

Harnessing Market Forces to Achieve Sustainable Materials Management

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*The content of this presentation reflects the views of the author and does not represent the policies or position of the U.S. EPA.

What is Sustainability?

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs

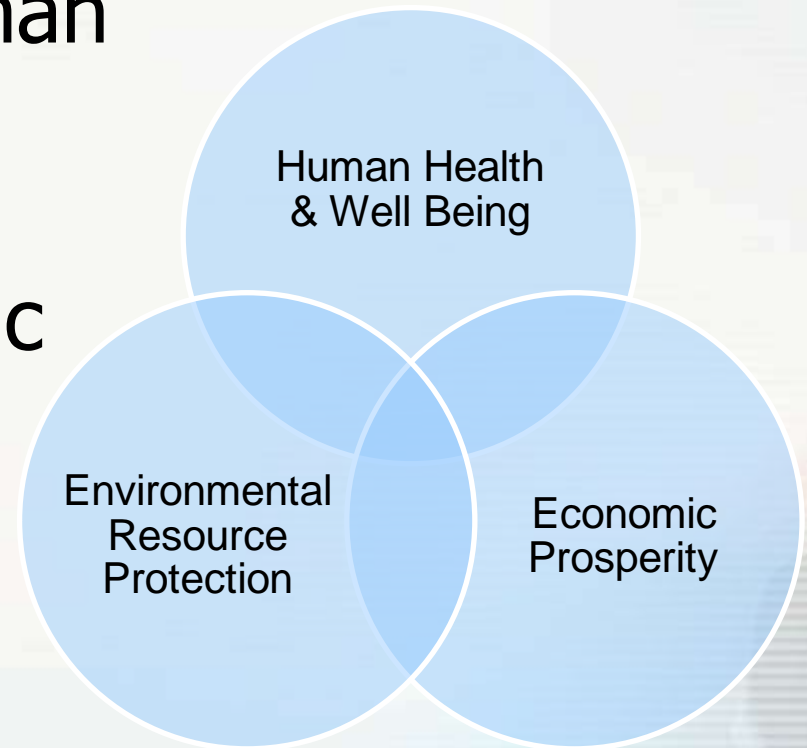


Brundtland Commission, 1987

What is Sustainability?

A more explicit definition...

The continuation of human health and well being, environmental resource protection, and economic prosperity—now and for generations to come

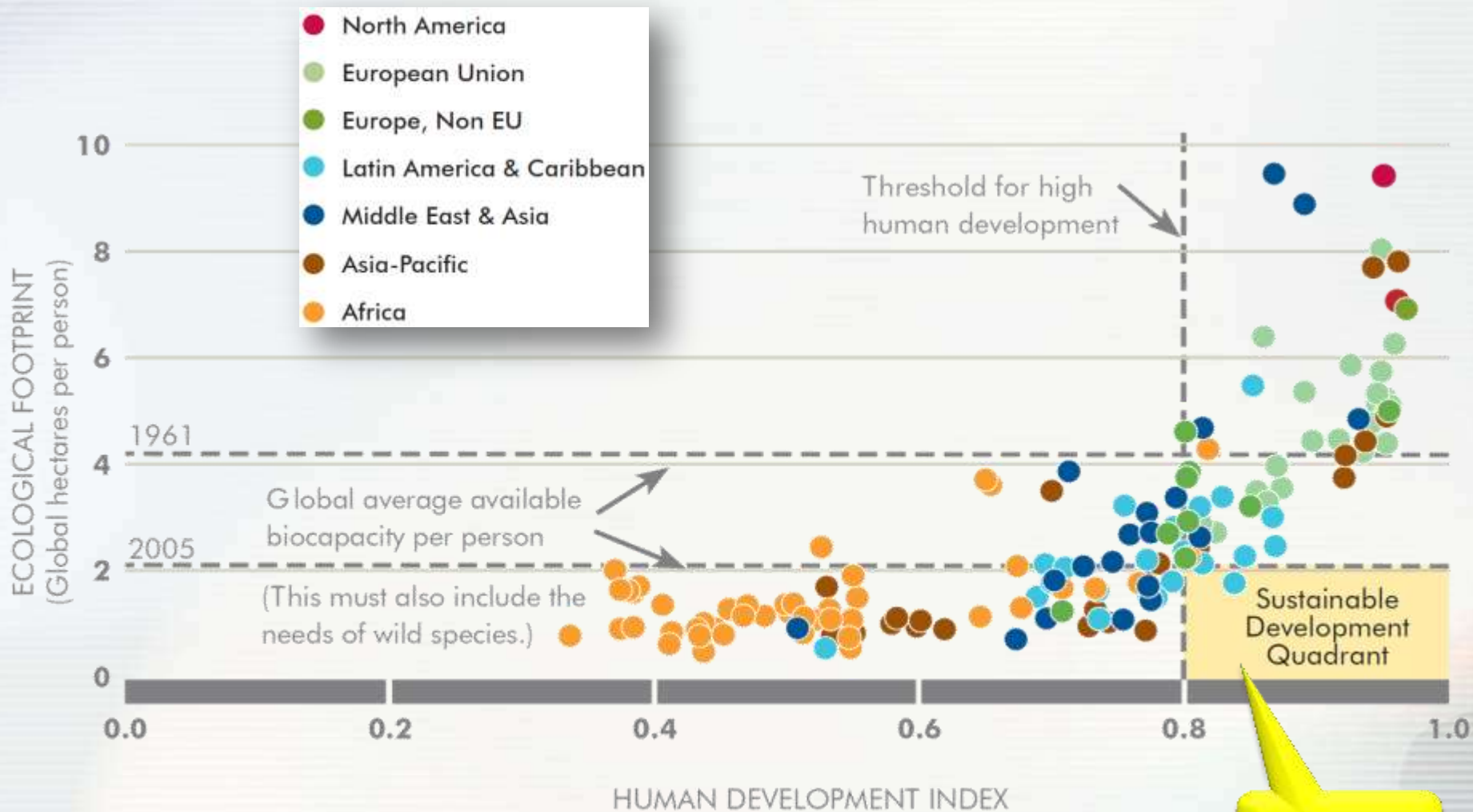


Challenges

- **Global warming, melting ice, rising oceans**
- **Ecosystem degradation, biodiversity loss**
- **Resource scarcity (water, land, minerals)**
- **Infectious diseases (viral, bacterial)**
- **Urbanization, social disintegration**
- **Income gaps (rich vs. poor)**
- **Population growth**



Trajectory of Human Progress



“SMM is an approach to promote sustainable materials use, integrating actions targeted at reducing negative environmental impacts and preserving natural capital throughout the life-cycle of materials, taking into account economic efficiency and social equity.”

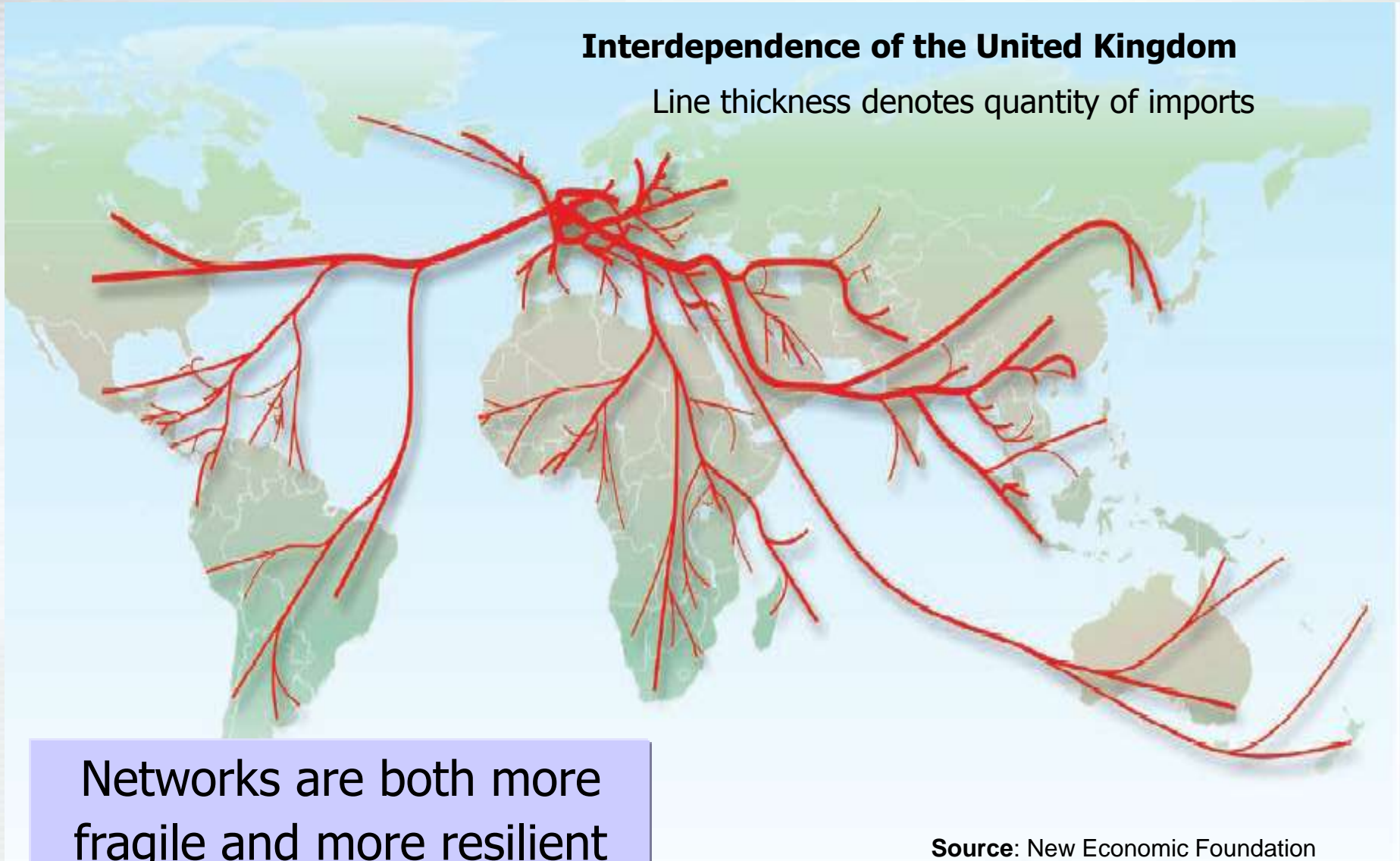


*Working Group on
Waste Prevention
and Recycling*

Global Supply Chains

Interdependence of the United Kingdom

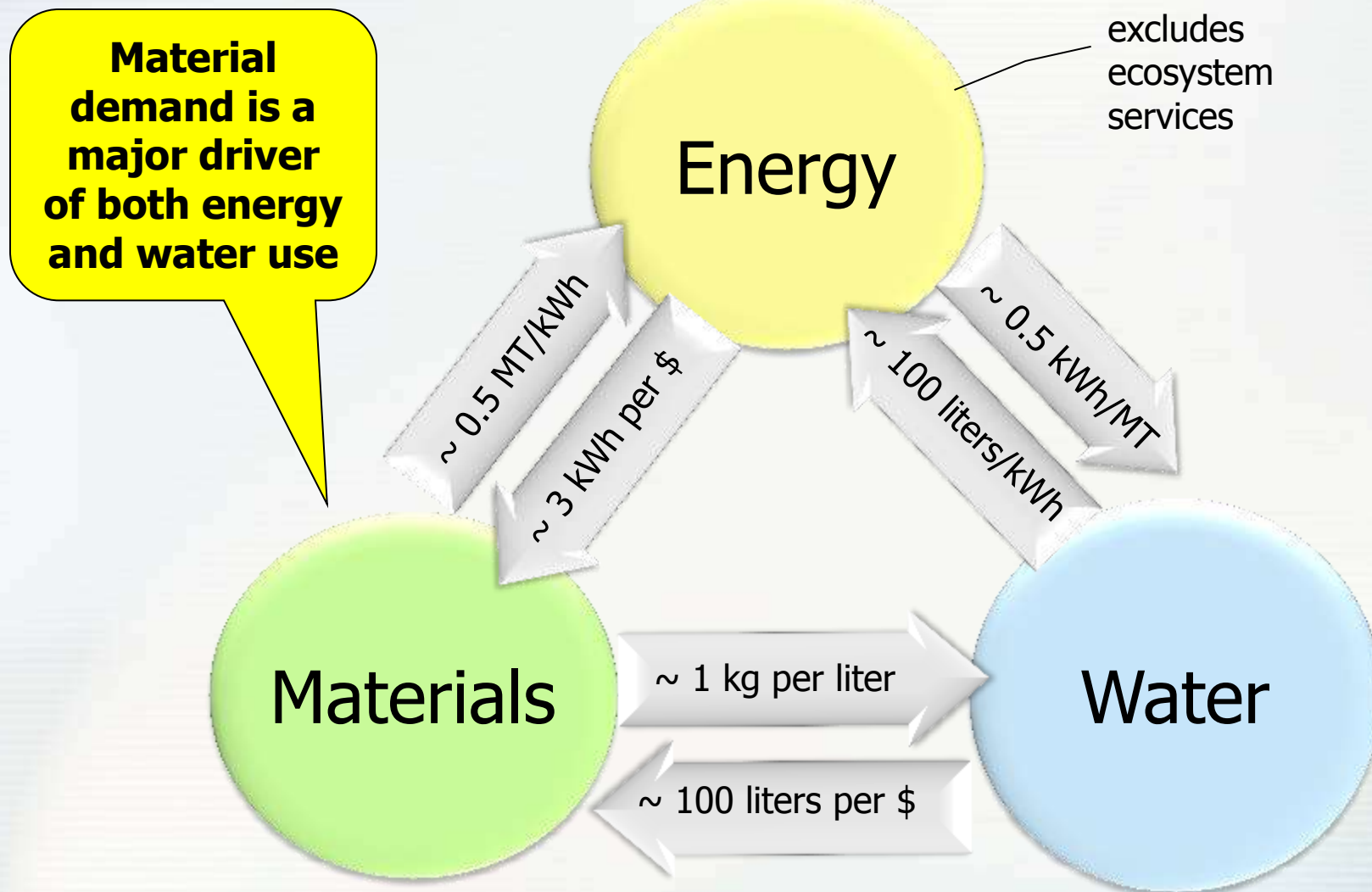
Line thickness denotes quantity of imports



Networks are both more fragile and more resilient than isolated systems

Source: New Economic Foundation

The Material-Energy-Water Nexus



Source: J. Fiksel, "Evaluating Supply Chain Sustainability,"
Chemical Engineering Progress, May 2010.

Systems View of Material Flows

Industry

(economic capital)



Society

(human capital)



products & packaging are distributed to consumers

residuals are released into air and wastewater

some wastes are recycled

pollution affects human health

solid waste disposal consumes land

ecosystem services may be degraded

water resources may be contaminated

land & material resources are used for industrial facilities and feedstocks

land & material resources are used for buildings, recreation, and other amenities

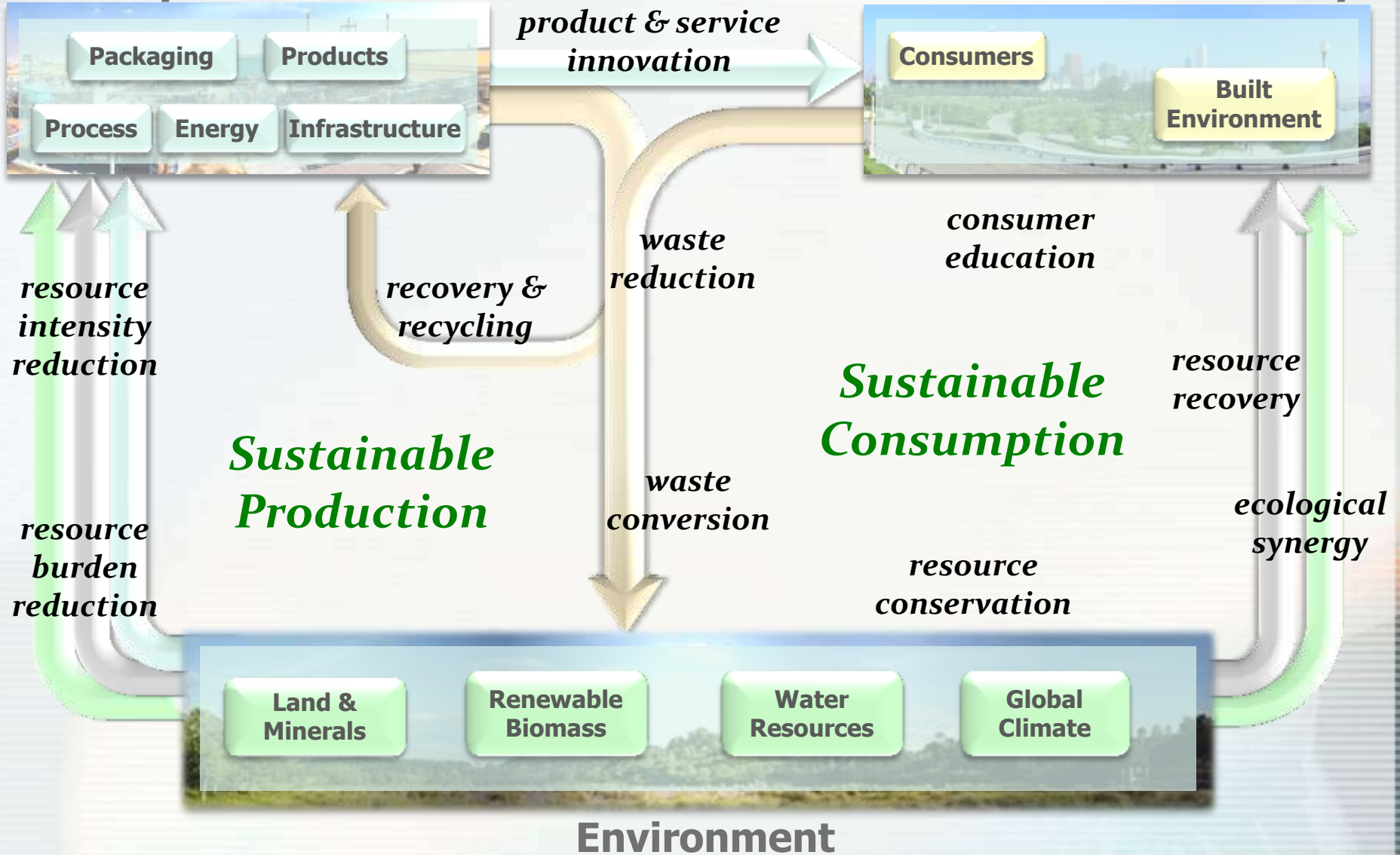
Environment (natural capital)



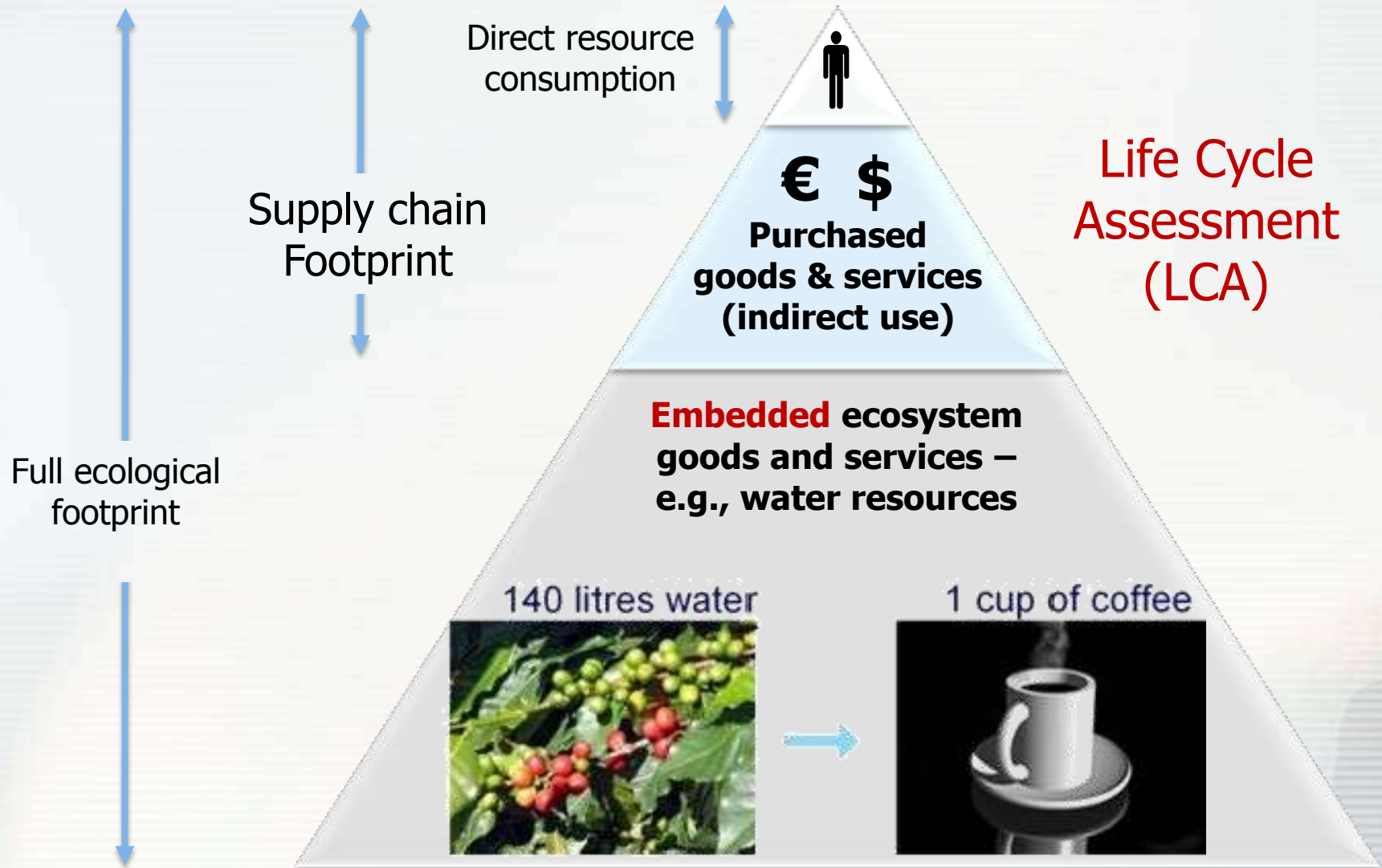
Alternative Strategies for SMM

Industry

Society



Hidden Resource Consumption

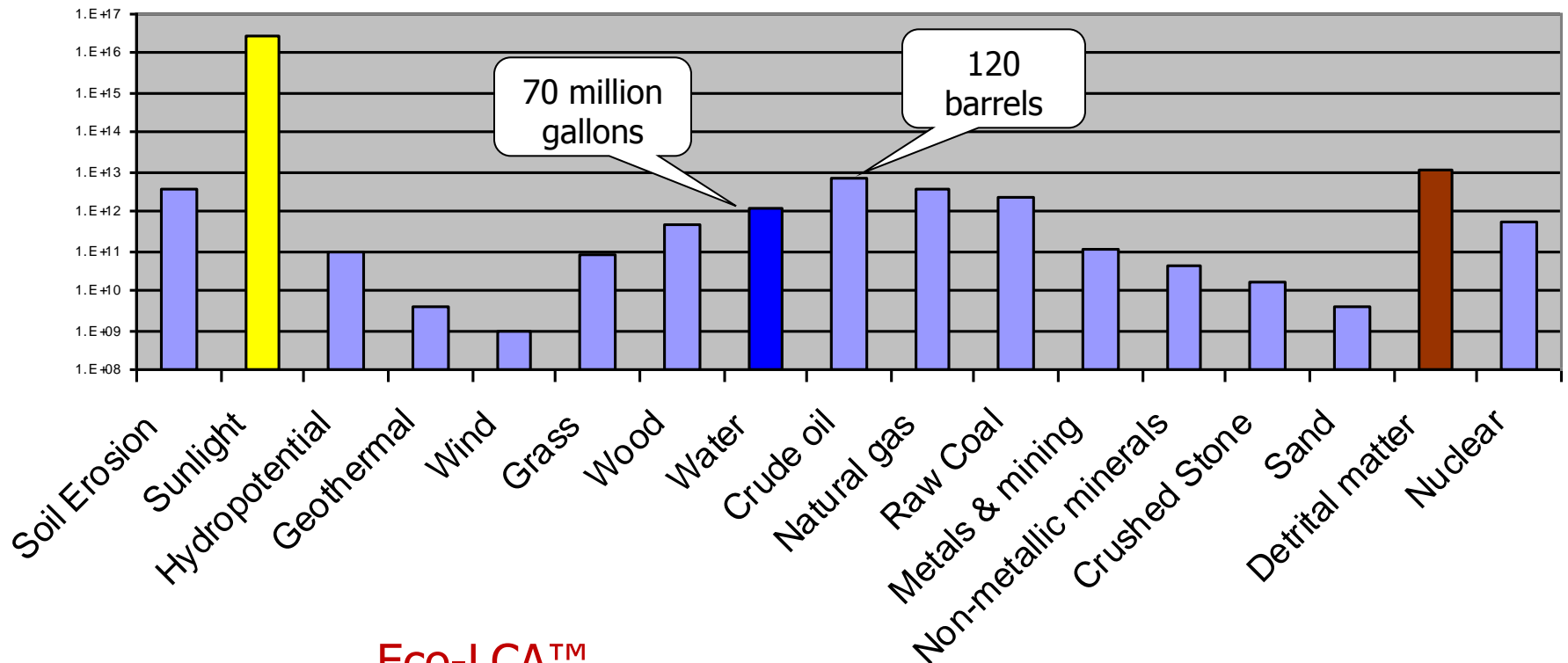


Example: Snack Food Industry

“Embedded” natural capital for a typical U.S. food supply chain, converted into energy equivalents

Source: OSU Center for Resilience

**Natural Capital Consumed (joules) per \$million Output
Snack Food Manufacturing Supply Chain – U.S. Average**



Example: Aluminum Industry

Life-Cycle of the Aluminum Can

Recycling uses 5% of energy & material flows vs. primary



Source: Alcan

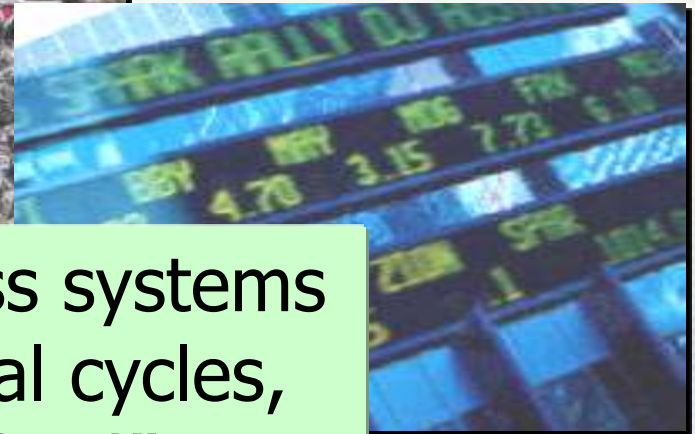
Industrial Ecology



Waste = Food

= Value

= Profit



Industrial ecology is a process systems approach that mimics natural cycles, converting waste into "food"

Locations of Ohio BPS Members



Converting solid waste streams into economically valuable byproducts

Fairmount Minerals

Marathon Oil

Dow Chemical

G&J Pepsi

City of Columbus

Cemex

Procter & Gamble



Ohio BPS Opportunities—2010



- Lime Slurry – Caustic Replacement
- Filter Cake – Compost
- Food Waste – Energy & Compost
- Foundry sand reuse
- Manganese & Cosmetics for brick colorant
- Aluminum oxide reuse
- Paint sludge for anaerobic digestion
- Bulk bag reuse
- Biosolids/sludge for anaerobic digestion

Eco-Flow™ Graphical Interface



EcoFlow Workbench

File Edit Window Help

150% Eco Flow Change

Resources

- Kansas City
 - Kansas City BPS Scenario 1.eflow
 - Chicago.solution
 - Example 1 .solution
 - Kansas City BPS Scenario 2.eflow
 - Example 2 .solution

Chicago Kansas City BPS Scenario 2

Harley-Davidson: Used Oils (Input)

Harley-Davidson: Wood Pallets (Input)

Johnson Co. Wastewater Treatment Sludge (Input)

Treatment (Conversion Process)

Harley used oil to Systech

Harley used oil disposal

Harley pallets to Systech

Harley pallet disposal

Sludge to Systech

Sludge to compost

Sludge to Lafarge

Sludge Disposal

Gerda residue disposal

Properties

Property	Value
Arc Capacity Type	Infinite
Arc Ratio	1.0
Co2 Emission (Co2 Output/Input)	0.043
Edge Name	Harley pallets to Systech
Fixed Transportation Cost	0.0
Type of Flow	Real
Variable Transportation Cost	13

start

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Material flow analysis and optimization tool (partially funded by EPA STAR grant)

Ohio BPS Network Estimated Benefits

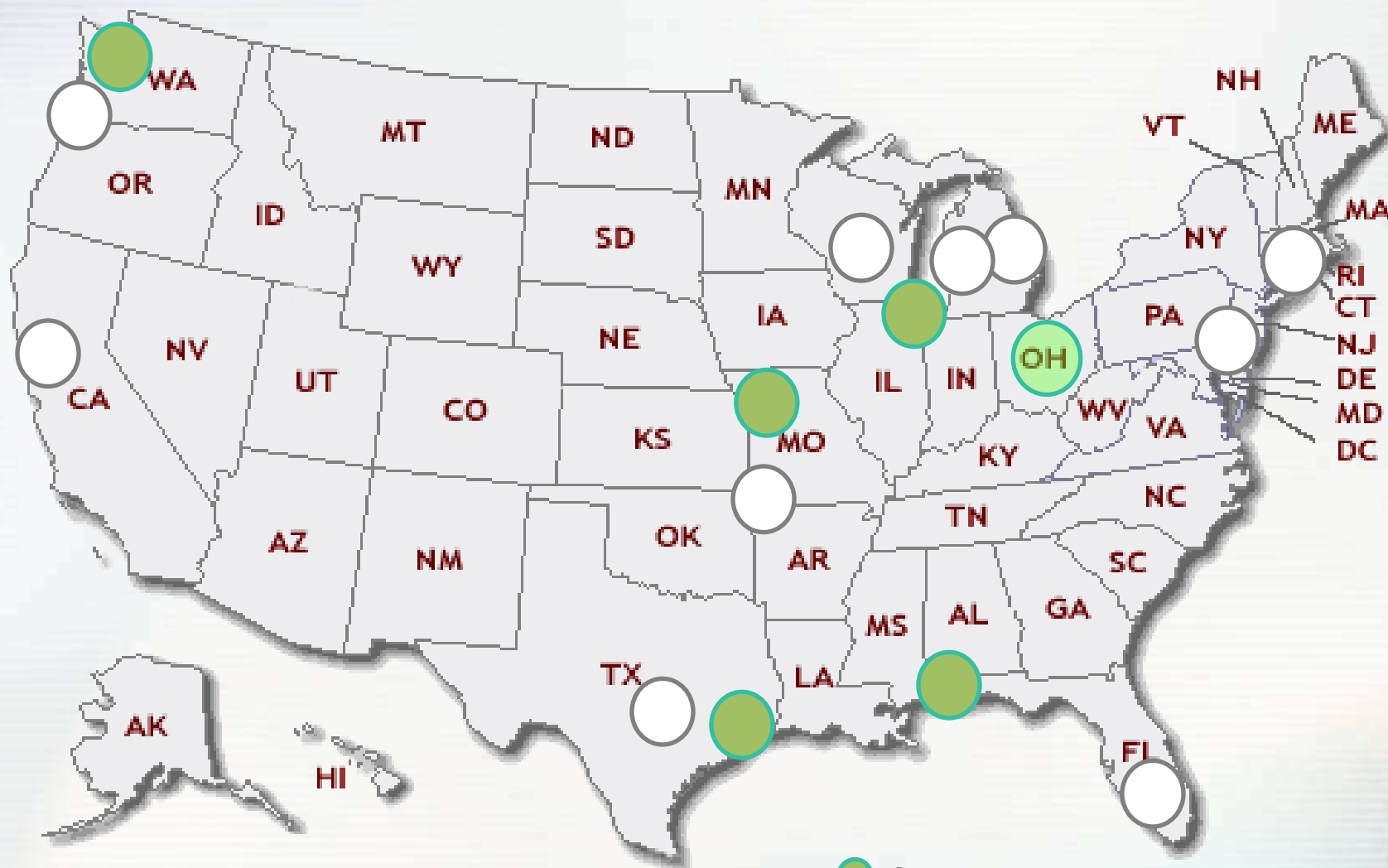


By-Product Synergy Metrics

Annual Savings

Total Cost Savings	\$3,559,601
Waste to Landfill avoided (tons)	30,252
Direct Greenhouse Gas Emissions (MT)	1,211
Life Cycle Greenhouse Gas Emissions (MT)	663,571
Life cycle Water Use Reduction (1000 gal)	31,400
Total Life Cycle Energy Use (1000 GJ)	96,923
Non-renewable Resources (1000 tons)	737,391

BPS Networks Across the U.S.



United States Business Council
For Sustainable Development

 **Current**

 **In Development**

Thank you!

www.OhioBPS.org

www.Resilience.osu.edu

www.USBCSD.org

