



Sustainable Manufacturing at Dow: *Designing and Building Processes and Supply Chains for a Sustainable Future*

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The Dow Chemical Company

16 February 2013



ADVANCING SCIENCE. SERVING SOCIETY

National Meeting, Boston, MA

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

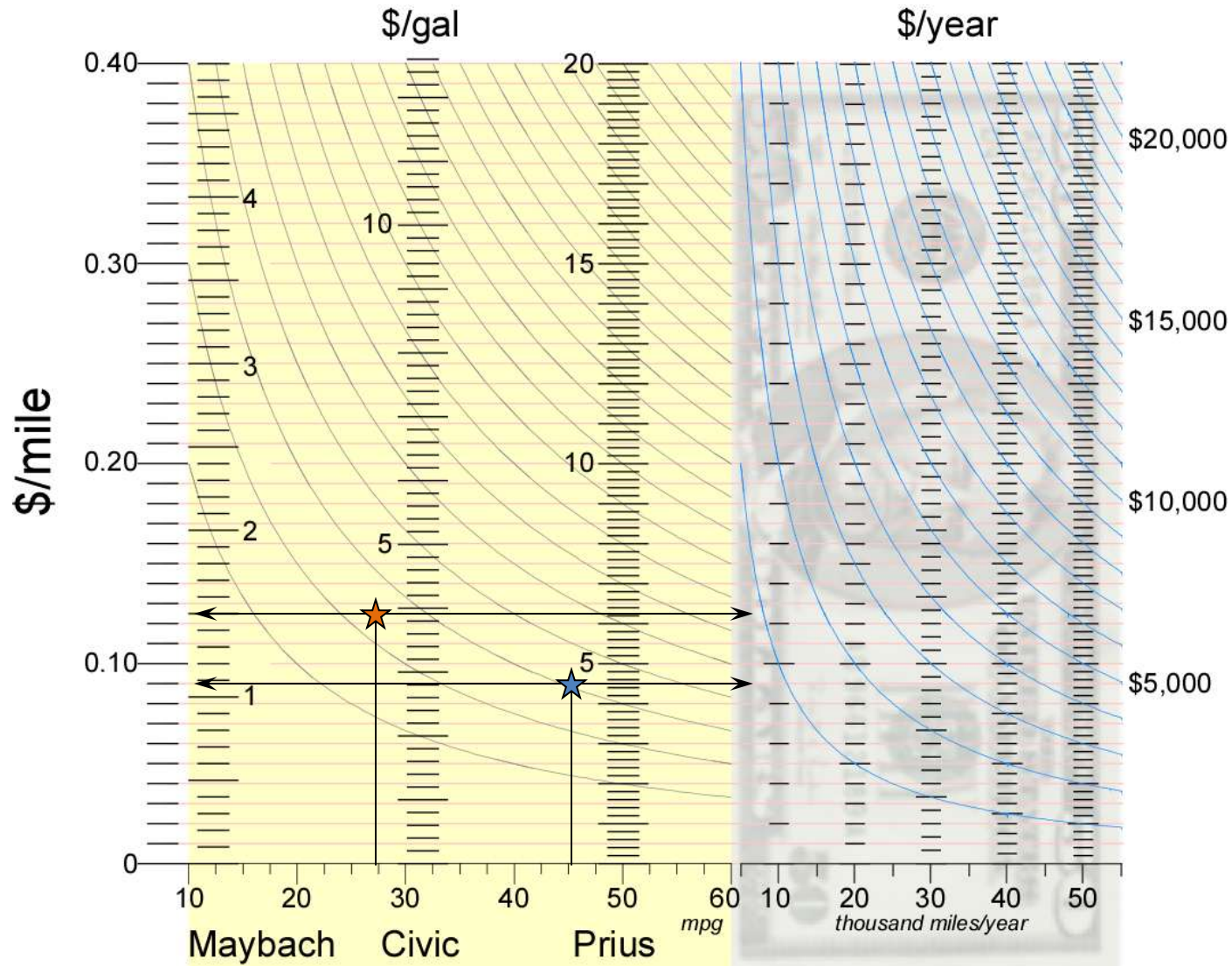


Energy
CERTIFIED

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



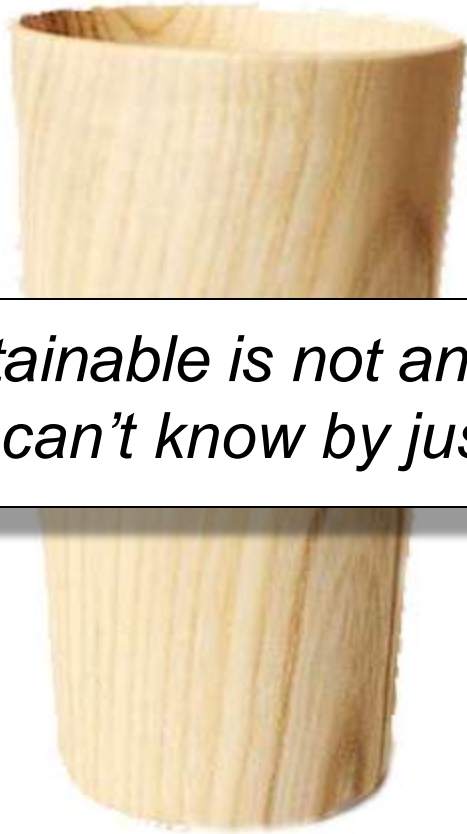
I Waste Time and Money At Home



Return Shareholder Value

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

Is this Cup Sustainable?



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

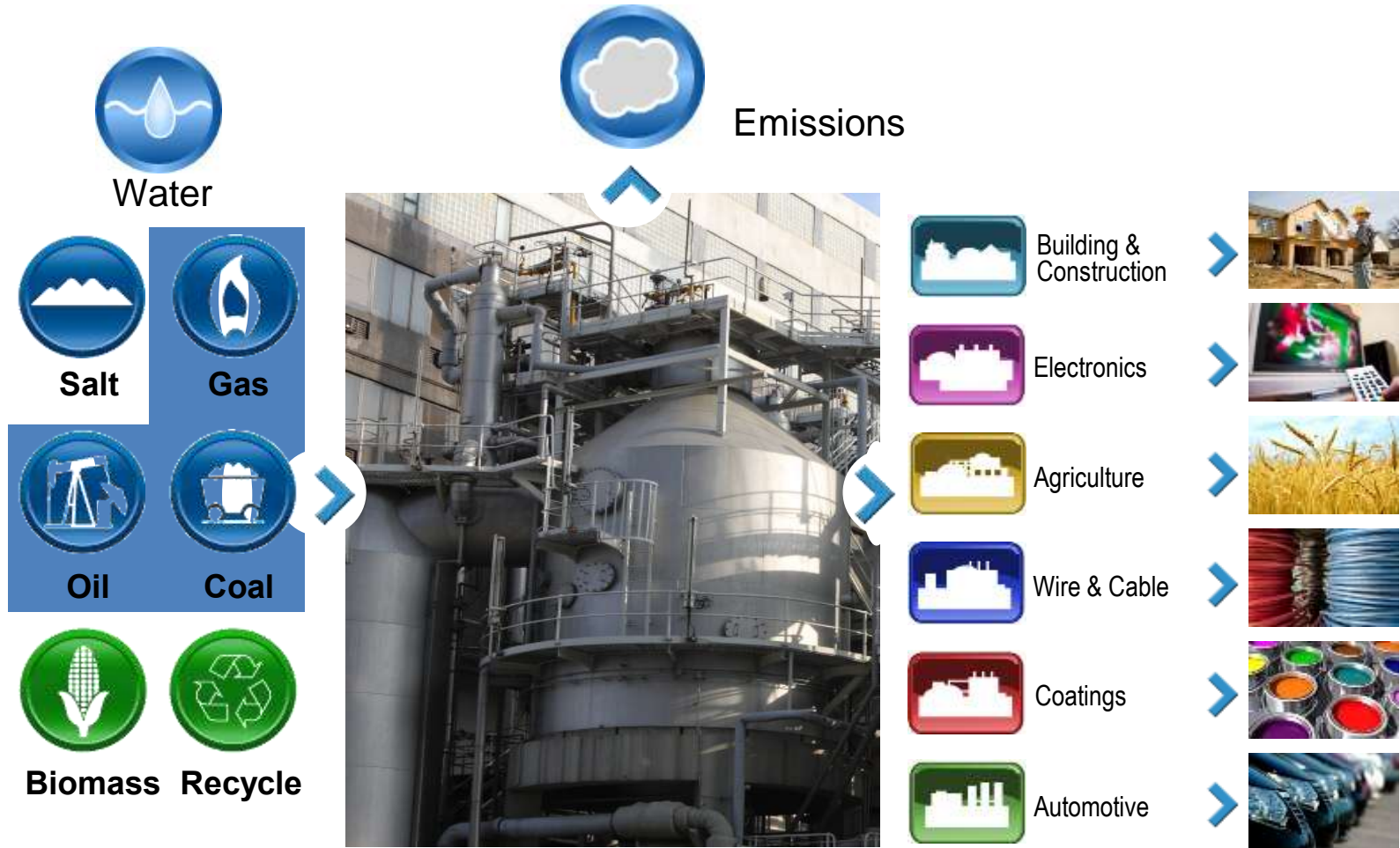
How about this one?



DOW

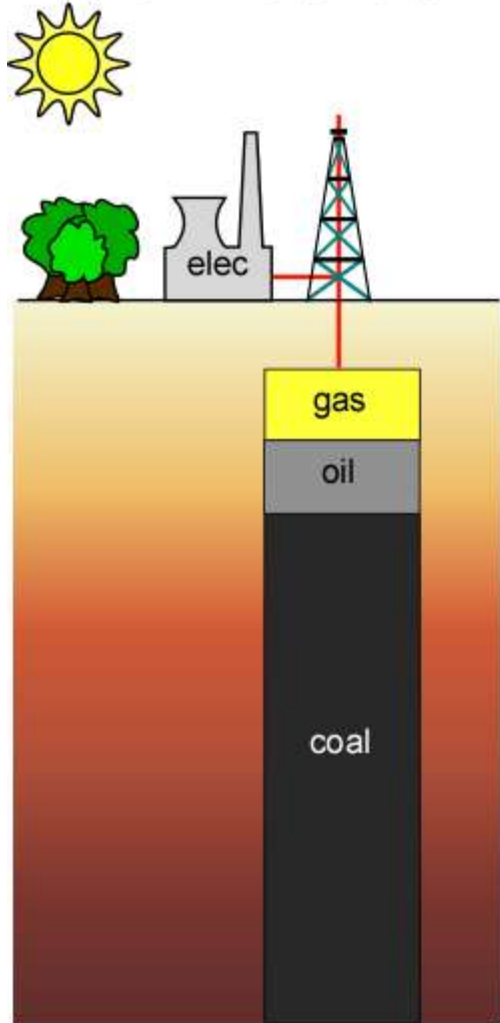
®

Chemical Industry Snapshot



Chemical Industry Snapshot

Raw Materials



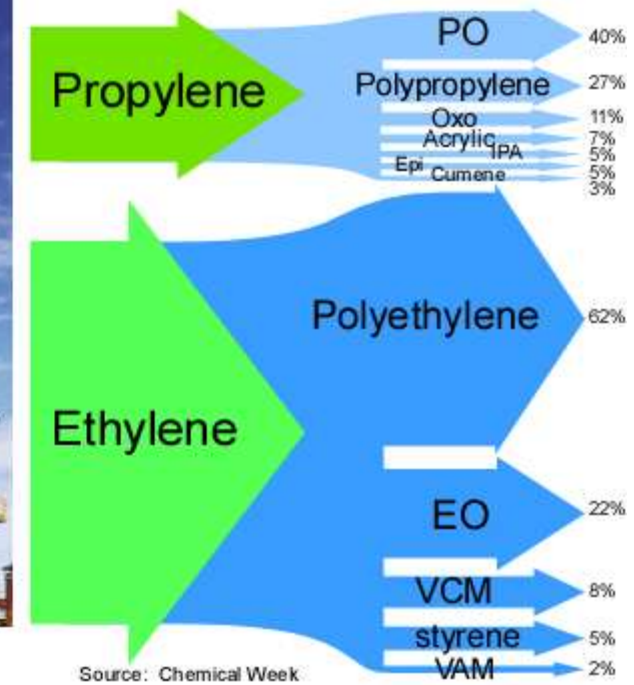
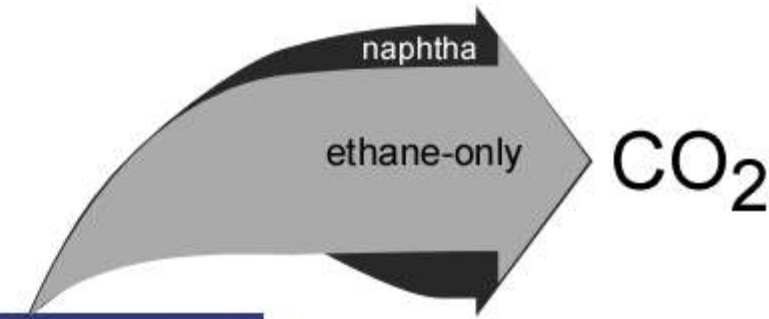
source: 2002 BP Statistical Review

Cracker



source: SRI 29G

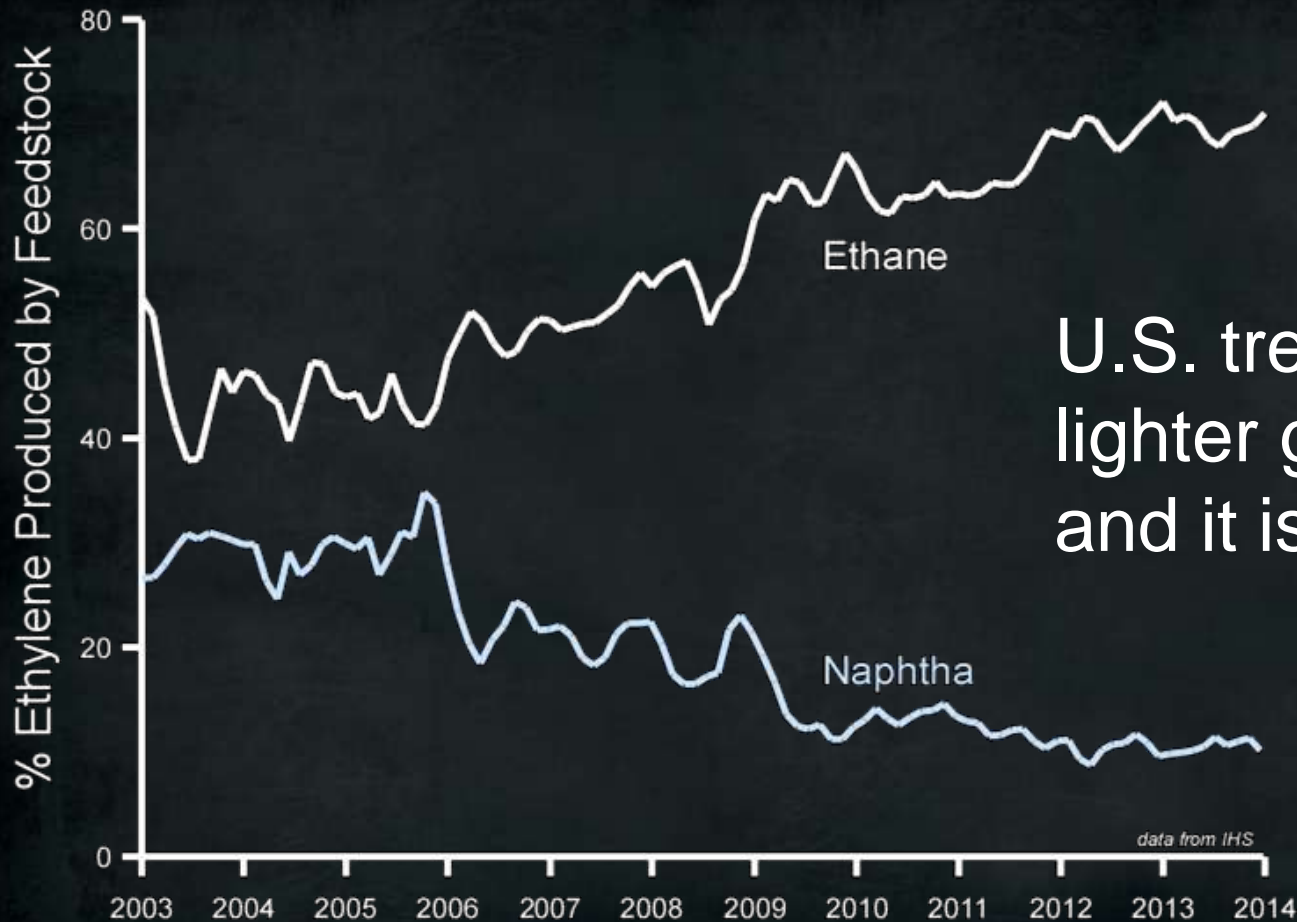
Products



Source: Chemical Week

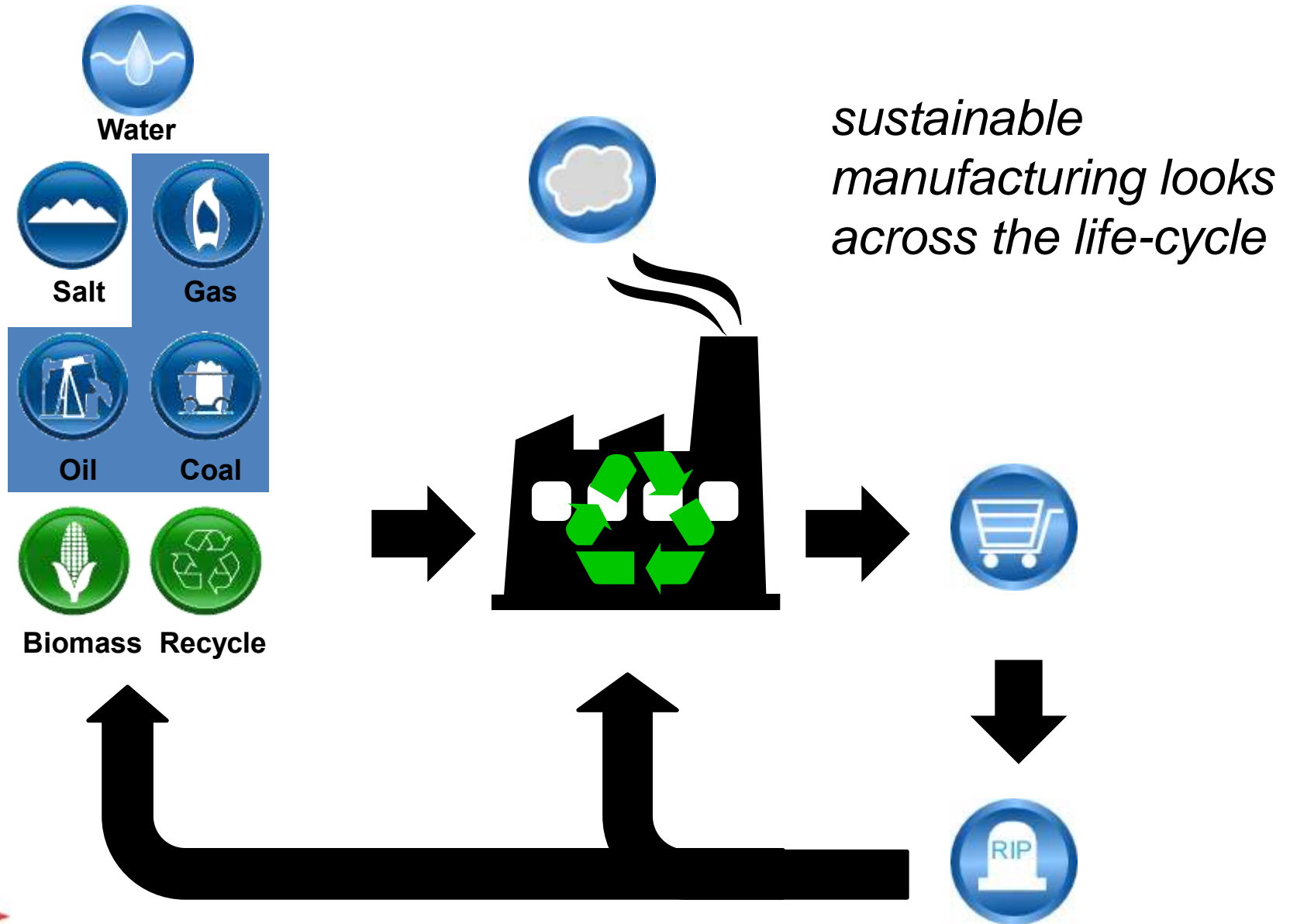


US Trend



U.S. trend is toward lighter gas cracking and it is an old trend

Sustainable Manufacturing Requires Broader Look

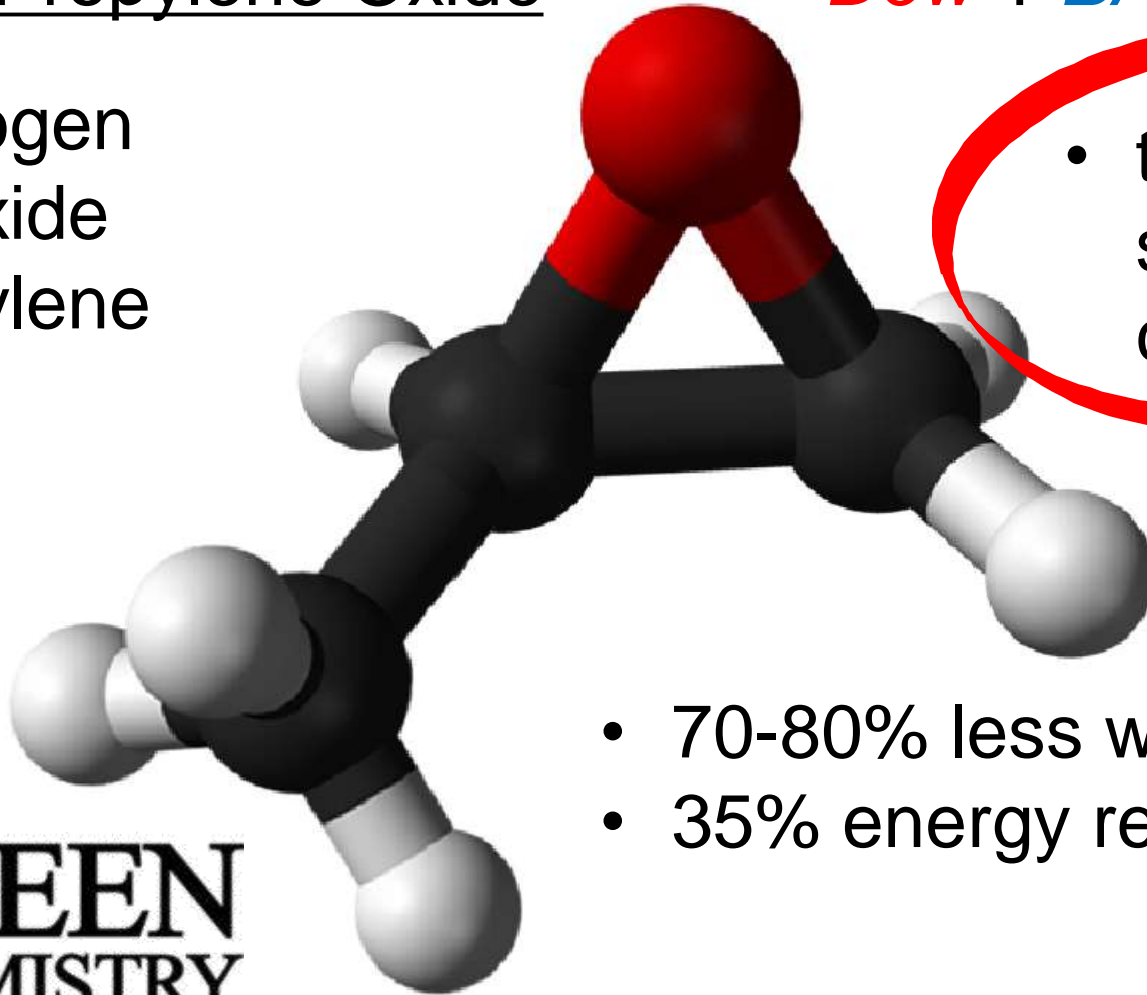


Sustainable Manufacturing Examples: Catalysis

Propylene Oxide

Dow + *BASF*

- hydrogen peroxide
- propylene



- titanium silicate catalyst

- 70-80% less water
- 35% energy reduction

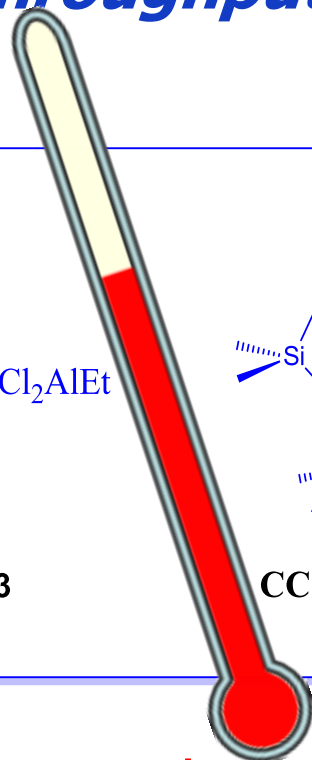


**GREEN
CHEMISTRY**



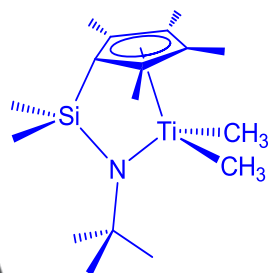
Sustainable Manufacturing Examples: Catalysis

Polyethylene: Higher Efficiency and Plant Throughput Through Improved Catalyst Design

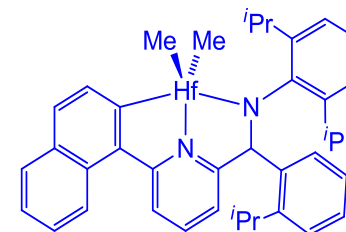
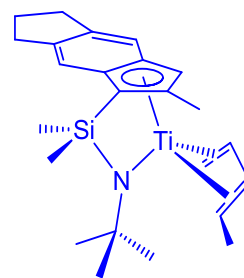
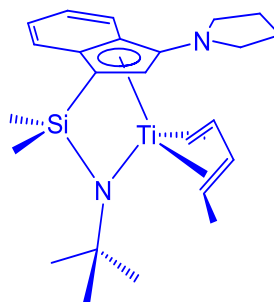


$\text{TiCl}_4/\text{MgCl}_2/\text{Cl}_2\text{AlEt}$

HEC-3



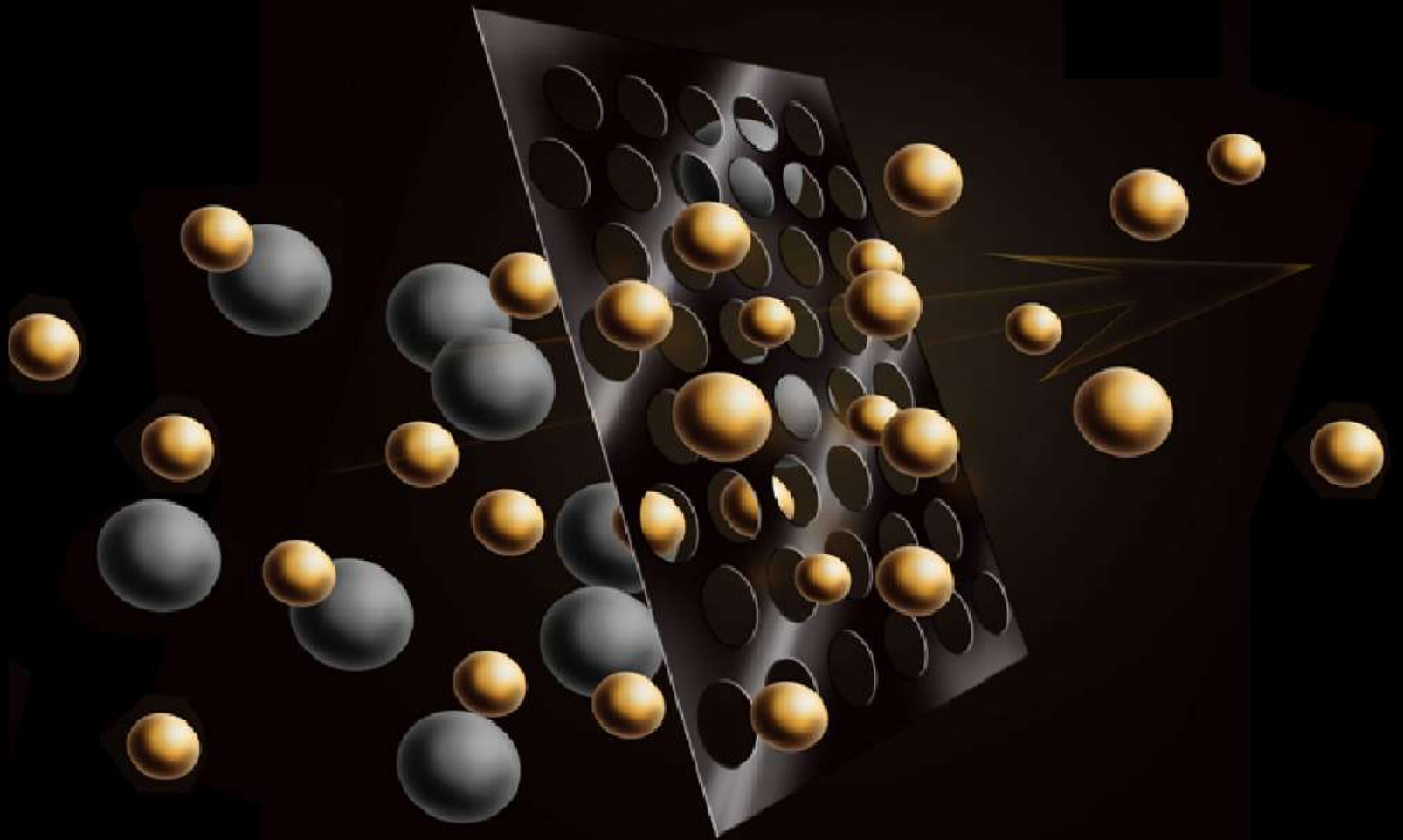
CCG-gen 1



gen n

Increasing Thermal Stability and Efficiency

Next Generation Manufacturing Processes



Demand for Bioproducts?

PANTENE *by* natureFUSION

UP TO **10X**
STRONGER HAIR

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

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

FUTURE FRIENDLY™

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®

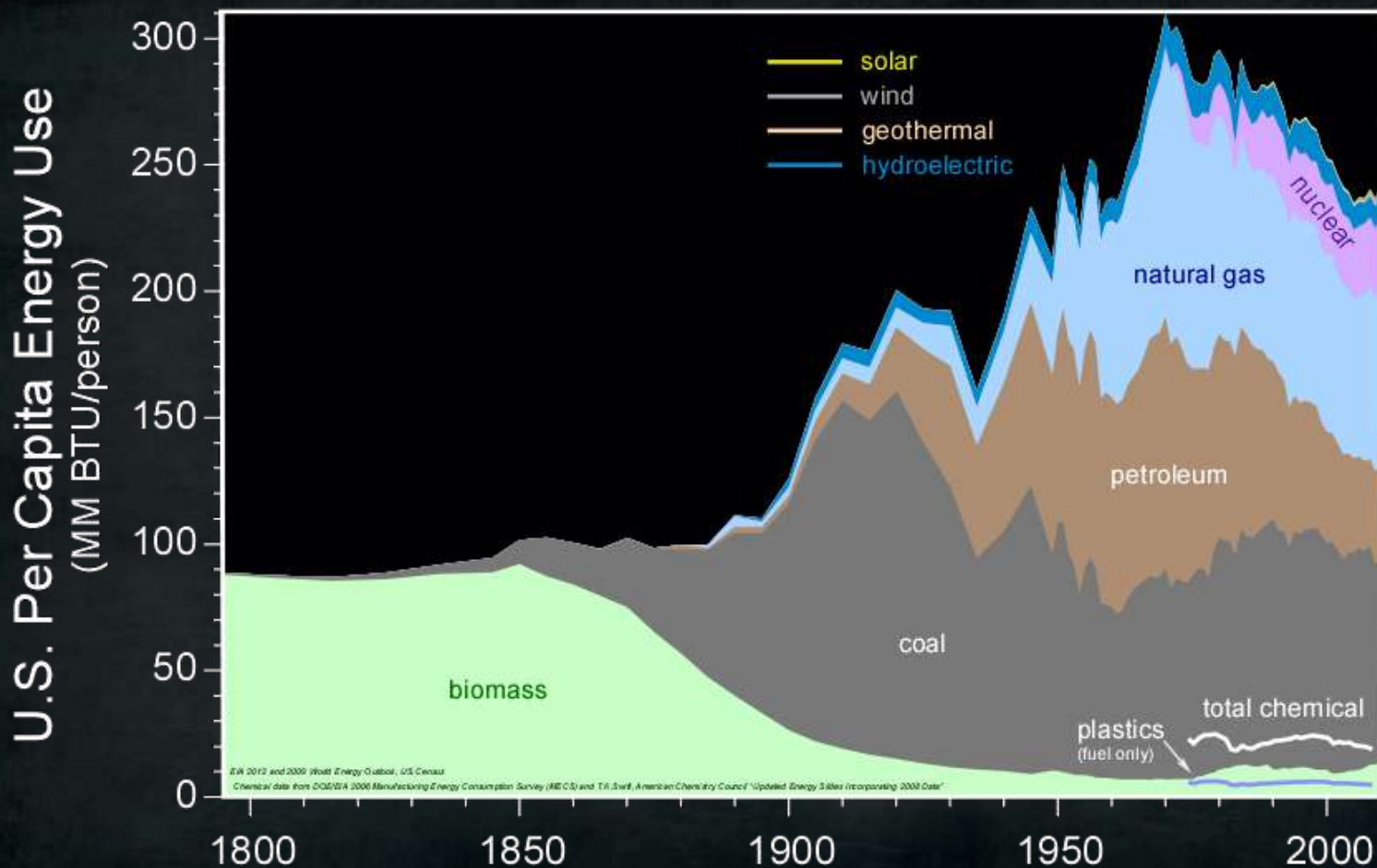
Up to 30% made from plants
100% recyclable plastic bottle

Delta Airlines Napkin
April 2012

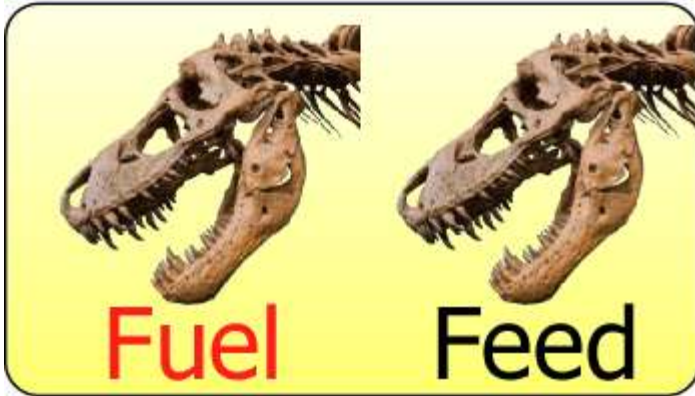
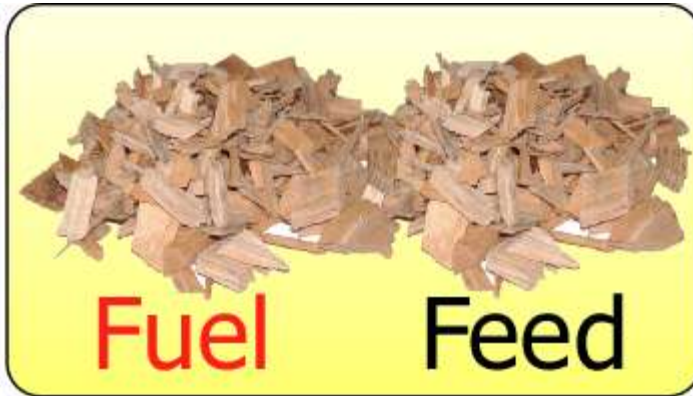
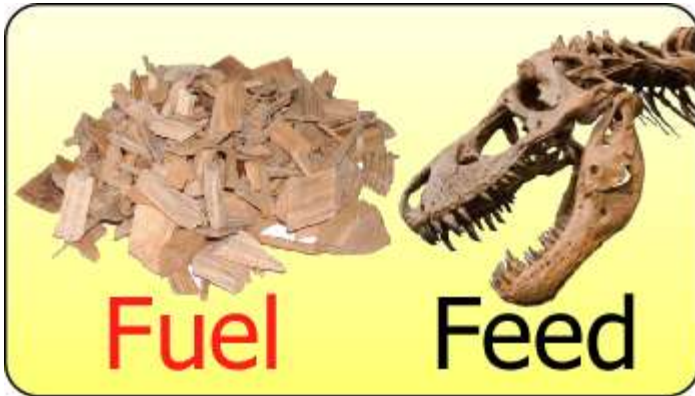
Midland Daily News
1 January 2012



Per Capita Energy Use



Two Carbon Flavors



What Impact?



PET



30%



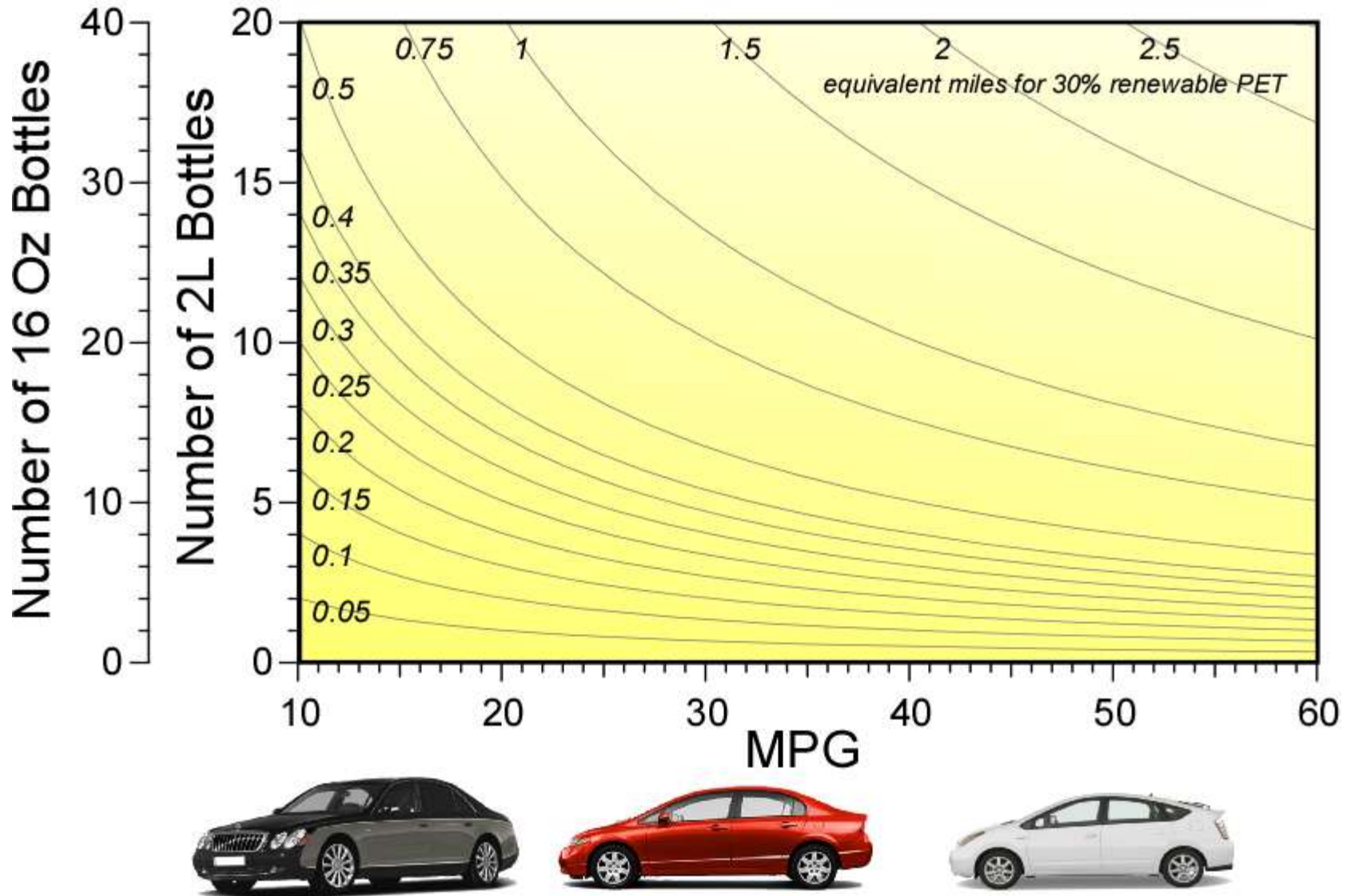
100% renewable PET (not yet available) would require ~80 2 L bottles to offset burning 1 gallon of gasoline or about 400 at today's 30%

material	per capita consumption (lb/yr)
PET packaging	17
petroleum	6619
natural gas	8037
coal	6439
gasoline	2495
sand and gravel	13923
cement	512
iron ore	340
salt	403
beef	54.3
chicken	55.7

data from HIS, 2012 ERS USDA, 2011 National Mining Assoc., World Bank



PET Comparison



Go After the 21,000 lbs



GO TO
WWW.DOW.COM
FOR MORE
SOLUTIONS

THE LIGHTER SIDE OF WIND POWER.

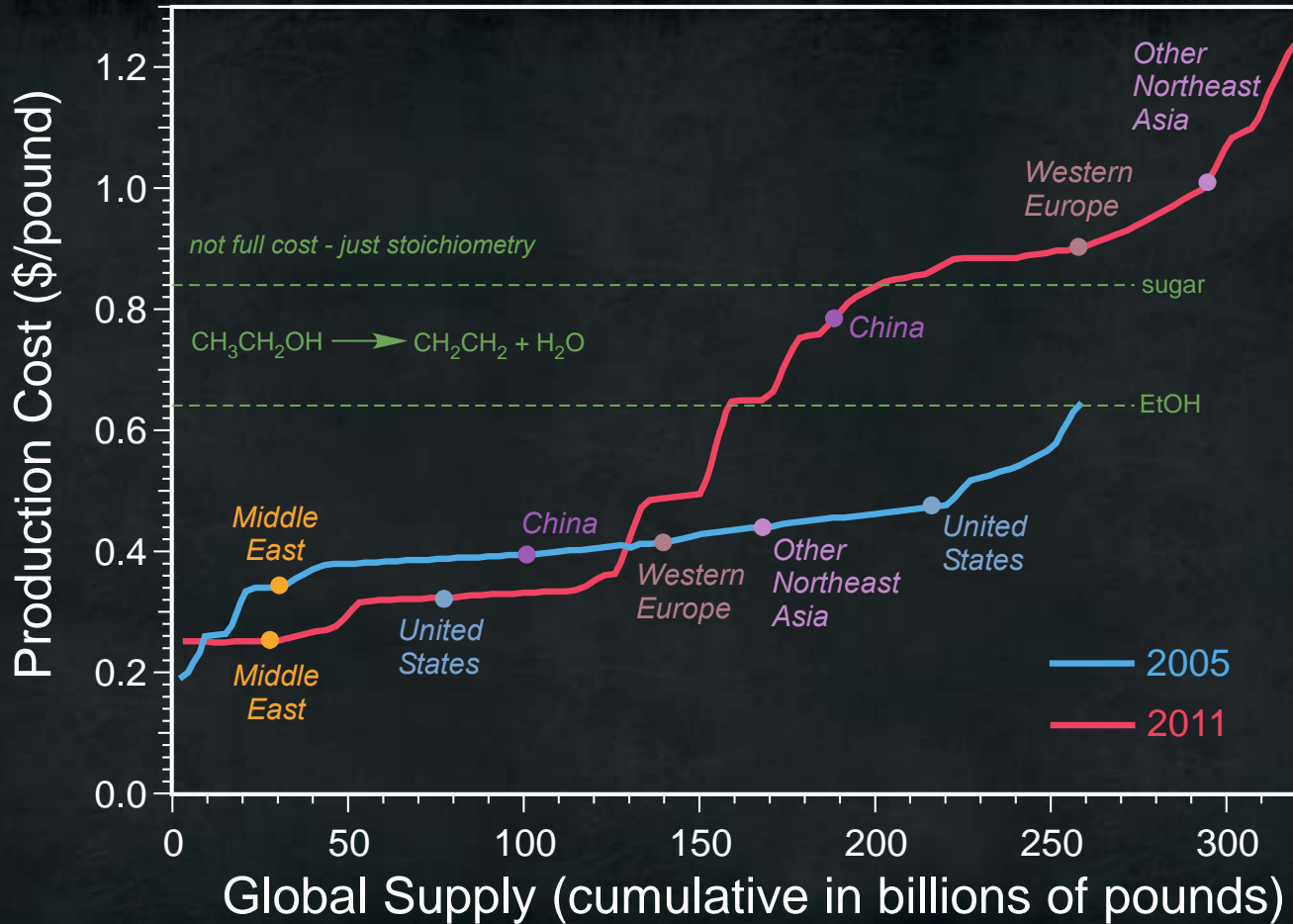
Dow solutions are making turbines lighter and stronger. Our **ABSORNET** and **COMPLEX** materials are helping to create lighter, more durable wind blades. Making sustainable energy even more sustainable. Together, the elements of science and the human element can solve anything. **Solut^{ion}ism. The new optimism.[®]**



The End

Questions?

Shale Gas Impact



Owen Kean and T.K. Swift, American Chemistry Council, "Industry-Transforming Natural Gas into Products", National Academy Forum on Unconventional Gas, 11 September 2012.

