附件三、IEMN 2018 Workshop 第二天簡報

Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)

Mission:

To foster and sustain healthy and resilient oceans, coasts, communities and economies across the Seas of East Asia through integrated management solutions and partnerships.

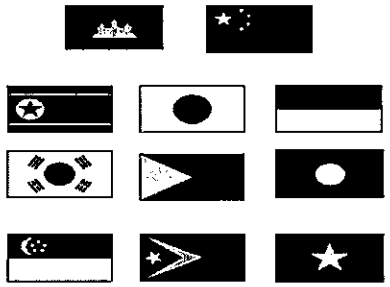
PEMSEA

Innovative Financing for Waste Management and Recycling

Aimee Gonzales
Executive Director
PEMSEA

2018 International E-Waste Management Workshop
Quezon City, Philippines, 25 September 25, 2018

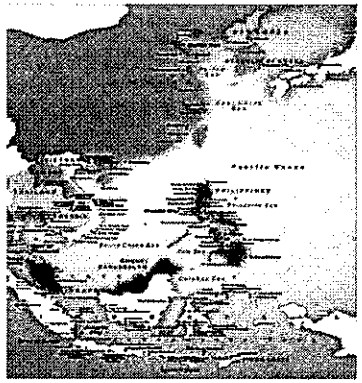
Country Partners



Non-Country Partners

Critical Role of Coasts and Oceans in East Asia

- 7 million km² / 235,000 km of coastline / 1.5 billion residents
- 1/3 of all coral reefs and mangroves, highest levels of biodiversity for coral reef fish, mollusks, mangroves and sea grass species
- 9 of the world's mega-cities (population more than 10 million), dozen other cities more than 5 million residents
- Marine and coastal industries comprise 15-20% of GDP in some East Asian countries
  - 83% of the world's aquaculture products
  - Over 32 million tons of annual fish catch
  - 9 of the 10 busiest container ports
  - 4 of the top 5 shipping economies



WHY

To catalyze capital to finance solutions to stop the flow of plastic into the ocean

Developed in partnership with

SDS-SEA Implementation Plan 2018-2022

PRIORITY MANAGEMENT PROGRAMS

Biodiversity Conservation	Climate Change and Disaster Risk Reduction	Pollution Reduction and Waste Management
• MPA/MPA Networking • Migratory marine species • Blue Carbon/Green Infrastructure	• Vulnerability/hazard risks in coastal communities and economies • Sustainable Cities • Green ports/green shipping	• Pollution/nutrient management • Integrated waste management/ plastics/ circular economy • Integrated river basin management/S2S • Renewable energy

GOVERNANCE PROGRAMS

Ocean Governance and Strategic Partnerships	Knowledge Management and Capacity Building	Blue Economy Investments and Sustainable Financing
• National ocean policy, institutional arrangement and legislation • SOC reporting system • Enhanced access to financing for SDS-SEA (e.g. Green Climate Fund accreditation) • Enabling partnerships and networks	• Regional knowledge hub for oceans and coasts • Regional training and technical support/services • Targeted research projects	• Ocean Investment Facility and Fund • Pipeline of investable blue economy projects • PPP/business sector working examples/ templates

The situation:

Waste is a looming international crisis

150 MILLION TONS

of plastic in the ocean right now and growing by 8 million tons every year

[illegible] in Asia needed for infrastructure improvement from 2016 through 2030 (ADB)

within that a 45% REDU[illegible]

In plastic leakage is possible by improving waste management and recycling in China, Indonesia, The Philippines, Vietnam and Thailand

Currently only [illegible]

of the region's needs are being allocated by the 100 largest Asian institutional investors (only $65 billion)

Pollution Reduction and Waste Management

Objective

To prevent and significantly reduce pollutant discharges and accidental spills from land- and sea-based sources in coastal and sub-regional sea areas of the region.

Expected Outcomes

- Accession/Compliance with International Treaties on Marine Pollution
- Implementation of integrated waste management/circular economy
- Demonstration of Integrated river basin/coastal management

The structural tenets

Investments not grants

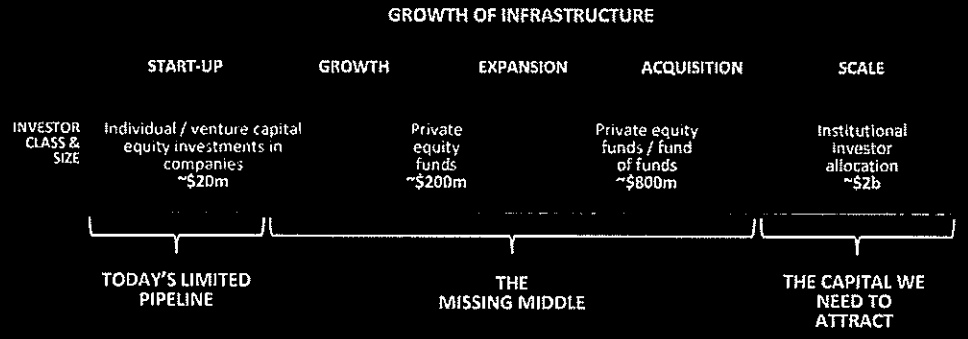
Scalability

Systemic change

Unlock co-investment

The capital problem

Capital Flow Framework: All investor classes and sizes must be active to enable a healthy investment ecosystem



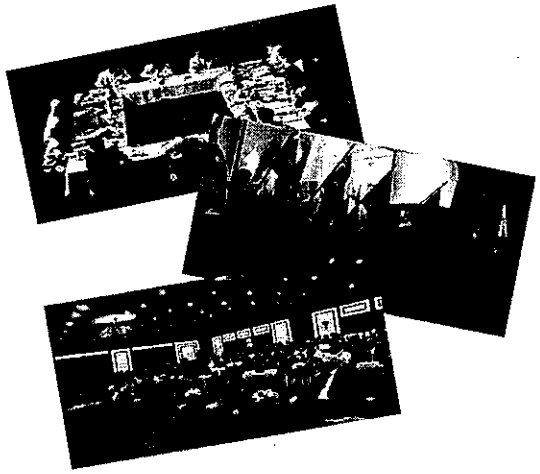
Investment thesis

- Viable opportunity
- Leverage existing value chains
- Localize
- Selectively invest in technology
- Acceleration / preparation

The capital solution: #catalyticcapital

	START-UP	GROWTH	EXPANSION	ACQUISITION	SCALE
PHILANTHROPIC ROLE	R&D / Innovation Test business models	Leverage private catalytic capital Incubate supportive ecosystem via TA			Evaluate and disseminate
CATALYTIC CAPITAL ROLE	Provide speculative equity capital	Market discipline Build track record Prove business models		Test at scale Reflect commercial needs	Hand-off to institutional investors

East Asian Seas (EAS) Congress



- Triennial Ocean Event
- 1000+ attendees from national / local government, scientific organizations, NGOs, donor agencies and companies
- Sessions on blue economy, coastal governance, climate change, marine pollution, sustainable fisheries, investment and more
- International Conference and Environmental Exhibit, Youth Forum, PNLG Forum, and Ministerial Forum

EAS CONGRESS 2018

November 27 -30, 2018

Iloilo City, Philippines

http://eascongress2018.pemsea.org/

PEMSEA

Fill the philanthropic and catalytic capital gaps

THE INCUBATOR NETWORK + THE OCEAN FUND

SOURCING

Distinctive public, non-profit and private networks

DILIGENCE

Proprietary due diligence frameworks select investments that build local infrastructure systems, support global supply chains and prevent ocean plastic leakage

SUPPORT SYSTEMS

Competitive advantage for portfolio companies through technical expertise, local networks and connections to global brands

PEMSEA

www.pemsea.org

http://seaknowledgebank.net/

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Holistic waste management opportunities:

- Implementation of more effective waste collection & aggregation strategies
- Galvanization of underutilized assets to more efficiently sort, process and recycle waste
- Technology, materials, applications and projects that support collection, processing, recycling and end markets

Content of the presentation

- European waste hierachy
- ReUse
- Upcycling
- Manual dismantling of e-waste
- Outputfractions
- Downstream markets and recycling options

Downstream Markets for fractions from e-waste

Elisabeth Smith

IEMN, Manila 25th September 2018

European Waste Hierachy

About me and DRZ

- Head of the DRZ and manageing the StEP network
- DRZ is a socio-economic facility treating e-waste
- Employment of long-term unemployed persons
- Treatment volume: 1.500t/year
- Manual dismantling – reuse – upcycling
- About 100 employees
- StEP is an international of various stakeholder groups working on the issue of e-waste
- Scientific based and hosted by UNU

Manual Dismantling of E-Waste

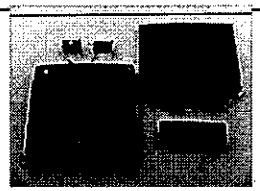
- Separation of reusable appliances
- Depollution: assured removal and controlled disposal of hazardous components
- Provide high valuable substances (like precious metals, rare earth metals) for recovery without losses
- Adequate conditioning of materials contained in electronic appliances for further mechanical recycling/ material recovery

ReUse

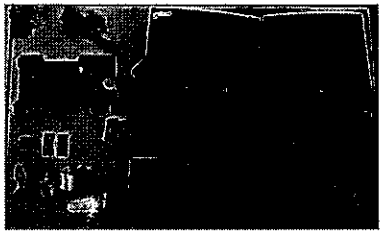
- Value preposition of equipment
- What to consider
- How does the market look like?
- Obstacles?
- Opportunities?

Dismantling Concepts

Level A) **Hazardous components** and **high valuable components**, like printed circuit boards are removed only and the remaining parts are destined to mechanical separation/ recycling.



Level B) Apart from removing hazardous components **manual dismantling** of components into more or less pure materials and recyclable fractions is conducted **where viable with reasonable effort.**



Level C) Appliances are dismantled up to a point, at which further **separation into pure materials** is not possible without mechanical shredding.

+

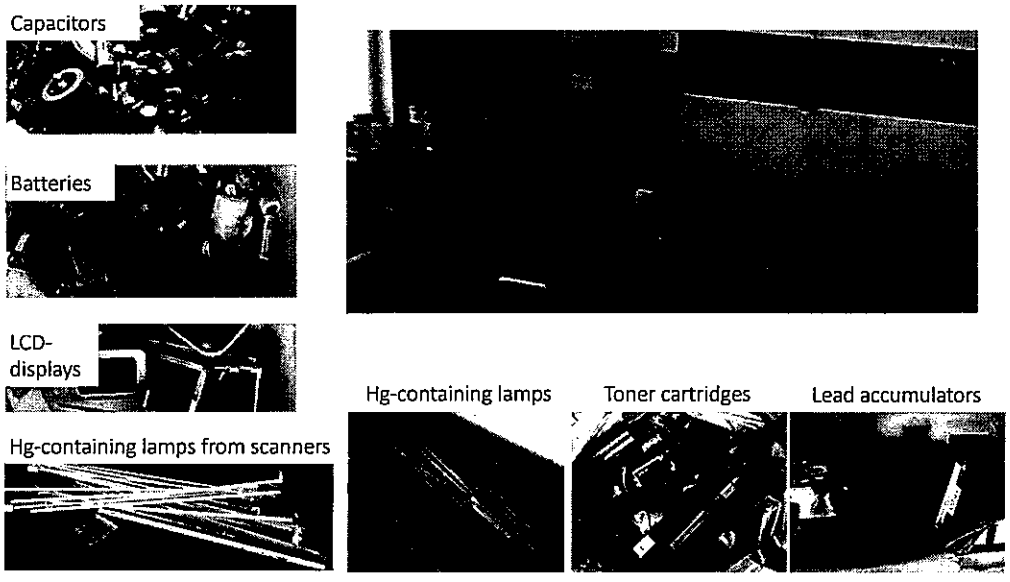
- dismantling HDD, CDD
- obtaining more pure metals (copper, etc.)
- removing impurities from plastic parts

UpCycling

- Value Preposition
- Obstacles
- Market opportunities
- Examples
- Video DRZ

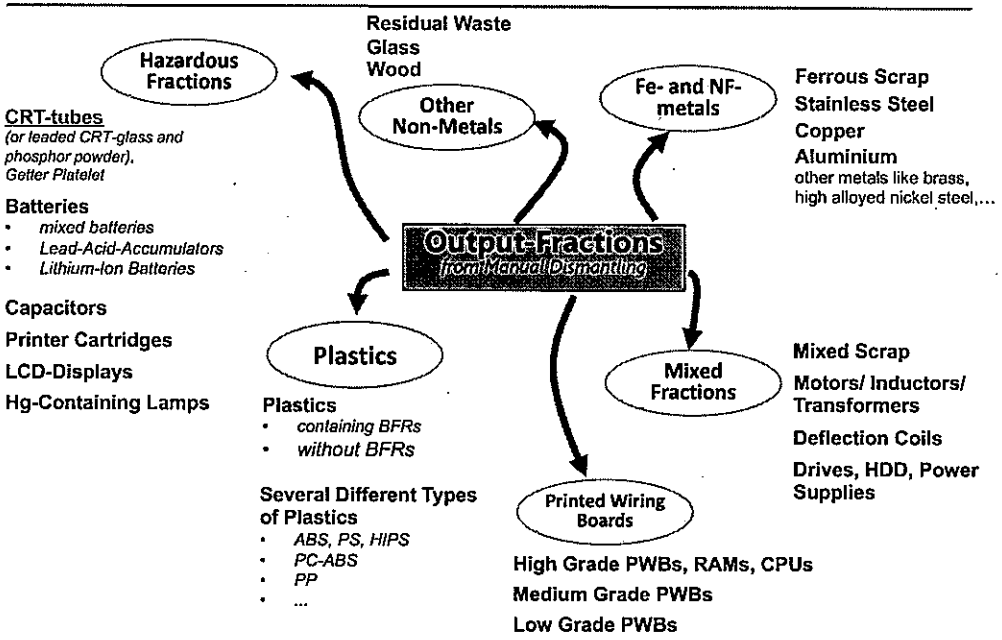
Thank you for your attention!

Hazardous Fractions from manual de-pollution and dismantling



Overview output fraction

Output fractions



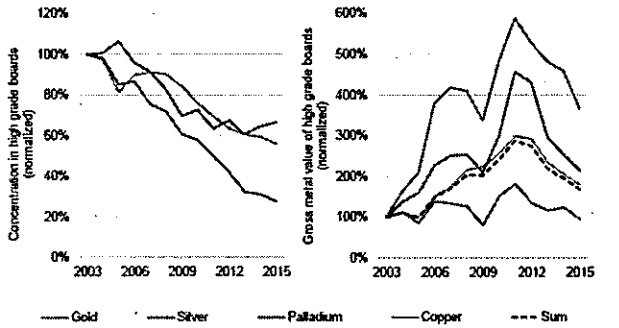
Downstream markets

- Market developments
- Availble downstream options
- Barriers for international trade

Recycling of Printed Wiring Boards

umicore Precious Metals Refining

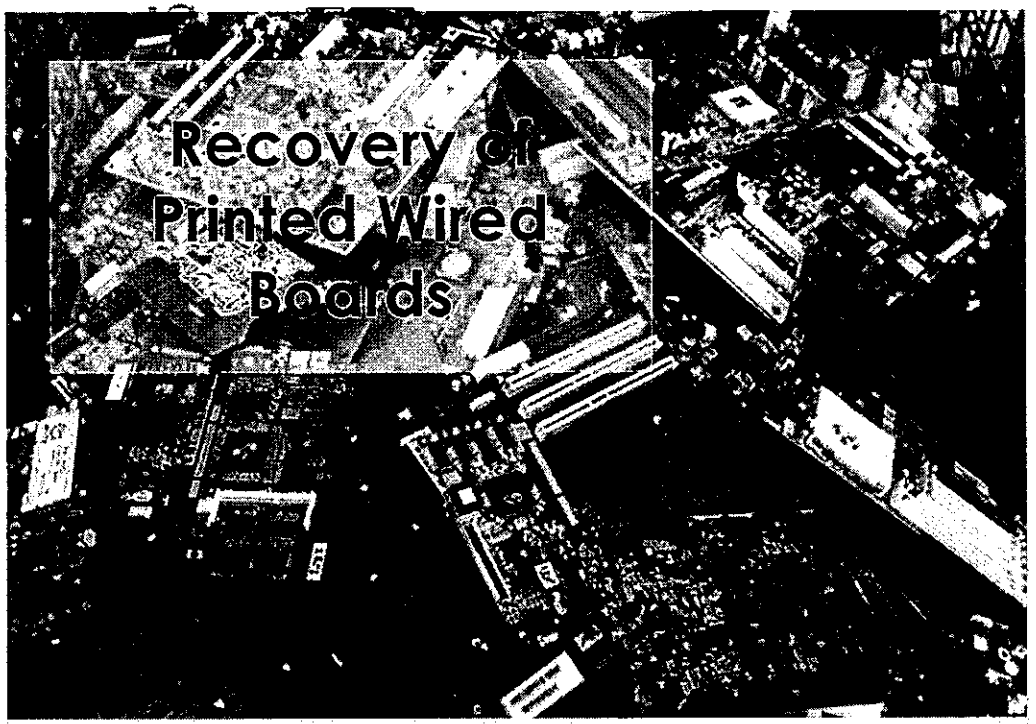
Declining precious metal content
The economics of e-scrap processing are dynamic!



Note: metal content for 2014/2015 not available, gross metal value based on metal contents for 2013 with 2014/2015 prices

Source: Lauwers, J.: Optimizing precious metals recovery from e-waste, EWAM Feb 2016, Nairobi

Overview output fraction



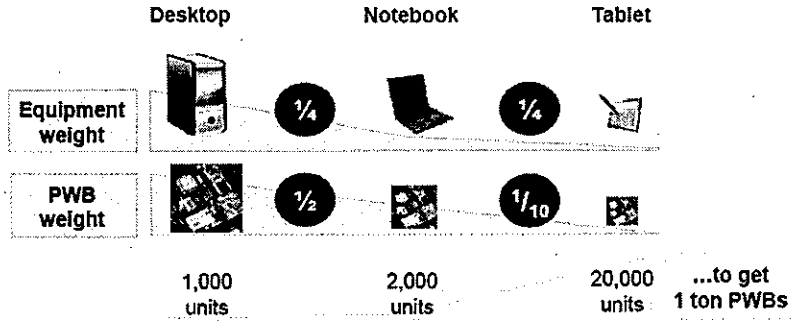
Recycling of Printed Wiring Boards

- most valuable fractions coming out of manual dismantling.
- Recovery of precious metals is a highly complex pyrometallurgic, hydrometallurgic and electrometallurgic process.
- Only a view smelters exist worldwide (mainly in Europe, Canada and Japan).
- Up to 17 different metals are recovered from PWBs by these smelters (recycling rates >99%; normally content of Au, Ag, Pd, Cu are reimbursed).
- Common difficulties in dealing with PWBs:
  - *Collection of minimum required lots for shipment in a reasonable time frame*
    - ✓ *Sales to intermediaries or cooperations with other recyclers might be necessary.*
  - *Strategy for separation of PWBs in different fractions depends on the sales opportunities*

Recycling of Printed Wiring Boards

umicore Precious Metals Refining

Impact of miniaturization on e-scrap volumes
Increasing efforts required to get 1 ton of PWBs



Sources: Umicore team analysis, P. Chancerel & S. Rotter in Waste Management vol 29 issue 8, 2011, Hobart Green Electronics Council tablets & slates workshop 2013

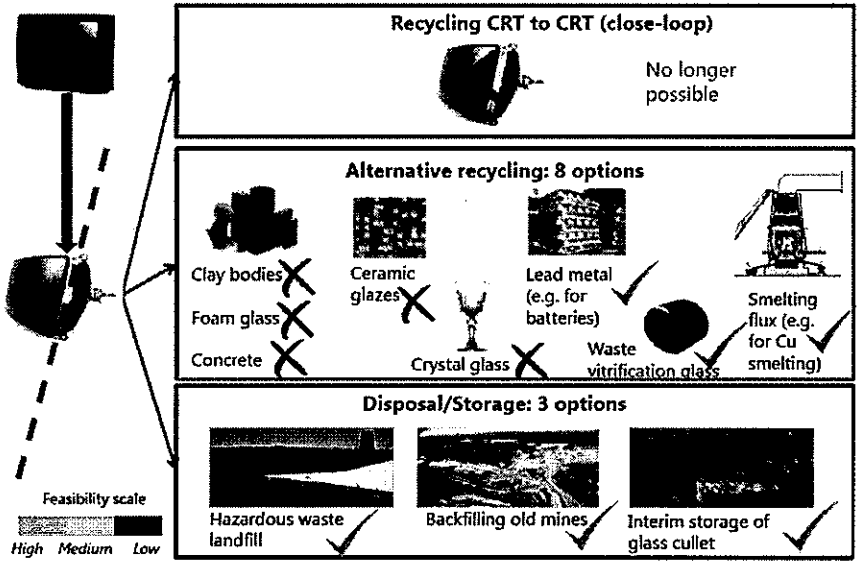
Source: Lauwers, J.: Optimizing precious metals recovery from e-waste, EWAM Feb 2016, Nairobi

CRT Recycling Process

- Manual dismantling
- Separation of leaded (funnel) and non-leaded (panel) glass by means of
  - *diamond cutting technology or a heating wire or*
  - *crushing and sensor-based sorting (x-ray transmission)*
- Cleaning of cullet from phosphors and other coatings
- Recovery- and/or Disposal-Options for main components
  - *Non-Leaded panel glass: glass-industry*
  - *Leaded funnel glass: see identified options by EMPA (following slides)*
    (CRT to CRT recycling is no longer possible, because CRT-devices are not produced anymore!)
  - *Phospor powder: Disposal of hazardous waste*

Results: evaluation of the options

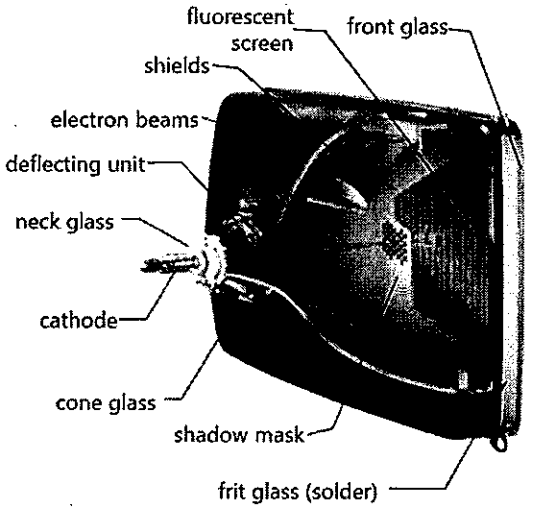
EMPA
Materials Science & Technology

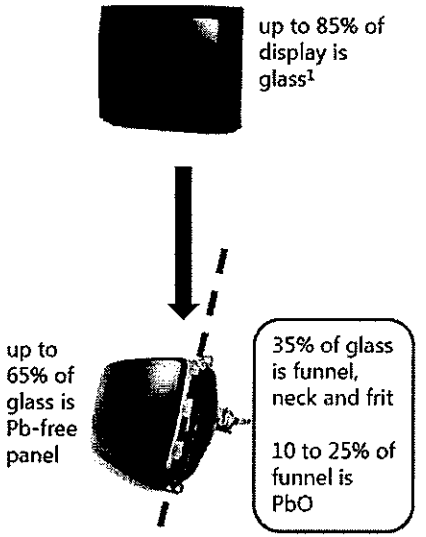


Overview output fraction

CRT components

EMPA
Materials Science & Technology





Source: Widmer, R.: The CRT Challenge, EWAM Feb 2016, Nairobi

Keeping retired electronics in use

» More revenue generated from reuse

» Improved environmental outcomes

» Increased job opportunities

» Affordable products to the market

CASCADE ASSET MANAGEMENT

International E-Waste Management Network Workshop

Quezon City, Philippines

September 25, 2018

Reuse of Electronics

Neil Peters-Michaud, CEO
Cascade Asset Management

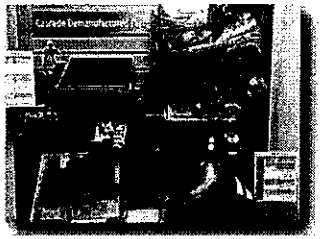
The challenges of reuse and recycling

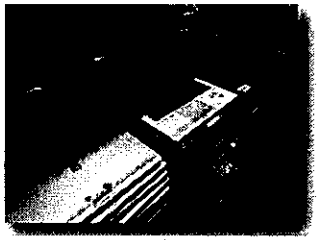
Recycling

» Light-weighting of products
» Lower precious metal content
» Volatility of global commodity markets
» Need volumes for processors
» Dealing with the hazardous wastes

Reuse

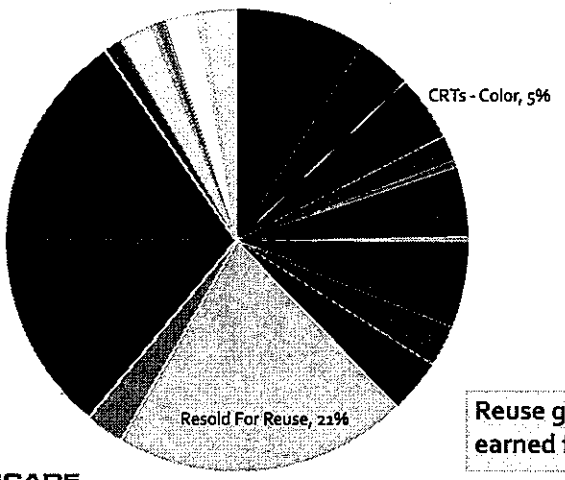
» Keeping up with product technologies
» Data sanitization requirements
» Finding and maintaining markets
» Warranty and product support
» After sales support





CASCADE ASSET MANAGEMENT

Q2 – 2018 Cascade Asset Management material outputs



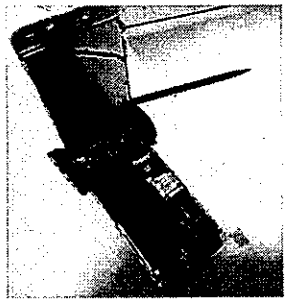
48 categories of materials separated out for recycling from Cascade's demanufacturing process.

Reuse generates more than 7x revenue earned from all recycling scrap.

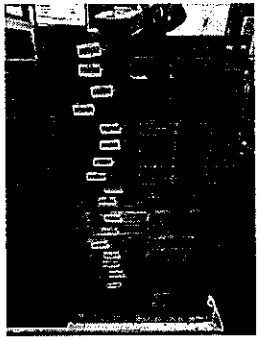
CASCADE ASSET MANAGEMENT

Data center and mobile device testing and refurbishment

Phones & tablets

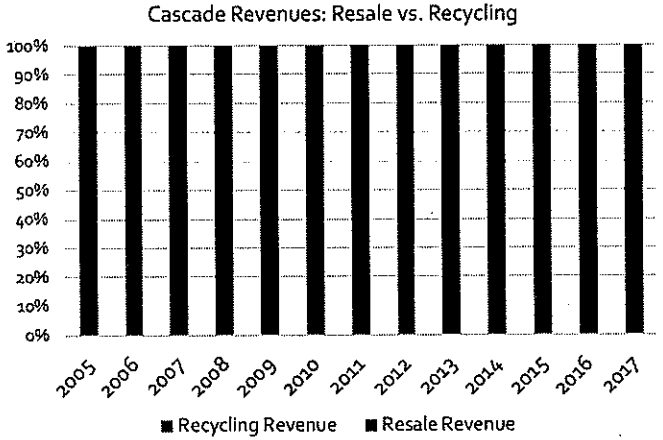


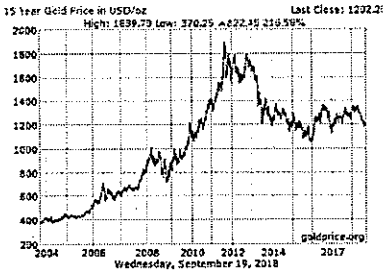
Network gear



Servers

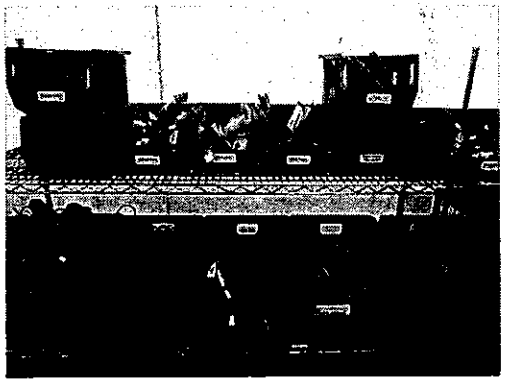
Reuse as a growing and stable part of our revenue stream



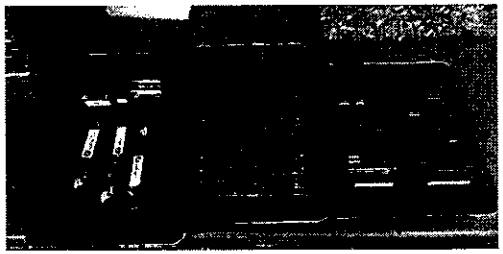


Parts harvesting

Adapters, caddies, screens



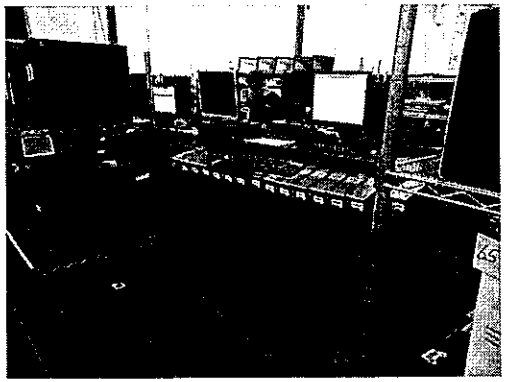
Memory modules



Traditional IT equipment processing

Monitors

Laptop and desktop computers



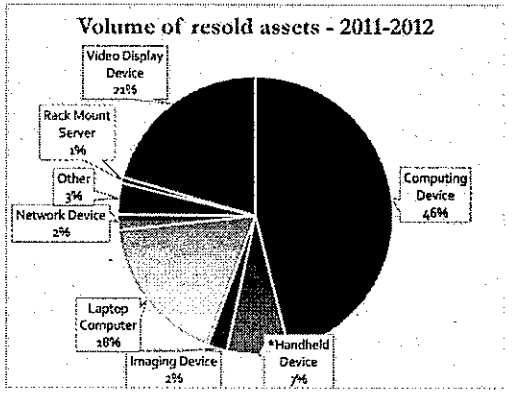
Increasing complexity of testing & sanitization

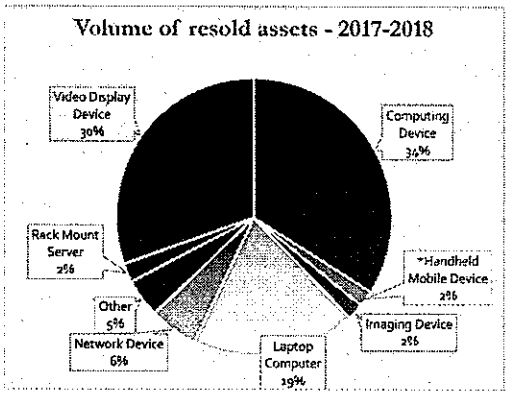
Sanitization is more complex with SSDs, mobile devices, enterprise equipment, increased customization, etc.

» Larger volumes of specialized testing required
» Requires higher level of knowledge & skill from technicians
» Additional hardware, software, and peripherals – flexible testing stations
» Increase in servers X increase in HDD storage = more capacity needed
» Testing requirements (e-Stewards, R2, NAID, etc)
» Licensing requirements

CASCADE ASSET MANAGEMENT

Product volumes are changing





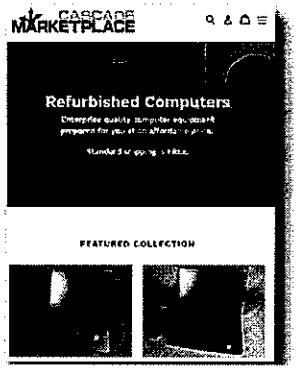
CASCADE ASSET MANAGEMENT

Reuse channels

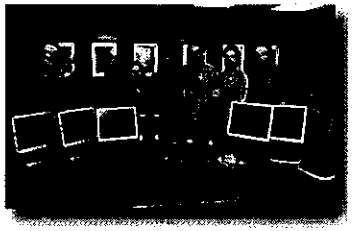
Depends on the type and quantity of devices – diverse options are important

» Wholesale
- Resellers
- Equipment maintenance organizations

» Retail
- Online store
- eBay

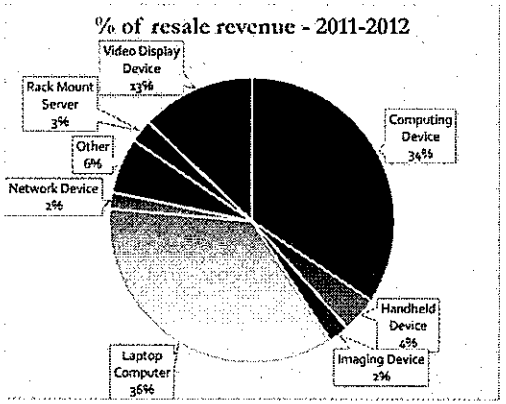


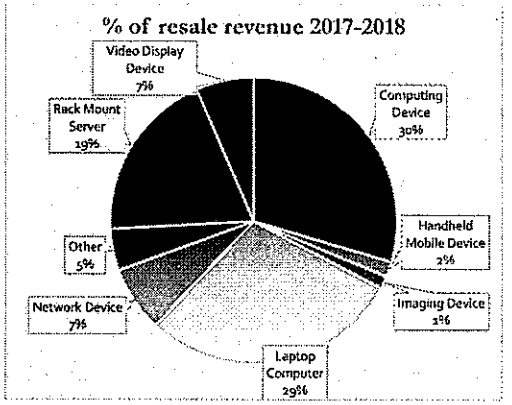
» Donation, redeployment
- Charity programs
- Customer reuse
- Short-term rental



CASCADE ASSET MANAGEMENT

Revenue by product is changing





CASCADE ASSET MANAGEMENT

CASCADE MARKETPLACE

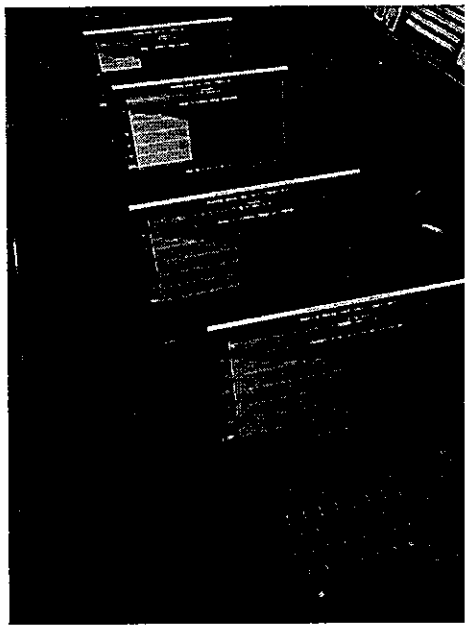
Neil Peters-Michaud

Cascade Asset Management

npm@cascade-assets.com

www.cascade-assets.com

CASCADE ASSET MANAGEMENT



Who SRS is

- Sims Recycling Solutions is part of Sims Metal Management
- SMM is the world's largest recycler of ferrous and non ferrous metals
- Both SRS and SMM have a global footprint
- SMM is publically traded on the Australian stock exchange

Sims Recycling Solutions

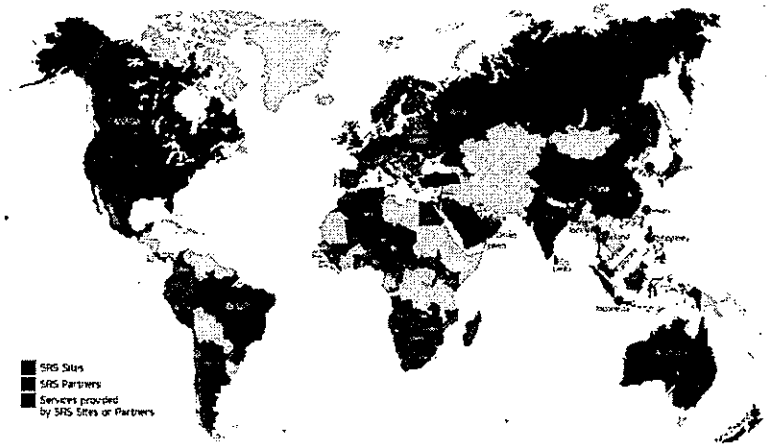
Products Produced

- Robust resale market
- Reuse parts capture
- Data destruction
- Commodities produced:

Aluminum	Plastic
Batteries	Municipal
Circuit Boards	Packaging
Copper	Paper
CRT Glass	PM Components
Ewaste Components	PM Fines
Ewaste Devices	PM Metals
Hazardous	Reusable
Lead	Stainless Steel
Media	Steel
Metal scrap	Toner/Ink

Mixed Non-Ferrous

Global Network



Markets

SRS's business is to turn unwanted electronics into smelter ready commodities

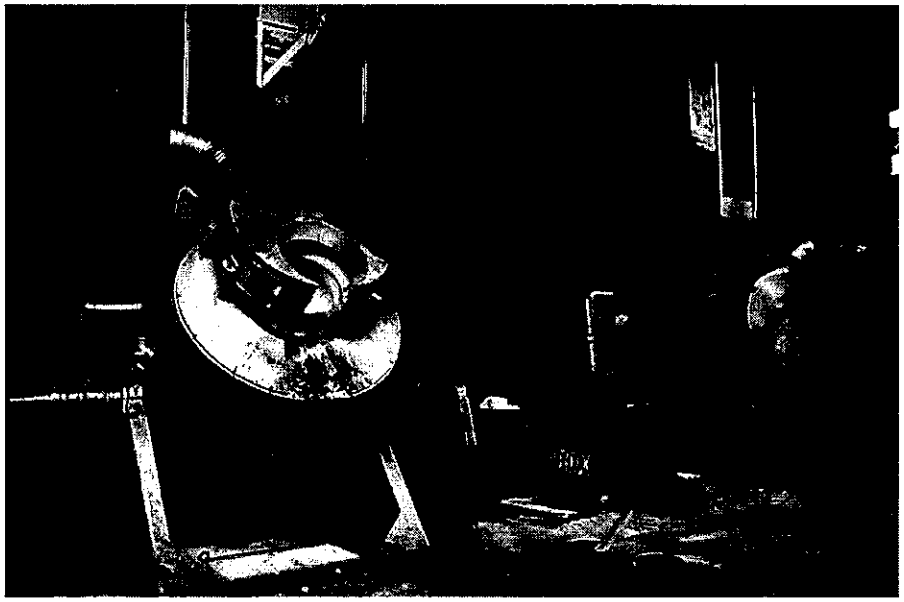
Markets

- Markets are constantly changing and evolving
- SRS/SMM both active in the global market
- Both share resources to assure consistent pricing
- Strive to minimize transportation impact on the environment and on the economics

Markets

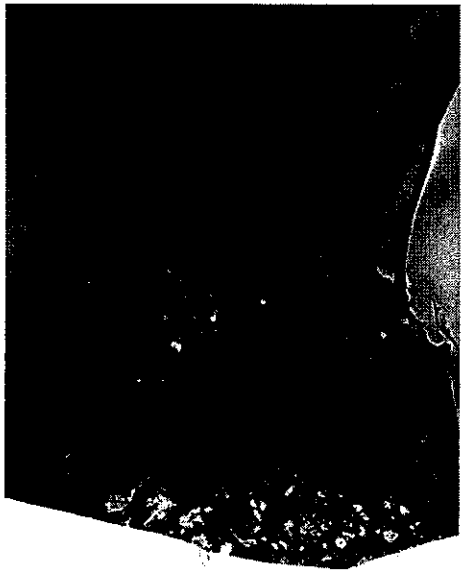
Markets for various types of e-waste???

Markets



Material that needs further processing

- Batteries
- Ink
- Toner
- Some types of plastics (CDs, shrink wrap)
- Mercury lamps
- CRT glass



Changing markets

SIMS RECYCLING SOLUTIONS

- CRT glass market is non-existent
  - Outlets for leaded glass are very limited
- Post consumer plastic market is growing (for pure streams)
- Commodity pricing is always changing
- Product composition is also changing

SIMS RECYCLING SOLUTIONS

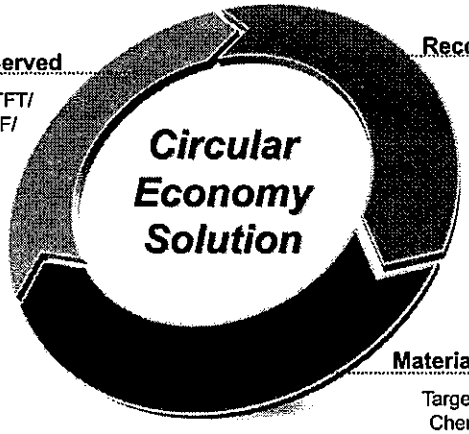
Must produce a product that someone wants

SOLAR Change for Excellence!

Business Model

Industries Served

MDS / ODS / TFT/
LED / Semi / LF/
PCB / Auto./
Petro Chem.



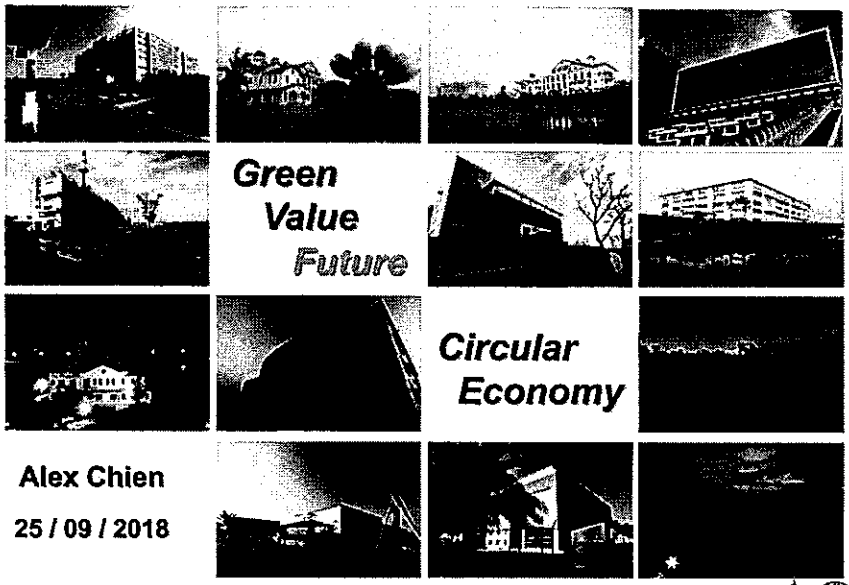
Recovery & Refining

Ag/Au/Pt/Pd/
Ru/In/Ga/Ta/
Cu/Ti

Materials Application

Targets / Slugs / Wires
Chemicals / Catalysts
Powders / Parts

SOLAR Solar Applied Materials Tech. Corp.



Alex Chien

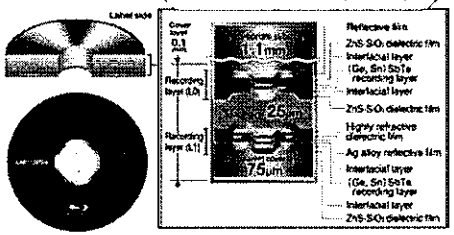
25 / 09 / 2018

For internal use only & Proprietary

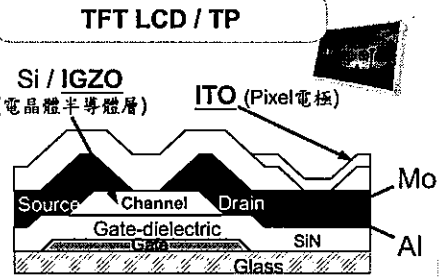
SOLAR Change for Excellence!

Thin Film Application

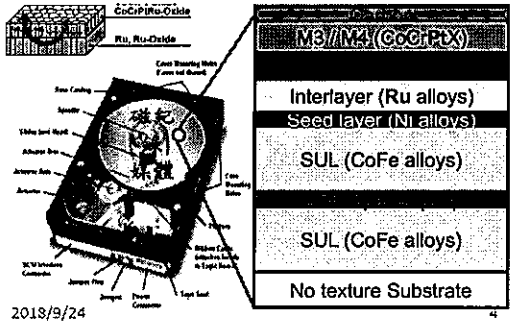
CD/DVD/BD (ODS)



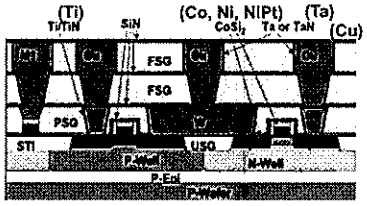
TFT LCD / TP



HDD (MDS)



Semi-Conductor



Ref.: Introduction to Semiconductor Manufacturing Technology, by Hong Xiao, 2001

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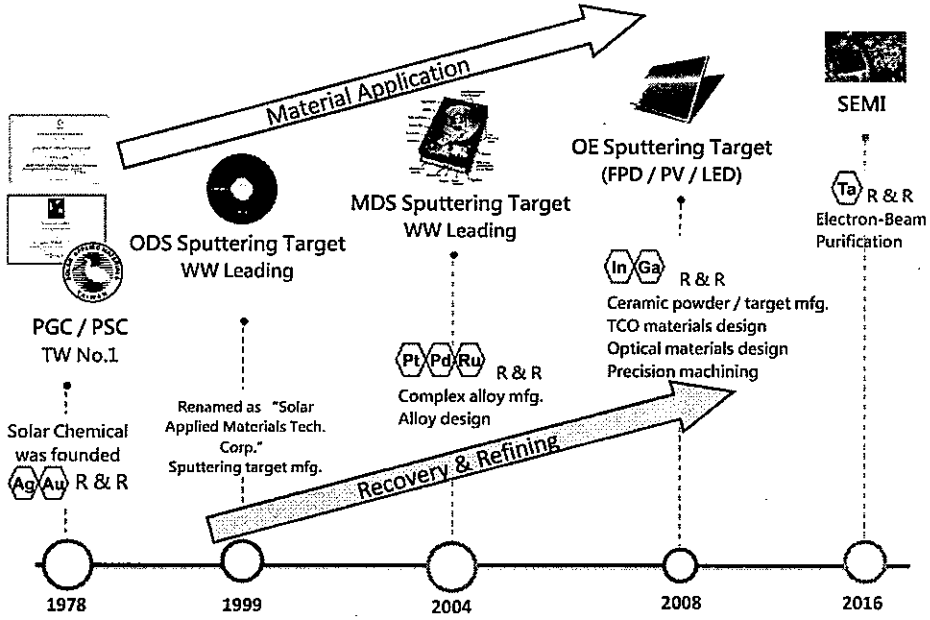
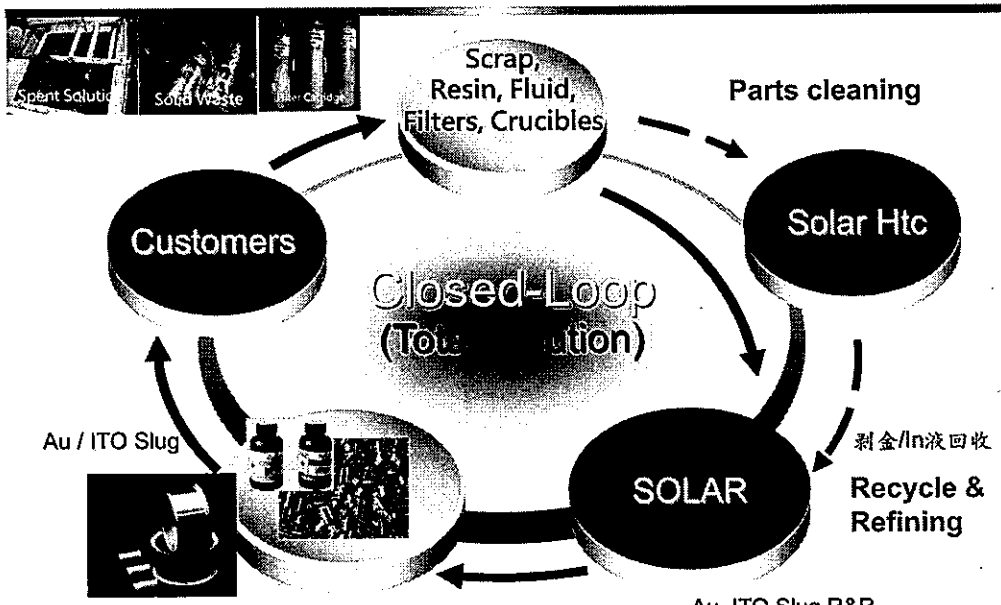
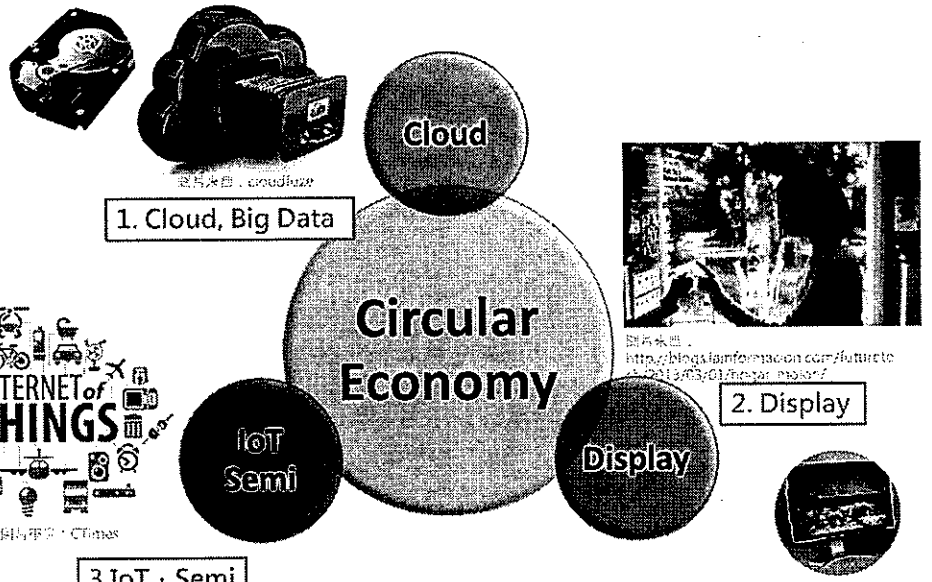
Milestones



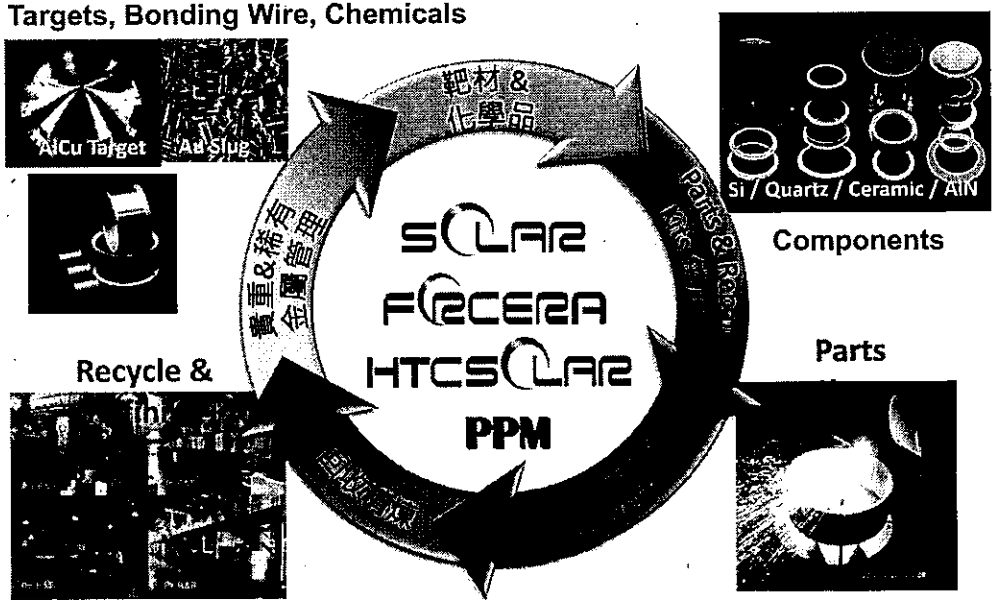
Circle of PCB、LED



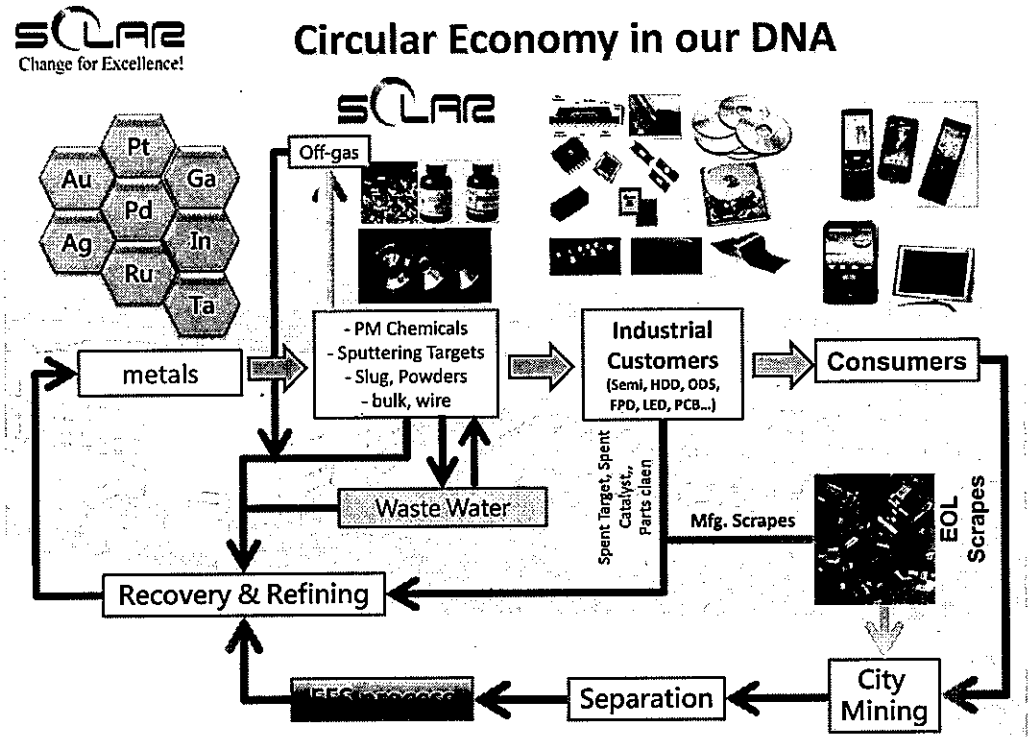
Connecting to your daily life



SEMI : Close-loop & ICTS

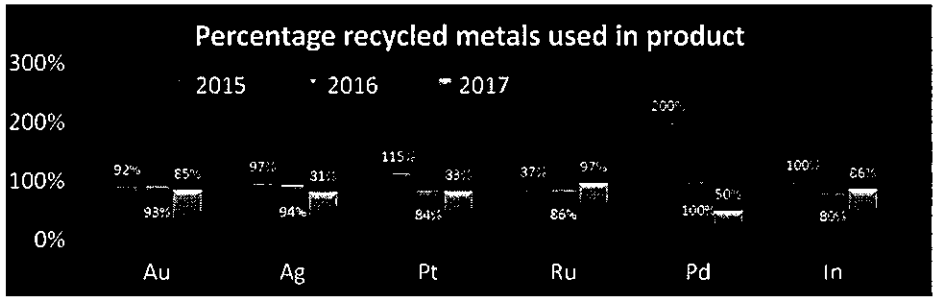


Circular Economy in our DNA

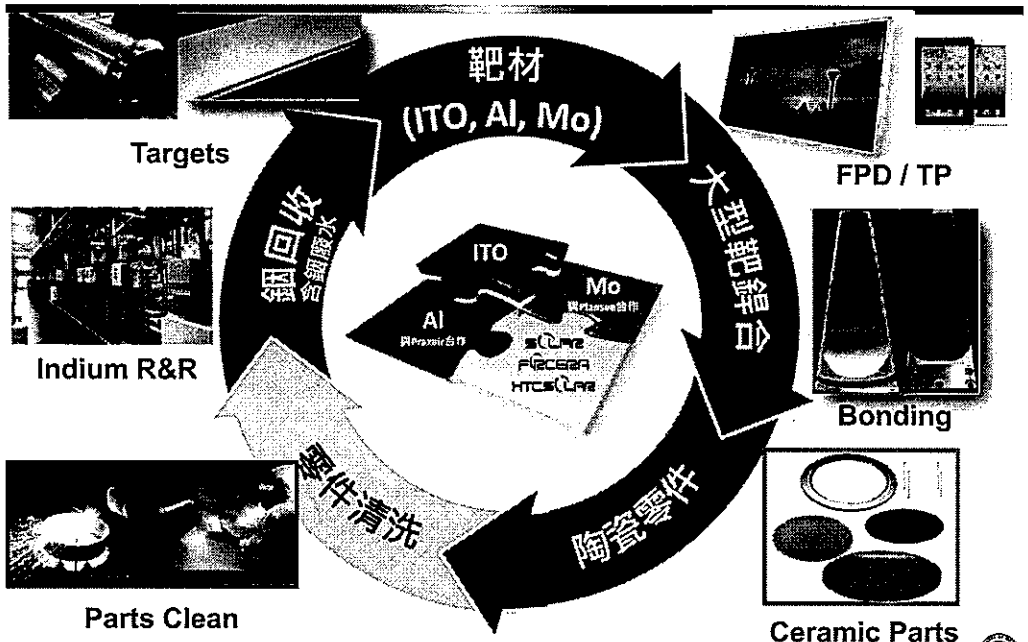


Usage of Recycled Materials

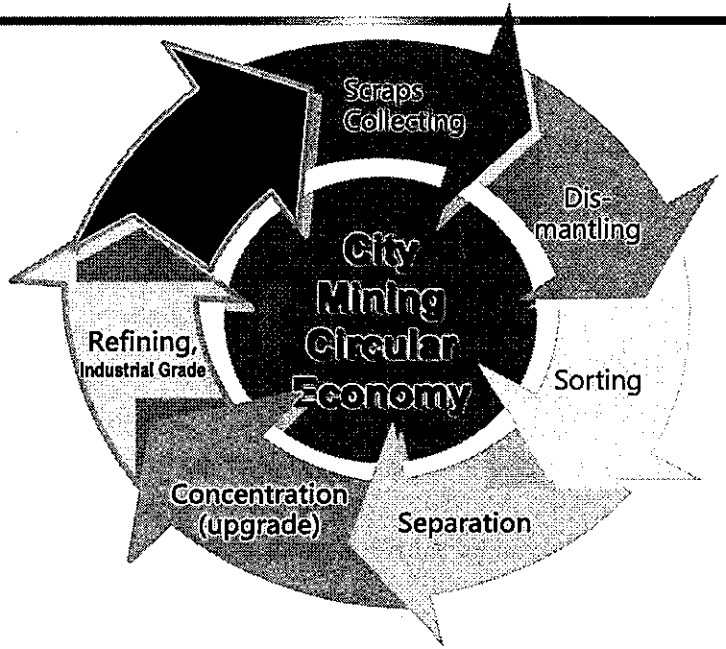
2015年						
Metals	Gold(Au)	Silver(Ag)	Platinum(Pt)	Ruthenium(Ru)	Palladium(Pd)	Indium(In)
Recycled(ton)	40.0	363.8	4.7	9.0	0.6	34.3
Product(ton)	36.8	376.9	4.1	10.3	0.3	34.4
2016年						
Metals	Gold(Au)	Silver(Ag)	Platinum(Pt)	Ruthenium(Ru)	Palladium(Pd)	Indium(In)
Recycled(ton)	15.2	235.0	3.8	8.3	0.4	23.3
Product(ton)	16.4	249.1	4.5	9.7	0.4	35.3
2017年						
Metals	Gold(Au)	Silver(Ag)	Platinum(Pt)	Ruthenium(Ru)	Palladium(Pd)	Indium(In)
Recycled(ton)	10.4	160.9	2.5	9.2	0.1	28.5
Product(ton)	12.2	197.9	3.0	9.5	0.2	33.1



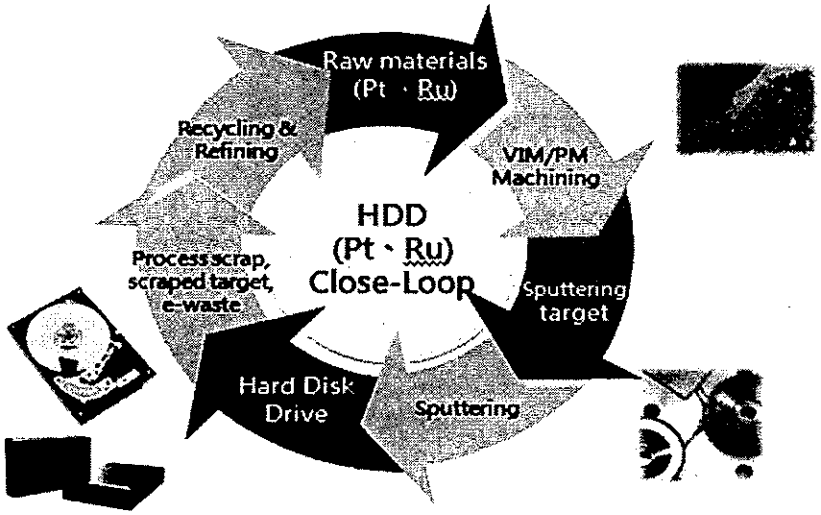
Circle of Panel Industry



Circular Economy for e-Waste

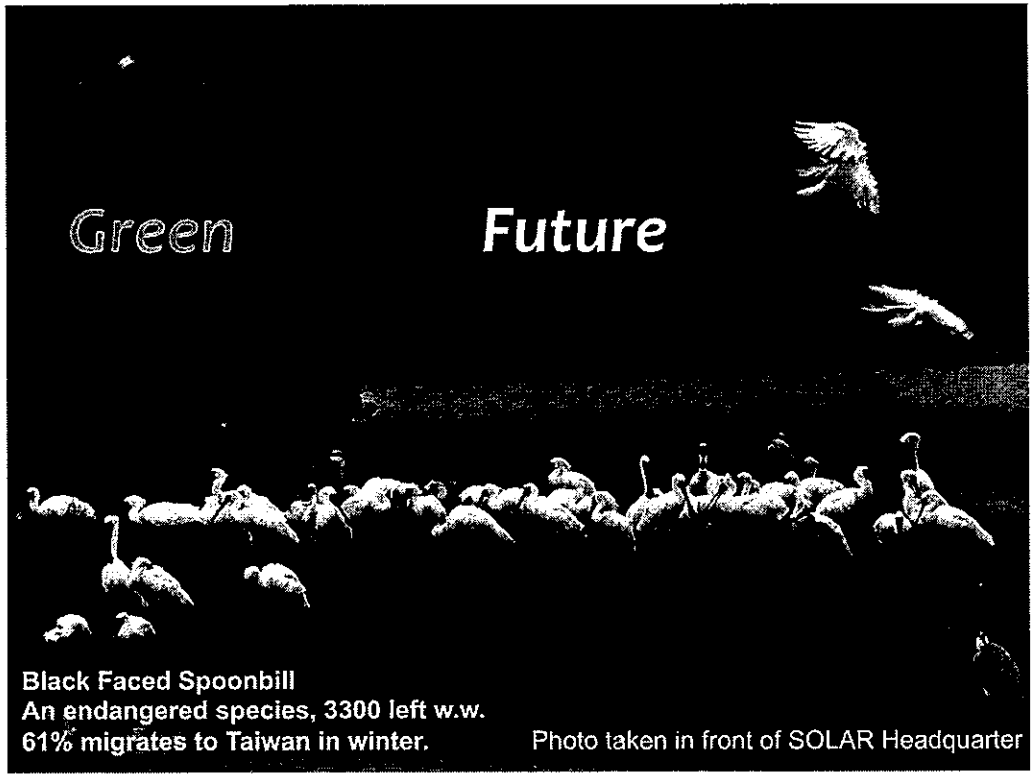


Circle of Hard Disc Drive



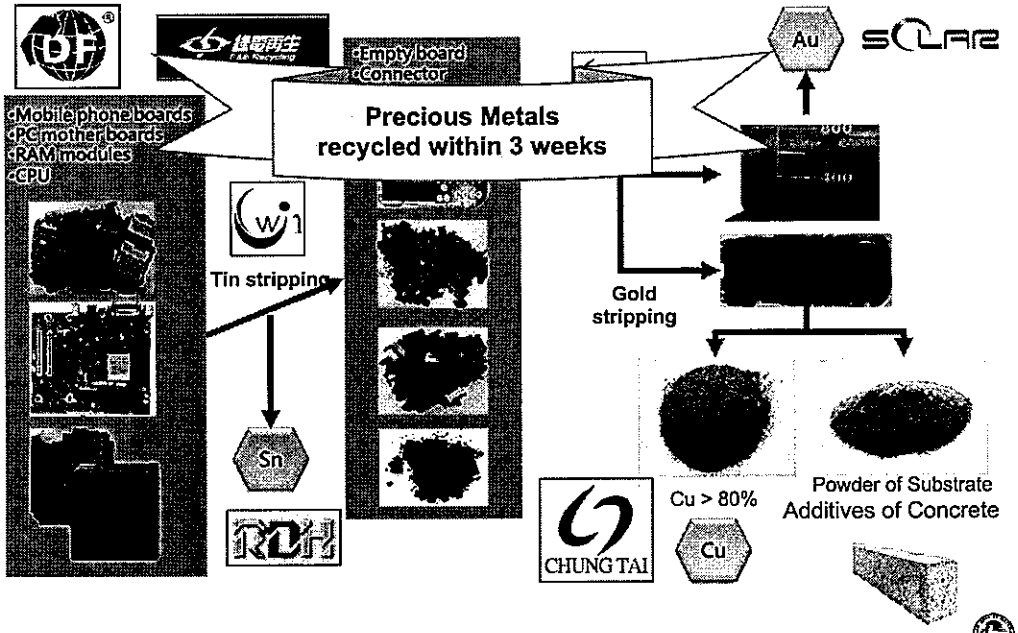
Advantage of the concept

- Lower investment → local solution → Minimize waste transportation
- Module Design → Invest with growing, flexibility for customization.
- Faster Precious Metal Recycle → better recycle efficiency (High value recycled first)
- Shorter Recycle Route of Conflict Metals (Au, Sn) → better traceability
- High Copper Concentrate (>80%) → Less Copper Recycle Process
- Powder of substrate to be used as additive of concrete → Less waste

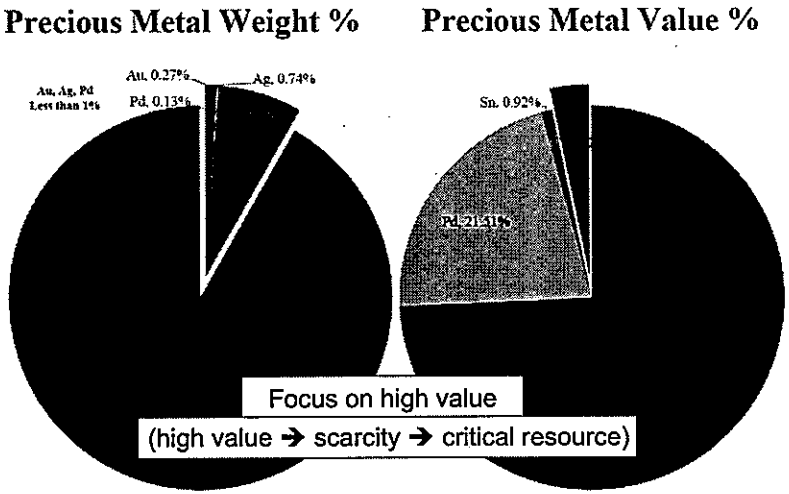


GERA - Green Electronic Resource Alliance

大豐環保、綠電再生、優勝奈米、光洋應材(光洋科)、瑞大鴻、中台資源



Value Allocation of i-Phone PCB




tusind tak
ngiyabonga
dziękuję
谢谢
dakujem vám
merci
ありがとう
suksema
danke
thank
baie dankie
you
धन्यवाद
molte grazie
gracias
tak
obrigada
obrigado
gràcie
tänan
teşekkür ederim
شكرا
tack så mycket
gettyimages

Thank you

UN environment
United Nations Environment Programme

Shunichi Honda (PhD)
International Environmental Technology Centre
Chemicals and Health Branch
Economy Division
https://www.unep.org/ietc/
shunichi.honda@un.org
Twitter: @unep_ietc

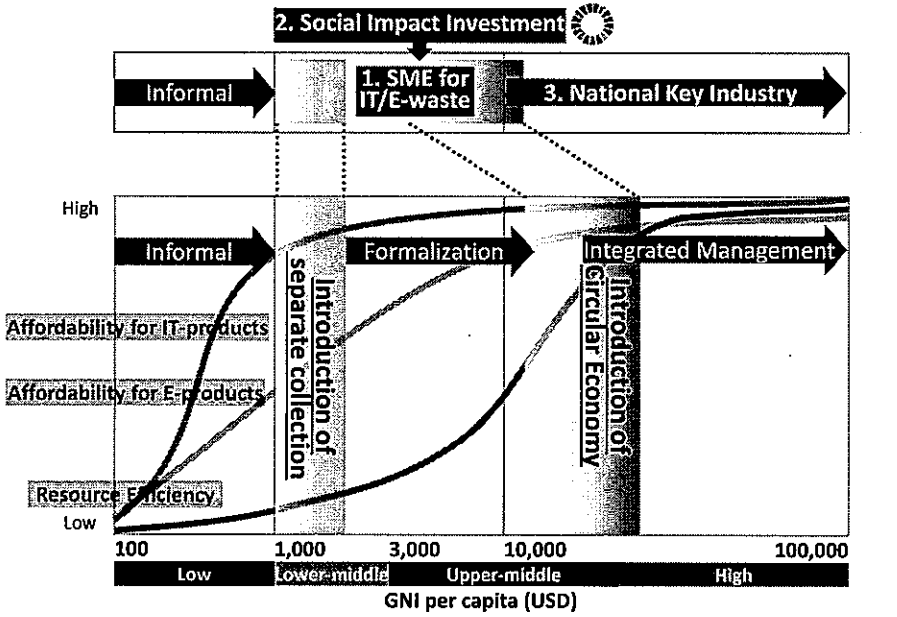
UN environment
United Nations Environment Programme

Challenges and Opportunities Created by Major Market

United Nations Environment Programme

Shunichi Honda (PhD), International Environmental Technology Centre, Economy Division
IEMN, Manila, 25 September 2018

Paradigm Shift of Recycling Industry



Overview: Lithium Batteries

Karen Pollard
U.S. EPA
Office of Resource Conservation and Recovery
Washington, DC

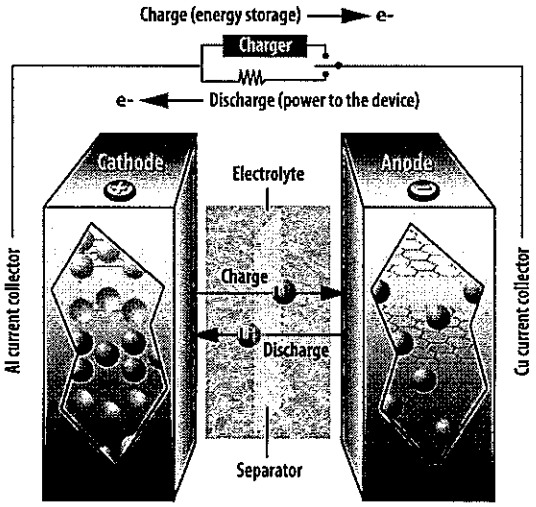
Lithium Batteries

Two types:

- Non-rechargeable, primary batteries that use lithium metal in the AA or 9V format.
- Rechargeable lithium-polymer cells which uses a lithium electrolyte that passes through a porous membrane, creating a voltage

Compared to other batteries:

- High charge density
- Lighter weights
- Charge lasts longer
- Potentially higher voltages (over 3 V compared to 1.5 V for alkaline batteries)



Rechargeable Lithium Cell - Argonne National Lab

What do Li-Batteries Look Like?

Technological improvements are being driven by an ever-increasing demand for portable electronic devices

- Battery cells are packed in a flexible plastic pouch
- May look like 'AA', 'AAA' or '9V' batteries and button cells
- May be difficult to find and identify in the device

Lithium-Ion Battery Prevalence

- Worldwide around 5.5 billion lithium ion cells are manufactured annually
- Found in most electronic devices and a host of other products.

- Examples
  - Cell phones
  - Tablets and laptops
  - Bluetooth
  - E-cigarettes
  - Handheld power tools
  - Earbuds, speakers, headphones
  - Appliances
  - Greeting cards
  - Automobiles

Sustainability or Safety issue?

BOTH!

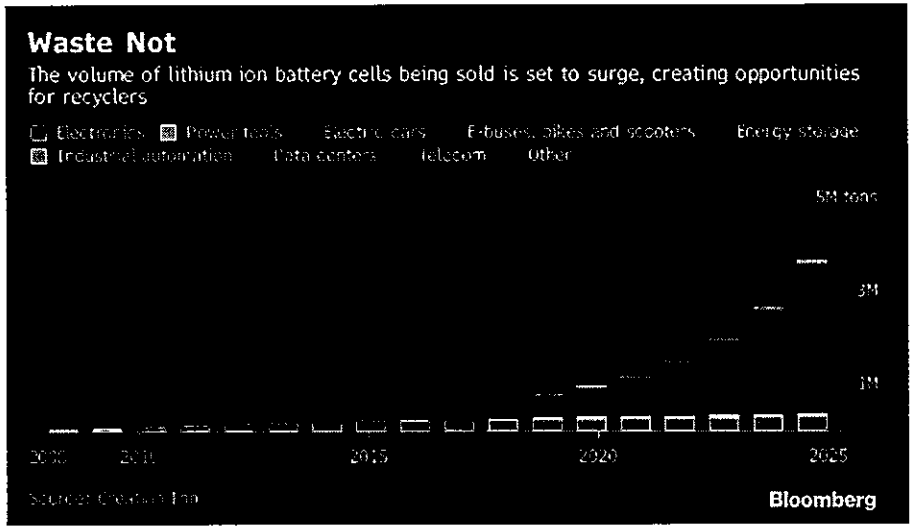
Safety issue:

- Caused fires at electronics recyclers; municipal recycling facilities; white goods and auto recyclers; and landfills

Sustainability issues:

- Decreases reuse of product
- Decreases recycling/ recovery
- Burnt products are generally not recyclable

Lithium-Ion Batteries: Worldwide



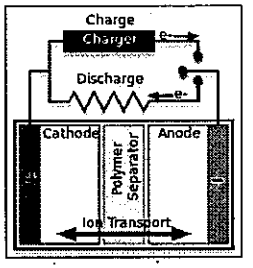
https://seekingalpha.com/article/4139266-look-lithium-ion-battery-recycling-industry-companies

Headlines

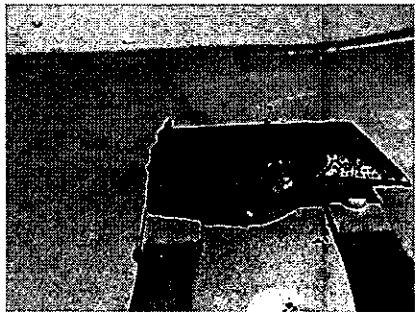
- **Fire at Jamaica [NY] recycling plant caused by improperly disposed-of lithium battery: FDNY**
  - AMNewYork, (3/18/18)
- **Cell phones thrown in the trash are exploding, causing 5-alarm fires in garbage trucks**
  - USA Today, (5/18/18)
- **Train car carrying Lithium batteries explodes near downtown Houston**
  - KOHU11, Houston (April 2017)
- **iPad Battery Malfunction Leads To Apple Store Evacuation In Amsterdam**
  - NPR (August 2018)
- **Fire Surge: Why Are We Seeing A 77% Increase In Waste & Recycling Facility Fires In The First Half Of 2018?**
  - Ryan Fogleman, Fire Rover
  - Lithium batteries may be one of several causes

How do Li-Batteries Start Fires?

- Polymer separator becomes damaged, allowing more Li^+ through, which can lead to overheating
  - Polymer cells can swell; more susceptible to further damage
  - Batteries can develop age or use related issues (dendrites)
- They can be 'bruised' during removal from the product during reuse or recycling
- They can break (e.g., be crushed) exposing the lithium to moisture in the air, starting fires



Li-ion battery thermal events



Li-ion polymer soft sided battery from iPad

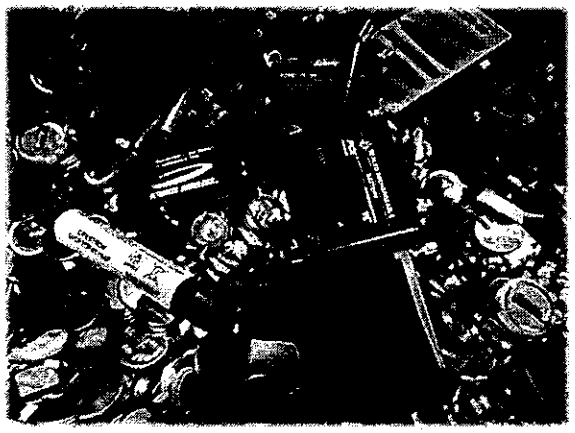
International E-Waste Management Network Workshop

Quezon City, Philippines

September 25, 2018

Batteries from Electronics

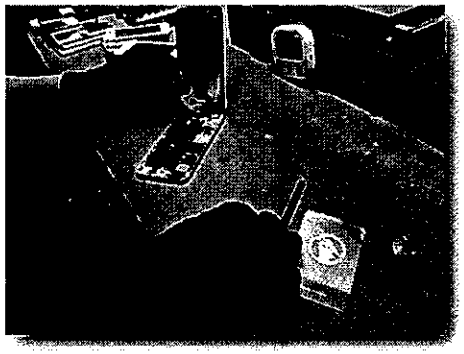
Neil Peters-Michaud, CEO
Cascade Asset Management



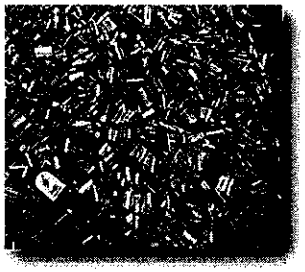
Safe battery handling

» These Li-ion Polymer batteries are glued into the aluminum case of the iPhone 6.

» The batteries are thin (about 2 mm thick) and are difficult to remove without bending and causing a reaction.



Battery variety in consumer electronics

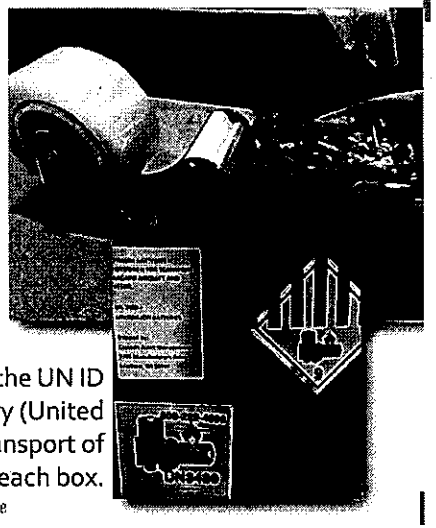


Photos from Cascade Asset Management 2018

Taping & labeling batteries

» Removed batteries are taped so that their contacts are not exposed. This limits the possibility of discharge and causing a reaction (and is a US Transportation requirement).

» Staff who handle batteries must successfully complete the US DOT Security Awareness Training as per 49 CFR 172.704(a)(4).



Cascade's emergency contact info and the UN ID that corresponds to the battery chemistry (United Nations Committee of Experts on the Transport of Dangerous Goods) is on each box.

Melting glue

» Once the electronics are removed, the case and battery are put on a low-temperature hot table for 4 minutes at ~100 degrees Celsius.

» This melts the adhesive without damaging the battery.

In case of fire . . .

» By all of our battery handling areas, we have a container with sand and a lid that can be used to contain the fire or reaction, if one occurs.

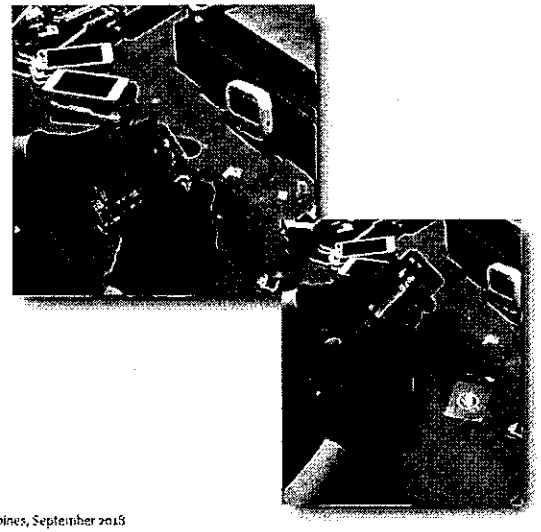
» There are tongs at each station to grab the battery and place it into this bin.

» The bin with the battery is then taken outside to isolate the battery from the rest of our inventory.

Peeling off the battery

» A thin plastic tool is used to gently pry to battery from the case, once the glue is melted.

» The battery is removed from the case. Some of the glue can still be seen on the case.

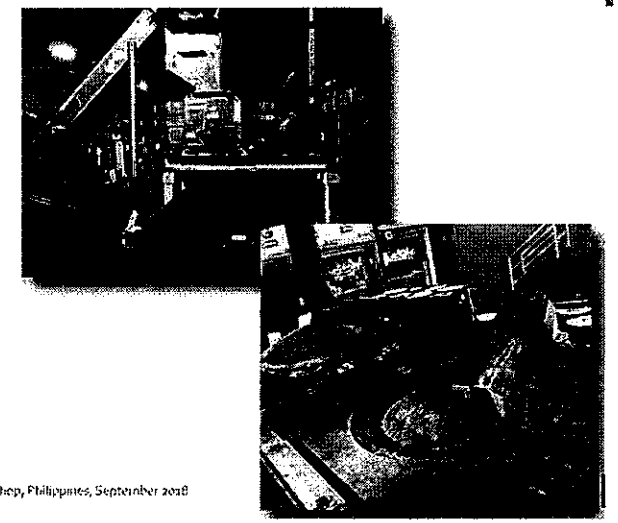


How batteries get recycled – lead acid

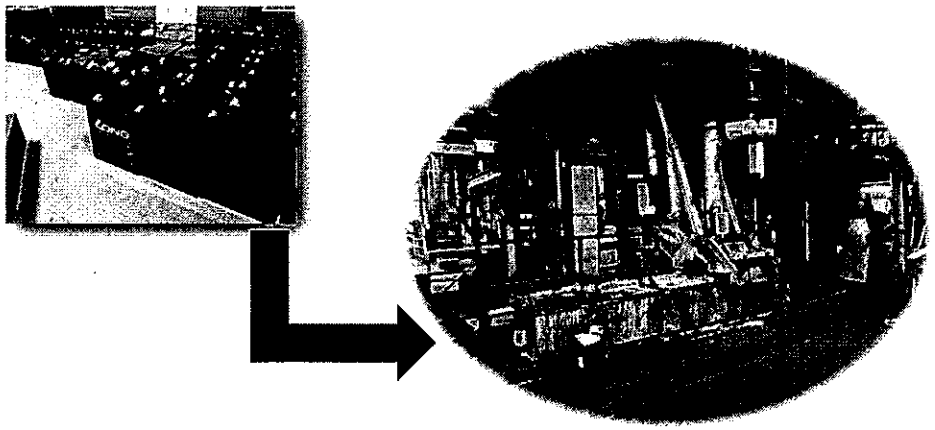
Washington Post review of battery challenges

How Li-ion batteries get recycled

- Focus on recovery of nickel and cobalt – largest portion of batteries
- Lithium recovery not commercially available, but is being developed
- Alternative approach – drain charge from cells, chop in hammermill, use chemical process to separate active materials from electrodes

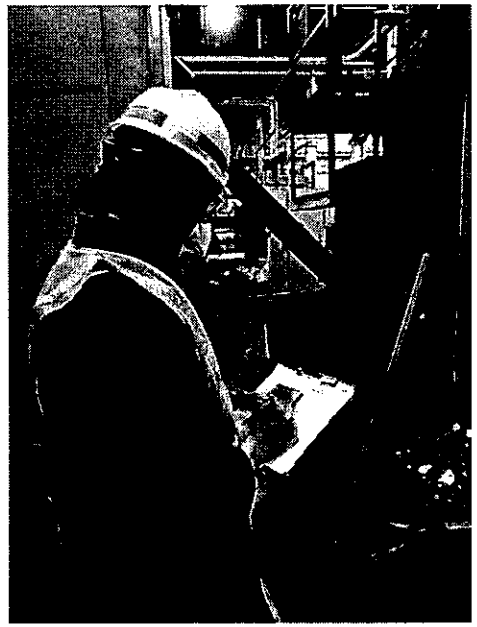


How batteries get recycled – lead acid



CASCADE
ASSET MANAGEMENT

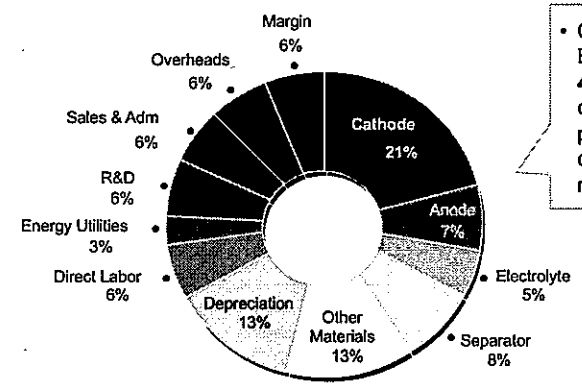
Neil Peters-Michaud
Cascade Asset Management
npm@cascade-assets.com
www.cascade-assets.com



41% of the manufacturing costs come from key metals and materials

LiB Manufacturing Cost Allocations

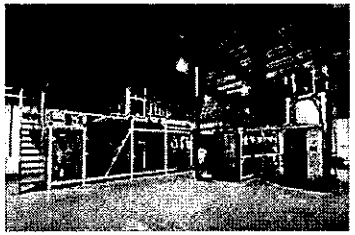
Numbers in %



- Cathode + Anode + Electrolyte + Separator = **41%** of manufacturing costs providing recovery processors significant demand for metals and materials

LiB Refining Processes

Pyrometallurgy



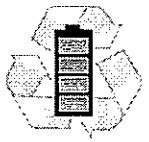
Hydrometallurgy

BlueWhale MATERIALS

Li-ion Battery (LiB) Processing

Developing Downstream Markets for Li ion Batteries

IEMN 2018 Workshop



BlueWhale MATERIALS

Leading U.S. based Full LiB Recycling Solutions Provider

Introduction

Robert Kang

CEO and Co-Founder of **Blue Whale Materials, LLC** (a leading U.S. based full LiB recycling solutions provider)

Established bridge between sources of material and the South Korean LiB recycling market

Executives with experience of delivering over 3,000 tons of LiB material to South Korea

Logistics and transportation pose challenges in the LiB market

1. Varied interpretations of material classification have created barriers in the cross border transport of LiBs
2. Risk of thermal events have reduced the number of logistics providers willing to service the transport of LiBs
3. Randomly differing safety and packaging requirements across jurisdictions and transporters

Ministry of Environment

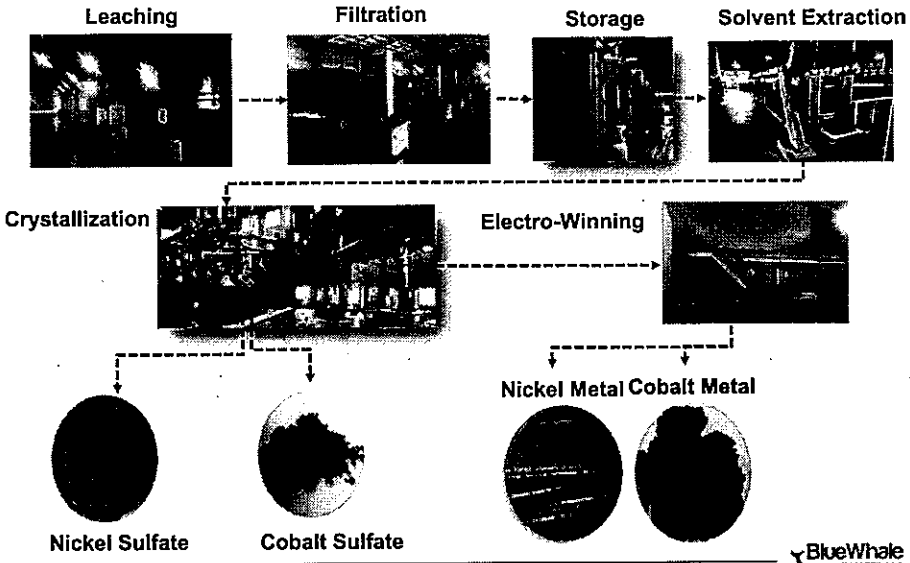
BASEL CONVENTION

UN

IMO INTERNATIONAL MARITIME ORGANIZATION

OECD BETTER POLICIES FOR BETTER LIVES

The hydrometallurgical process



Key Factors Affecting Downstream Markets

Ability to Move Hazardous Waste
Expensive and dangerous to ship li-ion batteries as hazardous waste to foreign processors.

Fluctuating Price of Cobalt
Higher cobalt price allows refineries to generate higher profit from fixed cost processing.

Environmental Benefits of a Closed Loop
Providing a true closed loop to customers makes recycled cobalt more attractive than mined material.

Availability of Supply
Securing steady supply of material is essential to economic feasibility.

Hydrometallurgy: Most Efficient Two Stage Process

1. **Black sand preprocessing** – discharges, grinds and separates batteries and scraps to a fine sand consistency
2. **Hydrometallurgical process** – extracts the precious metals through a chemical leaching and purification process

Low Environmental Impact

Economical Efficiency

75% Battery Recycling

95% Metal Recycling

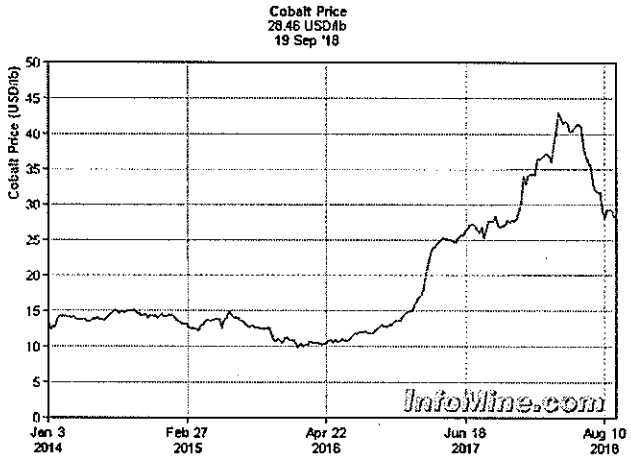
99.99% Purity of Retrieved Metals

Mines of the 21 Century

BlueWhale MATERIALS

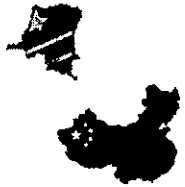
Solutions provider that optimizes: *revenue, environmental impact, transportation and logistics impacts, and transparency*

Price of Cobalt per pound in the last 4 years



The Need for Closed Loop: A Global Cobalt Crisis

SUPPLY: Demand is outpacing supply. Elimination of cobalt from li-ion batteries is not feasible.



GEOGRAPHIC CONCENTRATION: Chinese companies own a substantial percentage of the mining capability in the Democratic Republic of Congo (the source of over half of the world's cobalt) and produces approximately 80% of the world's cobalt sulfate.

ETHICAL SOURCING: Increased scrutiny of mining practices and difficulty auditing and ensuring the absence of "artisanal mined cobalt" or child labor in mining increases demand for recycled material.

Arguments about Circular Economy

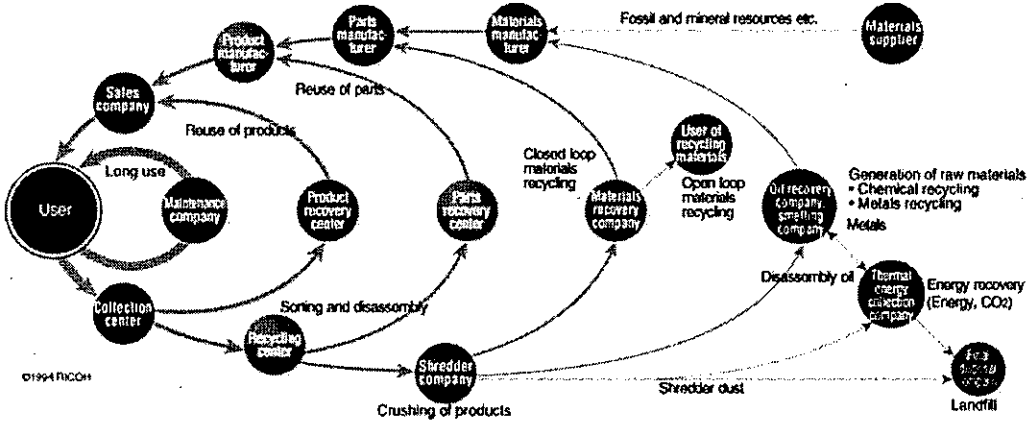
Beyond Recycling

Principles and Thoughts about Circular Economy

2018 International E-Waste Management Network Workshop

CIER 中華經濟研究院 CHUNG-HUA INSTITUTION FOR ECONOMIC RESEARCH

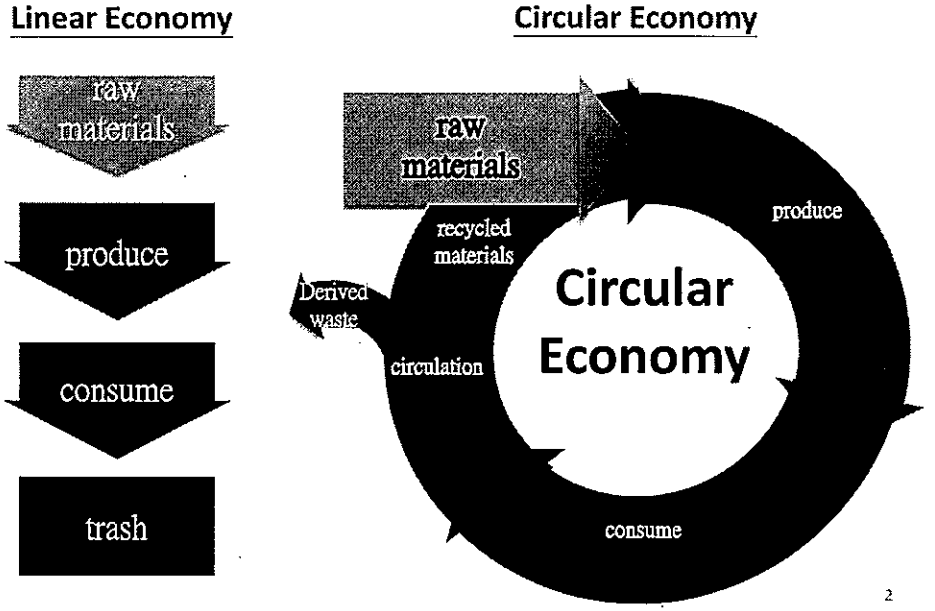
A System with Circular Resources



◆Representing Cases:

✓ Leasing programs by RICHO and Xerox

Circular vs. Linear



Green Economy, Green Growth and Green Deals

The term 'Green Economy' was revived and was viewed as a response to multiple global crises. The UNEP championed the idea of 'green stimulus packages' and identified specific areas where large-scale public investment could kick-start a 'green economy'.

Ministers and Heads of Delegation of the UNEP Global Ministerial Environment Forum acknowledged that the green economy concept 'can significantly address current challenges and deliver economic development opportunities and multiple benefits for all nations.'

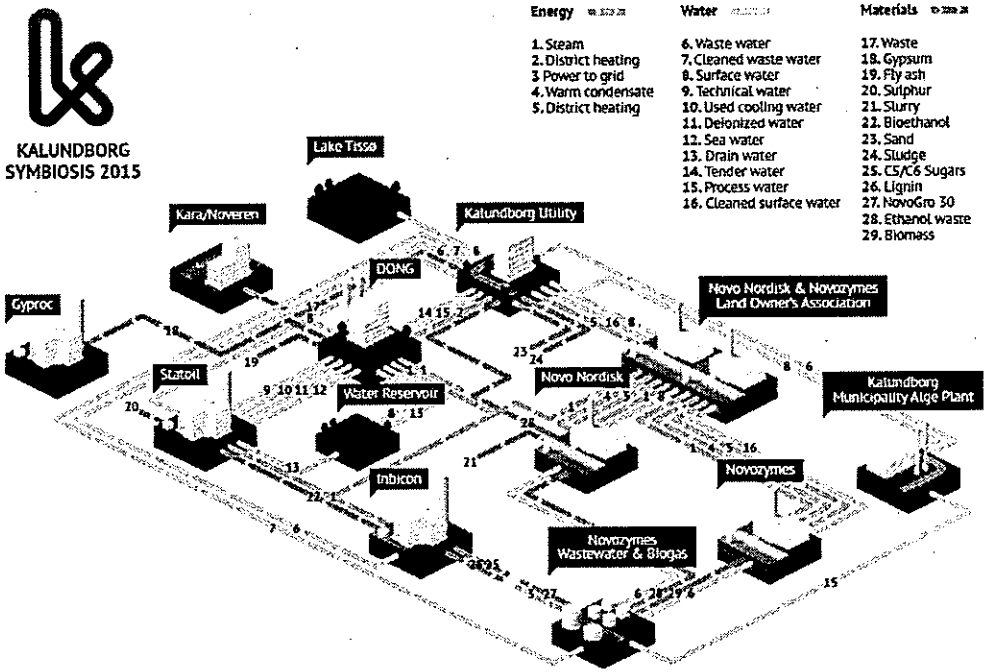
2008 | 2009 | 2010 | 2011

In Oct. 2008, the UNEP launched its Green Economy Initiative to provide analysis and policy support for investment in green sectors and for greening environmentally unfriendly sectors.

The term 'Green Economy Report' was firstly defined by the UNEP. 'Green Economy' is the one that results in 'improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.'

Efficient and Effective Business Mechanisms

KALUNDBORG SYMBIOSIS 2015



Another Concept

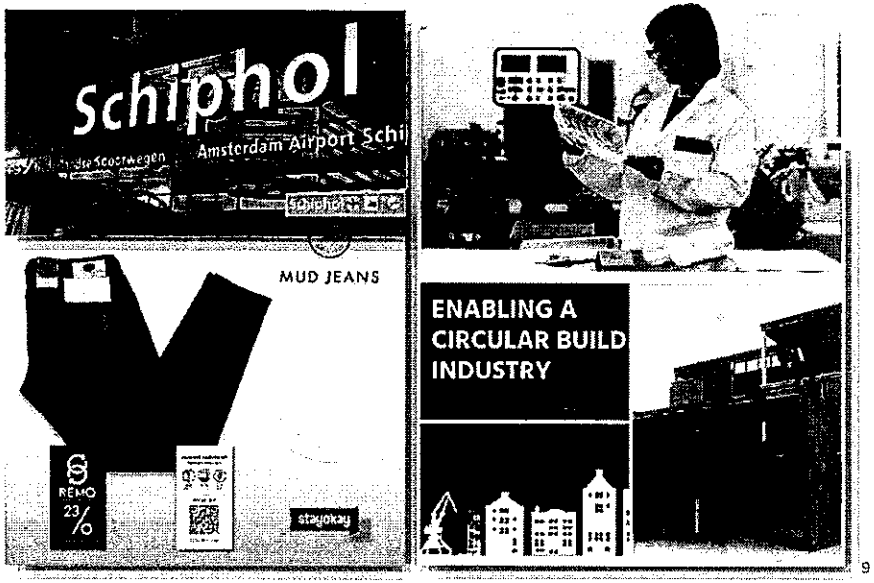
Green Deals, Green Economy and Green Growth

The term 'Green Economy' first appeared in a pioneering 1989 report for the Government of the United Kingdom by a group of environmental economists, led by Professor David W. Pearce.

1989 | 1990 | 1991

The authors released sequels to the first report in 1991. The sequels extended to the problems of the global economy, including climate change and ozone depletion.

Product and Business Innovations



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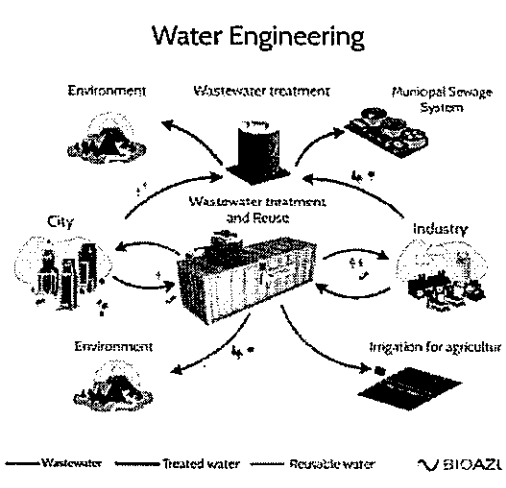
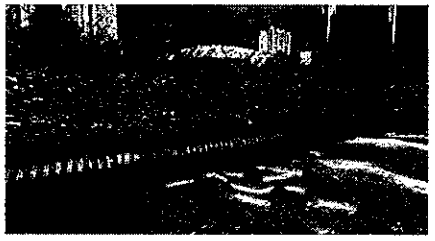
How about using energy-saving bricks made from recycled LCD fragments and cement?

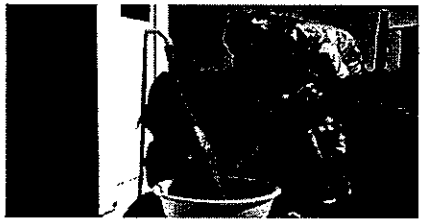
Spring Pool Glass Industrial Corp.

• Energy-saving bricks, made from recycled LCD fragments and cement, can withstand temperatures of up to 600 degrees. These bricks also offer excellent soundproofing and are only a fifth of the weight of conventional bricks.

Product and Business Innovations







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Taiwan EPA's Approaches

Production
- Material use database
- C2C Design
- Inter-industrial link

Disposal
- Sorting and Recycling
- Technology innovation
- Legal aspects

Consumption
- Green Consumption
- Green Procurement for secondary materials
- Product Life span

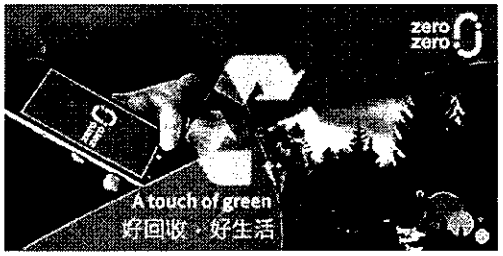
Secondary Material Market
- Quality Assurance
- Technology improvement
- Economic incentives

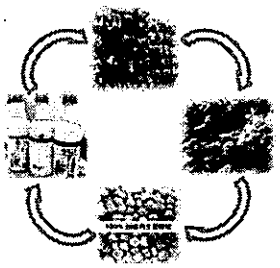
How about Precious and Rare Metal Refinement?

Solar Applied Materials Technology Corp.
- Taiwan largest precious material refiner (market share 60%)
- To dilute the waste material to metal by a recycling refinery platform.

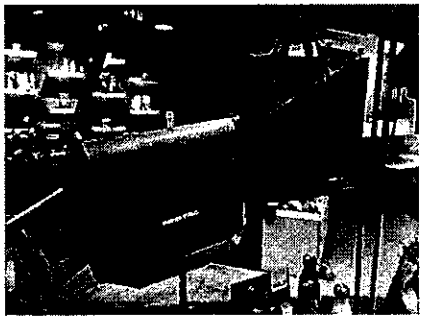
Taiwan EPA's Tasks

- Sorting mechanisms
- Organic waste/materials to energy
- Inorganic materials to construction materials
- E-Waste Recycling
- New Business models





How about Waste Truck Cover?



Summary of Circular Economy

- ***Increasing the efficiencies of Resources***
  - *Materials*
  - *Water*
  - *Energy*
- ***with the principles of***
  - *Reduce, Reuse, Recycle*
  - *Industrial Ecology*
  - *Green Deals, Green Economic Growth*
- ***By the Steps of***
  - *Process innovation*
  - *Product innovation*
  - ***Business model innovation***

Building up a Circular Economy, but how?

- *Guidelines for Industries*
- *Technology Limitations*
- *Financing and Marketing*
- *Interdisciplinary Cooperation*

Taiwan Circular Economy Awards

- ***Taiwan Circular Economy Awards***
  - ***By CIER***
  - ***Not just a competition event but more training and promotion***

Thank You
Partnership with CGE/CIER/EPAT

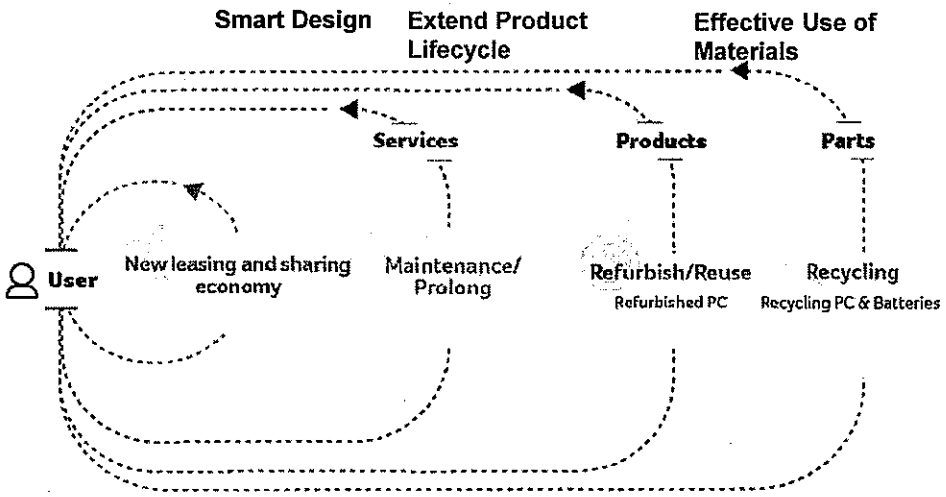
Contact Information

Chun-hsu Lin 林俊旭, Ph.D.
+886-2-27356006 ext 509
chlin@cier.edu.tw

Taiwan Circular Economy Awards

CGE 綠色經濟研究中心

Circular Economy and Acer



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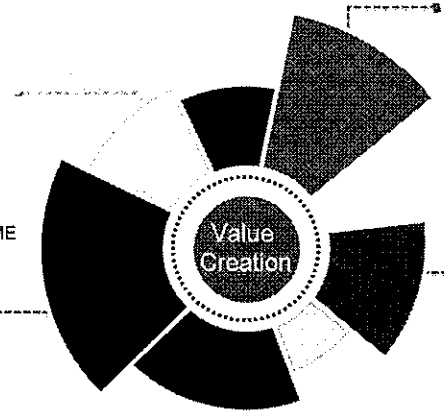
Pursuing Circular Economy

Grace Liu
Corp. Sustainability Office
Acer Inc.

Circular Economy and Acer

Rethink: make product use more intensive
- Product Longevity
  Acer Dust Defender, Modularized Design
- Product Service System
  Leasing and Sharing Economy in ME

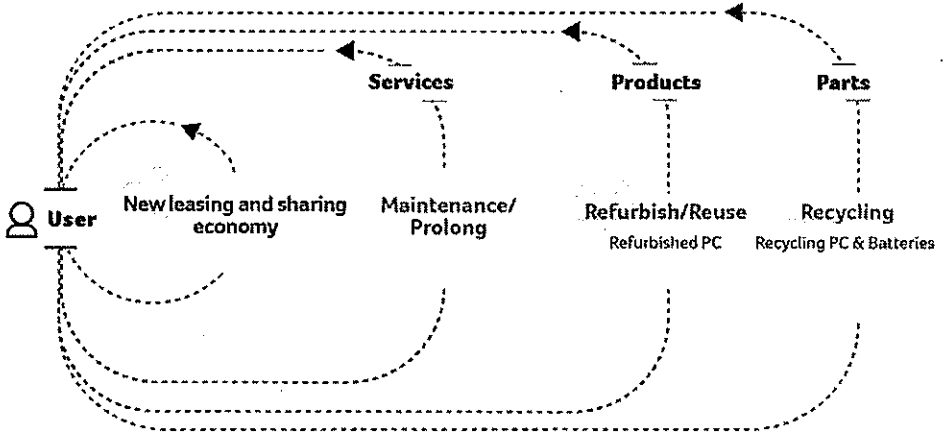
Extend Product Life Cycle
- Reuse: use post consumer materials
  PCR in Products
- Refurbish: restore old product and bring it up to date
  Repair & Refurbish



Reduce: increase efficiency or less natural resources
Packaging Reduction, Energy Efficiency , Improving Product Shipping Efficiency

Effective Use of Materials Recycle
WEEE, Battery Recycling

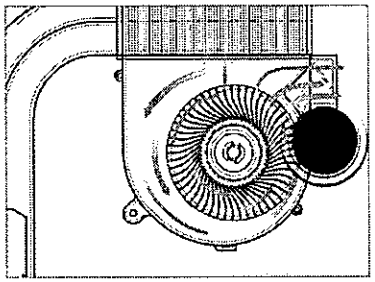
Circular Economy and Acer



Acer DustDefender

- Reverse airflow periodically, helping get rid of dust built up on the back vent
- Keep the interior of the computer cool, maintain optimal heat dispersal
- Extend life cycle of fan and notebook

ACER DUSTDENFENDER TECHNOLOGY

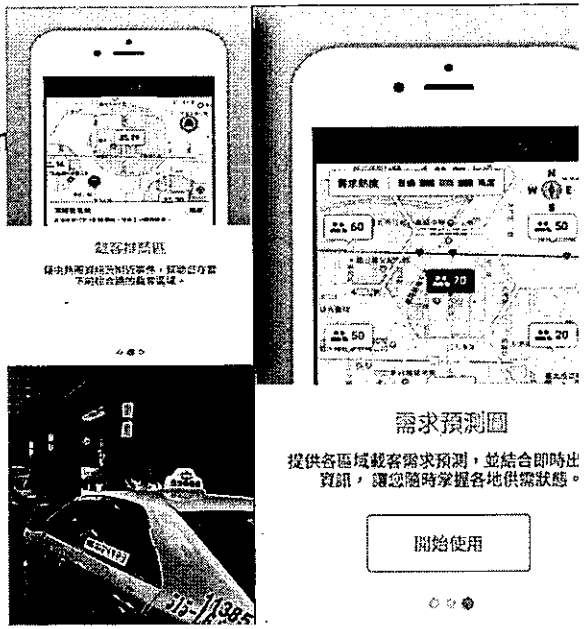


https://www.acer.com/acerdesign/views/dust_defender.html

Smart Taxi Operation Platform

AI and Big Data-enabled solution for taxi drivers

Acer partners with the Taiwan Taxi Company, the largest provider of taxi services in Taiwan, to develop the latest smart taxi operation platform, using AI technology and Big Data analysis. This platform provides popular pickup spot analysis and passenger demand forecast for taxi drivers.



Innovative Research and Design for the Environment

Nano-imprint lithography (NIL)

- A non-traditional surface processing method, using high-transparency patterned polymeric nanostructures
- No waste water, and more energy efficient than traditional processes.

SURFACE PROCESSING TECHNOLOGY

Revo Build

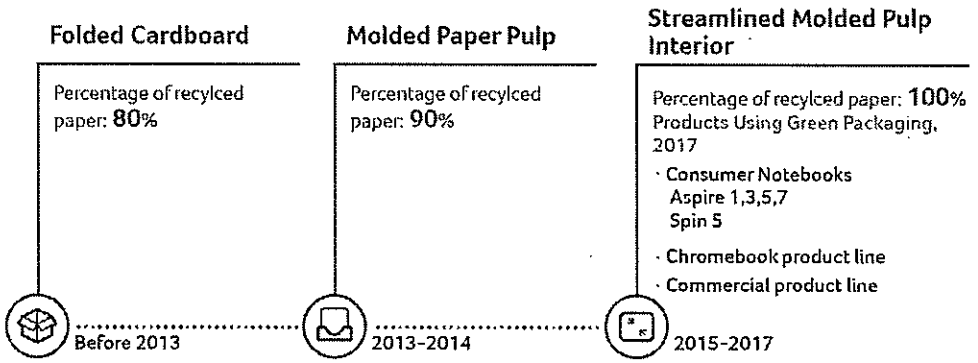
- An expandable, modular computer system
- Connect those modules with special magnetic pins, simply be swapped
- Allow users to build based on their needs and improve functionality or performance
- Extend product life cycle

REVO BUILD

DESIGN AWARD 2016

Small base, and as tall as you want:
https://www.acer.com/ac/zh/TW/content/series/revobuild

Reduction in Design



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the best is yet to come

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Definition

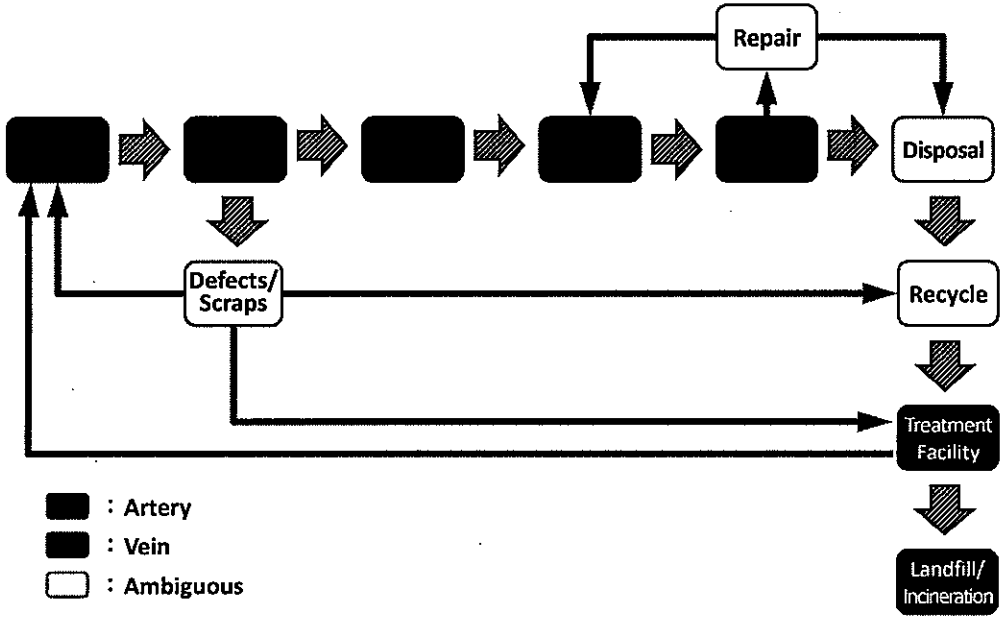
◎ **Artery Industry：Manufacturers**

- Production and consumption by using natural resources.
- Process：Resource → Product → Consumption

◎ **Vein Industry：Resource recycling Industry**

- Based on the premise of ensuring environmental safety, with the aim of conserving resources and protecting the environment.
- Using advanced technology to convert waste into reusable **resources** and **products.**
- To achieve recycling and reutilizing of various types of waste.
- Includes the conversion of waste **into renewable resources** and the processing of **renewable resources** into **products.**

Product Lifecycle – Material Flow

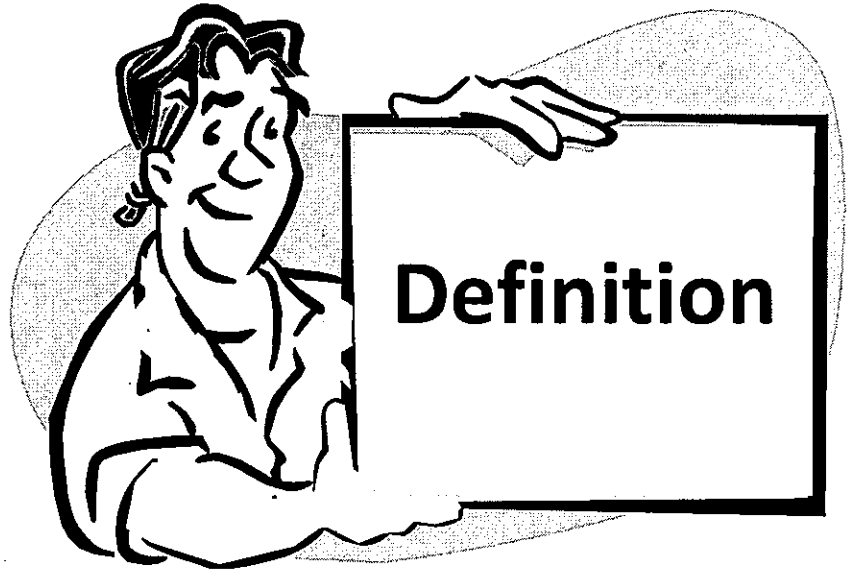


Circular Economy Value from Green Innovation

The challenges of industrial collaboration

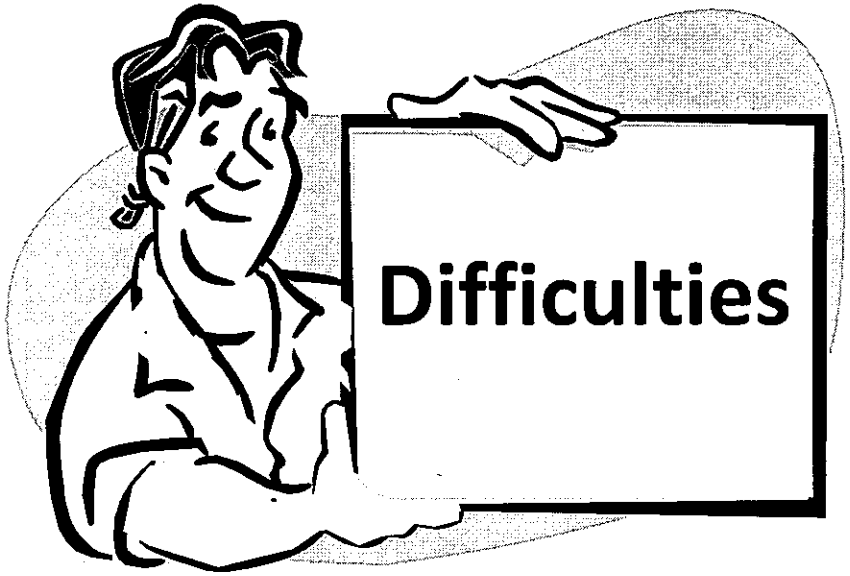
Introduction

2018.09.25 William Sui



綠電再生

Resource or Garbage ?



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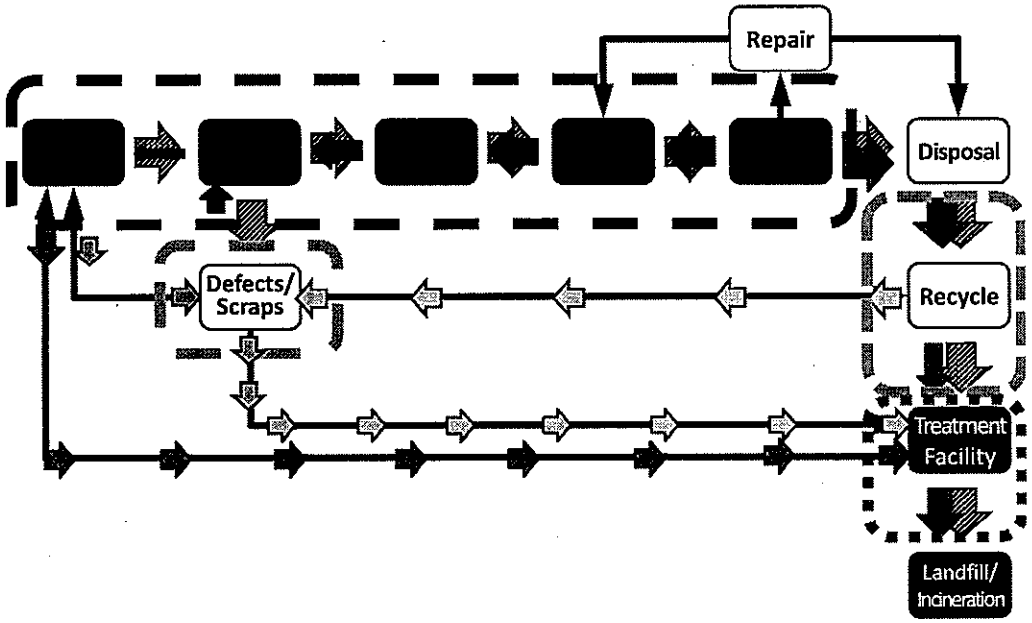
Product Lifecycle – Cash Flow



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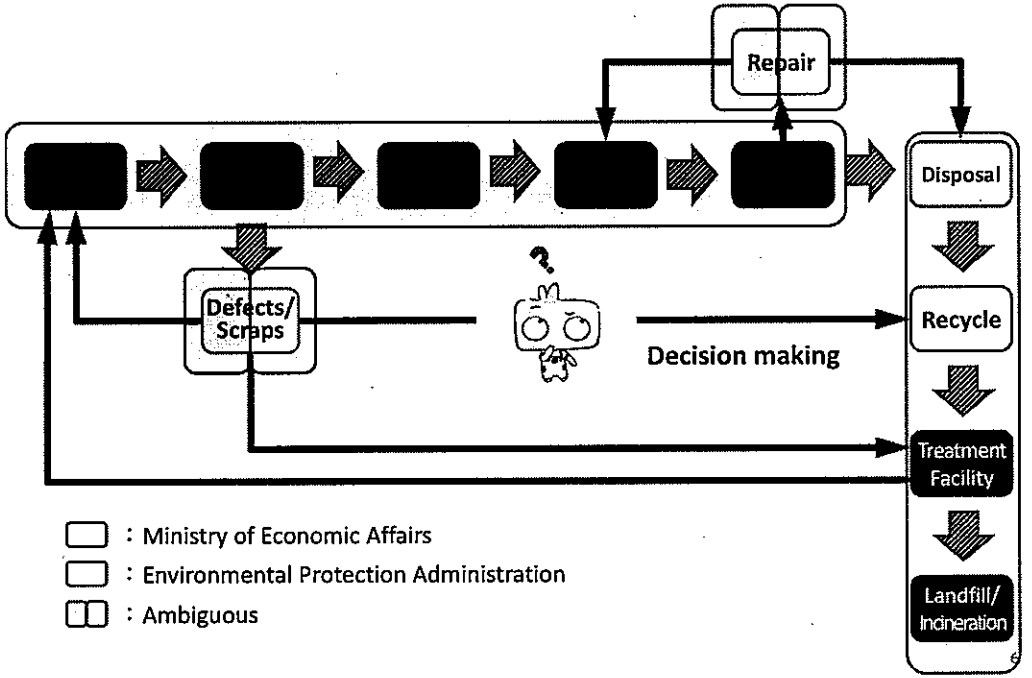
Product Lifecycle – Management Responsibility



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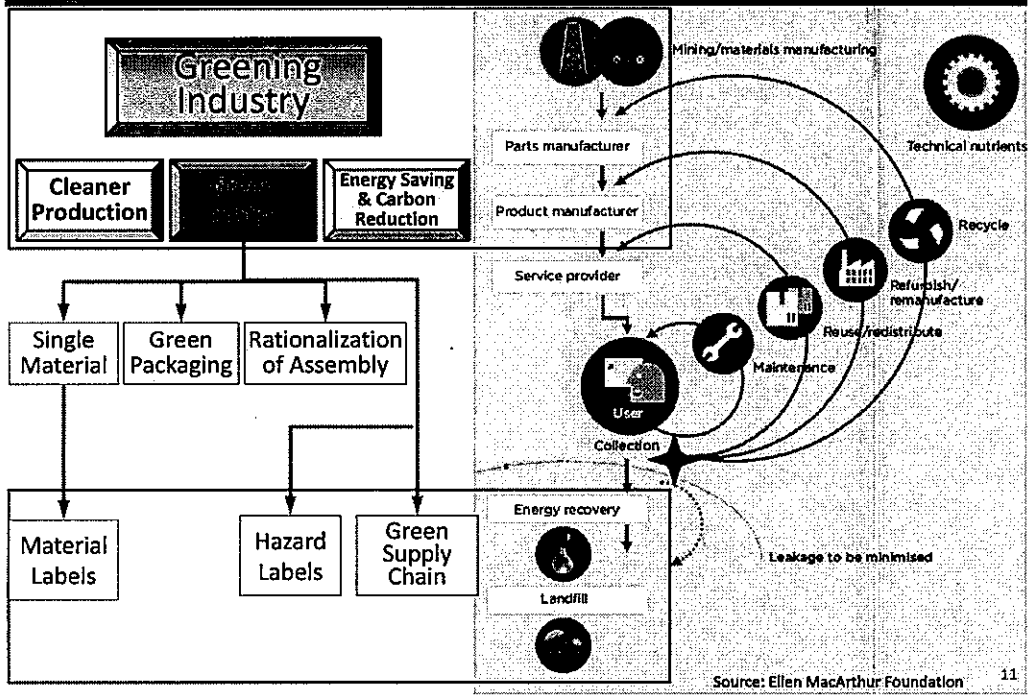
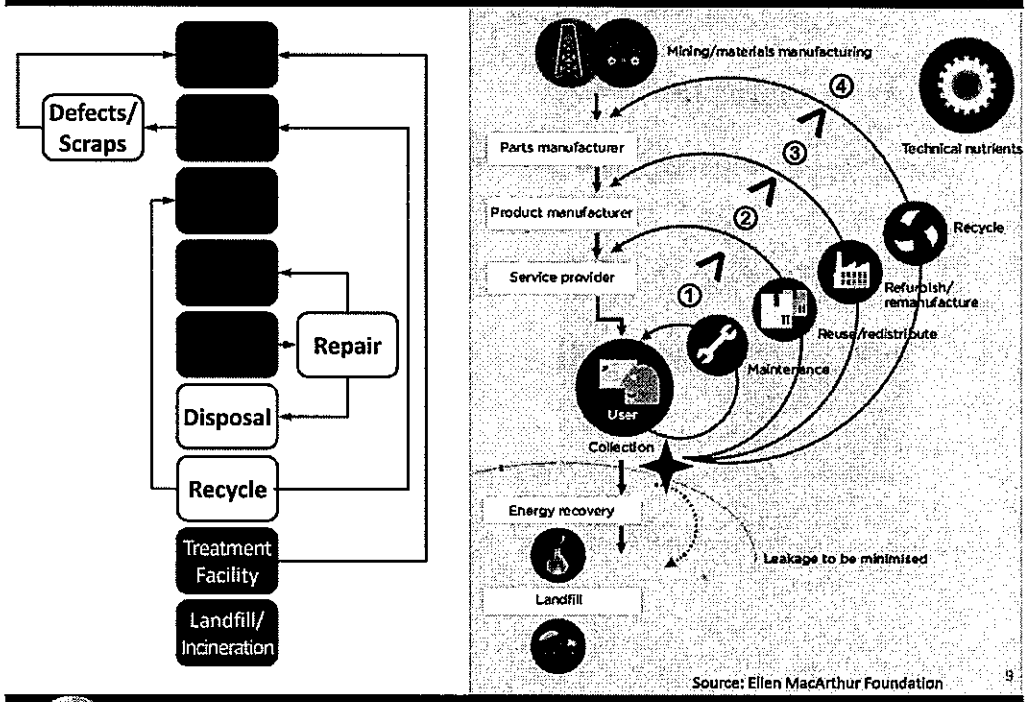
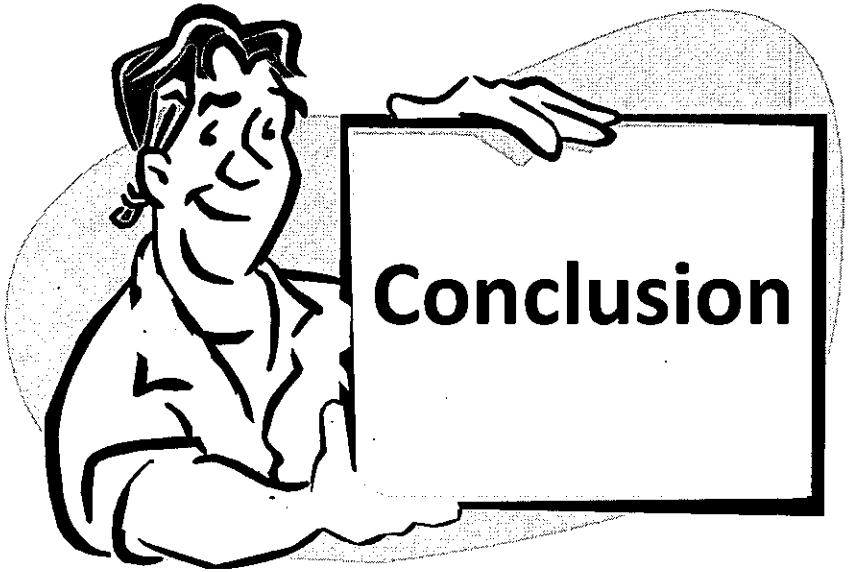
Collaboration of the Artery and Vein Industry – Extended Producer Responsibility



The Circular Economy – Industrial System





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Industrial System – the various stages

Item	Stage	Responsible Industry	Processing Content	Feasibility Assessment	Key -Point	
①	Mainten-ance	Service-Center	• Check Repair • Upgrade	The Ratio of Value and Cost of Repair	Law	• TAX • Responsible unit
②	Re-USE	Re-collectors	• Re-sale : 2nd hand	• Specification • Time Cost • Economic incentive	Rational	• Product liability • Product design
③	Re-Bulit Re-Make	Manufactors	• Test • Replace • Beautify	• Time • Cost • Reliability		
④	Recycle	Recycle Plants	• Mechanical • Chemistry Materialization	• Economic incentives • Waste decontamination	situation	• Consumer perception

Collaboration of the Artery and Vein Industry – Difficulties

◎ 『Resource』? 『Waste』? Or 『Circular resource』?

◎ Drivers ?

- Proper Guidance
- Efficient Process
- Consistent Regulation
- Experimental Zone
- Education and Promotion

桃李不言
下自成蹊