

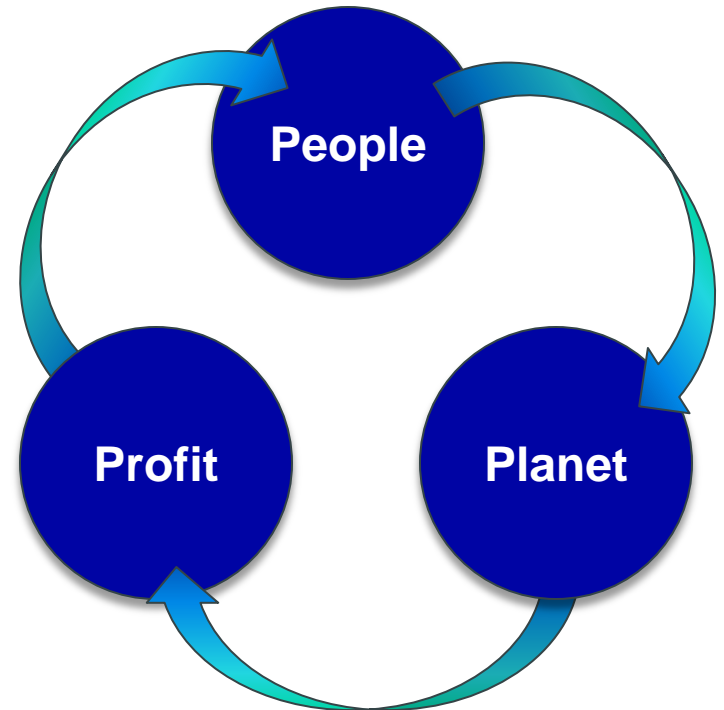


A Perspective from the Private Sector: The Business Realities of Waste Reduction, Recycling & Reuse

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Sustainability is Everyone's Responsibility



Dow Understands the Role We Play in Protecting Our Planet & Contributing to Society



Source: Dow 2015 Sustainability Goals

Sustainability Also Means Profitability

In our first set of Sustainability Goals (2005), we:

- Reduced solid waste by 1.6 billion pounds
- Reduced water use by 183 billion pounds
- Saved 900 trillion BTUs of Energy

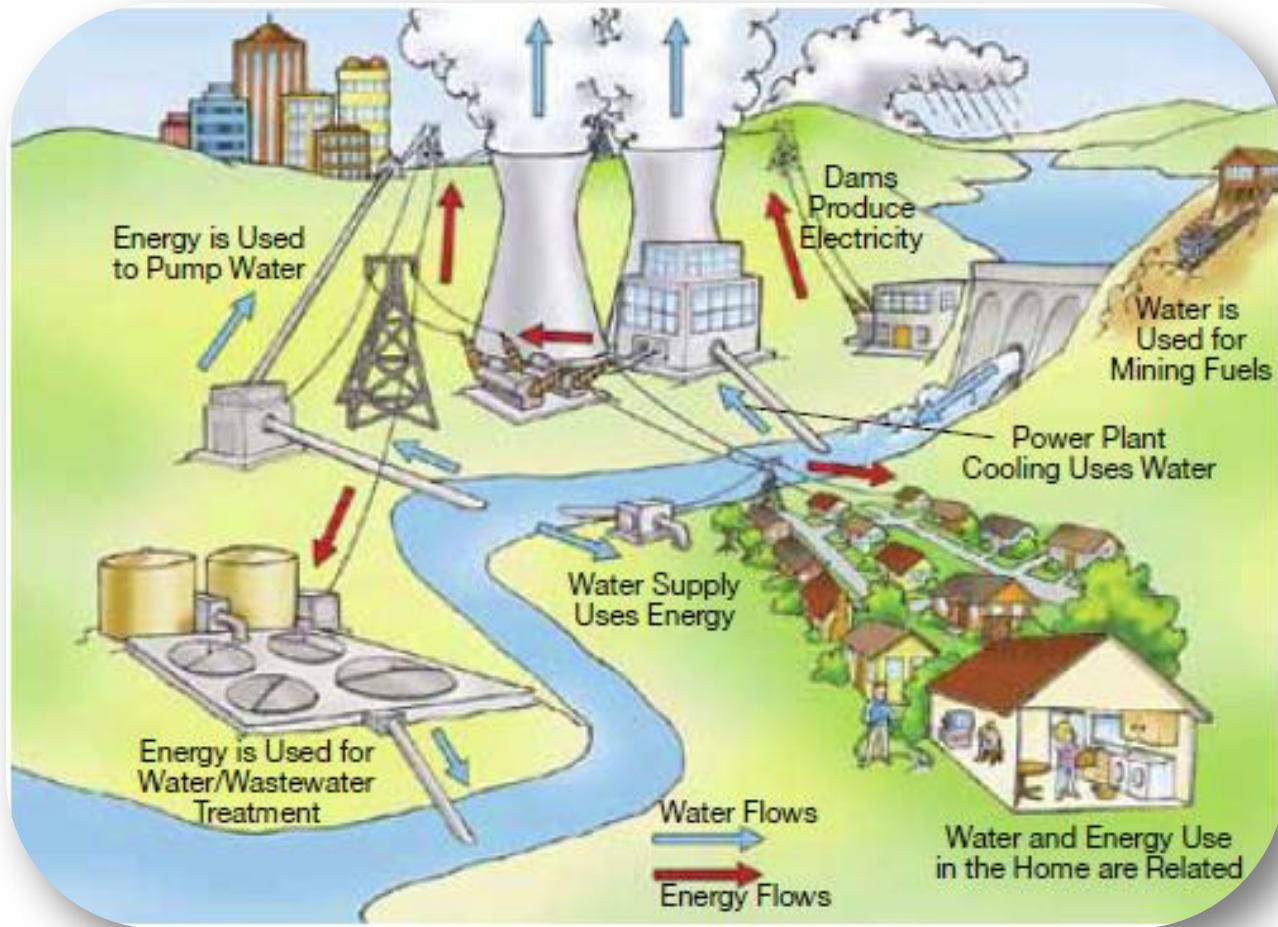
Translating to:

- Waste savings that could have filled 415 football fields 1 meter deep
- Water savings that could have served 170,000 homes for a year
- Energy savings that could have powered 8,000,000 single-family homes for a year

\$1B Invested → \$5 B Saved

Source: Dow 2005 Environment, Health & Safety Goal Reporting

As a Manufacturer, Dow Lives the Energy-Water-Waste Nexus



All Companies Must Evaluate Profitability of Alternatives



Source: U.S. Environmental Protection Agency

Waste Reduction is the Simplest Way to Drive Sustainability and Impact the Bottom Line



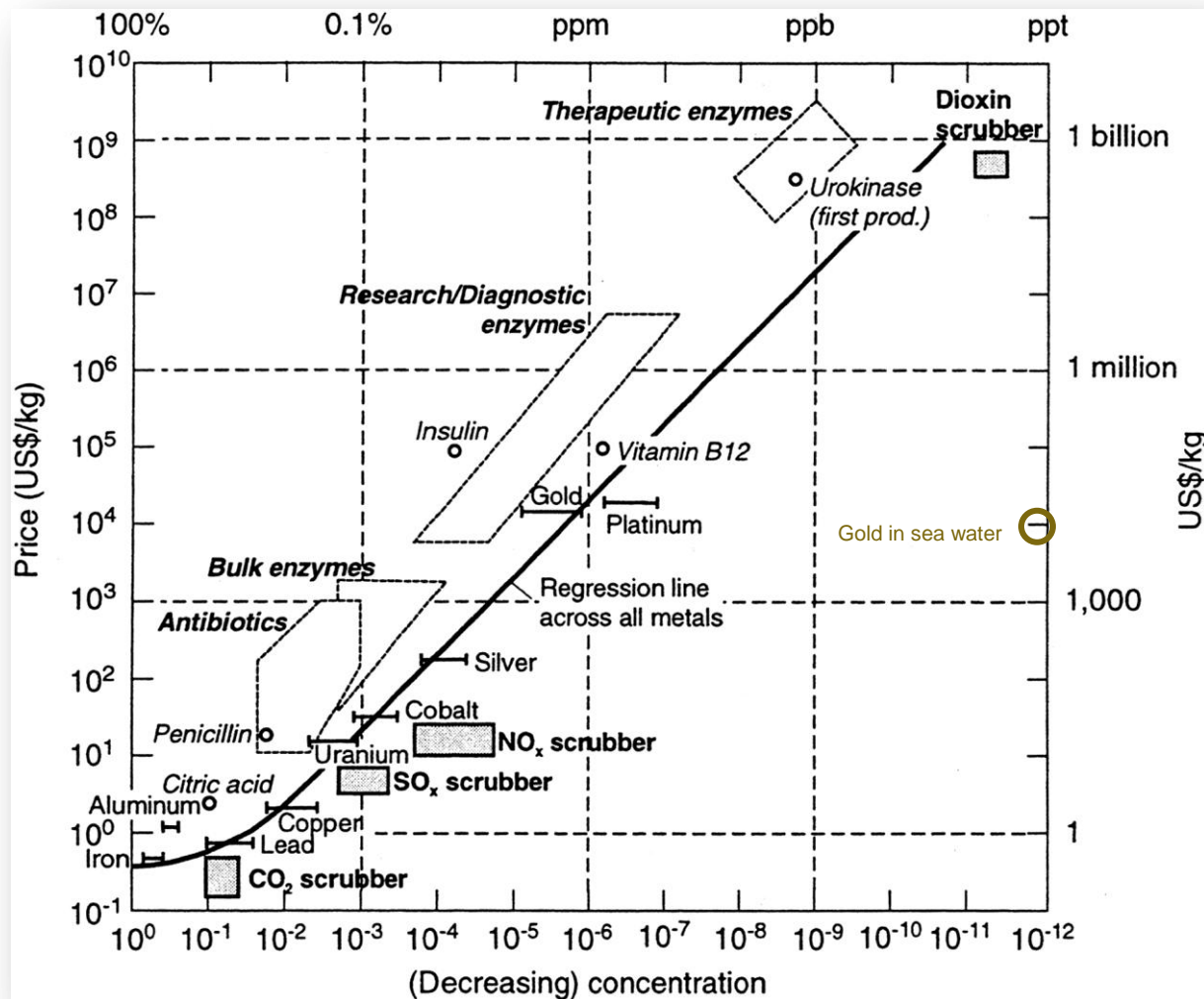
Material Reuse Can Also Deliver Value, Both to the Customer and the Bottom Line

SAFECHEM

- Fully enclosed solvent-delivery system in broad use in Europe
- Delivers solvent in this specialty container, which is connected to dry cleaning machines – resulting in zero emissions
- Once the solvent is exhausted, the container containing the waste is picked up and taken to our kilns
- The chlorinated waste streams are then burned, generating hydrochloric acid – which is then used on site or sold



Recycling is More Complex: Profitability Must be Assessed



Source: Dahmus and Gutowski

What Gets Recycled: An Information Theory Based Model for Product Recycling
Environ. Sci. Technol. 2007, 41, 7543-7550

The Cost-Benefit of Material Recycling Varies by Market

Recoverability* (per equipment/application)	PMs		PGMs		Rare earths (oxides)			Other					
	Ag	Au	Pd	Pt	Y	Eu	Other rare earths	Sb	Co	In	Ga	W	Ta
Washing machines													
Large household appliances (excluding refrigerators)													
Video recorders													
DVD players													
Stereo systems													
Radios													
Cathode-ray-tube televisions													
Mobile telephones													
Fluorescent lamps													
Light-emitting diodes													
Liquid-crystal display screens													
Batteries (NiMH)													
Recovery possible													
If separately recovered and/or if appropriate technology and recovery are available													
Limited recovery/recovery under certain conditions													
If separately recovered; partial or substantial losses during separation and/or processing/metalurgy; recovery if appropriate systems exist													
No separate recovery													
Pure recovery not possible; lost in bulk recyclates during separation and/or during metalurgy into different nonvaluable phases													
For a combination of colors													
Depending on process route followed, high recovery or high losses possible; requires careful attention to design, infrastructure, legislation, and so on; especially applies to most closely linked metals, where one metal can be recovered whereas the other is lost as a result; driven by thermodynamics, technology, design, and so on													

* Recovery is a function of processing route and product design, among other factors. The table indicates recoveries for the present most-likely route, but the results could change if suitable technology is developed.

Source: Materials Research Society 2012

Some Companies Are Making Recycling Their Business

CleanTech Project Opportunities



Gas Recovery

- Landfill
- Sewage Treatment
- Agricultural Waste
- Industrial Waste



Water Treatment & Reuse

- Desalination
- Sewage
- Industrial waste
- Produced water



Alternative Energy

- Unconventional Gas
- Biomass Conversion
- Green Diesel/Chemicals
- Solar



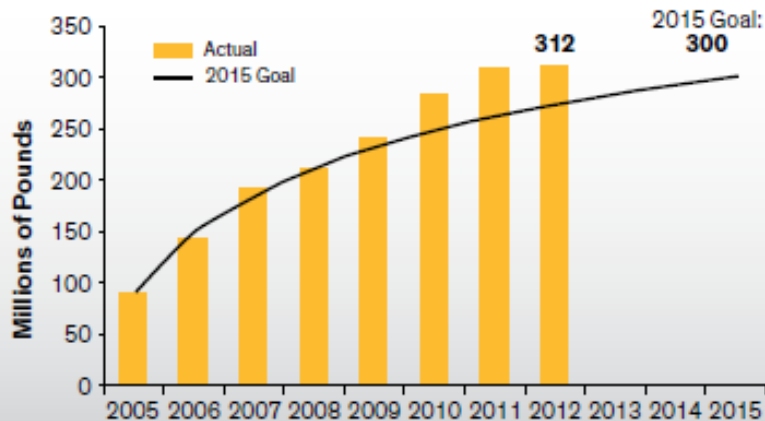
Waste-to-Value

- Gases
- Energy
- Minerals/metals
- Food elements/proteins/
pharma/nutraceuticals

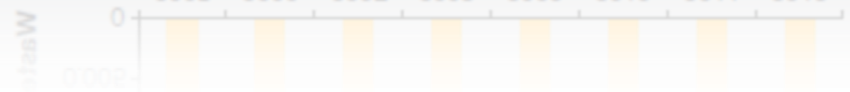
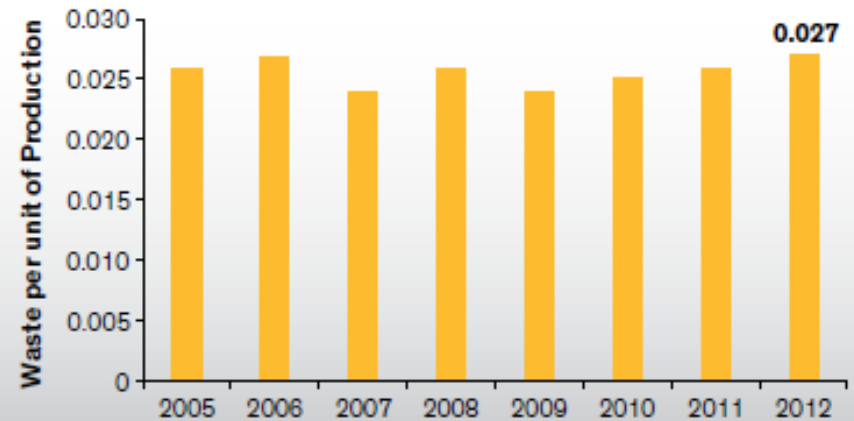
Corporations Are Paying Attention to Waste



By-Product Synergy



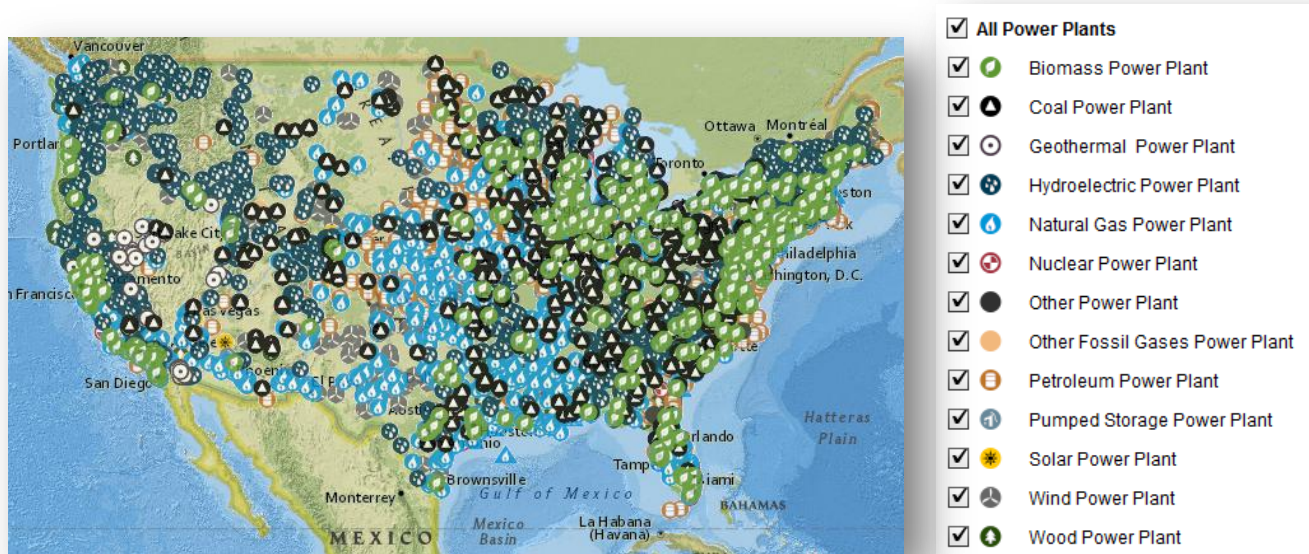
Waste Intensity



Source: Dow 2015 Sustainability Goals Reporting

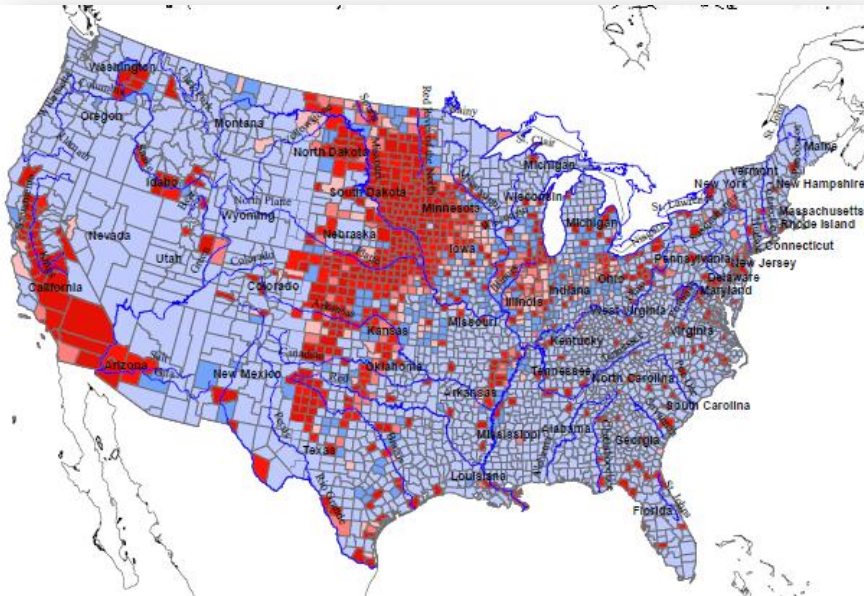


Corporations Still Face Challenges: Energy is Global and Transferrable...

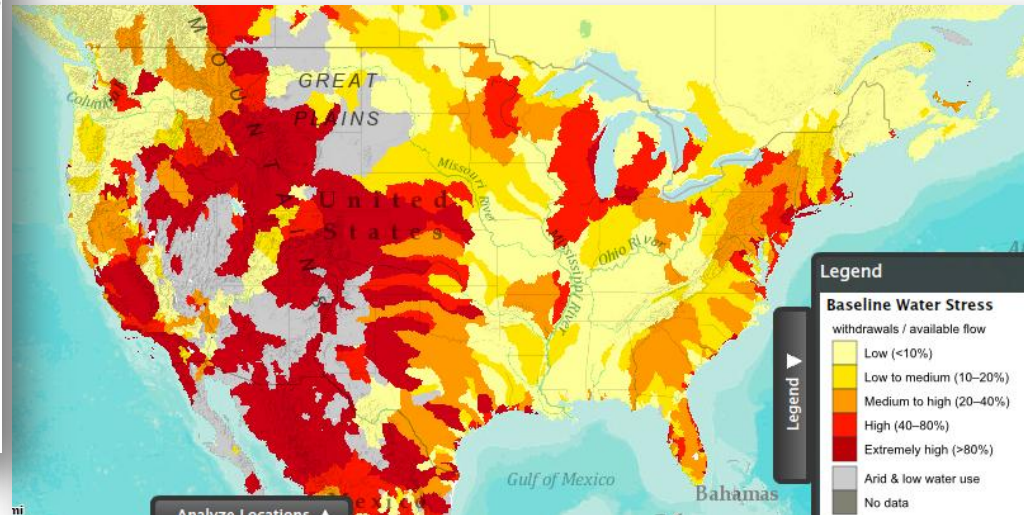


Corporations Still Face Challenges: ... But Water is Local

Water stress by county



Water stress by watershed



Source: World Resources Institute; Aqueduct

In Summary

- Sustainability requires three elements:
 - People, Planet & Profit
- The energy-water-waste nexus is an area of opportunity for sustainability
- Waste reduction, reuse and recycling can be sustainable solutions, when assessed via the economic lens
- The private sector is delivering results, though challenges remain



— **Thank**
You