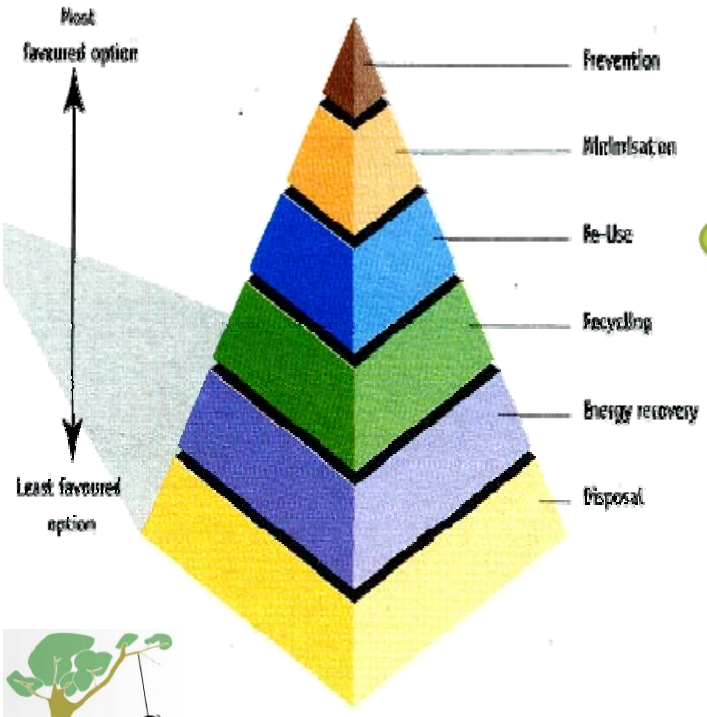
Gestión de los componentes después de la vida útil de los vehículos

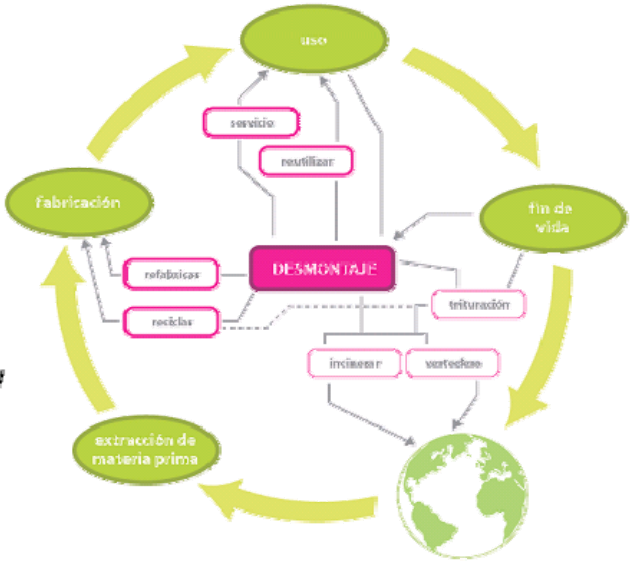
XI CONGRESO DE CALIDAD Y MEDIO AMBIENTE EN LA AUTOMOCIÓN
Bilbao, 22 y 23 de noviembre de 2006

SOSTENIBILIDAD

(Una sociedad orientada al reciclaje)

La jerarquía de la sostenibilidad





Policies and Legislations "to Create a Recycle-Oriented Society"

Europe

- **IPP** (Integrated Product Policy)

  IPP is an approach which seeks to reduce the life cycle environmental impacts of products throughout their life cycle.

  (Green paper, the European Commission, 2001)

- **EU Directives** **(specific waste recycling)**

  - ELV (2000/53/EC, end of life vehicles) 
  - WEEE (2002/96/EC, waste electrical and electronic equipment) 
  - RoHS (2002/95/EC, restriction of the use of certain hazardous substances in electrical and electronic equipment)

Preventive measures in Europe (1)

Limit the use of hazardous substances in vehicles

Design new vehicles taking into account dismantling, reuse and recycling

Develop market for recycled materials in vehicles

Phase-out of heavy metals

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Preventive measures in Europe (2)

Phase-out of heavy metals:

Applies to the use of lead, mercury, cadmium or hexavalent chromium

Applies to materials and components of vehicles put on the market after 1 July 2003 (not to the vehicles itself!)

List of exemptions, in case the use is unavoidable. On a regular basis according to technical and scientific progress

Objetivos

FECHA DE ENTRADA EN VIGOR	SUSTANCIAS REGULADAS	SISTEMAS DE RECOGIDA DE VFU	OBJETIVO DE REUTILIZACIÓN Y RECICLAJE	OBJETIVO DE VALORIZACIÓN
Julio 2002		Para todos los vehículos vendidos después de Julio de 2002		
Julio 2003	Plomo. Cadmio. Mercurio y Cromo IV prohibidos (excepciones a revisar)			
Enero 2006			70% para vehículos vendidos antes de Enero de 1980 80% para el resto de vehículos	75% para vehículos vendidos antes de Enero de 1980 85% para el resto de vehículos
Enero 2007		Para todos los vehículos (Después de Julio de 2007)		
Enero 2015			85%	95%

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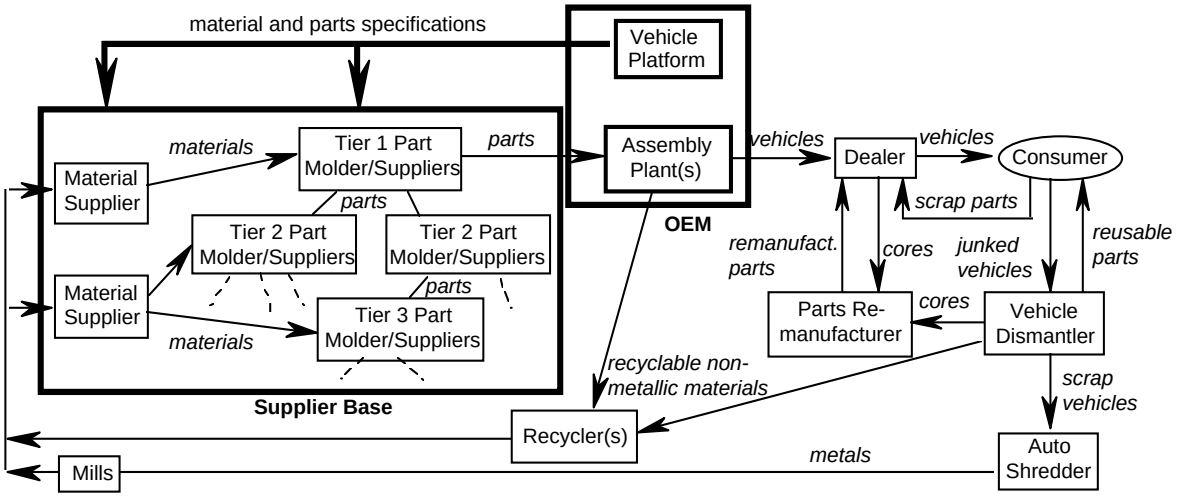
LIFE CYCLE

Automobile Life-Cycle



Many modern products like automobiles are assembled by OEMs (Original Equipment Manufacturers) from components manufactured by numerous suppliers, creating a complicated network of interactions.

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Sustancias Peligrosas – Reciclado – Reutilización – Logística

Diseño

SUSTANCIAS PELIGROSAS

Lead-Free Wheel Balancing

External Balancing

- Tin, Zinc, Steel (UK)
- Steel (Japan)
- Zinc or ZAMA alloy (Italy, Germany) - zinc, aluminum and copper alloy
- Thermoplastic Polypropylene, high specific gravity plastics (US)

Internal Balancing

- Glass, metal or polymer balancing beads (Canada/US)
- Primarily on heavy duty vehicles

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International Materials Data System (IMDS)

International Materials Data System (IMDS)

Material Management Software Solution

EDS' IMDS Material Management solution tracks chemical ingredients of parts and assemblies across the entire automotive OEM supply chain. The solution helps original equipment manufacturers (OEMs) comply with the increasing number of national and EU regulations related to material handling and disposal.

IMDS consists of a centralized, automated application and database that's accessible globally via a Web-based portal. The system captures data from suppliers and distributes it to an OEM in the form of standardized data sheets and interfaces.

Executive Overview

- Comply with national and EU material legislation (such as 91/155/EWG, UmweltHG, ISO 9001/4.7+4.8 and CHEMG)
- Reduce or eliminate penalties and their associated costs
- Cut costs by reducing data errors up to 15%
- Gain back productive time – 300 or more hours per month

EDS built IMDS for Opel, Volvo, Porsche, Volkswagen, Ford, BMW and Chrysler, and has been supporting its use across the global automotive industry since 2000. In late 2003, IMDS had approximately 50,000 users and was adding about 1,500 users each month.

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Diseño

ELV - RECICLADO

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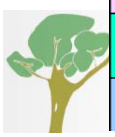
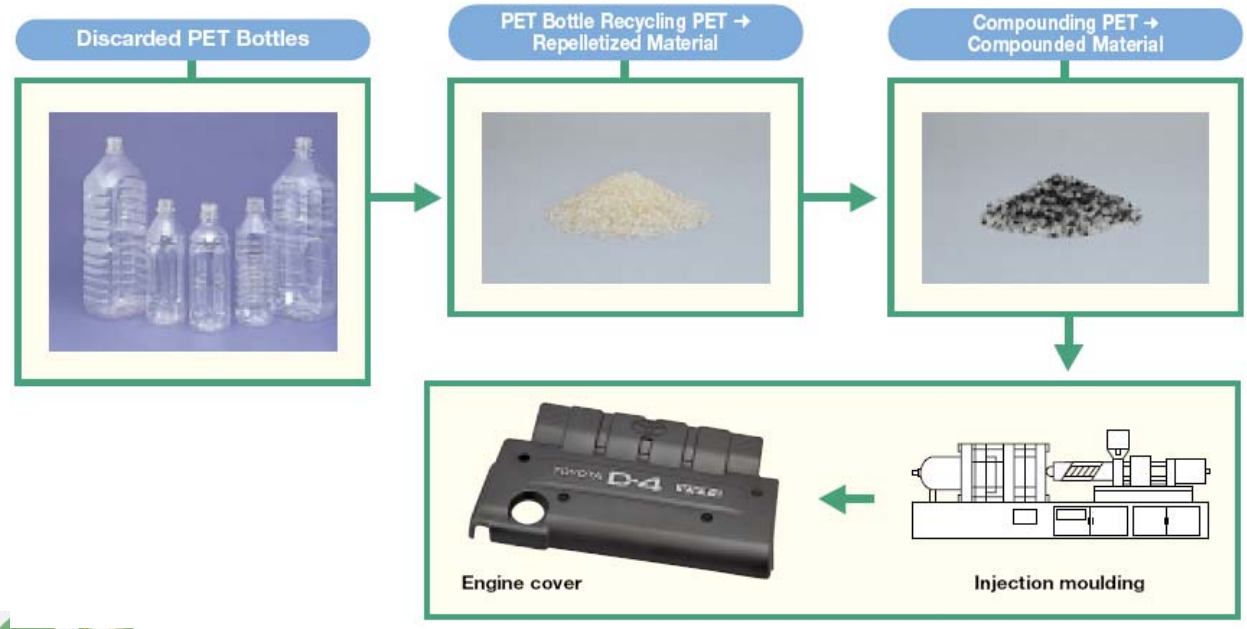
ELV – Plastics

Type of Plastic	%	Properties	Applications for Recycled Grades
PP (Polypropylene)	39.2	Hard, flexible, translucent or transparent. Wide property range for many applications, good chemical resistance	Crates, boxes, plant pots, compost bins, automotive parts, building materials, etc.
ABS (Acrylonitrile-Butadiene-Styrene)	18.8	Rigid, impact, chemical and heat resistant, tough, glossy, good dimensional stability, easily paintable	Furniture, frames, other specialty moulded products
PU (Polyurethane)	12.6	Abrasion and corrosion resistant, very durable, high tensile and tear strength, oil and solvent resistant, broad range of hardnesses	Carpet underlay, rebond inserts, mattresses, cushions
PVC (Polyvinyl Chloride)	11.4	Hard, rigid or flexible, good chemical & impact resistance, can be solvent welded, printable, inexpensive	Pipes & hoses, carpet undercoating, floor coverings, shoe soles, electrical conduit
PA (Polyamides/Nylon)	5.8	Tough, abrasion & chemical resistant, good fatigue endurance, high strength and rigidity, low friction	Carpets, floor coverings, automotive parts, sod reinforcements, soundproofing
HDPE (High Density Polyethylene)	3.4	Low weight, good chemical resistance, excellent electrical insulator, tough, transparent to opaque, non-toxic, odourless, prone to deform	Shopping & garbage bags, agricultural pipe, bins, crates & pallets
ASA (Acrylonitrile Styrene Acrylate)	1.6	Thermal stability, good chemical resistance and excellent weathering, ageing and yellowing resistance	Unknown
POM or Acetal (Polyoxymethylene or Polyformaldehyde)	1	Good abrasion, fatigue & chemical resistance, high strength and rigidity, low friction, good electrical properties	Unknown
SAN (Styreneacrylonitrile)	1	Hard, rigid, transparent, good heat and chemical resistance, easy to process	Specialty moulded products
TPE (Thermoplastic Elastomer)	0.9	Similar to natural or synthetic rubber, yet moulds like a plastic, light weight, good resistance to compression set	Unknown
PMMA (Polymethylmethacrylate Or Acrylic)	0.6	Excellent weathering resistance, notch sensitive, combustible, poor flow, excellent clarity	Fibers for blankets, clothing, etc.
PC (Polycarbonate)		Tough, transparent, excellent impact strength, good electrical properties, poor chemical resistance, dimensionally stable	Building materials, Heating and Air conditioning parts



PET made Engine Cover (TOYOTA)

Example of manufacturing of engine covers from recycled PET bottles, in Japan



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Development of Easy to Recycle Materials (NISSAN)

The Case of The Serena

To avoid recycling difficulties when, for example thermoplastics and thermosetting plastics are mixed after use, we have developed markers to clearly identify the materials used.

Sustancias Peligrosas – Reciclado – ***Reutilización*** – Logística

Diseño

ELV - REUTILIZACION

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TOYOTA Remanufactured Parts

The following parts, tested and approved in accordance with Toyota standards, are available:

- remanufactured starter
- remanufactured alternator
- remanufactured clutch kit
- remanufactured automatic transmission
- remanufactured air conditioning compressors
- remanufactured power steering racks

NISSAN - Use of Reusable Parts (Japan)

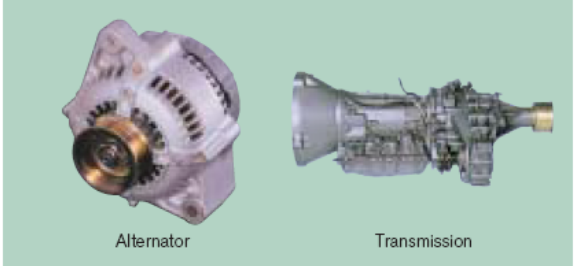
GREEN PARTS

Reusable parts are removed from ELVs, cleaned, checked to ensure their quality, and then resold as used parts. These activities are carried out according to specified quality standards and a standard work procedures manual.

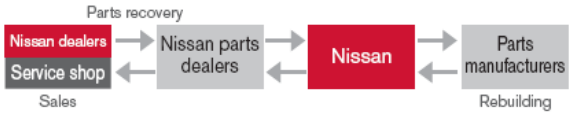
Flow of operations for reusable parts

GREEN PARTS

Parts recovered from ELVs or parts replaced during repairs are disassembled, and any worn or deteriorated structural components are replaced with new ones. The parts are then re-assembled, checked to ensure their quality, and sold as rebuilt parts with their functional performance restored to that of the original items.



Flow of operations for rebuilt parts



Asociación Europea de Fabricantes de Componentes (CLEPA)

Lista de piezas y componentes que no deberían reutilizarse:

Componentes del motor y tren de transmisión	Unidades electrónicas de control
	Módulo para el suministro de combustible
	Inyectores de combustible
	Sensor de oxígeno
	Válvula EGR
	Medidores de la corriente de aire
	Evaporadores
	Intercambiadores de calor
Componentes del interior del vehículo	Airbag's / Unidades Electrónicas de control de Airbag's
	Componentes de cinturones de seguridad, incluidos:
	pretensores, hebillas, retractores, ajustadores de altura y
	dispositivo pirotécnico
	Fijaciones de bastidores de asientos a la carrocería y
	mecanismos de ajuste
	Volantes de dirección

Componentes del chásis / suspensión	Discos de freno / tambores de freno
	Zapatas de freno y forros
	Piezas de freno hidráulicos (cilindros, galgas, válvulas)
	Piezas de frenos mecánicos (zapatas, cables, muelles,
	palancas)
	Servo frenos o frenos asistidos
	Piezas de frenos electrónicas
	Sistemas de dirección
	Cubos de ruedas / montantes y rodamientos
	correspondientes
	Piezas de suspensión (brazos de dirección, varilla de
	horquilla, bastidor, piezas electrónicas)
	Amortiguadores
	Ejes
	Convertidores catalíticos
	Silenciadores
Componentes exteriores del automóvil	Faros

Sustancias Peligrosas – Reciclado – Reutilización – ***Logística***

Diseño

Return Logistics

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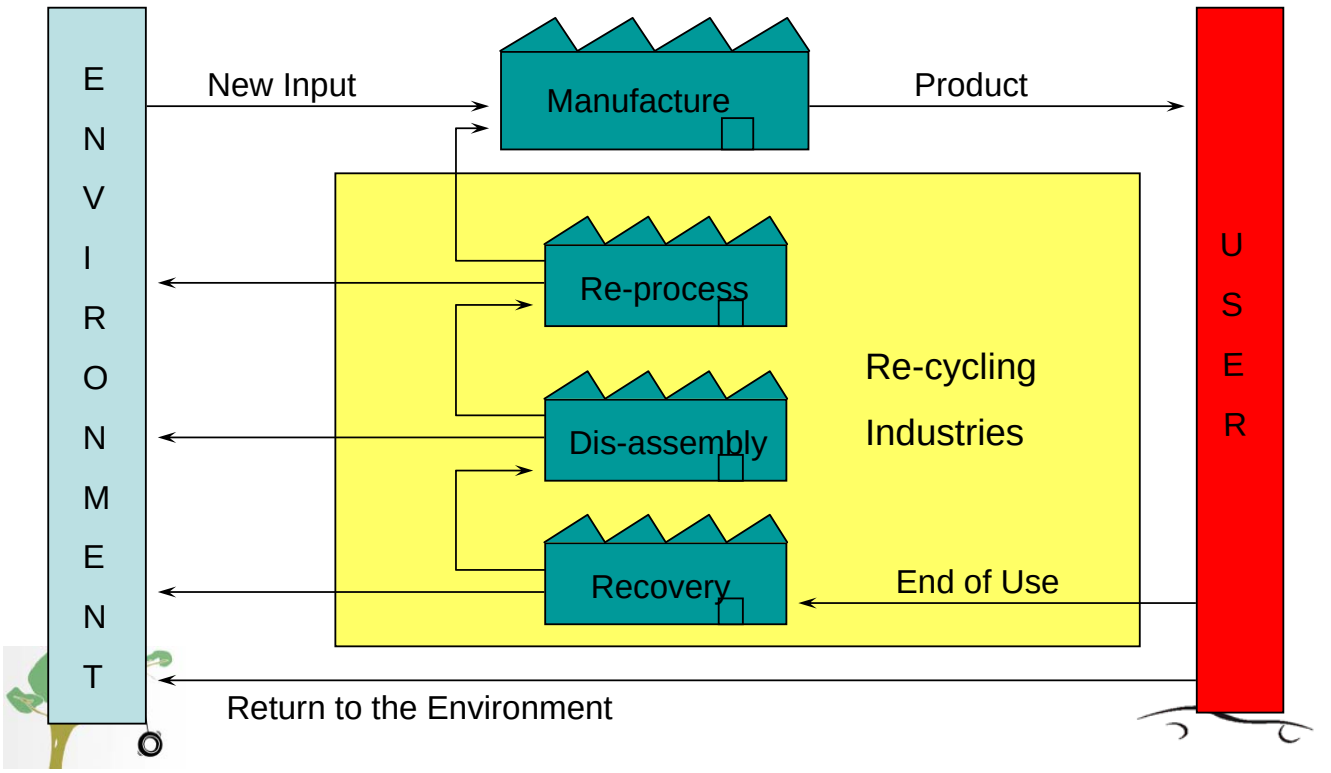
Environmental Burden – moving towards closed system supply loops



Sustancias Peligrosas – Reciclado – Reutilización – Logística

Diseño

Design for Environment

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Products Design

Raw Materials Design
Design for resource conservation
Design for low impact materials

Distribution Design
Design for efficient distribution

Manufacturing Design
Design for Cleaner Production

Product

End of Life Design
Design for re-use
Design for re-manufacture
Design for disassembly
Design for recycling
Design for safe disposal

Usage Design
Design for energy efficiency
Design for water conservation
Design for minimal consumption
Design for low-impact use
Design for service and repair
Design for durability

COSTES Y DISEÑO

Recovery of a dashboard:

Removal of dashboard from car = 35 min.

Removal of dash components = 35 min.

At $20/hour, labor cost - $23

In order to break even with material recycling, more than 10 kg of copper (most valuable scrap material in table) would have to be recovered

Or, dash components (gauges, etc) would have to be sold for re-use. Big questions:

What is the market willing to pay for recovered dashboard components?

How much value would remanufacture add to recovered components?

Re-Design of dash is desirable ! (Any suggestions how ?)

Material	Mass [kg]	[%]	Virgin price [$ / kg]	Scrap pric [$ / kg]
Steel / Iron	1004	72.38		0.12
Aluminum	71	5.12		1.32
Zinc	9	0.65		1.07
Copper	23	1.66		2.20
Lead	10	0.72		0.25
Polyurethane foam	12	0.87	2.20	0.00
Polypropylene	15	1.08	1.10	0.11
Poly Vinyl Chloride	11	0.79	1.00	0.22
ABS	13	0.94	2.50	0.73
Nylon	10	0.72	3.00	0.00
Polycarbonate	9	0.65	3.30	0.66
Polyurethane	10	0.72	3.50	0.00
Polyethylene	5	0.36	0.90	0.40
Polyester	20	1.44	3.30	0.00
Rubber	61	4.40	2.45	0.05
Other polymers	5	0.36	2.30	0.06
Gasoline	15	1.08		0.30
Oil	5	0.36		0.05
Antifreeze	5	0.36		0.06
Other hazardous fluids	5	0.36		0.00
Glass	39	2.81		0.00
Plastic Reinforced Fibers	5	0.36		0.00
Plastic Composite Fillers	5	0.36		0.00
Miscellaneous	28	2.02		0.00
Total weight of car	1395	100		

Typical 1990 vehicle material mix

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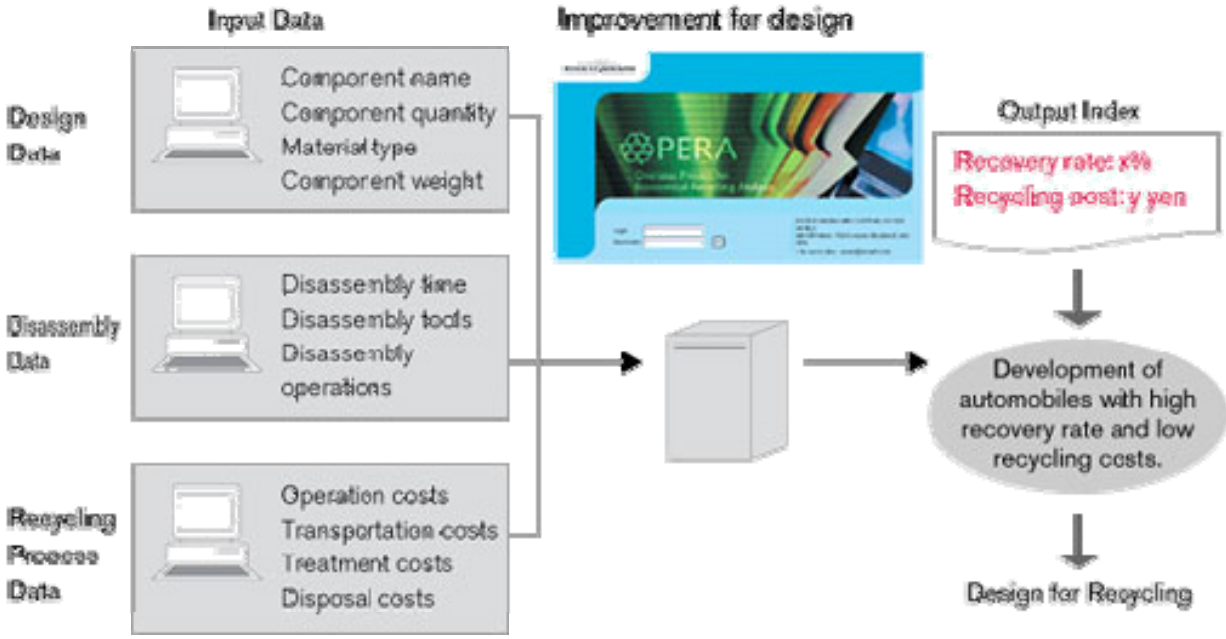
COSTES Y DISEÑO: Car Bumpers (D. Thurston in1993)

- Is the $value the best attribute?
  What is the “Assembly Time” here?
- Different requirements in different countries
- What are the future requirements?
- Do we really know the long-term effects?
- What are the long-term responsibilities of industries?

Development of Recycling Simulation System (NISSAN)



OPERA stands for Outil de Pilotage Economique du Recyclage Automobile, which means the overseas project for the recycling cost calculation system.

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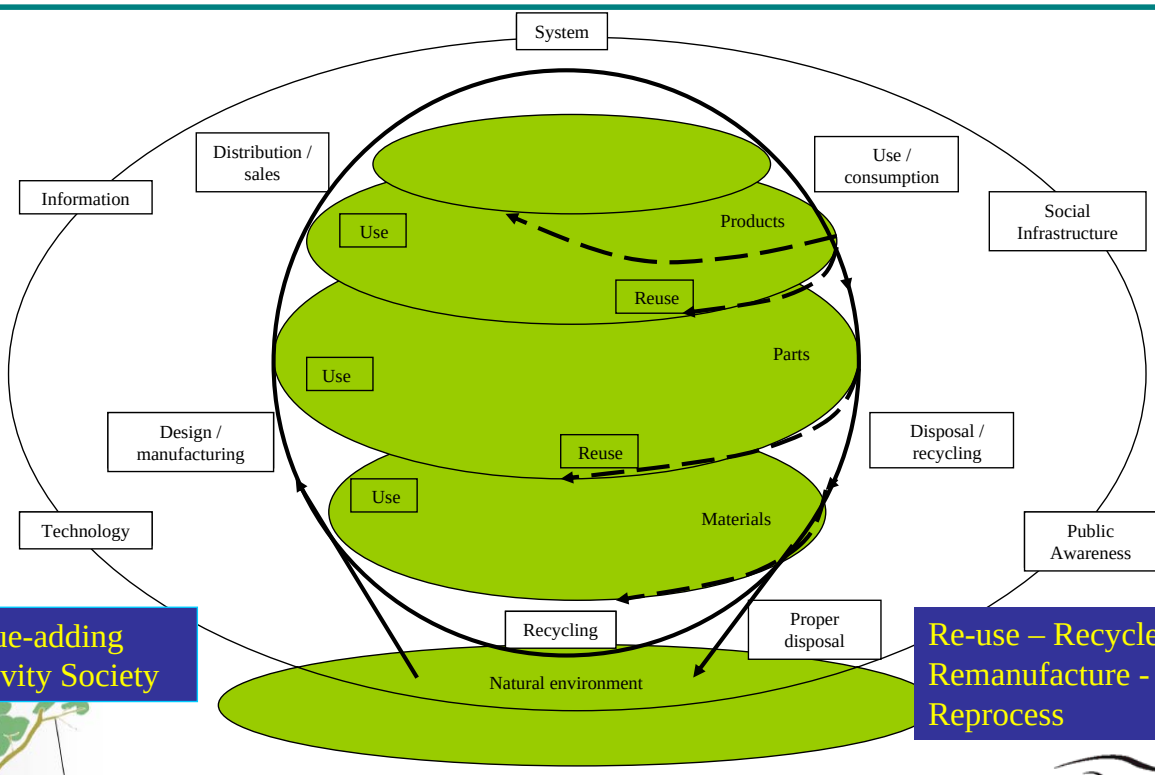
CONCLUSIONES

Life Cycle Approach



Value-adding Activity Society

Re-use – Recycle – Remanufacture - Reprocess

Source: Kitakyuchu Ecotown, 2001

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Start with design

80% of the basic manufacturing costs of a product are determined by its design

Similarly, 80% (say) of the recovery costs at end of life and the potential recovery value are also determined at the design stage.

Planning for end of life recovery must become integral to the design process of all products and not left to ad hoc provisions.

Improve the productivity of non renewable resources...

The multiple use of materials, through remanufacture and recycling, leads to dramatic increases in the "productivity" of non-renewable resources.

Creating a market for recycled and remanufactured products results in the development of improved sustainability in design, development of improved disassembly technologies, design for refurbishment, development of new materials which can be recycled without degradation in performance, etc.

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The challenge...

The greater challenge is how to promote much higher levels of

component remanufacture and reuse.

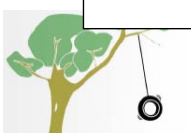
The useful life of many components exceeds that of the parent product.

Advantages over recycling:

costs

eco-efficiency (less energy/pollution)

but only if the logistics are well managed.



The concept of Material Banks

Non-renewable materials must be regarded as an enduring asset, drawn from the “material bank” for use in a product, and returned to the bank when no longer required to be reused time and again.

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Important issues in return logistics

Who collects the product, reclaims and distributes the salvaged materials and components – manufacturers or third party providers

Number and location of take back centres

Incentives/directives for product returns

Control of secondary product markets

Value of remanufacturing to spares

Given the increasing trend to greater product variety and shorter life cycles, remanufacturing may prove to be the most economic way of fulfilling a company's spares policy.

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Exploitation of secondary markets

Cost effective reconditioning/remanufacturing of products can lead to effective exploitation of secondary markets, usually under alternative branding.

Condition monitoring

The reducing cost of IT makes it feasible to build sensors and memory chips into products to record details of a products use over its lifetime.

Bosch have built sensors into the motors of their power tools to assess the condition, and hence the feasibility of remanufacture.

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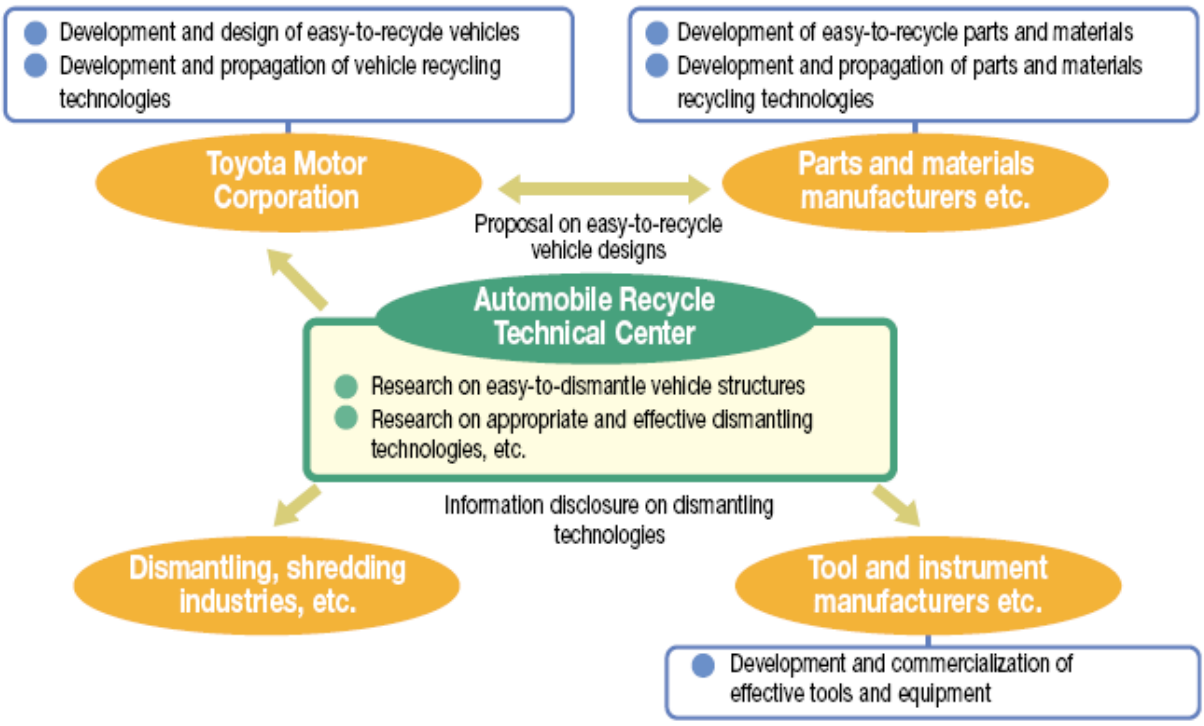
We need research

TOYOTA Automobile Recycle Technical Center



UN PRESENTE

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UNA RESPONSABILIDAD

UN FUTURO

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¿UNA ELECCION?