



**Asia-Pacific
Economic Cooperation**

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Sustainable Development and the Benefits of Global Remanufacturing

Submitted by: Rochester Institute of Technology (RIT)



**Remanufacturing Workshop
Singapore
21 February 2009**

Sustainable Development and the Benefits of Global Remanufacturing

APEC Market Access Group

Singapore, February 21, 2009

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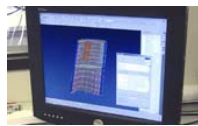


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NC3R is internationally-recognized as a leading center for applied research in remanufacturing.

NC3R's mission is to deliver to industry advanced technologies and tools for efficient and cost-effective remanufacturing that have no negative environmental impacts.

Core Areas

- Sustainable Design for Remanufacturing
- Structural & Material Analysis
- Clean Technologies
- Intelligent Testing & Diagnostics
- Life Cycle Engineering
- Condition assessment and non-destructive testing
- Enterprise planning for remanufacturing
- Logistics & Policy

Examples of Sponsors



Gleason Corporation



Remanufacturing and Sustainability



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Production and Consumption

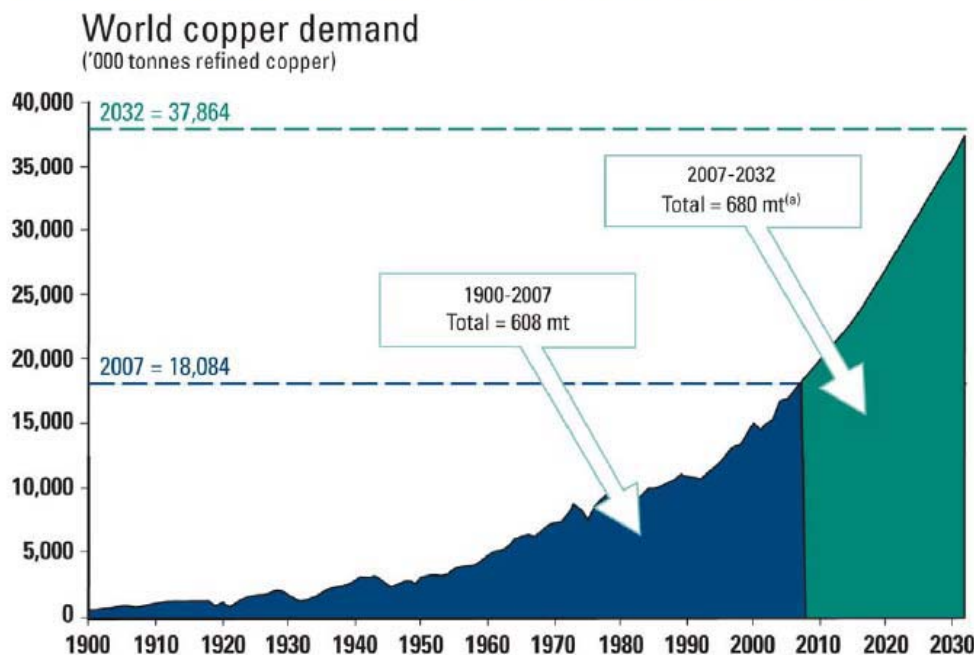
The major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialized countries.

Agenda 21 action plan for sustainable development - the United Nations Conference on Environment and Development (UNCED)



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To satisfy demand the world may need to mine as much copper over the next 25 years as throughout history



Source of data: CRU Copper Quarterly (January 2008); CRU archive data.
(a) Future copper consumption based on a hypothetical world average growth rate of 3% p.a. based on a projection of similar growth patterns in world demand to the past 20 years.



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Materials Example

Plastics

- Price and supply of petroleum based chemicals and polymers are impacted by crude oil prices

Media

- Increased energy prices directly impact the cost to produce all print medias



Copper

- Prices have skyrocketed with demand increases

LCD Materials

- **Indium** supplies are project to see a 33 metric ton deficit in 2009

Semiconductors

- Solar Panel makers purchased 50% of all silicon wafers produced in 2006, compared to 10% in 2000



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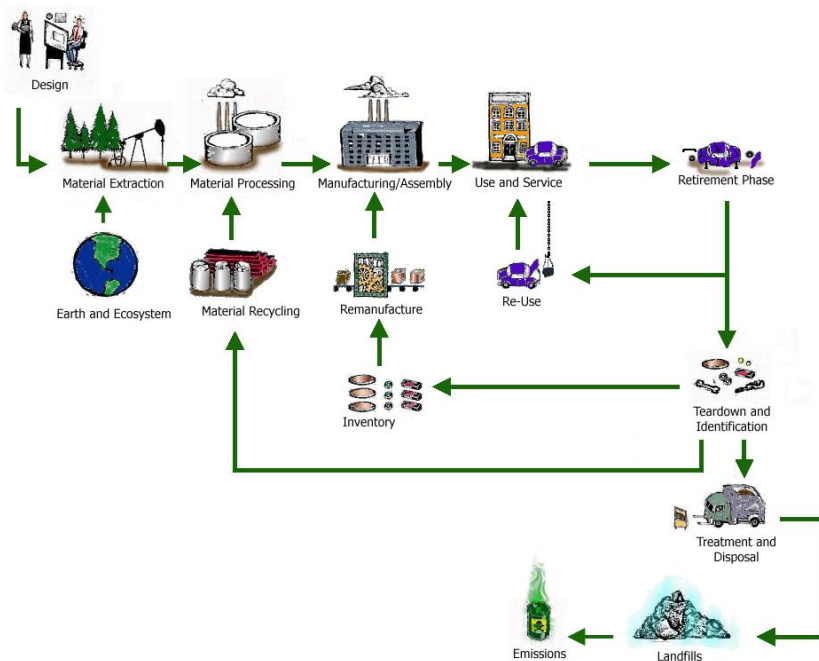
Sustainable Production

is the economical creation of goods and services using technologies and processes that are non-polluting, conserve energy and natural resources, and safe for employees, communities, and consumers.

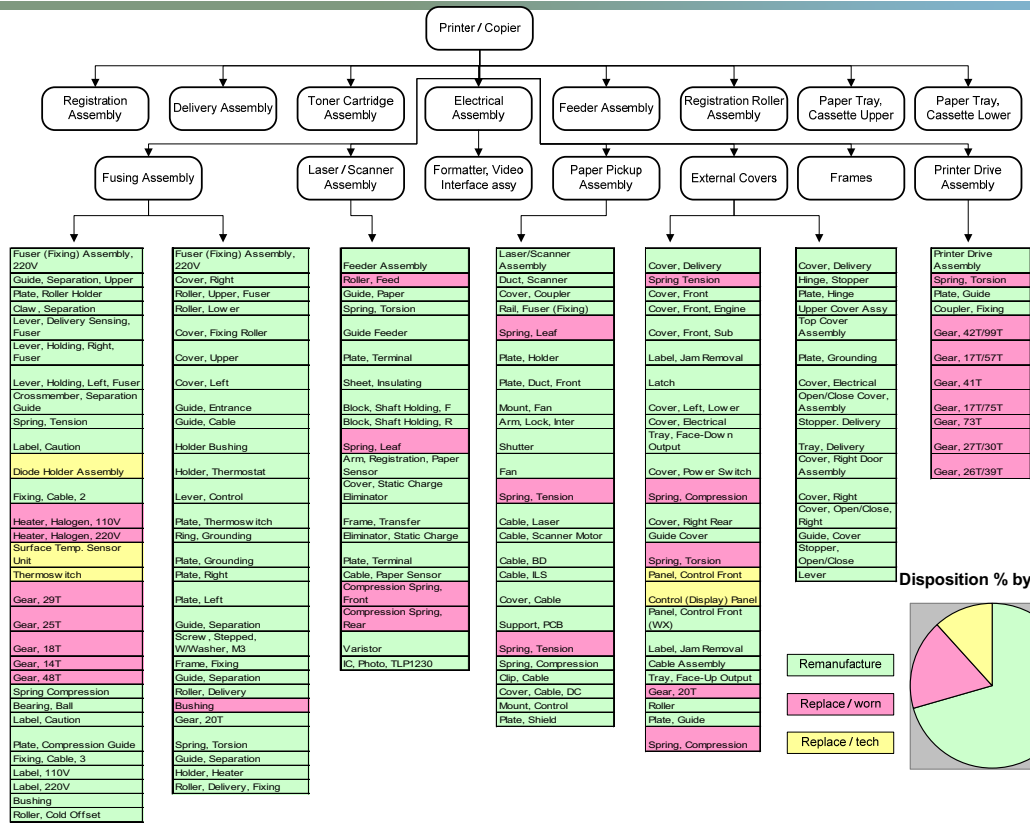


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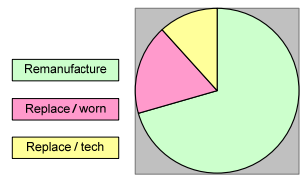
Recycle • Reuse • Remanufacture



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Disposition % by Weight



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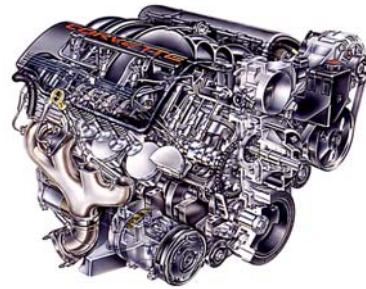
The Gold Mines



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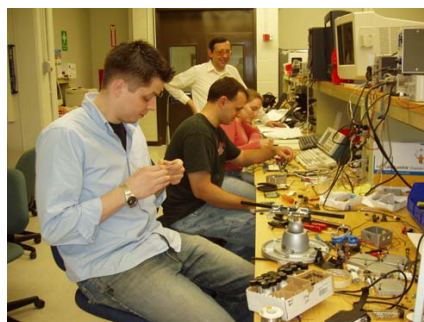
What is Remanufacturing?

An industrial process in which non-functional or retired products are restored to like-new conditions.



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Reman Process Development



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Reman VS. Service Life Extension

Original Service Life



Interrupted Service Life Repair/Reconditioning



Original Service Life

Reman Cycle 1



Incomplete Service Life

Reman Cycle 1



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Remanufacturing Sectors

- Defense
- Aerospace
- Automotive
- Medical Equipment
- Imaging Products (copiers, printers)
- Locomotives
- Marine
- Consumer Products
- Electrical Apparatus
- Compressors
- Machinery (construction equipment, machine tools)
- Office Furniture/Equipment
- Tires
- Toner/Inkjet Cartridges
- Valves
- Others



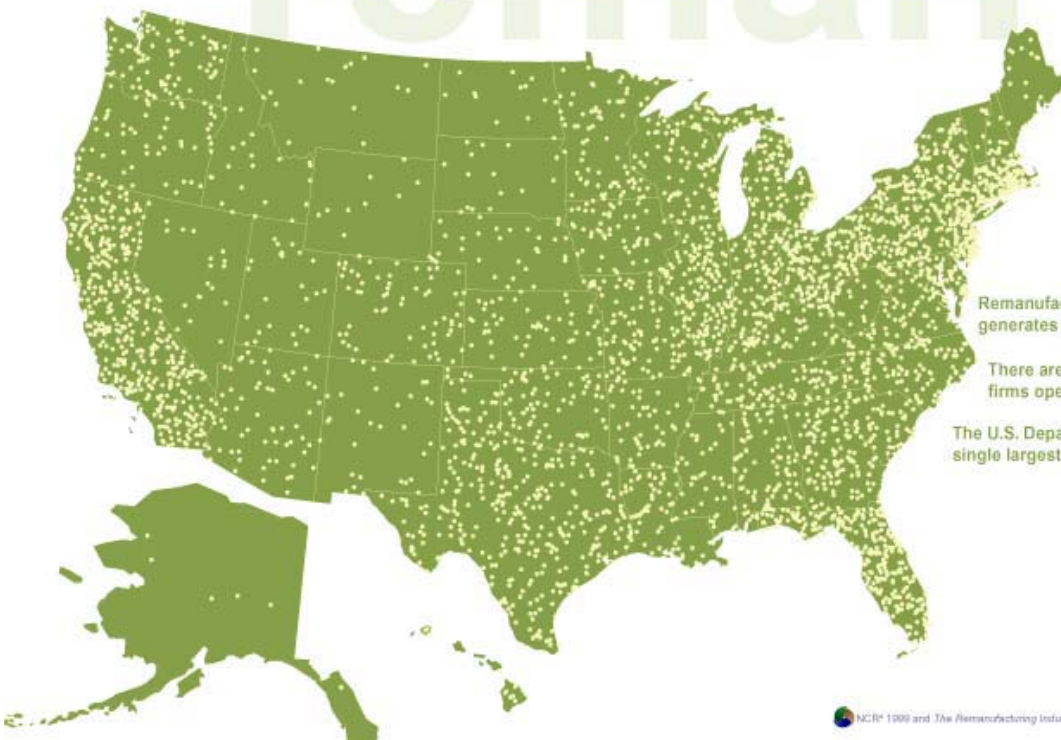
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Remanufacturing is Diverse



Reman

Remanufacturing in the United States



Remanufacturing in the United States generates \$53 billion in annual sales.

There are 73,000 remanufacturing firms operating in the United States.

The U.S. Department of Defense is the single largest remanufacturer in the world.

Remanufacturing Firms, Industry Sales and Employment*

Sector	Total Number of Firms	Total Sales (Millions)	Total Employment
Automotive	50,538	\$36,546	337,571
Compressors	155	\$249	2,878
Electrical Apparatus	13,231	\$4,633	47,280
Machinery	120	\$434	3,155
Office Furniture	720	\$1,663	12,148
Tires	1,390	\$4,308	27,907
Toner Cartridges	6,501	\$2,475	31,872
Valves	410	\$589	4,577
Other	250	\$2,009	14,372
Total	73,315	\$52,906	481,760

*"The Remanufacturing Industry: Hidden Giant", Robert Lund



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Industry Vision

Remanufacturing Industry Vision for 2020

October 1998
Facilitated by the
U. S. Department of Energy



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The Remanufacturing Industries Council

- Recycling Industries
 - \$ 7.2 Billion
 - 103,000 Jobs
- Remanufacturing Industries
 - 73,000 Companies
 - \$53+ billion in sales
 - 481,760 Jobs



REMANUFACTURING INDUSTRIES COUNCIL



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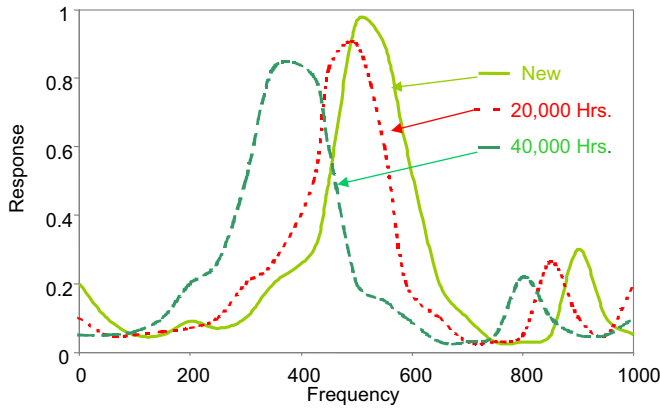
Remanufacturing Technology Challenges



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Material Aging

Material Aging Can Be Quantified Using Condition Based Monitoring Techniques (Signature Analysis)

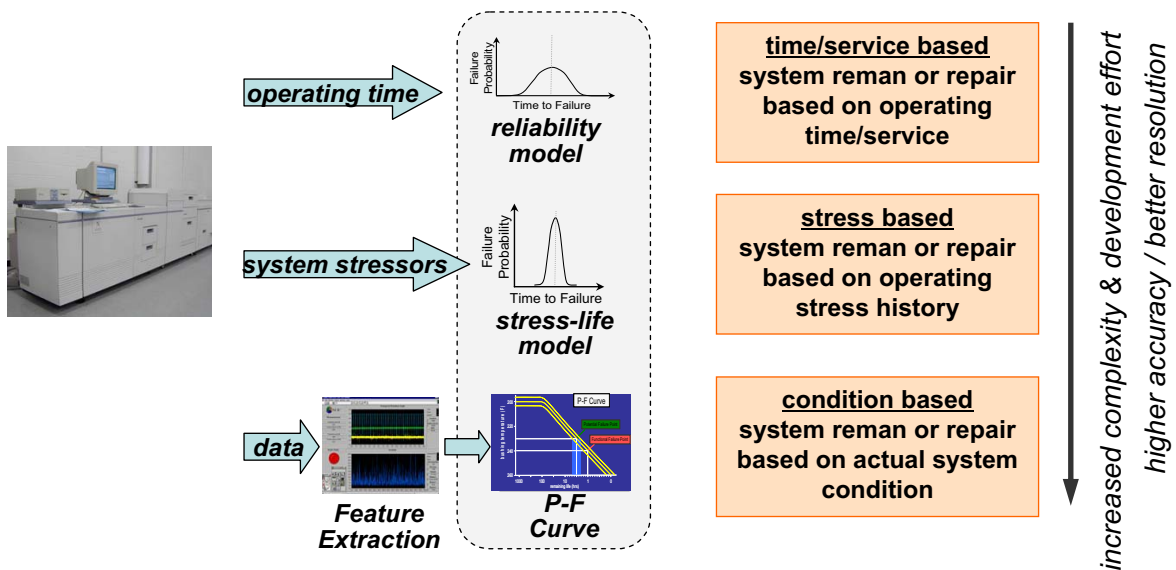


Characteristic Frequency Shift Caused by CV Joint Wear



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Reman Decision Models



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Examples of Remanufacturing



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OPC Drum Life-Cycle Analyzer

Solution: OPC Drum Life-Cycle Analyzer

- the OPC Drum Life-Cycle Analyzer detects how many times the drum can be reused
- 15 million drums represent used annually in the US
- tons of materials are diverted from landfills



Did you know?

Annually in the U.S.,
15 million OPC drums
are used only once
and then thrown away

15 million drums,
made of aluminum
and plastic,
weigh
221 tons



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Office Furniture Remanufacturing

Did you know?

Average workstation
= 1000 lbs.

Recycled content
of remanufactured
station = 85%

Average of 850 lbs.
diverted from
landfill
per station

Sponsor:
Davies Office Refurbishing, Inc.

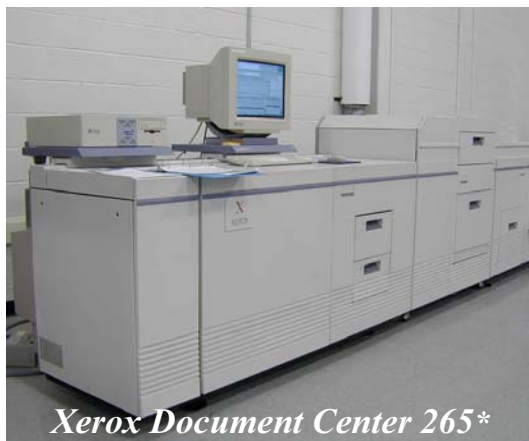
Findings

- Costs 25–75% less than new furniture
- Natural resources, such as wood and aluminum, as well as steel, plastics, and fiber, may be reused over and over to the fullest extent possible
- Conserves labor and manufacturing energy
- Reduces global warming, acid rain, photochemical smog, and other forms of air pollution



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Remanufacturing at Xerox



*Xerox Document Center 265**

- Corporate Goal: Waste Free Products and Manufacturing
- 70-90% of the parts by weight are remanufactured. Up to 60% of the parts are common with previous models.
- Designed to be upgraded

- Xerox saves **several hundred million dollars** per year by designing parts for remanufacture and recycling.
- Since 1991, more than 2.8 million copiers, printers, and multifunction systems have been remanufactured while diverting almost two billion pounds of potential waste from landfills (111 million pounds in 2006 alone)

*http://www.xerox.com/downloads/usa/en/x/Xerox_Global_Citizenship_Report_2007.pdf.



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Eastman Kodak Company One Time Use Cameras (OTUC)

Corporate Goal: Improve the environmental attributes of KODAK products throughout their life cycle

- Kodak Film Products Group achieved \$1.968 Billion in revenue of which OTUC are a significant contributor
- Since 1990, the total number of OTUC collected reached 1.2 billion
- In 2007, alone, Kodak collected 120 million single-use cameras
- Since 1990, 800 million Kodak OTUC have been remanufactured and the balance sent back to other manufacturers
- **Approaching 100%** of Kodak OTUC manufactured from recycled bodies and/or parts.



Source: Eastman Kodak Company 2007 Global Sustainability Report

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