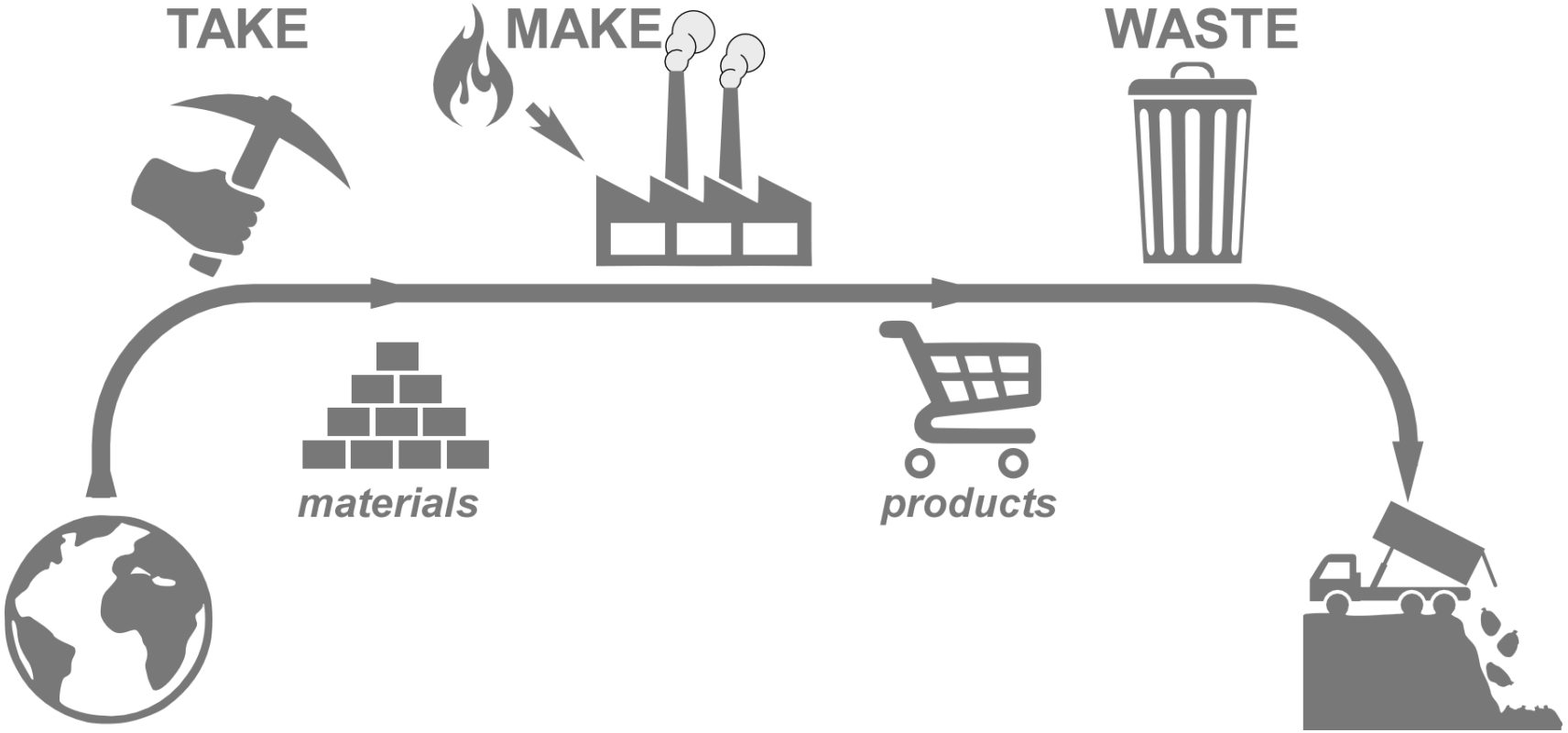
Main Focus Areas

Natural Cycles

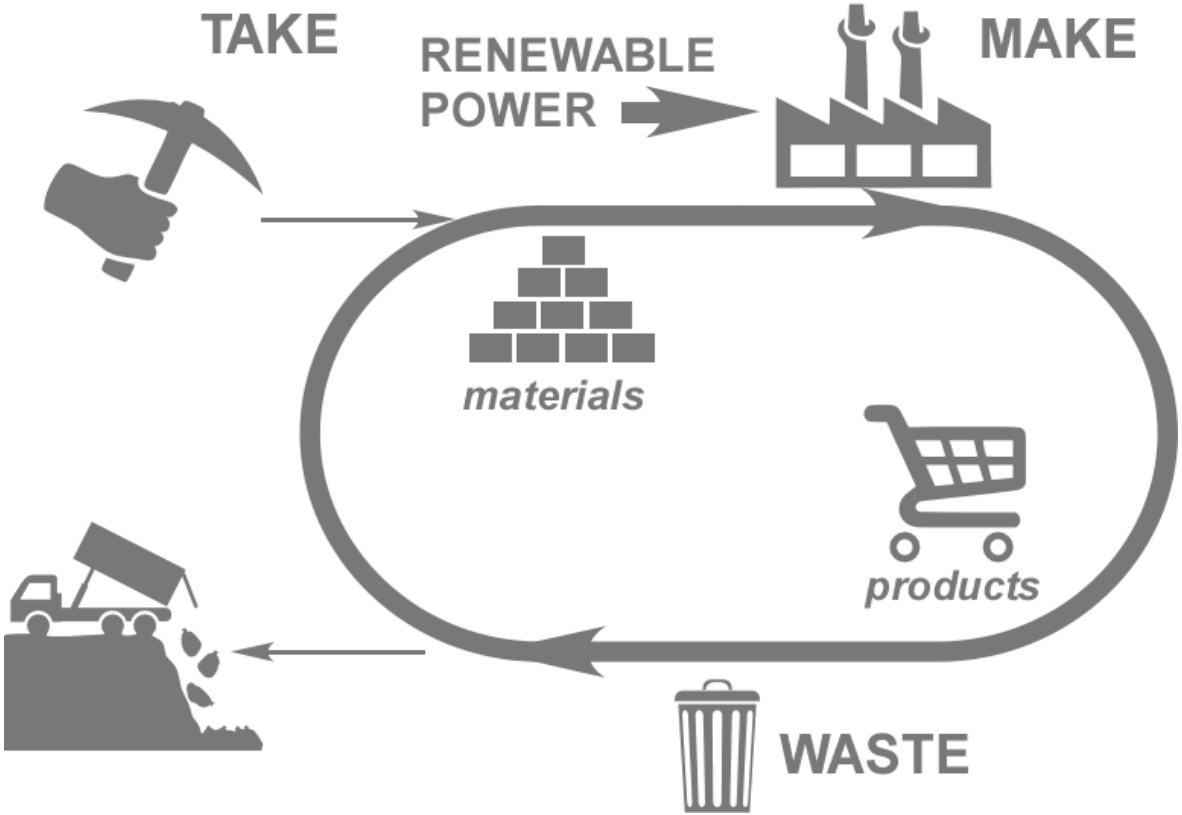




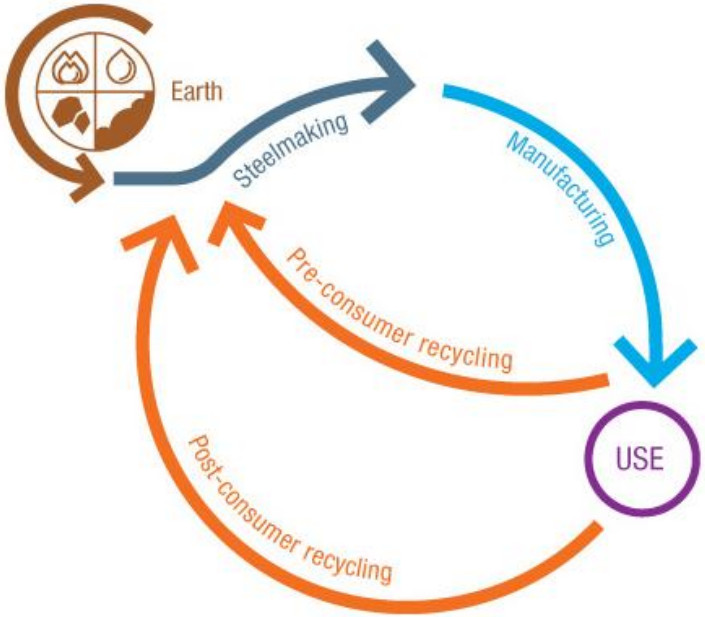
LINEAR ECONOMY



Circular Economy



SUCCESSFUL CIRCLES



Steel attributes — Benefits of steel recycling

Infinite recycling without loss of properties

Permanent material

Easy magnetic separation and recovery

Raw materials conservation

One tonne of steel recycled saves on average :
1,400 kg iron one
740 kg coal
120 kg limestone

70% Energy saving

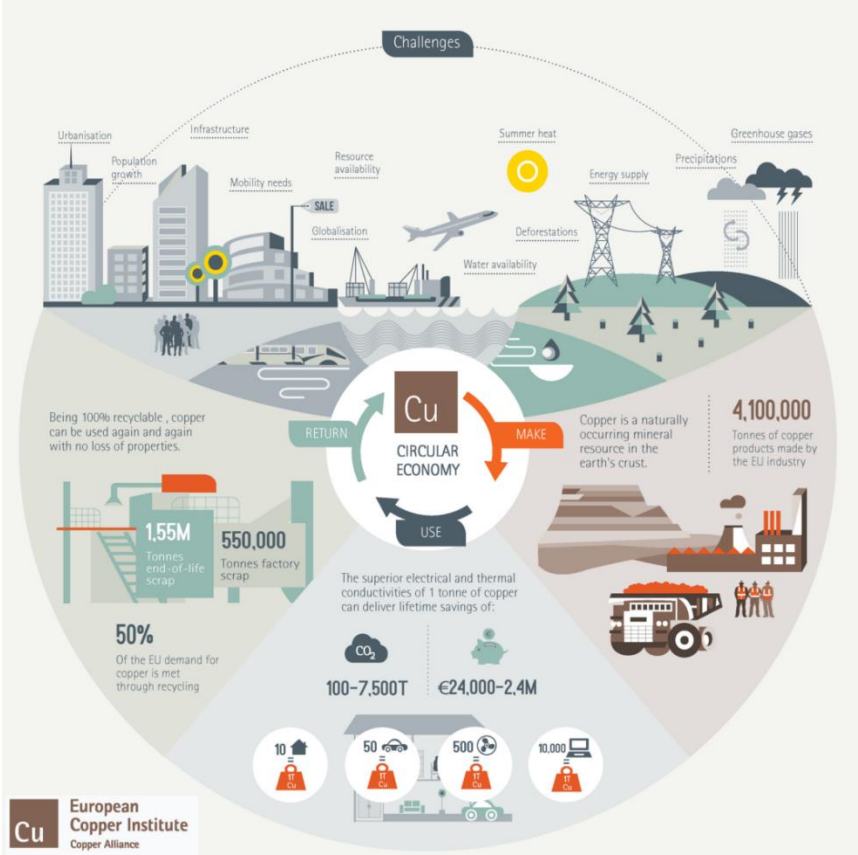
Recycling a single steel can saves :
1 laundry load, or
1 hour TV, or
4 hours lighting (60 watt bulb)

Job creation

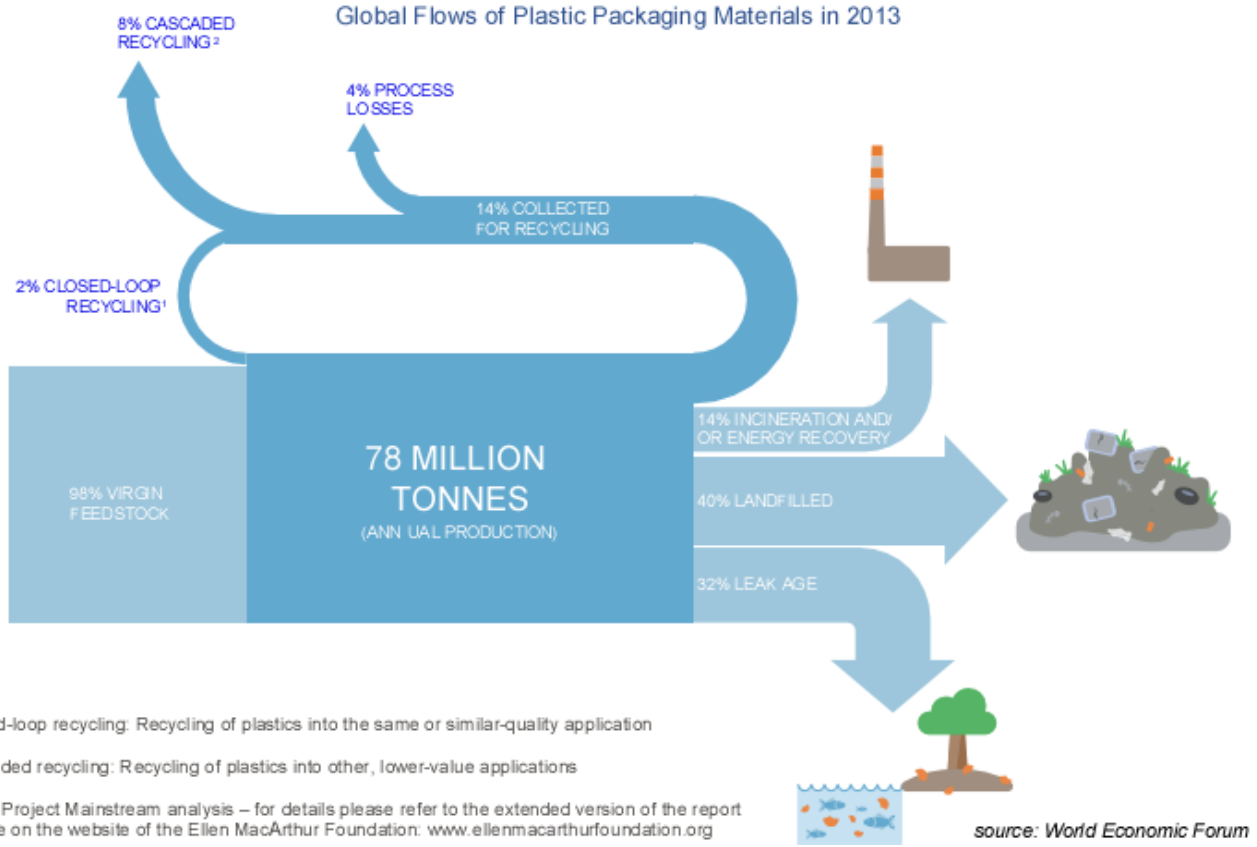
Jobs required for scrap collection, separation and recycling

http://circulareconomy-worldsteel.org/

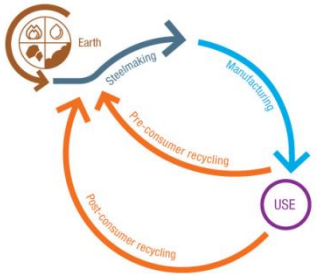
SUCCESSFUL CIRCLES

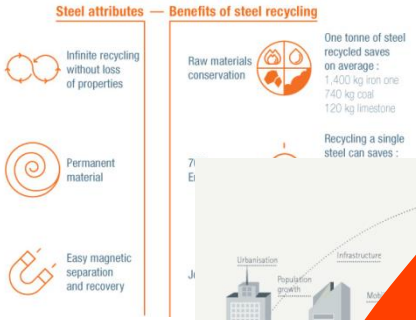


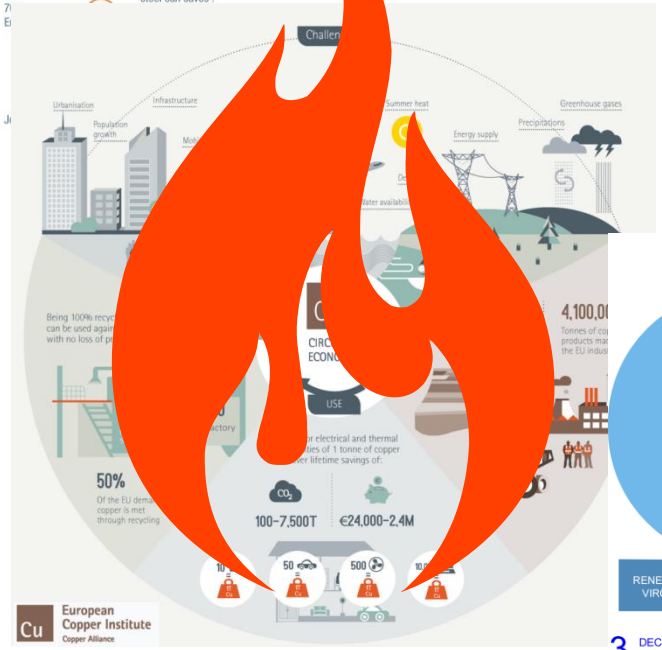
PROBLEMATIC CIRCLES

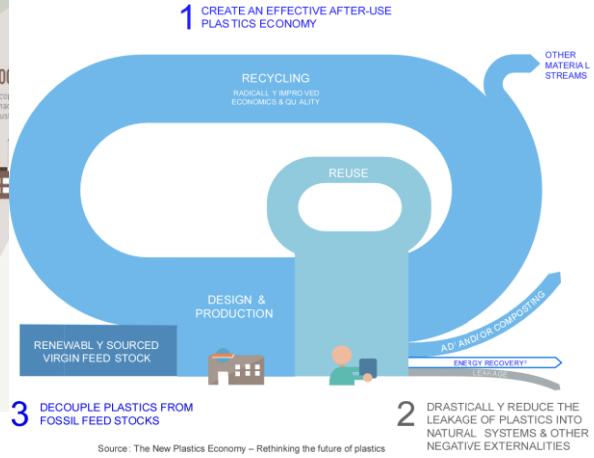


WHAT IS MISSING









Orthogonal Axes

WHICH IS MOST VALUABLE

~2¢

Recycling Prices

0.61¢

0.01¢

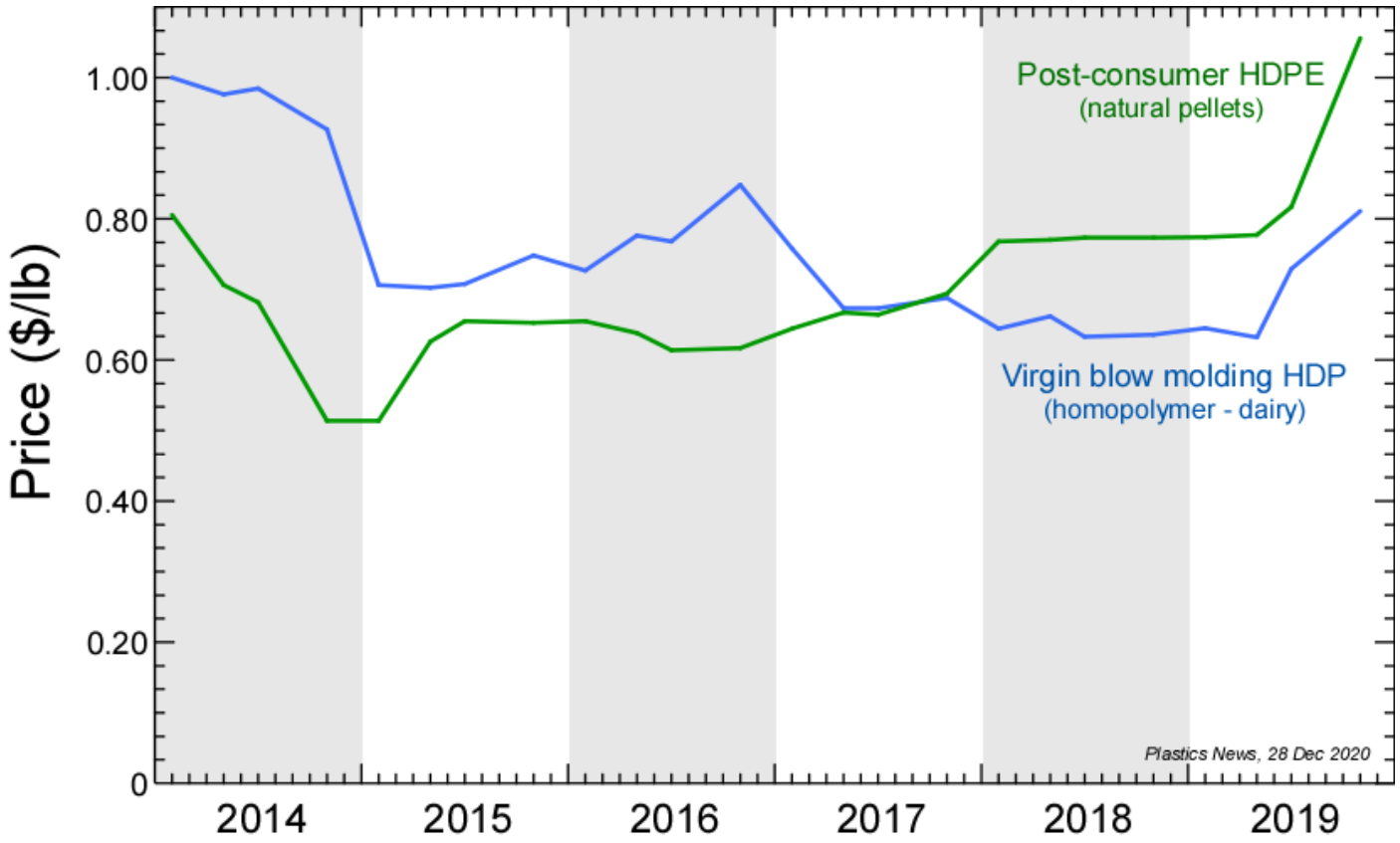
~2¢

9.16¢

0.22¢

0.20¢

Good News


Price ($/lb)
1.00
0.80
0.60
0.40
0.20
0
2014
2015
2016
2017
2018
2019
Post-consumer HDPE
(natural pellets)
Virgin blow molding HDP
(homopolymer - dairy)
Plastics News, 28 Dec 2020

Sustainability of Tires

QUESTIONS

Seek

Together™