Closed-Loop Manufacturing

And how it drives competitive advantage
Team Members

Laura Clise  
Joel Montgomery  
Dan Ferranti  
Darika Sutthitham  
Gabriel Meranze Levitt
Project Objectives

• Identify the leading organizations developing and implementing closed-loop manufacturing systems

• Understand the challenges of designing, constructing and executing closed-loop systems

• Examine the role of “reverse logistics” as a driver of additional costs or source of cost reductions and what the key determinants of profitability are

• Explore the role of government regulations requiring product take back and extended producer responsibility for full product lifecycles from manufacture to end of life disposition

• Determine whether closed-loop strategies theory actually works
Agenda

• Definition of End-of-Life (EOL) & Closed-Loop Manufacturing (CLM) Activities
• Closed-Loop Manufacturing Strategies
• The Business Case
• Regulation & Future Trends
• Recommendations
• Q&A
In our 13 week study of closed-loop manufacturing, we have...

- Performed an extensive literature review of theoretical and practical papers, including 57 with strong relevance to the study

- Attended a seminar in Los Angeles conducted by the Reverse Logistics Association

- Conducted an extensive study of regulations in 70 countries including…

  Through direct contact with industry experts and UNIDO officials, searches of governmental and NGO websites and literature searches, Reviewed relevant regulations discovered in 37 countries

- Researched over 150 companies including…

  Through secondary and primary sources resulting in the discovery 75 companies that are engaged in closed-loop manufacturing practices
Methodology

In our 13 week study of closed-loop manufacturing, we have...

- Investigated over 30 industries including:

- Conducted One-on-One interviews with:
  • 25 industry experts
  • 32 companies
Closed-Loop Manufacturing

Any proactive EOL strategy that keeps a manufacturer’s products out of a landfill or from being incinerated
Benefits of CLM

• Savings on virgin material
• Revenue on recovered material
• Cost differential between new and used parts
• Savings on landfill tipping fees
• Long-term relationships with customers and suppliers
• Environmental Benefits = Green image
Hierachy of EOL Activities

1. Prevent Discarding
2. Reuse of the product
   a. Reuse as complete product
   b. Repair product to working order
   c. Refurbish product to working order, not “as new”
   d. Remanufacture product to “as new” condition
3. Cannibalization
   a. Reuse of subassemblies
   b. Reuse of components

Adapted From: “Adventures in EcoDesign of Electronic Products” & “Product Modularity and the Design of Closed-Loop Supply”
4. Material Recycling
   a. Back to original application
   b. Downcycling to lower grade applications
   c. Back to feedstock (Revert to chemical inputs)

5. Incineration
   a. With energy recovery
   b. Without energy recovery

6. Disposal as waste
   a. Controlled
   b. Uncontrolled

Adapted From: “Adventures in EcoDesign of Electronic Products” & “Product Modularity and the Design of Closed-Loop Supply”
“Rемanufacturing thinking upends conventional manufacturing wisdom... Caterpillar is turning it into a competitive advantage”

Source: BusinessWeek: “Everything Old Is New Again”
# CLM Strategies

## Activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Technological Cycle</th>
<th>Biological Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Individual Reuse</td>
<td>Group Reuse</td>
</tr>
<tr>
<td>Reuse as complete product</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Repair product</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Refurbish</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Remanufacture</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reuse of subassemblies/Components</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Recycle back to original material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycle to new material</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

## Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Technological Cycle</th>
<th>Biological Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-house</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Outsource</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

---

Thunderbird Team Analysis
CLM Strategies

1) Individual Reuse

Reuse: NEC, Applied Material, AMD
Repair: Chaco Sandals (Repair Program)
Refill: Kodak, Konica, Brother, Coca-Cola (Glass)
Refurbish: Learjet
Remanufacture: Bosch (Remanufacturing Depart)
Modularity: Simmons

Best Practices from Sterling

Mattress
Producer → End User → Used Mattress → Reuse main parts of bed → New Mattress

Change cover
CLM Strategies

2) Group Reuse
   * Reuse: Chaco
   * Repair: Tumi
   * Refill
   * Refurbish
   * Remanufacture
   * Modularity

Best Practices from Chaco Sandals

Shoes
Producer -> End User
Collection @ Point of Sale (3rd Parties)
Refurbish
3rd Parties for Distribution to Needy communities
Donation

Refurbished Shoes

Thunderbird Team Analysis
3) Individual Recycling

* Products are designed to be recycled at end of life
* Producer controls the entire process and the recycled materials are used to form new products

**Best Practices from Armstrong**

- **Used Ceiling Tiles**
  - End User
  - Stack Old Tiles on Pallet
  - Armstrong Picks Up Tiles

- **New Ceiling Tiles**
  - Recycle @ Producer’s Facility
  - End User

---

CLM Strategies
CLM Strategies

4) Group Recycling

Best Practices from Patagonia

- **Shirt**
  - Producer
  - End User
  - Collection @ Point of Sale
  - Recycle @ 3rd Party in Japan
  - New shirt
  - Producer

Best Practices from MAC Cosmetics

- **Cosmetics Case**
  - Producer
  - End User
  - Collection @ Point of Sale
  - Recycle @ 3rd Party
  - Plastic Furniture

*Similar to Individual Recycling.
Producer doesn't control the entire process and the recycled materials are used to form the same type of product (Closed) or different type of product (Open).*

Closed Group
Ford (Gage), M&S, Patagonia (Teijin)

Open Group
Nike, Apple (Metech), Coca-Cola, GE, MAC Cosmetics, IKEA, ParAid Medical, Aveda, and Sharp

Thunderbird Team Analysis
5) Individual Value Capture
* Maximize value of returned product by using a hierarchical approach based on multiple EOL activities
* Products are designed to be reused at end of life

Best Practices from Xerox

Producer → End User → Collection By Producer When Servicing

1st Reuse
2nd Remanufacture
3rd Cannibalize
4th Recycle
6) Group Value Capture
* Maximize value of returned product by using a hierarchical approach
* Similar to Individual Value Capture **BUT** outsource some EOL Activities

**Best Practices from Cisco**

- **Producer**
- **End User**
- **Collection @ Producer’s facility**

1. **1st Reuse**
2. **2nd Remanufacture (Sale to 2nd Market)**
3. **3rd Recycled by 3rd parties**
CLM Strategies

7) Industrial Compost
   * Returned products are sent to industrial composter
     Company: Interface

8) Naturally Biodegradable
   * Designed to be biodegradable
     Companies: Wheatware, Cargill-Dow(NatureWorks)
     STOROpack, Rohner Textil Ag
Is There A Business Case?

Many companies have successfully created profitable models based on CLM…

…however the business case depends upon a variety of factors.

Source: Thunderbird Team Analysis
The Value Life Cycle

- Preproduction
- Production
- Use
- Recycling
- Reuse
- Remanufacture
- Landfill w/o energy
- Incineration w/ energy

Time

Value

Thunderbird Team Analysis
A product’s End-Of-Life Value is equal to the highest market price of the available EOL activities.

**Factors That Affect Market Price:**

- Predictability/Volume/Quality of Supply
- Incentives
- Regulation
- 2nd Market Price Sensitivity
- Perception of Quality
- Technological Evolution

**Profitability** = EOL Value − (Reverse Logistics + Processing)
Profitability By CLM Strategy

- Value Capture
- Reuse
- Recycle
Plastic Bottle Recycling companies can make > $100/ton from Recycled PET flakes, which in turn will save customers as much as $500 below the price of virgin PET flakes.

“The Profitability of Electronics Recycling] is negative for 80-90% of the products, even at today’s high metal prices, this is also due to the rules of the European take back laws”

Source: 2007 Report on Global Citizenship, Email from Dr. Ab Stevels 4/22/08, Semih Yuzen, Petfor 6/2007
Indirect Profitability Defined

Many companies engage in CLM activities that incur losses, but they benefit in indirect ways, including:

- Brand Image
- Drive Sales
- Comply with Regulation
- Competitive Response
Companies benefiting from Indirect Profitability

- Cisco (UK)
- Apple
- Mannington
- Milliken
- Armstrong
- USG
- Applied Materials
- Motorola (Thailand)
- AMD
- Rickshaw Bags Rock
- Unilever (Brazil)
- MAC Cosmetics
- Aveda
- Nike
- Comet Skateboards
- Fujitsu
- HP (InkJet & Toner)

Thunderbird Team Analysis
Indirect Profitability In Action

Nike’s Reuse-A-Shoe Program rebuilt playgrounds after Hurricane Katrina, bolstering its brand image.

Comet Skateboard’s pilot skateboard take-back program improves its image as an environmentally responsible company.

Some of Armstrong’s customers are purchasing recycled ceiling tiles from them so they can towt the environmental benefits.
Regulations have been a significant driver of CLM activities and innovation.

Firms should anticipate the inevitable spread and increased enforcement of CLM legislation around the world.
Varied motivations drive CLM Regulations

- Climate change mitigation
- Save landfill space
- Reduce heavy metals in landfills → water supply
- Job creation
- Contain waste regionally – Basel convention – prevents dangerous e-waste from being transported to developing countries
An Example of cutting edge legislation: EU’s WEEE

• Waste Electrical and Electronic Equipment Directive (WEEE) was passed in 2003

• Producers are responsible for the environmentally safe disposal of electrical and electronic equipment

• Sets collection, recycling and recovery targets for electrical goods

• In theory, this provides incentives to design electronic equipment in a more environmentally efficient way

• Consumers must be able to return equipment free of charge

• (“ELV” End of Life Vehicles: 2003)

• (“RoHS” Restriction on Hazardous Substances 2006)
CLM driving legislation “on the books” is becoming a global norm

- EU, East Asia, North America, Oceania, : The enforcement of WEEE/EVL/RoHS-style regulations will increase
- Countries which did not traditionally create recycling legislation will follow the global trend of Extended Producer Responsibility
  - (Brazil, Thailand, Mercosur)

However, what is on the books is not always uniformly enforced:

- How will developed countries streamline regional regulations?
- What about countries with weak regulatory bodies?
- Will free disposal consist of “orphans” for too long?
  - Traditionally, these products have spent considerably more time on the second hand market- they retain value for longer
Regulations will drive future trends

Regulations are coming, so make changes now!
Firms should employ the ‘one step ahead’ principle
– Comply with RoHS/WEEE before the law requires
– A firm that preempts regulation will produce more innovative products and strategies
  • Become a leader in innovation (Xerox)
• Remanufacturing, recycling, designing for disassembly since figured out lease and service model 20 years ago.
• Xerox already had recycled content in its new machines
• Xerox already collecting machines from customers
• There was very little they had to do when the WEEE came out
  • Avoid becoming a straggler and victim of bad press (Apple)
• Apple claims it is “green”
• Greenpeace, The Center for Environmental Health disagree
• Legal battle over the hazardous substances in the I-Phone
• Apple has taken a reactive approach to eco-design
Recommendations
CLM is not just about doing good

- Environmental regulation is becoming ubiquitous and increasingly stringent
- Companies should proactively use CLM strategies to drive competitive advantage
- Companies implementing CLM strategies can profit both directly and indirectly
- CLM strategy selection should be driven by the product’s EOL value, willingness to change current operations, importance of profitability, and desired environmental impact
Leverage expertise of member companies to support CLM business case

Help to fill the business case information gap by facilitating a group of member companies willing to share their top line business case with non-competitors
How can BSR benefit from CLM?

Explore the integration of CLM strategies into existing Supply Chain consulting practice
Bibliography
Research Bibliography


Research Bibliography


Research Bibliography


Research Bibliography


Regulation Bibliography


Springer Link Website. 2 March, 2008. http://www.springerlink.com/content/b08x5qv7196g7412/.


Product Life-Cycle

- Raw material extraction
- Refining
- Material production
- Production
- Use

Collection

Upgrading

Recycling

- Incineration energy recovery
- Incineration no energy recovery
- Landfill

Refurbishment

Reuse (2nd Hand)

Adapted From: Adventures in EcoDesign of Electronic Products
Very few companies were willing to share the profitability numbers associated with their CLM activities

- Many companies do not do a good job at tracking profitability of CLM activities
- Regulation forces many companies to treat CLM activities as another product expenses
Profitability of CLM Strategies

- High EOL value and long product life cycles improve profitability
- Economies of scale are critical to profitability
- B2B is more profitable than B2C
- Strong customer relationships facilitate collection and often improve profitability (e.g. Leasing)
- Overall profitability depends on Product Mix
- Products with slim margins are less likely to be profitable since recovery may exceed savings

Adapted From: “Time Value of Commercial Product Returns”, “Adventures in EcoDesign of Electronics Products” & Team Analysis
Profitability of CLM Strategies

- Value Capture is the most profitable CLM strategy, followed by Reuse and Recycling
- Generally, strategies with fewer members are more profitable
- Unaffiliated 3rd Parties closing the loop signifies profitability → Potential Missed Opportunity?
  - Examples: Used clothing, shoe repair, toner cartridge & cell phone recycling, electronics refurbishing/ remanufacturing

Adapted From: “Time Value of Commercial Product Returns”, “Adventures in EcoDesign of Electronics Products” & Own Analysis
CLM Strategies

From EOL Activities to CLM Strategies

• Technical or Biological Cycle?
• Which **EOL Activities** to pursue?
• In-house or Outsource?
• Individual or Group Strategy?
• Single Process or Hierarchical Approach?
• Reverse Logistics & Collections?

CLM Strategies

1. Individual Reuse
2. Group Reuse
3. Individual Recycling
4. Group Recycling
5. Indiv. Value Capture
6. Group Value Capture
7. Industrial Compost
8. Naturally Biodegradable
CLM Strategies

Reverse Logistics & Collections

- Producer collects product while servicing
- Customer returns product:
  - @ Point of Sale
  - @ Community recycling center
  - @ 3rd party organization
  - @ Customer’s location (With pre-paid postage or online service)
Metal Prices

Source: Metalprices.com
CLM Costs for Electronics

1. Take-Back Costs: ~50%
2. Logistics: ~40%
3. Systems: ~10%

Source: “Adventures in EcoDesign of Electronics Products”
## Cost Neutral Disassembly

<table>
<thead>
<tr>
<th>Precious Metals</th>
<th>Metals</th>
<th>Glass</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>Copper</td>
<td></td>
<td>PPE</td>
</tr>
<tr>
<td>0.05g</td>
<td>300g</td>
<td>6000g</td>
<td>250g</td>
</tr>
<tr>
<td>Palladium</td>
<td>Aluminum</td>
<td>50000g</td>
<td>PC, POM</td>
</tr>
<tr>
<td>0.15g</td>
<td>700g</td>
<td></td>
<td>350g</td>
</tr>
<tr>
<td>Silver</td>
<td>Iron</td>
<td></td>
<td>ABS</td>
</tr>
<tr>
<td>5g</td>
<td>50000g</td>
<td></td>
<td>800g</td>
</tr>
</tbody>
</table>

Source: “Adventures in EcoDesign of Electronics Products”
# Environmental Value

<table>
<thead>
<tr>
<th>Material</th>
<th>Environmental Value (mPt/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastics</td>
<td>4-6</td>
</tr>
<tr>
<td>Iron/Steel</td>
<td>12-15</td>
</tr>
<tr>
<td>Aluminum</td>
<td>53</td>
</tr>
<tr>
<td>Copper</td>
<td>76</td>
</tr>
<tr>
<td>Nickel</td>
<td>380</td>
</tr>
<tr>
<td>Lead</td>
<td>580</td>
</tr>
<tr>
<td>Zinc</td>
<td>640</td>
</tr>
<tr>
<td>Silver</td>
<td>1,500</td>
</tr>
<tr>
<td>Gold</td>
<td>100,000</td>
</tr>
<tr>
<td>Palladium</td>
<td>375,000</td>
</tr>
</tbody>
</table>

Source: “Adventures in EcoDesign of Electronics Products”
Eco-efficiency

Maximum in Eco-efficiency

Source: “Adventures in EcoDesign of Electronics Products”
Choosing a CLM Strategy

• Critical Questions:
  – What is the value of my product at end of life or end of use?
  – To what extent am I willing to change my current operations?
  – How important is profitability?
  – What level of environmental impact do I want to have?

Adapted From: Own Analysis
Choosing a CLM strategy

<table>
<thead>
<tr>
<th>Strategies Tree 1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Level</strong></td>
</tr>
<tr>
<td>1 EOL Value</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>2 Complexity</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>3 Profitability</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>4 Environment</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
</tbody>
</table>

Adapted From: Own Analysis
Profitability by Activity

Reuse

**Mattresses - Traditional Model**

- **Forward Logistics**
  - Manufacturer: $400
  - Retailer: $600
  - Hotel: $10

- **Reverse Logistics**
  - Mexican Buyer

- 2nd Hand Consumer

**Modular Mattresses (Simmons)**

- **Forward Logistics**
  - Manufacturer: $400
  - Retailer: $600
  - Hotel

- **Extended Mattress Life**

- **Save $850**

Source: Email 4/19/08 Sterling Modular Bedding
Profitability by Activity

Reuse

*Used Clothing (Extreme Example)*

**Developed Country**
- Collection
- Charity
- Used Clothing Exporter

**Developing Country**
- Reseller
- Consumer

$1

$2.6

Source: Saluala: The World of Secondhand Clothing and Zambia
Recycling

Profitability by Activity

Used Plastic Bottle Recycling

Collection Used bottles

Recycle

E-Pet Flakes
$1,000/ton

Buyer Saves $500 from Purchasing virgin

$500 Per Ton

$100 Per Ton

$500 Per Ton

Source: Interview with Semih Yucen, Pet for $2007
Profitability by Activity

Recycling

Apple Computer & Metech International

Customer Purchases New Computer

Consumer → Apple Store → Metech (Apple’s supplier)

- $30 (For shipping to Metech)

Remanufacture / Recycle

$1.5-$2 or > $100

Appendix

Regulation
What are the targets of WEEE:EU?

- (a) for WEEE falling under categories 1 and 10 (Large household appliances, Automatic dispensers)
  - the rate of recovery shall be increased to a minimum of 80% by an average weight per appliance, and
  - component, material and substance reuse and recycling shall be increased to a minimum of 75% by an average weight per appliance;

- (b) for WEEE falling under categories (IT and telecommunications equipment, Consumer equipment)
  - the rate of recovery shall be increased to a minimum of 75% by an average weight per appliance, and
  - component, material and substance reuse and recycling shall be increased to a minimum of 65% by an average weight per appliance;

- (c) for WEEE falling under categories 2, 5, 6, 7 and 9 (Small household appliances, Lighting equipment, Electrical and electronic tools (with the exception of large-scale stationary industrial tools), Toys, leisure and sports equipment, Medical devices (with the exception of all implanted and infected products), Monitoring and control instruments
  - the rate of recovery shall be increased to a minimum of 70% by an average weight per appliance, and
  - component, material and substance reuse and recycling shall be increased to a minimum of 50% by an average weight per appliance;

- (d) for gas discharge lamps, the rate of component, material and substance reuse and recycling shall reach a minimum of 80% by weight of the lamps.

Source: WEEE Directive
WEEE is still young legislation.

- Has only recently (2005-2007) come into rigor in most EU member states.
- Each member state was responsible for drafting local legislation
  - The result has been inconsistent
    - Timing
    - Language
    - Implementation
    - Streamlining problems
      (Growing Pains?)
A UNIDO EXPERT writes about ELV.

- All Member States have provided the Commission with details of their laws, regulations and administrative provisions introduced to comply with the Directive. Currently, **infringement proceedings** are in progress against 9 Member States (Belgium, Denmark, Spain, France, Italy, France, Ireland, Portugal, and the United Kingdom).

- Overall, although significant progress has been made in several Member States to transpose the Directive, implementation of this legislation cannot be considered fully satisfactory, as demonstrated by the number of ongoing infringement proceedings. In some Member States, although the Directive has been almost literally transposed into national law, the end-of-life vehicles management systems are not necessarily fully operational. Deficiencies in the effective functioning of waste management systems often result from the lack of enforcement rather than missing transposition of the Community legislation.

- Data on the recycling and recovery rates are not yet available in most the Member States. These figures, which are important to have a complete picture of situation, are to be reported to the Commission in mid-2008. Given the significant number of infringement proceedings, it can be expected that proper transposition of the Directive is an issue in some member States.

Source: Letter from Cleaner Production Unit requested by Ned Clarence Smith: United Nations Industrial Development Organization
RoHS Complements the WEEE.

- **Restriction of Hazardous Substances (2006)** restricts the use of certain hazardous substances in the design and production of electrical and electronic equipment.

- **6 hazardous substances** of immediate concern (Others can be added)

- The **maximum concentration values** tolerated for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) is 0.1% by weight in homogeneous materials and for cadmium is 0.01%.

- **Covered electrical and electronic equipment**: All household appliances; IT and telecommunications equipment; consumer equipment; lighting equipment and light bulbs; electrical and electronic tools (except large-scale stationary industrial tools); toys, leisure and sports equipment, vending machines.

- Category 8 (Medical devices (with the exception of all implanted and infected products)) and category 9 (Monitoring and control instruments) are currently exempt from RoHS laws because would require extensive testing to pass other safety and environmental directives.

Source: RoHS Directive
Vehicles are recycled under ELV.

- **July 2003 "ELV Directive"** makes vehicle dismantling and recycling more environmentally friendly,
- Sets clear quantified targets for reuse, recycling and recovery of vehicles
- Pushes producers to manufacture new vehicles also with a view to their recyclability.
- Provide free of charge collection systems for all vehicles and set up a system of deregistration upon presentation of a certificate of destruction. Such certificates are to be issued when the vehicle is transferred, free of charge, to a treatment facility.

[http://ec.europa.eu/environment/waste/elv_index.htm](http://ec.europa.eu/environment/waste/elv_index.htm)
WEEE, RoHS regulate specific covered items.

- 1. Large household appliances
- 2. Small household appliances
- 3. IT and telecommunications equipment
- 4. Consumer equipment
- 5. Lighting equipment
- 6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
- 7. Toys, leisure and sports equipment
- 8. Medical devices (with the exception of all implanted and infected products)
- 9. Monitoring and control instruments
- 10. Automatic dispensers

(8,9, exempt from RoHS)

Source: WEEE Directive
Are the RoHS Special exemptions Temporary?

- Category 8 (Medical devices (with the exception of all implanted and infected products) and category 9 (Monitoring and control instruments) are currently exempt from RoHS laws because they are medical devices and other sensitive items that would require extensive testing to pass other safety and environmental directives.

- The philosophy is that Sensors, detectors and electrodes are cutting edge and should be encouraged to innovate without regulations slowing the process. (Military goods are included in RoHS)

- The performance of Lead free solder is still unconfirmed under extreme circumstances.

- The thought is that some devices should be exempt for up to 12 years because of their complexity. (Newer generations will not use toxic substances, but it would be too costly to modify already existing designs. Also it is a relatively small amount of hazardous material that is contained in all of the units sold in EU.)

- This represents an important potential change in legislation further down the road for BSR’s companies which belong to the Pharmaceuticals and Biotechnology industry. There is a lot of debate as to the validity of changing something that works to save lives in order to keep a negligent amount of hazard substances from being produced.
European Leaders

- Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.
Which countries are active in Asia?

- China has pending WEEE/RoHS legislation
- Japan, South Korea, Taiwan WILL become more strict as they have been leaders in recycling legislation.
Japan is an Asian leader in legislation.

- **Japan Home appliance recycling law: 2001, covers:**
  1. Televisions,
  2. Refrigerators,
  3. Washing machines
  4. Air conditioners

The law requires that
(i) Consumers pay a recycling fee when disposing of home appliances;
(ii) Retailers take back discarded appliances and pass them on to manufacturers;
(iii) Manufacturers recycle discarded appliances thus retrieved (Manufacturers include costs in their prices)

Also: Rationalization of Use of Raw Materials, 2001

**ELV Laws strong too- must harvest some components before shredding**

Source: http://www.springerlink.com/content/b08x5q7196q7412
South Korea is an Asian leader in legislation.

The EPRS Law of 2003 requires that consumers can bring back like items free; if not buying new, they must pay a sticker fee. Manufacturers must take back A/C, TVs, computers, peripherals, lamps and cell phones in 2005. The industry is to either establish a collection organization or pay a government tax.

• South Korea issued similar to RoHS legislation called "The Act for Resource Recycling of Electrical/Electronic Products and Automobiles" to the World Trade Organization (WTO) on March 30, 2006. According to legislation, The Minister of Environment and the Minister of Commerce, Industry and Energy will determine and publish methods for analyzing hazardous substances, and methods to evaluate improvement in design and material choice relating to recyclability and recoverability (no timeframe specified). Also, Manufacturers will be responsible for collecting and managing the material composition data that shows their compliance to the law and have this information to appropriate government officials on demand.

• "The Act for Resource Recycling of Electrical/Electronic Products and Automobiles" emphasizes the penalty provision. Failure to provide data to government officials regarding the material composition could result in one year in jail and a fine of up to $50,000.

• This legislation was planned to be enforced on July 1, 2007.

Source: http://www.productstewardship.net/policiesElectronicsIntl.html
Taiwan is an Asian leader in legislation.

- The current system covers end-of-life computers, printers, and major appliances such as TVs, fridges, washing machines and air conditioners. Electronics recovery has been required since March 1998. The government requires fees on covered electronics in parts and on the appliances. An industry collection system has been formed.

- However, the system has been criticized for not being strict enough.

  Source: [http://www.productstewardship.net/policiesElectronicsIntl.html](http://www.productstewardship.net/policiesElectronicsIntl.html)
Who is the African “leader”?

- **South Africa** which should have a minister in charge of creating CLM legislation by 2009.
- Once again, enforcement is the question.
- Bill mandates that by AUG 2009, the “minister” will submit a plan for how South Africa will tackle the issues related to WEEE. The Bill does not provide specifics as to how the waste should be treated, rather it empowers the minister to suggest and enable a plan for increased re-use and recycling. The Bill also requires the minister to work closely with businesses and get input from them. As far as I am concerned, this bill sets forth far too many guidelines for the minister to follow.

Leaders in the Americas?

In recent years important changes have swept Latin America and the Caribbean (LAC)

- Various jurisdictions in Brazil have adopted take-back laws for batteries, lamps, plastic packaging and used pesticide packaging, and extended producer responsibility (EPR) laws for electronics, non-returnable packaging, end-of-life vehicles (ELVs), expired medicines, used oil, tires and even computer diskettes.

- Mexico adopted a comprehensive waste law that requires certain industries to submit for approval waste management plans that include such options as deposit-return systems.

- Uruguay adopted a packaging waste law and a take-back regulation for batteries.

- Argentina prepared a draft regulation to impose EPR on batteries, lamps, and printer cartridges.

- Belize, Guyana, Jamaica and St. Lucia imposed eco-taxes on packaging, Mexican authorities announced their intent to impose an eco-tax on PET packaging, and a Uruguayan jurisdiction imposed an eco-tax on plastics and batteries.

- MERCOSUR (Brazil, Argentina, Paraguay, Uruguay) proposed “Policy on Environmental Management of Wastes and Post-Consumer responsibility” for electronics waste management

- Brazil RoHS legislation proposed

- Colombia – Hazardous Waste

- Costa Rica – draft electronic waste regulation focusing on computers, printing accessories, photocopiers, scanners, digital cameras, cellular telephones and batteries, and fluorescent lamps.

- (http://thor.inemi.org/webdownload/newsroom/Presentations/SMTAI_2006/Americas.pdf)

Source: http://thor.inemi.org/webdownload/newsroom/Presentations/SMTAI_2006/Americas.pdf
USA?

• States in US WILL create new EPR legislation, but federal regulations do not seek to “rock the boat” and many times, they speak to what most states are already doing
• (see appendix for individual state profiles)
• (EX: battery recycling laws, mercury laws)
• US has been traditionally more concerned with legislation that prevents chemicals and heavy metals from leeching into the groundwater or getting into the air than it is with the volume of trash that goes into landfills.
• Will this shift with new leadership?
HIGHLIGHTS OF US LAWS

- Arkansas
- California
- Connecticut
- Maine
- Maryland
- Massachusetts
- Minnesota
- New Hampshire
- North Carolina
- Oregon
- Texas
- Washington
Arkansas

- Will fund e-recycling via an extra $ .25 per cubic yard or $1 per ton fee for disposal in landfills.
- Arkansas Code § 25-34-111:
  Computer and electronic equipment landfill ban. Effective January 1, 2010, the Arkansas Pollution Control and Ecology Commission may establish and implement rules banning the disposal of all computer and electronic equipment in Arkansas landfills."

California

California requires recycling of e-waste. (Regulations: Title 14, Natural Resources--Division 7, CIWMB ) Law passed in 2003 requires an Advance Recycling Fee of $6-$10 charged at the point of sale on video display devices.

California seeks to recover heavy metals from electronic waste. Of note is the thorough nature of the bill. It specifies extra prices which consumers must pay when they purchase different sized screens to be recycled. (The program is sustainable through this funding which then aids in the collection and disposal/recycling process. It prohibits the sale of electronics not permitted by the EU. Exportation of waste is to be monitored.)

Source: http://www.ciwmb.ca.gov/Regulations/Title14/Chap08pt2/default.htm
Connecticut's Electronic Recycling Law July, 2007, Public Act No. 07-189. This act creates a mandatory recycling program for discarded covered electronic devices (CEDs). Under the law, manufacturers must participate in a program to finance the transportation and recycling of covered electronic devices (computers, computer monitors and televisions). The law only applies to CEDs generated by households. The Department of Environmental Protection (DEP) has the authority to expand the list of CEDs through regulations.

Manufacturers of TVs and computer monitors are responsible for the costs of processing their branded products (and in certain cases orphans, as well) that are delivered to consolidators.

Source: http://www.maine.gov/dep/rwm/ewaste/index.htm
Maine- Cell Phone Recycling Programs

- Through The Cellular Telecommunications & Internet Association (CTIA), the following member companies have established a program called “Wireless – the New Recyclable” to promote the recycling of cell phones through public outreach on its member companies’ cell phone recycling programs. These companies collect cell phones at all their retail locations; some also provide collection through free shipping. In Maine, these include:
  - Cingular Reuse and Recycle - Cingular’s program donates, recycles and resells wireless phones and accessories.
  - Motorola’s “Race to Recycle” - This program raises funds for accredited K-12 schools. Motorola provides prepaid shipping labels through its web site to schools that want to participate and to anyone who wants to donate to this program.
  - Sprint Project Connect – Donated wireless phones are recycled or sold, with a portion of the net proceeds benefiting K-12 education programs. Sprint makes postage-paid mailing labels available over the internet.
  - T Mobile – “T-Mobile Huddle Up” program provides funding and other support to support high quality afterschool programs in urban areas.
  - Verizon – Verizon’s HopeLine© program collects no-longer-used cell phones from any service provider; it donates phones and airtime to domestic violence victims as well as funding to domestic violence shelters and prevention programs.
  - The Wireless Foundation CALL TO PROTECT – This national non-profit program established by CTIA generates funds to provide phones, with matching airtime, to domestic violence agencies as well as grants to national organizations working to prevent domestic violence.

- Cell phone recycling programs are also offered by companies that are not handset manufacturers or wireless service providers. Those accessible to Maine residents include:
  - The Body Shop – This personal care products retailer began offering its “National Cell Phone Collection Program” in September 2002 at all Body Shop stores. Proceeds are donated to the National Coalition Against Domestic Violence.
  - The Charitable Recycling Program - Provides a fundraising program for non-profit organizations and municipalities, or donats proceeds to a charity of your choice.
  - CollectiveGood – CollectiveGood collects cell phones to benefit charities specified at its website through the mail (mailing costs may be covered by selected charity) and through collections organized by local partners (including Staples retail stores).
  - ECO-CELL – ECO-CELL partners with conservation and public organizations to set up profitable local collection programs.
  - GRC Wireless Recycling – Through its “Recycling Alliance” and “Shelter Alliance” programs, GRC Wireless offers cell phone fundraising and recycling programs for schools, non-profits, religious organizations, community groups, municipal recyclers, shelters, and social service groups. Donations of used cell phones are accepted from businesses and consumers.
  - Rechargeable Battery Recycling Program (RBRC) – RBRC accepts cell phones for recycling through its rechargeable battery collection program. RBRC collection boxes are currently available at over 150 retail locations throughout Maine; RBRC provides free collection boxes and shipping to municipalities.
  - ReCellular – ReCellular offers cell phone collection and recycling program support to all kinds of organizations, including big box retailers, to help these organizations raise funds for charitable and environmental programs.

Source: http://www.maine.gov/dep/rwm/recycle/cellphones.htm
Manufacturers of more than 1000 video display devices (as of October 2007) per year must register with the state and pay an annual $5000 fee that is deposited in a fund for making grants for local collection programs. As of October 2007, the initial registration fee for any new manufacturer is $10000. Manufacturers can reduce the annual fee to $500 by establishing an approved computer takeback program.

Massachusetts

Regulation bans CRTs from disposal, incineration, or transfer for disposal, at a solid waste disposal facility since April 2000.

Law passed in 2007 requires manufacturers of video display devices to recycle 60% of their market sales weight in 07-08, and 80% from July 2008 on. Ban of CRTs from mixed municipal solid waste passed separately and was effective as of July 2006. 

- **Session Laws 2007 - Chapter 48**
- **Subd. 7. Covered electronic device.** "Covered electronic device" means computers, peripherals, facsimile machines, DVD players, video cassette recorders, and video display devices that are sold to a household by means of retail, wholesale, or electronic commerce.
- b) A manufacturer must annually recycle or arrange for the collection and recycling of an amount of covered electronic devices equal to the total weight of its video display devices sold to households during the preceding program year, multiplied by the proportion of sales of video display devices required to be recycled, as established by the agency under section 115A.1320, subdivision 1, paragraph (c).
  (c) The obligations of a manufacturer apply only to video display devices received from households and do not apply to video display devices received from sources other than households.
  (d) A manufacturer must conduct and document due diligence assessments of collectors and recyclers it contracts with, including an assessment of items specified under subdivision 2. A manufacturer is responsible for maintaining, for a period of three years, documentation that all video display devices recycled, partially recycled, or sent to downstream recycling operations comply with the requirements of subdivision 2.
  (e) A manufacturer must provide the agency with contact information for a person who can be contacted regarding the manufacturer's activities under sections 115A.1310 to 115A.1320.
Subd. 2. **Recycler's responsibilities.** (a) As part of the report submitted under section 115A.1316, subdivision 2, a recycler must certify, except as provided in paragraph (b), that facilities that recycle video display devices, including all downstream recycling operations:

1. comply with all applicable health, environmental, safety, and financial responsibility regulations;
2. are licensed by all applicable governmental authorities;
3. use no prison labor to recycle video display devices; and
4. possess liability insurance of not less than $1,000,000 for environmental releases, accidents, and other emergencies.

(b) A nonprofit corporation that contracts with a correctional institution to refurbish and reuse donated computers in schools is exempt from paragraph (a), clauses (3) and (4).

(c) Except to the extent otherwise required by law, a recycler has no responsibility for any data that may be contained in a covered electronic device if an information storage device is included in the covered electronic device.

Subd. 3. **Retailer's responsibilities.** (a) By July 1 of each year, beginning in 2008, a retailer must report to a manufacturer the number of video display devices, by video display device model, labeled with the manufacturer's brand sold to households during the previous program year.

(b) A retailer who sells new video display devices shall provide information to households describing where and how they may recycle video display devices and advising them of opportunities and locations for the convenient collection of video display devices for the purpose of recycling. This requirement may be met by providing to households the agency's toll-free number and Web site address. Retailers selling through catalogs or the Internet may meet this requirement by including the information in a prominent location on the retailer's Web...
New Hampshire

- Law signed in 2006 bans video display devices from NH landfills and incinerators as of July 1, 2007. Video display devices defined as a "visual display component of a television or a computer, whether separate or integrated with a computer central processing unit/box, and includes a cathode ray tube, liquid crystal display, gas plasma, digital light processing, or other image projection technology, greater than 4 inches when measured diagonally, and its case, interior wires, and circuitry."

North Carolina

- Law passed in 2007 requires computer equipment (excludes TVs) manufacturers to develop and implement recycling plans as of January 2009. Manufacturers must fully cover the costs of processing discarded computer equipment received from discarded computer equipment collectors.

Oregon

- Law passed in 2007 requires manufacturers of desktops, laptops, monitors, and TVs to participate in a recycling plan or pay a fee to the State Contractor program. Recycling programs begin on January 1, 2009.

[http://www.leg.state.or.us/07reg/measures/hb2600.dir/hb2626.en.html](http://www.leg.state.or.us/07reg/measures/hb2600.dir/hb2626.en.html)
Texas

- Law (H.B. No. 2714) passed in 2007 requires computer equipment (excludes TVs or monitors which contain a tuner) manufacturers to develop and implement recycling plans as of January 2009.

http://www.capitol.state.tx.us/tlodocs/80R/billtext/html/HB02714F.htm
Washington

- Law signed in March 2006 requires producer responsibility as of January 1, 2009. Manufacturers of televisions, computer monitors, desktop and laptops computers, are required to join the standard plan or create an independent plan to manage their equivalent share of collected products.

AMD

- Industries: Microprocessors
- Country: US
- Motivation: Regulation
- Strategy: Internal Reuse
- Activities: Reuse
- Brief description: AMD has an in-kind donation program for reclaimed microprocessors. Goes to schools and charities.
Apple

- Industries: Computers
- Country: US
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Apple’s take-back program appears to be geared around creating customer loyalty. Taken back equipment seems to go to a 3rd party recycler who specializes in e-waste.
Applied Materials

- Industries: Semiconductors Equipment
- Country: US
- Motivation: Responsibility
- Strategy: Internal Reuse
- Activities: Reuse
- Brief description: Recycle excess equipment and donate to schools and charities.
Armstrong

- Industries: Ceiling Tiles
- Country: US
- Motivation: Economic
- Strategy: Internal Closed Loop Recycling
- Activities: Recycle
- Brief description: Armstrong collects old ceiling tiles from large replacement projects. Tiles are ground up and mixed with virgin materials to make new tiles.
Aveda

- Industries: Cosmetics
- Country: Germany
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Give customer a discount to recycling bottle caps as loss-leader program.
Bosch

- Industries: Power Tools, Auto Parts, Rechargeable Batteries
- Country: Germany
- Motivation: Economic
- Strategy: Internal Value Capture/External Value Capture
- Activities: Remanufacture, Recycle
- Brief description: Bosch remanufactures for resale Bosch Power Tools. Bosch also remanufactures over 700,000 auto parts per year from various OEM’s. Bosch has an active recycling program for rechargeable batteries.
BMW

- Industries: Automobiles
- Country: Germany
- Motivation: Economic/Regulation
- Strategy: External Value Capture
- Activities: Reuse, Remanufacture, Recycle
- Brief description: BMW is engaged in a number of programs to remanufacture auto-parts. Due to EU Vehicle EOL legislation, BMW is trying to increase the recycleability of their vehicles to 95%.
Canon

- Industries: Photography and printing
- Country: Japan
- Motivation: Economic
- Strategy: Internal Value Capture
- Activities: Reuse/Recycling
- Brief description: Canon printer cartridges from customer site. They are cannibalized for reusable parts, plastic is recycled in-house and metal parts are recycled by an outside company.
Brother

- Industries: Office Automation Equipment
- Country: Japan
- Motivation: Economic
- Strategy: Internal Reuse
- Activities: Reuse

Brief description: Brother uses prepaid mailing labels to collect used printer cartridges which it refills in-house for resale.
Coca-Cola

- Industries: Beverage
- Country: US
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Coke has actively begun recycling post-consumer plastic bottles and has developed a bottle to bottle plant which grinds up used bottles, turns them into new bottles and fills them all in the same facility.
Cargill-Dow (NatureWorks)

• Industries: Plastics
• Country: US
• Motivation: Economic
• Strategy: Naturally Biodegradable
• Activities: Biodegrade
• Brief description: Cargill-Dow has created a biodegradable plastic substitute made from cornstarch that will break down at an industrial composter.
Caterpillar

- Industries: Industrial equipment and remanufacturing
- Country: US
- Motivation: Economic
- Strategy: Internal Value Capture
- Activities: Remanufacture
- Brief description: Caterpillar has a remanufacturing services division dedicated to providing service to other OEM’s.
Chaco Sandals

- Industries: Footwear
- Country: US
- Motivation: Economic
- Strategy: Internal Reuse/External Reuse
- Activities: Repair/Reuse
- Brief description: Chaco sandals are designed to be repaired and old Chaco’s are collected to be sent to third world countries for reuse. The retailer assists in collection.
Chapparel Steel

- Industries: Recycling
- Country: US
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Recyclers of scrap steel.
Cisco

- Industries: Computers
- Country: US
- Motivation: Responsibility/Regulation/Economic
- Strategy: External Value Capture
- Activities: Reuse/Remanufacturing/Recycling
- Brief description: Cisco has a take-back program form reuse and remanufacturing of product. Any product that cannot be remanufactured is recycled.
Dell

- Industries: Computers
- Country: US
- Motivation: Economic
- Strategy: Internal Value Capture
- Activities: Reuse/Remanufacture/Recycle
- Brief description: Dell has a product take-back program that has a hierarchical structure for determining the closed-loop activity to be employed.
Ford

- Industries: Automobile
- Country: US
- Motivation: Economic
- Strategy: Closed Group Recycling
- Activities: Recycling
- Brief description: Ford’s bumper-to-bumper recycling program collects car bumpers from a nationwide network of car dismantlers. The special plastics used in the bumpers is expensive. Ford grinds up the bumpers and uses the plastic for new bumpers.
Fuji

- Industries: Cameras
- Country: Japan
- Motivation: Responsibility
- Strategy: Internal Value Capture
- Activities: Cannibalization/Recycling
- Brief description: Fuji disassembles its one time use cameras. Lenses and electric flash units are reused. Bodies and other parts are recycled.
Fujitsu

- Industries: Mainframe servers
- Country: Japan
- Motivation: Economic
- Strategy: External Value Capture
- Activities: Cannibalization
- Brief description: Fujitsu reclaims old servers from customers. They cannibalize the old servers for data storage disks.
GE Healthcare

- Industries: Medical Equipment
- Country: US
- Motivation: Economic
- Strategy: External Value Capture
- Activities: Reuse/Refurbishment
- Brief description: GE Healthcare has a program for refurbishing/remanufacturing medical equipment coming off lease. They will also refurbish and donate older, outdated equipment to clinics in developing countries.
Glaxo Smith Kline

- Industries: Pharmaceuticals
- Country: US
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Recycling of plastic pharmaceutical bottles. Collection at community recycling centers.
Haworth

- Industries: Office Furniture
- Country: US
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Reuse/Remanufacture/Recycle
- Brief description: Builds office chairs that are remanufacturable, 95% recyclable and designed for ease of disassembly.
Herman Miller

- Industries: Office Furniture
- Country: US
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Recycle
- Brief description: Design chairs for ease of disassembly for recycling.
Hitachi

- Industries: Office Furniture
- Country: US
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Recycle
- Brief description: Hitachi uses a rental/leasing program on computer systems to recapture product at EOL. They are focusing on reusing and recycling at the end of life.
Hewlett-Packard Consumables

• Industries: Printer consumables
• Country: US
• Motivation: Responsible
• Strategy: Internal Closed-Loop Recycling
• Activities: Recycle
• Brief description: HP internally recycles inkjet and laser toner cartridges. Collection through direct returns from end-user in prepaid packaging.
Ikea

- Industries: Furniture Store
- Country: Swede
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Recycle
- Brief description: Ikea has a recycling program for high efficiency light bulbs. Collection is in-stores.
Interface

- Industries: Commercial Carpeting
- Country: US
- Motivation: Responsible
- Strategy: Industrial Compost
- Activities: Composting
- Brief description: Interface carpet is designed to biodegrade in an industrial composting facility.
Kodak

- Industries: Cameras
- Country: US
- Motivation: Responsible
- Strategy: Internal Reuse (Refill)
- Activities: Remanufacturing
- Brief description: Kodak one-time-use-cameras are collected at the film developer and returned to Kodak. The shell is refilled and sold as a new OTUC.
Konica

- Industries: Cameras
- Country: Japan
- Motivation: Responsible
- Strategy: Internal Reuse (Refill)
- Activities: Remanufacturing
- Brief description: Konica one-time-use-cameras are collected at the film developer and returned to Konica. The shell is refilled and sold as a new OTUC.
Learjet

- Industries: Business Jet
- Country: US
- Motivation: Economic
- Strategy: Internal Reuse
- Activities: Refurbishing
- Brief description: Learjet has a refurbishing department for extending the life of the business jets they manufacture and sell.
Lexmark

- Industries: Printers
- Country: US
- Motivation: Economic
- Strategy: Internal Value Capture
- Activities: Remanufacturing
- Brief description: Lexmark pays for the reverse logistics. Cartridges and equipment are remanufactured and resold.
Mac Cosmetics

- Industries: Cosmetics
- Country: USA
- Motivation: Responsible
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: Mac Cosmetics offers a discount to people who return empty containers to the store. The case is then recycled.
Mannington Commercial

- Industries: Commercial Carpeting
- Country: US
- Motivation: Responsible
- Strategy: Internal Value Capture
- Activities: Reuse/Remanufacture/Recycle
- Brief description: When Mannington collects used carpet tiles, they can chemically remove the pattern from tiles that are in good shape, re-dye them a darker color and resell them as an eco-line. They have a donation plan. They grind up non-reusable carpet tiles and use it in the backing of new tiles.
Marks and Spencer

- Industries: Food Sales
- Country: UK
- Motivation: Responsible
- Strategy: Closed Group Recycling/ Open Group Recycling
- Activities: Closed/ Open Group Recycling
- Brief description: Recycling food packaging and food through anaerobic digestion.
Defense Industry

• Industries: Defense
• Country: US
• Motivation: Economic
• Strategy: External Value Capture
• Activities: Remanufacturing
• Brief description: The US military uses remanufacturing to return weapons systems and equipment to their original format and/or add upgrades. A vehicle like the Chinook helicopter has gone through 4 upgrade/remanufactures over 35 years.
Milliken Carpet

- Industries: Commercial Carpet
- Country: US
- Motivation: Responsible
- Strategy: Internal Value Capture
- Activities: Reuse/Remanufacture/Recycle
- Brief description: When Milliken collects used carpet tiles, they can chemically remove the pattern from tiles that are in good shape, re-dye them a darker color and resell them as an eco-line. They have a donation plan. They grind up non-reusable carpet tiles and use it in the backing of new tiles.
Motorola

- Industries: Telecommunications
- Country: US
- Motivation: Economic
- Strategy: Closed Group Recycling/Internal Value Capture
- Activities: Recycling/Remanufacturing
- Brief description: In Thailand, Motorola purely recycles its cell phones from its take-back program, but in the United States, Motorola will remanufacture phones it gets through its take-back program and resell them.
NEC

- Industries: Electronics
- Country: Japan
- Motivation: Regulation
- Strategy: Internal Reuse
- Activities: Reuse
- Brief description: NEC has a PC recovery and reuse program.
Nike

- Industries: Footwear Company
- Country: US
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling

Brief description: Nike collects old sneakers and recycles them into raw materials which are turned into running paths and tracks.
Nokia

- Industries: Telecommunications
- Country: Finland
- Motivation: Economic
- Strategy: External Value Capture/Closed Group Recycling
- Activities: Remanufacturing/Recycling
- Brief description: Nokia has a take back program in which it remanufactures used mobile phones. Nokia uses a 3rd party to administer its program to recycler mobile phone batteries.
ParAid Medical

- Industries: Medical Equipment
- Country: US
- Motivation: Economic
- Strategy: Open Group Recycling
- Activities: Recycling
- Brief description: ParAid has a program for recycling Infant incubator products, thermo-regulators, and garments. Collection is done at the customer site and returned to ParAid.