RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

Rutgers Supply Chain Archeology

Procurement's Role

In Sustainable Development and Waste Management

Kevin Lyons, Ph.D.

Rutgers Business School-Dept of Supply Chain Mgt-Mrk Sci

Ctr for Supply Chain Management-Supply Archeology Lab

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Green Purchasing and Waste Research

Supply Chain Archeology

A Supply Chain Manager's and Purchaser's Perspective On:

Understanding the History, Behavior, Movement and Business of Waste;

http://www.sustainabledevelopment.loreal.com/

http://www.garnierusa.com/_en/_us/pure_clean/index.aspx#/home

Consumerism, Consumption and the Linking and Integrating of Solid Waste into the Supply Chain Management Process

Supply Chain Archeology; Archeological Waste Research - *The Concept*

- Archeological Site Research – Global Landfill Sites:
  - Conducting Global Archeological Digs (K. Lyons)
  - Merge Supply Chain and Environmental Mgt/ISO 14001
  - Product resource input/output analysis (end of life resource value analysis)
  - Waste as Feedstock/Commodity
  - Data used for Upstream Design and Technology (Waste and Resource Prevention DfE Criteria)
  - Influence Innovative Development along the SC
  - Product Specific Btu Methane and Waste Research
  - New Emerging LCA Waste Value Contract Development

How Sustainability (Greening) Could Be the Key Driver of Innovation; Project Considerations and Ideas

- ***Sustainability Policy/Mission Statement and Policy Directives; Viewing Compliance as Opportunity***
- **Main Challenge:** To ensure that compliance with norms becomes an opportunity for innovation.
- **Competencies Needed:** The ability to anticipate and shape regulations. The skill to work with other companies, including rivals, to implement creative solutions.
- **Innovation Opportunity:** Using compliance to induce the company and its partners to experiment with sustainable technologies, materials, and processes.

Identify Product, Follow Product Through Supply Chain; Making Value Chains Sustainable

- **Main Challenge:** To increase efficiencies throughout the supply chain.
- **Competencies Needed:** Expertise in techniques such as carbon management and life cycle assessment. The ability to redesign operations to use less energy and water, produce fewer emissions, and generate less waste. The capacity to ensure that suppliers and retailers make their operations eco-friendly.
- **Innovation Opportunities:** Developing sustainable sources of raw materials and components. Increasing the use of clean energy sources such as wind and solar power. Finding innovative uses for returned products.

Designing Sustainable Products and Services

- **Central Challenge:** To develop sustainable offerings or redesign existing ones to become eco-friendly.
- **Competencies Needed:** The skills to know which products or services are most unfriendly to the environment. The ability to generate real public support for sustainable offerings and not be considered as "greenwashing." The management know-how to scale both supplies of green materials and the manufacture of products.
- **Innovation Opportunities:** Applying techniques such as biomimicry in product development. Developing compact and eco-friendly packaging.

Creating Next-Practice Platforms

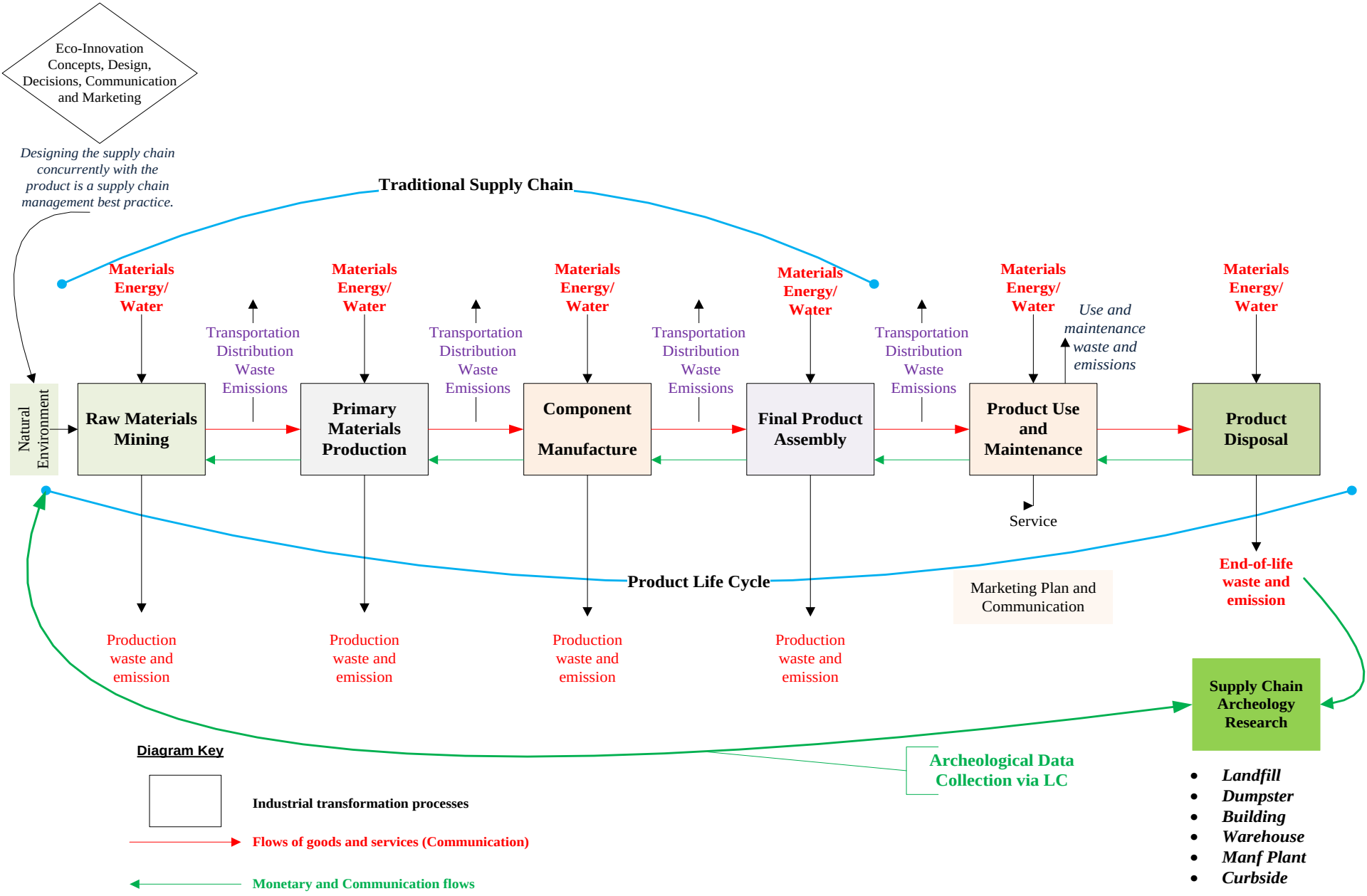
- **Central Challenge:** To question through the sustainability lens the dominant logic behind business today.
- **Competencies Needed:** Knowledge of how renewable and nonrenewable resources affect business ecosystems and industries. The expertise to synthesize business models, technologies, and regulations in different countries.
- **Innovation Opportunities:** Building business platforms that will enable customers and suppliers to manage energy in radically different ways. Developing products that won't need water in categories traditionally associated with it, such as cleaning products. Designing technologies that will allow industries to use the energy produced as a by-product.

The Supplier

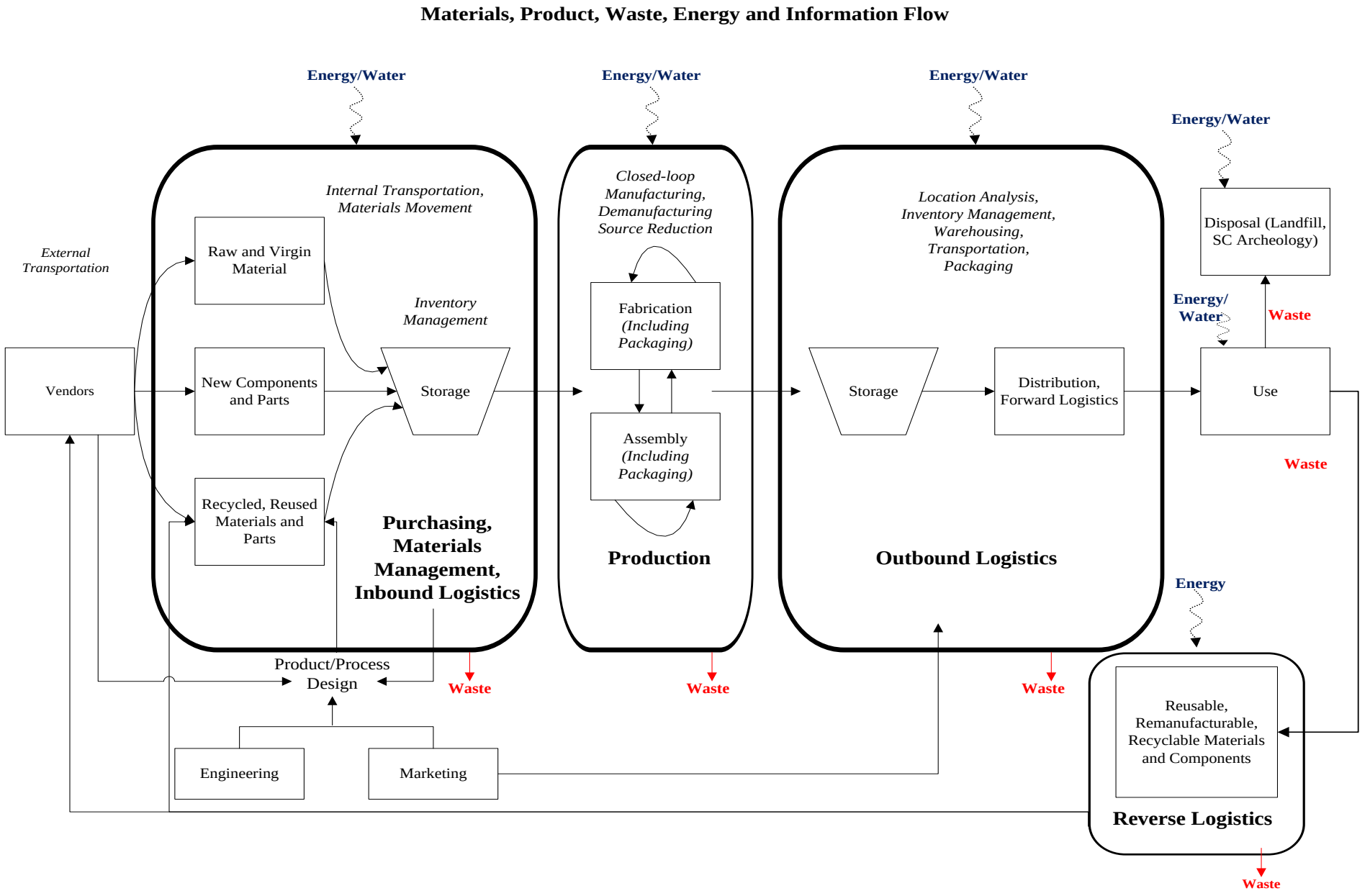
Business Roundtable (BRT) is an association of chief executive officers of leading U.S. companies with nearly $6 trillion in annual revenues and more than 13 million employees. BRT member companies comprise nearly a third of the total value of the U.S. stock market and invest more than $114 billion annually in research and development – nearly half of all private U.S. R&D spending. BRT companies pay more than $179 million in dividends to shareholders.

BRT companies give nearly $9 billion a year in combined charitable contributions.

Detailed View of Supply Chain Industrial and Consumption Systems – Using Life Cycle Perspective



Materials, Product and Information Flow. Forward and Reverse Logistics



Life Cycle Assessment (LCA, NPV)

ISO 14040 Criteria (research investment, risks, decisions)

Reverse Logistics: Opportunity/Innovation

Raw Material
Product downsizing, extensive recycling

Manufacturing
Energy conservation, conservation and recycling of raw materials, measures to prevent air, water and underground water-pollution

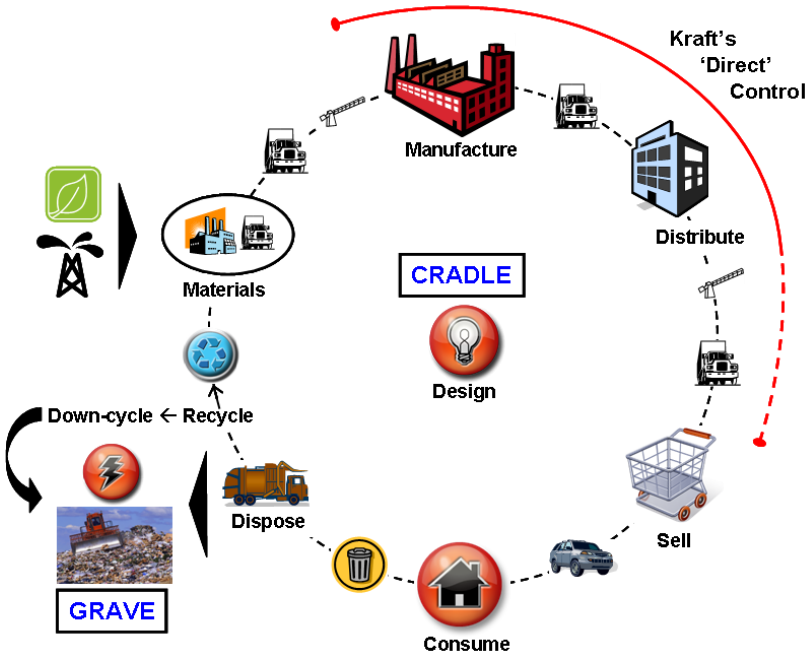
Distribution
Simplified packaging, efficient distribution, use of low-pollution delivery vehicles

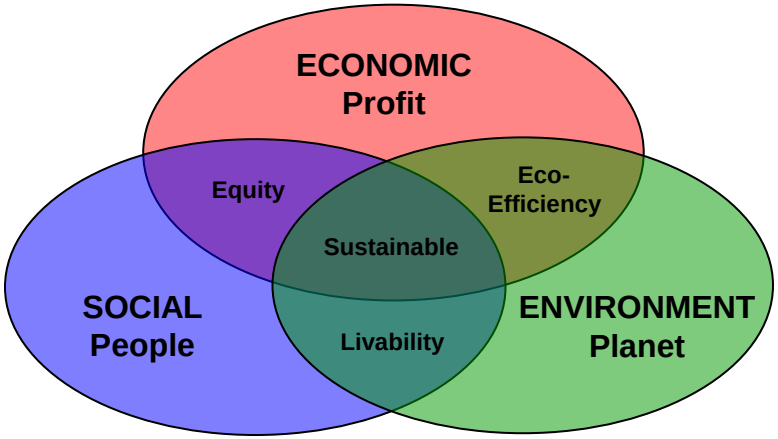
Consumer Use
Products that consume less power, reduce use of auxiliary materials (products that require less use of water, detergent and other materials)

Post Consumer Use
Products designed for easier recycling, lower amounts of environmentally harmful substances (Risk Mgt Research)

= Logistics/ Transportation

LCA- Draft
Life Cycle Assessment
Bio-Bottle
Design for the Environment -DfE





LCA - Draft

Data Quality Requirements

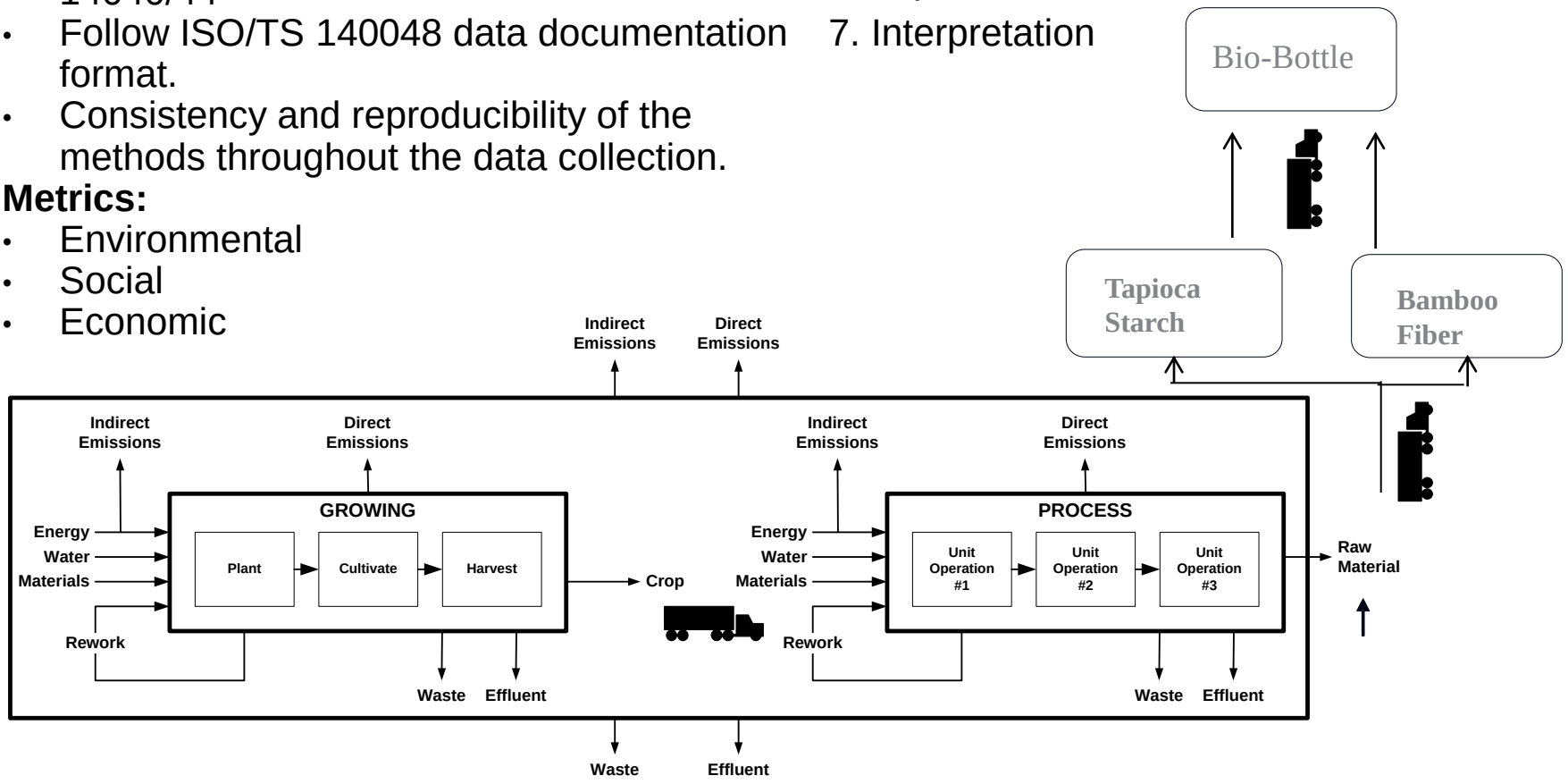
- Modeling is carried out using a software package GaBi.
- Consequential modeling - Use of ISO 14040/44
- Follow ISO/TS 140048 data documentation format.
- Consistency and reproducibility of the methods throughout the data collection.

Metrics:

- Environmental
- Social
- Economic

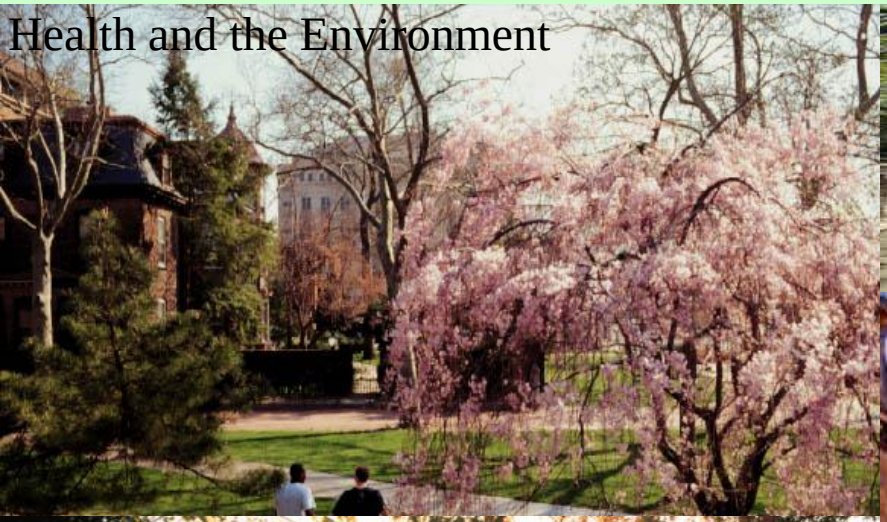
Inventory analysis

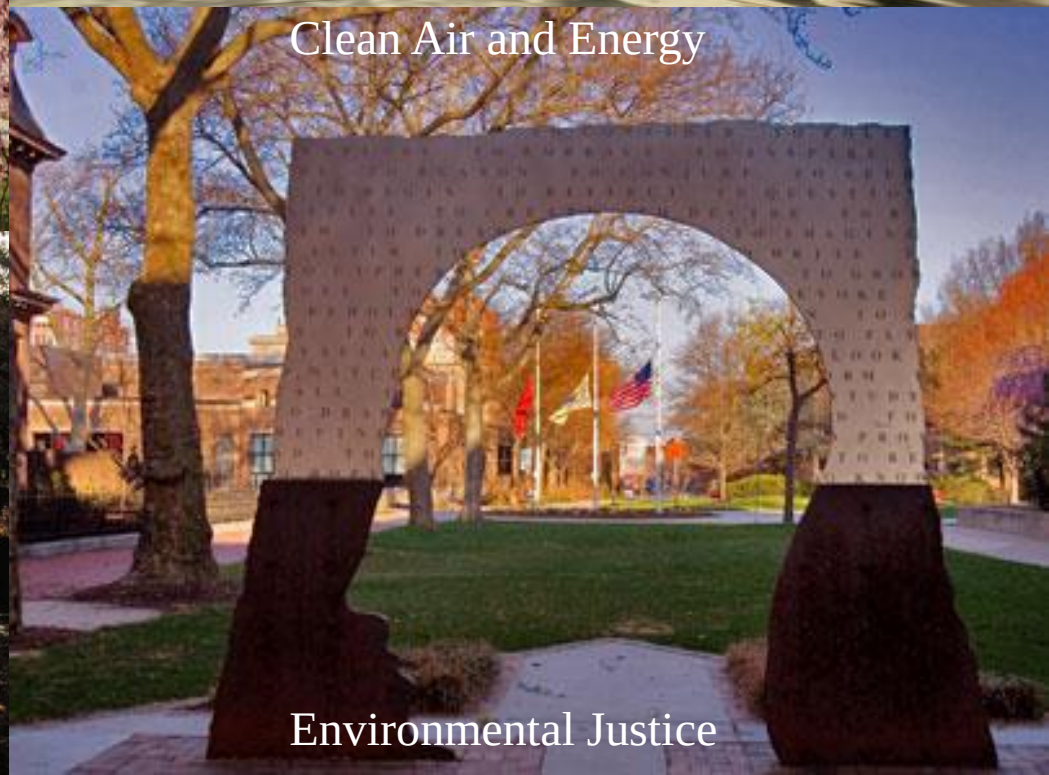
1. Raw materials (releases to air, water and land)
2. Distribution
3. Sell
4. Use
5. Dispose
6. Impact assessment
7. Interpretation

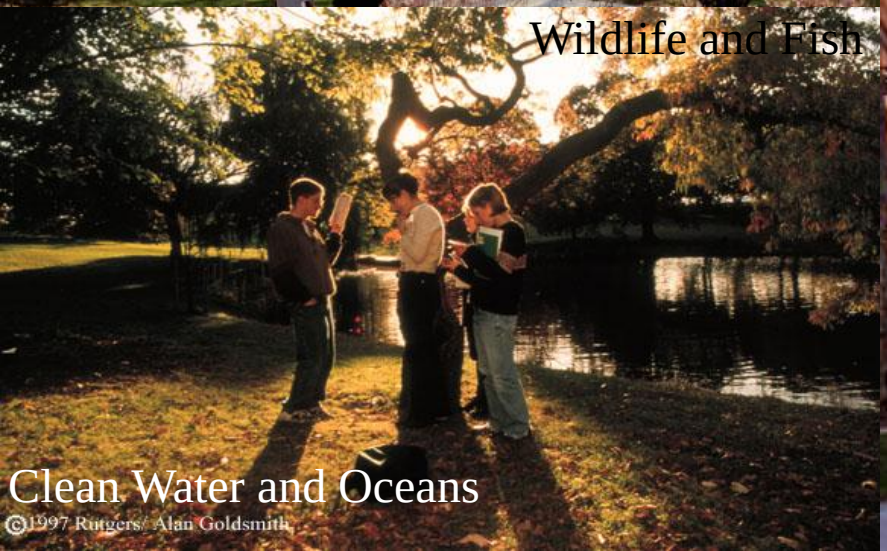


RUTGERS *Sustainable Solutions!*

Greening the Supply Chain; A Case Study and Success Stories *by Dr. Kevin Lyons*







Energy Purchased on the New Brunswick / Piscataway / Newark / Camden Campus – F/Y 2010-11 - **Resource Data**

$2.5 Billion Assets
6200 Acres
$550 Million/Yr
Commodities and Services
HE - $500 B
US Fed Gov - $500 B

Electric	**$23,300,000.00**
Natural Gas	**$ 35,700,000.00**
Water	**$ 3,700,000.00**
Totals	**$62,700,000.00**

900 Buildings
6200 Tons/Waste
26 Waste Commodities
63% Recycling Rate
Cost Reductions 10yrs!

- **Electric – Purchase, 292,100,000 kWh – Produce 115,000,000 kWh = 407,100,000 kWh per year**
- **Natural Gas – Purchased 2,988,738 dekatherms**
- **Oil – 290,000 gallons**
- **Water – 566,000,000 gallons**
- **Carbon Footprint – 345,197 tons CO2**

Software installed through networks
Places computer into sleep mode
Based on 40,000 Computers
Installation Cost $660,000.00
Annual Savings $480,000 - $800,000
Annual Reoccurring Cost $80,000
1 Year payback
Annual Net Savings $640,000.00

http://purchasing.rutgers.edu/green/

Rutgers The State University of New Jersey

Rutgers Green Purchasing Policy and Guidelines

A. Goal

In accordance with the University's Purchasing Policy, Rutgers is committed to the use and purchase of environmentally and socially responsible materials and products. Departments are expected to support this policy in accordance with established guidelines and procedures contained in this Green Purchasing Policy. This document is a way in which Rutgers' procurement decisions are made using multiple factors. These procurement decisions include economic criteria as well as strong commitments towards environmental protection.

B. Assessment of Current Status and Opportunities

The Rutgers' Purchasing Department and those Administrative Units with delegated purchasing authority are responsible for the procurement of goods and services for the entire Rutgers University System.

Selected Goals:

- To develop and maintain a consistent 'cradle-to-cradle' supply chain and purchasing process which considers economic, ethical, social and environmental impacts for all contracts and purchases; where all waste should first be eliminated or avoided and where any remaining waste be considered feedstock for new product development.
- To integrate green purchasing concepts and products into architectural designs, final construction documents and into the final construction of all Rutgers buildings, renovations of property or facilities owned by Rutgers.
- To utilize environmentally responsible biodegradable solvents and citrus-based, rather than oil-based, cleaners.
- To utilize bio-based products, fuels and solvents (e.g. soy-based inks and lubricants).
- To purchase equipment and fleets which utilize alternative fuel and/or alternative environmentally responsible energy methods; target and help Rutgers develop new sources of alternative fuel that can be produced at Rutgers utilizing Rutgers waste.
- To conduct research and procure alternative energy from reliable, certified alternative energy suppliers.
- To make use of recycled paper: used paper is turned into scratch pads for distribution to departments on campus.
- To procure recycled content office supplies (folders, writing pads, etc.).
- To procure environmentally responsible and ergonomically designed furniture and furnishings including floor coverings and window treatments.
- To reuse packing material and plastic bags.
- To comply with New Jersey State recycling policies and regulations and identify, implement and record data for new categories of recycling.
- To increase recycled content offerings across all commodities.
- To recycle ink and toner cartridges.

Rutgers Green Purchasing Policy and Guidelines 1

Green Purchasing Policy

Consumption (is it needed?) >**Zero Waste**

Cradle-to-Cradle concepts (more than price!)

Green Buildings (Design, Landscaping, Construction, Renovation)

BioBase, Biodegradable, etc.

Energy/Water Conservation

Eco-Labels; Certifications

Corporate Social & Environmental Reporting

Changing the Mindset Outside the Campus

Criteria we will be considering when we procure an item will be:

- The availability of the item; the potential impact of procurement on the solid waste stream
- The economic and technological feasibility of producing the item; and
- Other uses of the recovered materials used to produce the item.
- Ethics and Socially Responsible policies and practices

- Items you may want to share could include:
- Company/Corporate annual report (current or prior year) highlighting current 'green' initiatives
- Documents presenting ideas for new 'green' initiatives
- Company/Corporate policies regarding office recycling, reducing packaging, etc.

If your company does not have a policy or initiative in place currently, we would be happy to work with you to develop a plan that fits your company's specific needs.

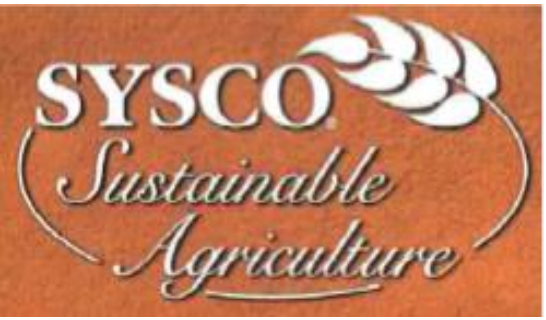
Supplier Responses

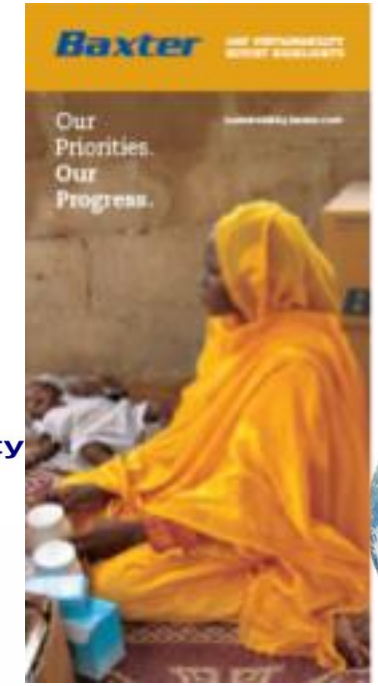
Wind energy credits offset the Zody assembly CO_2 emissions—avoiding emissions of over 1.4 million pounds in the next two years, which is equivalent to planting 194 acres of mature trees, shaving 1.5 million miles off the average car or taking 124 cars off the road permanently.

HAWORTH

Timberland

3M





HopeLine from Verizon Wireless

Agilent Technologies

SYSCO Corporate Sustainability and Responsibility Report

BARNES & NOBLE

Letter from SYSCO's Chairman, CEO and Presi
Richard J. Schnieders

www.bn.com

Global Corporate Social and Environmental Reporting

- Community
- Diversity
- Environment
- Ethics
- Financial Responsibility
- Human Rights
- Safety

Russell Athletics:

MAGIC JOHNSON ENTERPRISES
WE ARE THE COMMUNITIES WE SERVE
Starbucks V2V redefining community

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- *SRM App!*
- *SRM Supplier Profiles*
- *Supplier Catalogs*
- *Waste Tracking, etc.*

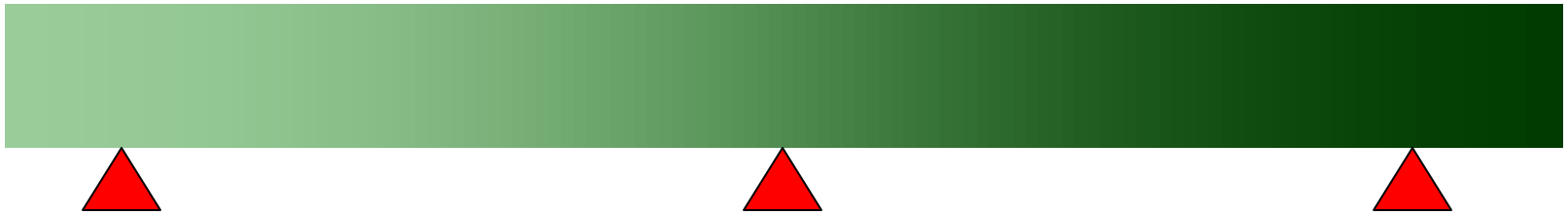
Kevin Lyons, Ph.D.
CPO/RBS-SCMMS

Why Is SRM Important at Rutgers and for Sustainability?

- *Supplier CRM/Performance Portfolio*
- *Market trends and opportunities for suppliers*
- *Responsiveness as A Competitive Differentiator*
- *Effective Communication Strategies*
- *Technology; eProcurement and SRM*
- *Key considerations for identifying Environmentally Preferable Purchasing goals within Procurement*
- *Supply Chain CSER Reporting*

Evolution of Green Strategies

How Do You Incorporate It?



Request for Information

(RFI)

Data Gathering!

Included in Evaluation Criteria

(RFP, RFQ)

Competitive Thinking!

Required

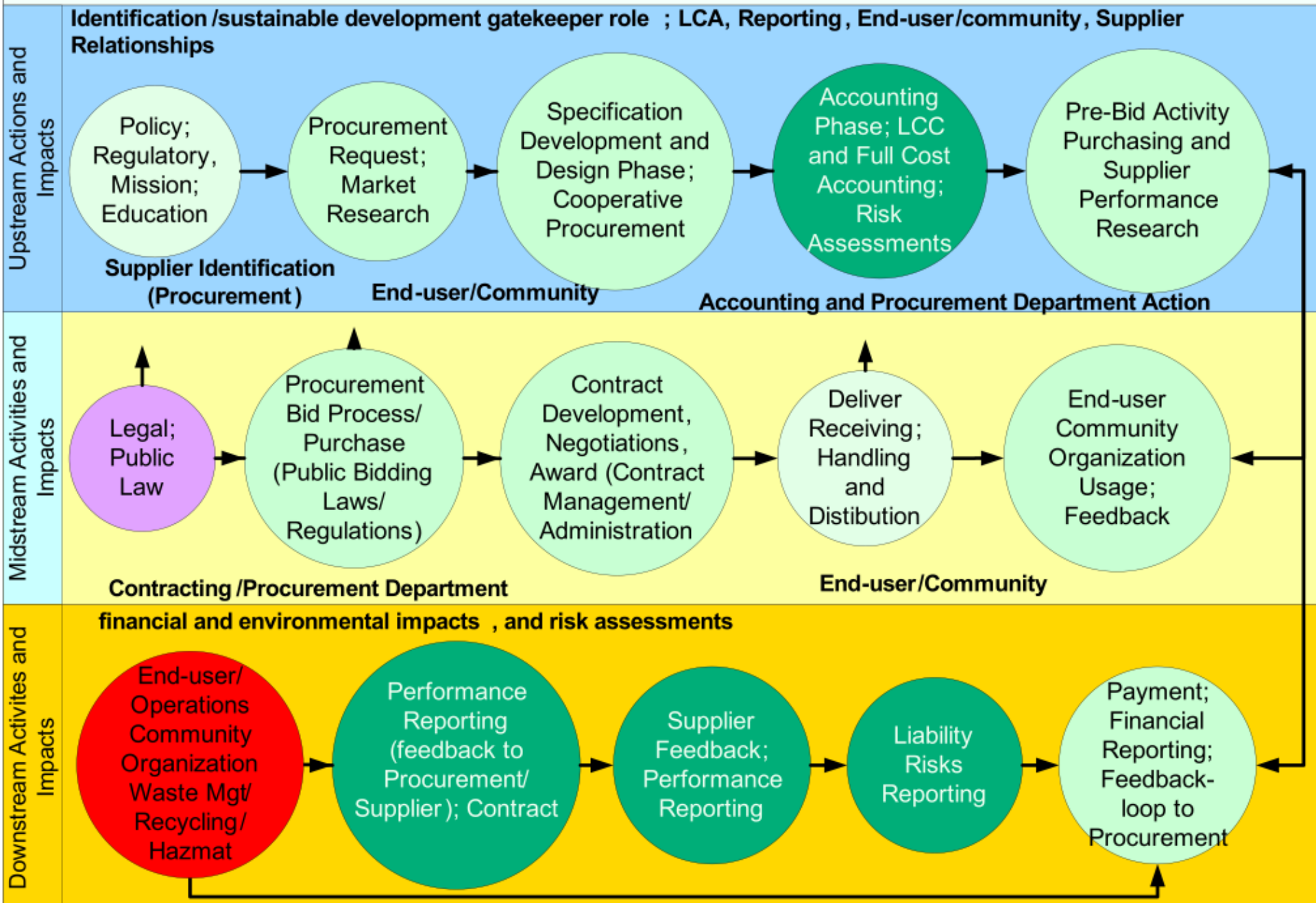
(Contracts)

Implementation! Research/Testing!

Environmental Attributes

- Product-specific attributes (including packaging)
- Process-specific attributes
- Hazardous Profiles
- Manufacturer-specific attributes
- Waste/Recycling Profile
- Life cycle perspective

Green Purchasing; Performance-Based Contracting; Procure-to-Waste



Rutgers PC Cycle RFP Language

6.1 Environment

Responders must describe their Product environmental improvement program in each of the following areas: reduction/minimization/avoidance of the use of toxic and hazardous constituents (cadmium, chromium, mercury, and/or lead); compliance with international directives such as the European Union's Directive "restriction of Hazardous Substances", reduction of chlorinated plastics (PVC) and brominated flame retardants; certification by independent third party eco-labeling programs (TCO, Blue Angel, and Nordic Swan); and the migration to the use of recyclable, nontoxic packaging. Responders must specifically identify each equipment item or peripheral model number that has been certified and the type of certification obtained. In addition, Responders must list the model numbers of units being submitted for certification as well as a schedule for any remaining units. Finally, Responders must describe how certified units are labeled and identified as such on the web site.

6.2 Energy Efficiency

6.3 Packaging Alternatives, Takeback (EPR)/Recycling

6.4 Corporate Environmental Policy

6.5 IEEE 1680 Standard for the Environmental Assessment of Personal Computer Products

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Green Purchasing and Waste Research

Supply Chain Archeology

A Supply Chain Manager's and Purchaser's Perspective On:

Understanding the History, Behavior, Movement and Business of Waste;

http://www.sustainabledevelopment.loreal.com/

http://www.garnierusa.com/_en/_us/pure_clean/index.aspx#/home

Consumerism, Consumption and the Linking and Integrating of Solid Waste into the Supply Chain Management Process

Waste is a Commodity!

Mack
Truck/Volvo

Waste is Food!

Rutgers Eco-Complex Resource Renewal

- Anaerobic digester
- Food waste = ENERGY

Rutgers EcoComplex

The RUTGERS EcoComplex is RUTGERS University's Environmental Research and Extension Center. It is the nation's first research, technology development and outreach center that is dedicated to enhancing the environment and agriculture through education, outreach and green business development.

MORE >

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Decision Green℠

UPS's approach to environmental sustainability

UPS Transport & The Environment

Rutgers University

New Brunswick, NJ

April 2009

Projects From Recycled Plastic Polymers

http://www.youtube.com/watch?v=0hE-ymdio44

http://www.youtube.com/watch?v=3dD3ml_t77Y&feature=related

Corporate Logistics and Packaging

A 120-ton diesel locomotive crosses newly built plastic lumber bridge at the Army's Fort Eustis installation in Newport News, Virginia.

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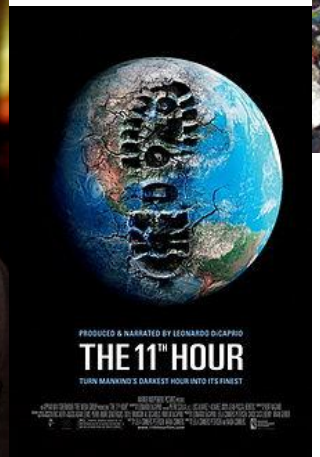
Green Purchasing and Waste Research

Supply Chain Archeology (Ocean)

Designing a Ocean Vessel equipped with plastic polymer extruder to capture, process and extrude lumber … return to port!



Linking and Integrating of Plastic Waste into the Supply Chain Management Process

Kevin Lyons, Ph.D. ***http://purchasing.rutgers.edu/green***

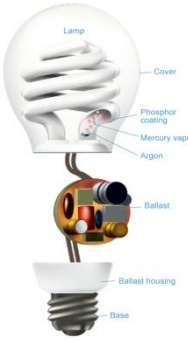
eProcurement – RU eEnergy Grid System (NSF - IGERT Grants)

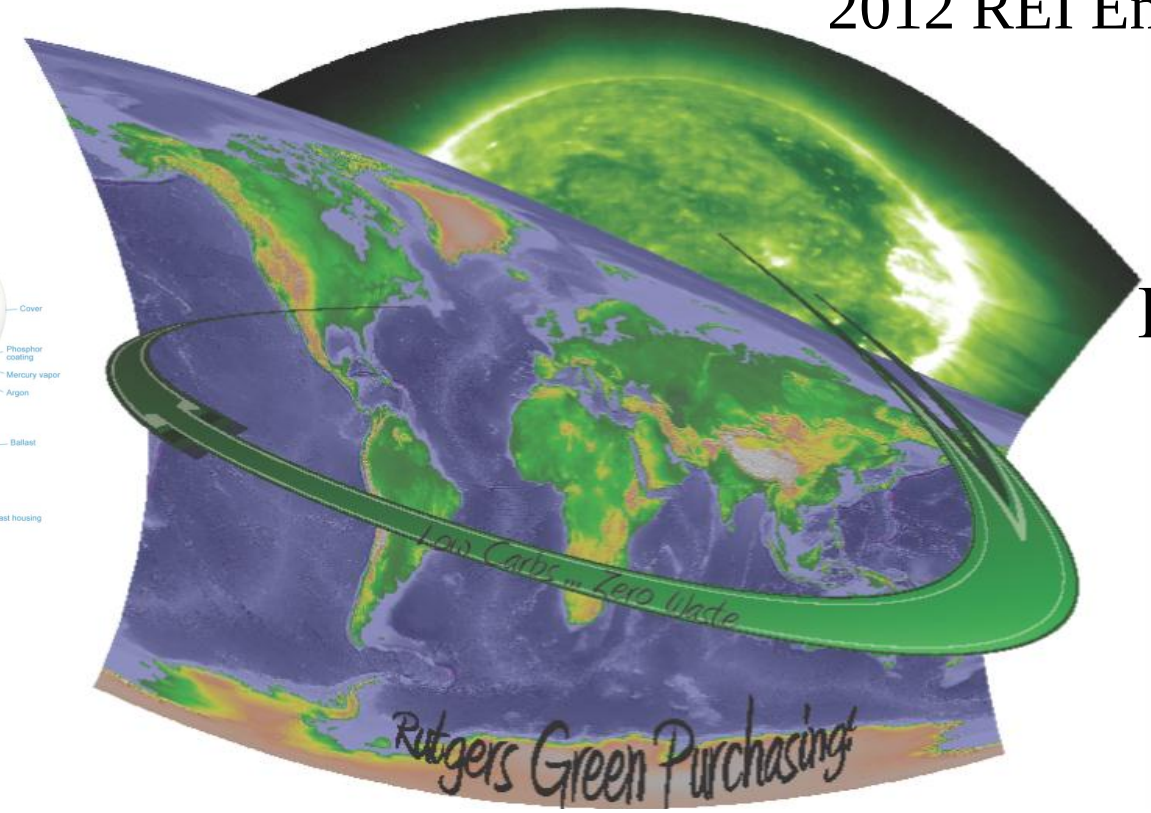
ORACLE

ENERGY PROCUREMENT INTELLIGENCE, REALIZED!

GP

2012 REI Energy Innovation Contest





Rutgers University

Product Carbon/Climate Impact Research; Product Labeling and Certification

Measuring carbon emissions at every step of the supply chain could lead to valuable energy and cost saving opportunities (for the General Public, Rutgers, and our Manufacturers). "*Carbon Footprinting*" *is a way to measure the impact human activities have on the environment, in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide.*

EcoLabel Research

Nutrition Facts

Serving Size 6 oz

Servings Per Container 25

Amount Per Serving

Calories	690	**Calories from Fat**	76

		% Daily Value *
Total Fat	8g	**13%**
Saturated Fat	3g	**15%**
Cholesterol	126mg	**42%**
Sodium	408mg	**17%**
Total Carbohydrate	109g	**36%**
Dietary Fiber	3g	**11%**
Sugars	27g	
Protein	43g	

Vitamin A 2% * Vitamin C 3%

Calcium 3% * Iron 10%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs :

	Calories :	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 * Carbohydrate 4 * Protein 4

Environmental Facts

Overall Weighted Score ..... / 10

Energy

Embodied energy 2,800kWhr
Type of energy used: 2,000kWhr coal, 800kWhr solar PV
Energy usage, avg. est. 1,900kWhr/yr
Transportation origin
Product: USA
Materials: USA, China, Korea, South Africa

Resources

Product
Mass 10kg
Non-virgin material 5%
Recyclable/Compostable material 30%
aluminum, steel, plastic #1
Ingredients: Polyethylene terephthalate (PET), aluminum, steel, glass, copper, fiberglass, acrylonitrile-butadiene styrene (ABS), lead-free solder, nematic liquid crystals, polyimide, indium-tin oxide, Polycarbonate, Poly(methyl methacrylate) (PMMA), Styrene-butadiene co-polymer, Polyethylene ether, Triphenyl phosphate, polybrominated flame retardant, silicon, silicon dioxide, silicon nitride, selenium, cadmium, antimony, dopants
Life Expectancy 4-7yrs
End-of-life ..... return to manufacturer

Packaging & Misc.
Mass 800g
Non-virgin material 20%
Recyclable/Compostable material 100%
cardboard, paper, PLA plastic
Ingredients: cardboard, paper, PLA plastic, soy-based ink
End-of-life ..... recycle, compost

Toxins

Restricted/Toxic ingredients: polybrominated flame retardant, cadmium, antimony, dopants
Restricted/Toxic production waste: toluene, mercury oxides, cadmium, antimony, arsine, silane, chlorine, phosgene, perfluorocompounds (CF_4, C_2F_6, NF_3, SF_6, CHF_3)

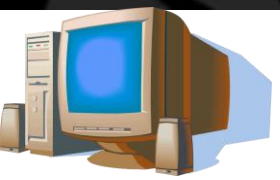
Water

Embodied water 2,600L
Water pollution 2/10

Social

Labor Practices 8/10
Fair trade 4/10
Transparency 6/10

Timberland®



30% Cost and Energy Reduction

Rutgers PC-Laptop Purchasing Program

Recycle!

Environmental Status Report

lenovo

hp

DELL™

- EPEAT/ISO 14001
- Energy Star
- Environmental Mgt Plan
- Corporate Social and Environmental Reporting Criteria
- Extended Product Responsibility (Recycling On-Site)

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Solar Project

RU Solar Farm

The University installed one of the largest ground mounted solar arrays on any one campus in the United States. The 1.4 mega Watt system provides 10% of the power to the Livingston campus. The project cost was 10 million dollars. $4,900,000 dollars of the project was funded through a BPU Core Solar rebate. Currently the University is expected to make $1.1 million for the first year on its SRECS

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Rutgers Livingston Campus Solar Parking Lot Canopy
$40Million/15 Year Lease
Capital Project Planning Guide

Multiple RFPs

New Sustainable Vision for Livingston Campus

- seven-acre solar energy facility that provides about 10 percent of the power needs of the Livingston Campus;
- 32-acre solar canopy energy system to be completed in summer 2012 that will generate approximately $1.2 million in electricity;
- expanded use of geothermal systems for heating and cooling of new academic buildings;
- the creation of artificial wetlands and planted areas and installation of a biofiltration system to capture storm-water runoff that would otherwise wash into sewers and the river;
- creation of naturalized meadows around campus that save energy, reduce pollution, and cut down on the use of fertilizers;
- an improved pedestrian- and bicycle-friendly circulation network;
- reduced reliance on automobiles and increased emphasis on mass transportation; and
- accessible recreational amenities and green spaces, including integration of the Rutgers Ecological Preserve into the campus design.

Student Research Projects

SKANSKA

UBS

BD

Bayer

DELL

ORACLE

Starbucks V2V redefining community

KPMG

Prudential

MetLife

Johnson & Johnson

Playboy Enterprises, Inc.

hp

GE imagination at work

TimeWarner

Gap Inc.

kraft foods
make today delicious

adidas ORIGINALS

RU Bike Share Pilot Program

- 150 Bikes
- 20 Dept
- Admin/Maint

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Projects and Initiatives

BARNES & NOBLE
www.bn.com

TimeWarner

DUKE FARMS

ELIJAH'S PROMISE

VIRTUS SEMPER VIRIDIS
THE LAWRENCEVILLE SCHOOL
1810

GREEN IS GOOD BUSINESS
EMBRACE SUSTAINABILITY
MetLife

m
MARS

THE LAWRENCEVILLE SCHOOL

ORACLE

UTT

B&Q

THE ISLAND SCHOOL

Middlesex County
Vocational and Technical Schools

WACHOVIA

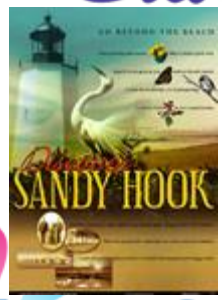
WWF for a living planet

Cadbury

Office of the
Federal Environmental Executive
Promoting sustainable environmental stewardship throughout the federal government

WATCHUNG HILLS REGIONAL HIGH SCHOOL

NATIONAL PARK SERVICE



UNIVERSITY OF OXFORD

University of Oxford

Green
Economic
Development
Zone

GO GREEN
Presented By:
Middlesex County
Showroom of
Environmental
Technology
M.C.S.E.T.
SAVE GREEN

Bloomberg MetLife kraft foods

Kevin Lyons, Ph.D. ***http://purchasing.rutgers.edu/green***