



Axiom **polymers**™  
Materials for a sustainable future

1. Intro to Axion
2. Shape of Automotive Economy
3. Future vision

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**Marketing Director**  
sep 2015

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## What Axion Polymers does:-

- Fully Integrated Materials Resource Recycling
  - End-of-Life Vehicles & WEEE
- ELV Collection – CarTakeBack
- De-pollution – ATFs
- Metals Recycling – S Norton
- ASR sorting process – SWAPP plant
- Plastics refinery – Salford plant

**“We ‘Close-the-Loop’ for  
automotive & electronic plastic”**



# 'Above Ground' Mined Materials



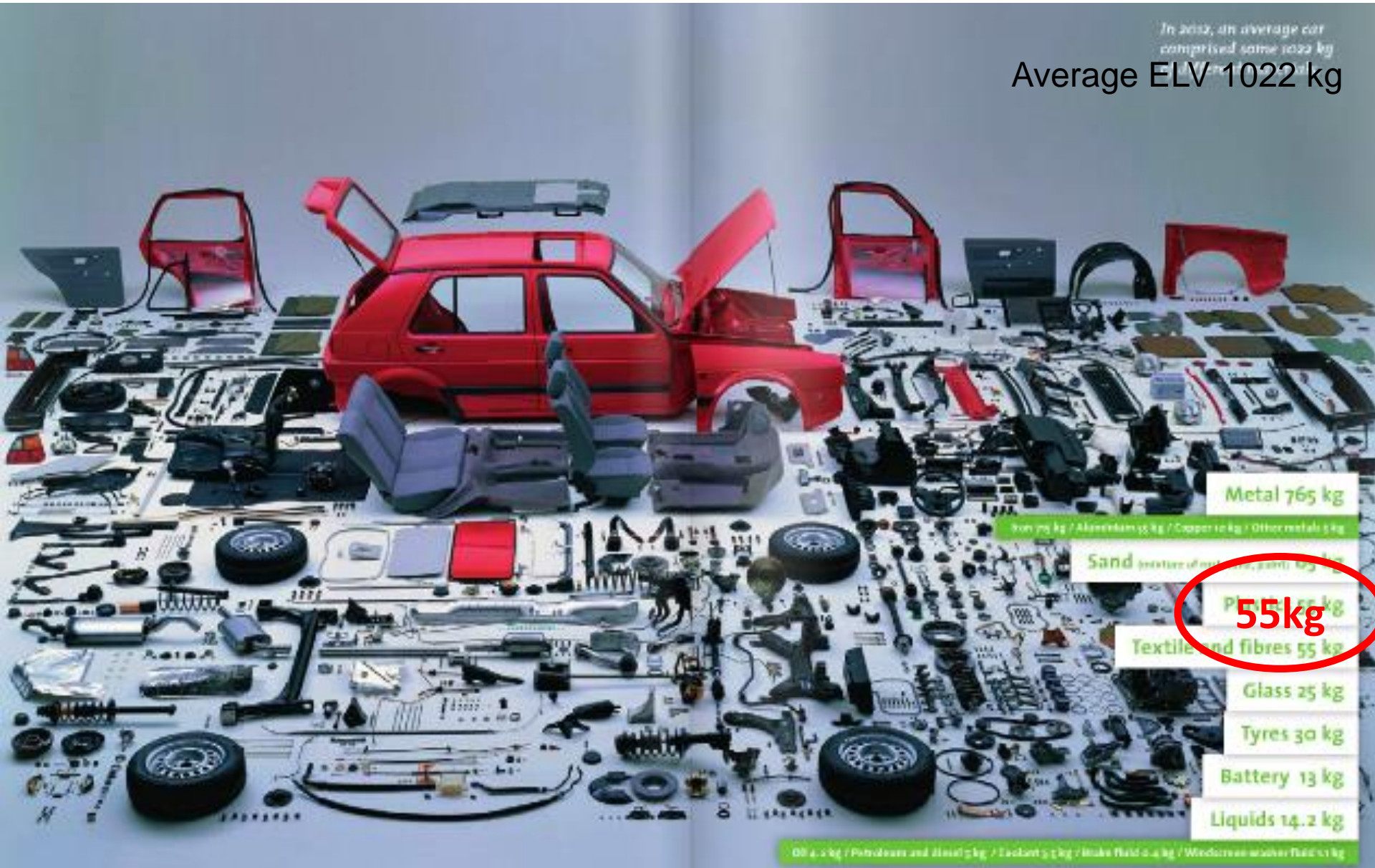
UK - 30 million cars



# Complex Feedstock

In 2022, an average car comprised some 1022 kg

Average ELV 1022 kg



Metal 765 kg

Iron 725 kg / Aluminium 35 kg / Copper 10 kg / Other metals 5 kg

Sand (mostly of mineral origin) 45 kg

Plastic 55 kg

55kg

Textile and fibres 55 kg

Glass 25 kg

Tyres 30 kg

Battery 13 kg

Liquids 14.2 kg

Oil 4.5 kg / Petroleum and diesel 5 kg / Fuel tank 5 kg / Brake fluid 0.4 kg / Windscreen washer fluid 1 kg

# Modern Materials Mix



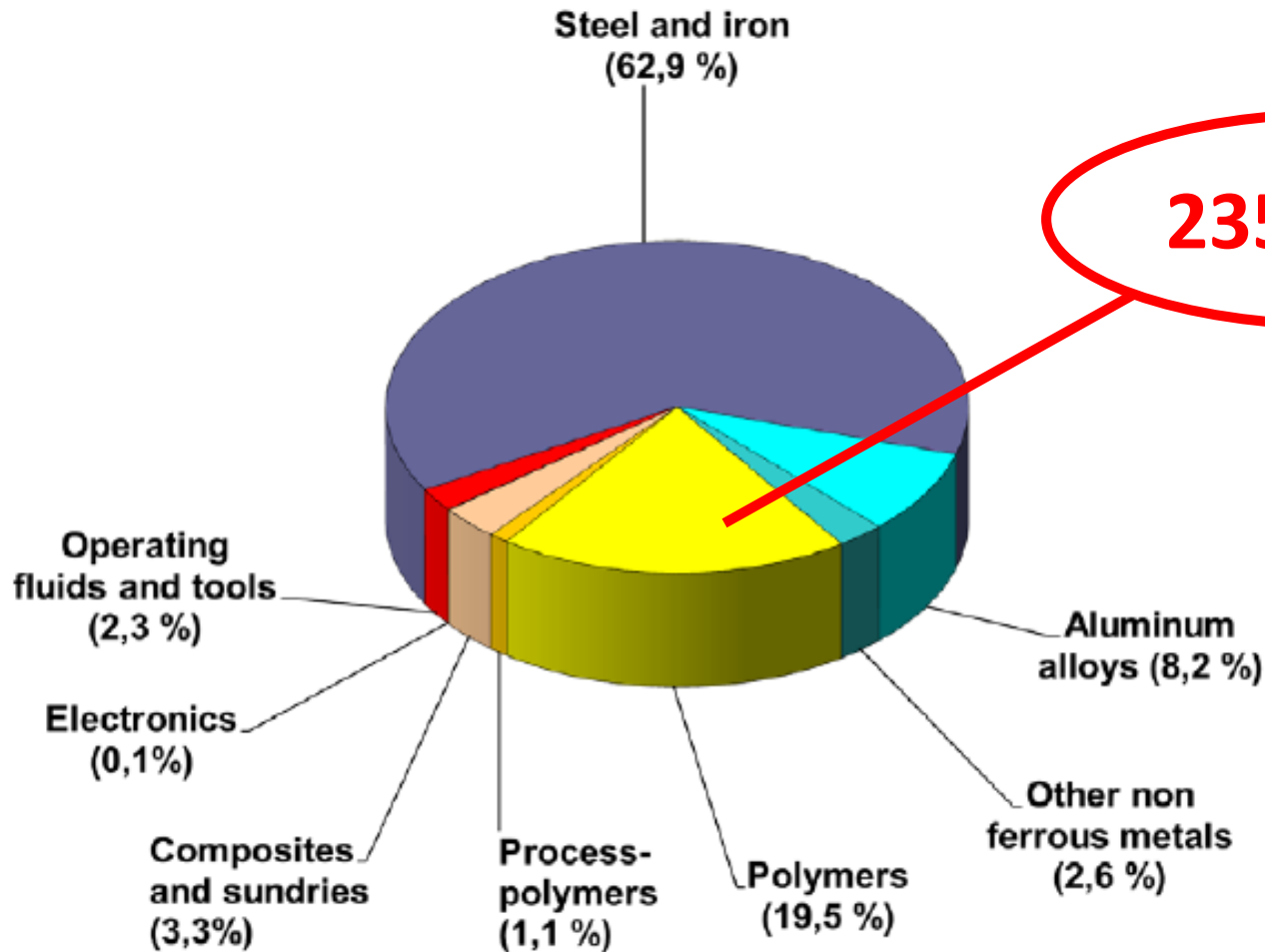
Vehicles are made from increasingly higher-value materials and contain numerous additional components:

- airbag,
- Catalytic converter,
- air conditioning
- electronic steering
- Infotainment
- etc.



# VW Golf VII - 2014

$\frac{3}{4}$  of the material share of the Golf is metal.



**235 kilos !**

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## End of Life Journey for Cars

- Collection – Take-back schemes
- De-pollution + parts recovery – ATF's
- Shredding for Metals Recycling
- Post Shredder Treatment – PST
  - Plastic
  - Aggregates
  - SRF – Solid Recovered Fuel
- Plastics Refinery + Compounding



# De-Pollution ATF





A large pile of crushed and shredded cars at a recycling facility. The cars are in various colors, including blue, red, and silver, and are completely mangled. The background shows a cloudy sky. A blue banner with yellow text is overlaid on the image.

2 million ELV's/yr.

Shredder Infeed - Raw Material Resource



# Primary Processing





# ASR – Light Fluff



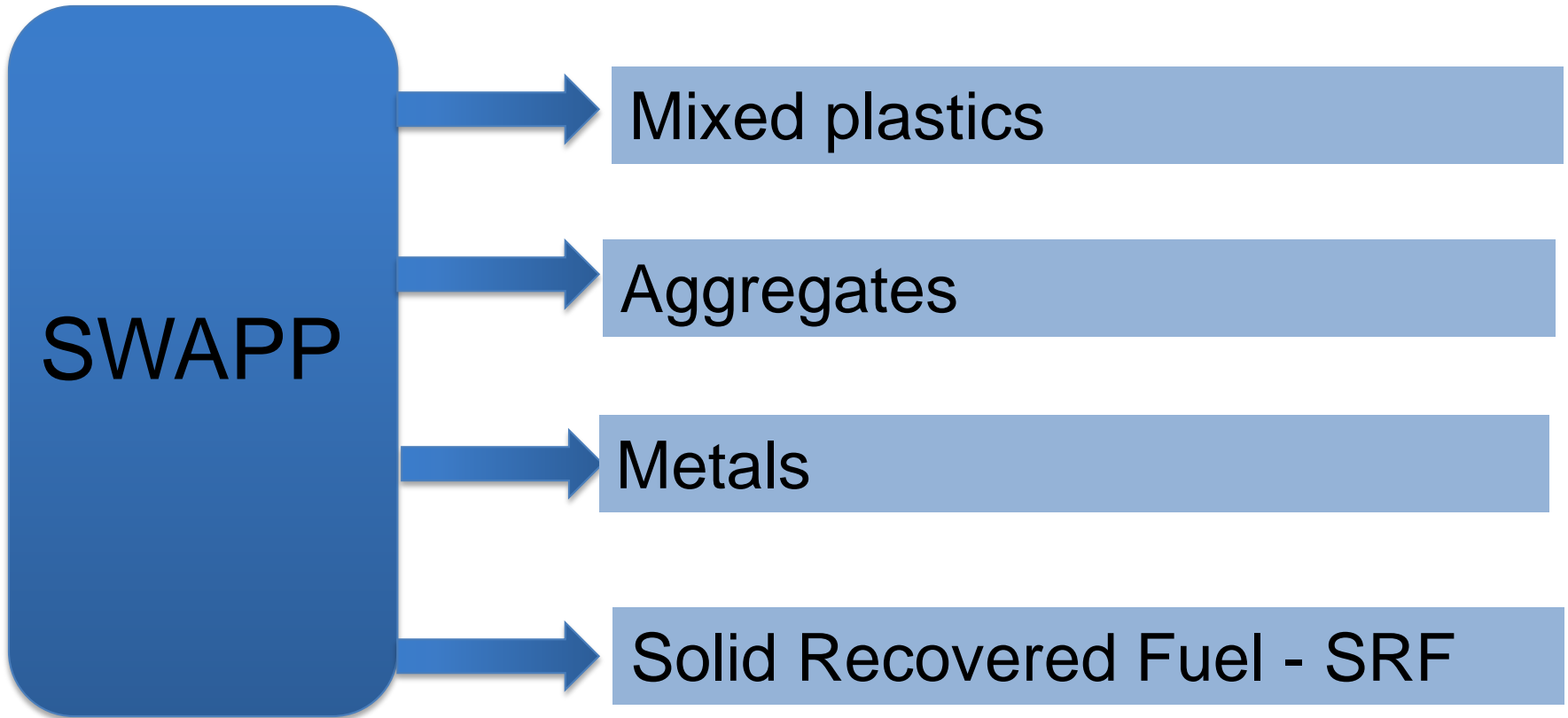
750 KTpa





# Axion Polymers SWAPP

# PST Outputs





Axionrecycling

DATE: 23/2/11

~400 KPa

10cm 20cm

Automotive Plastic  
Concentrate from SWAPP1



# SWAPP2 – New Plant





# Clean Mixed Plastic Chip



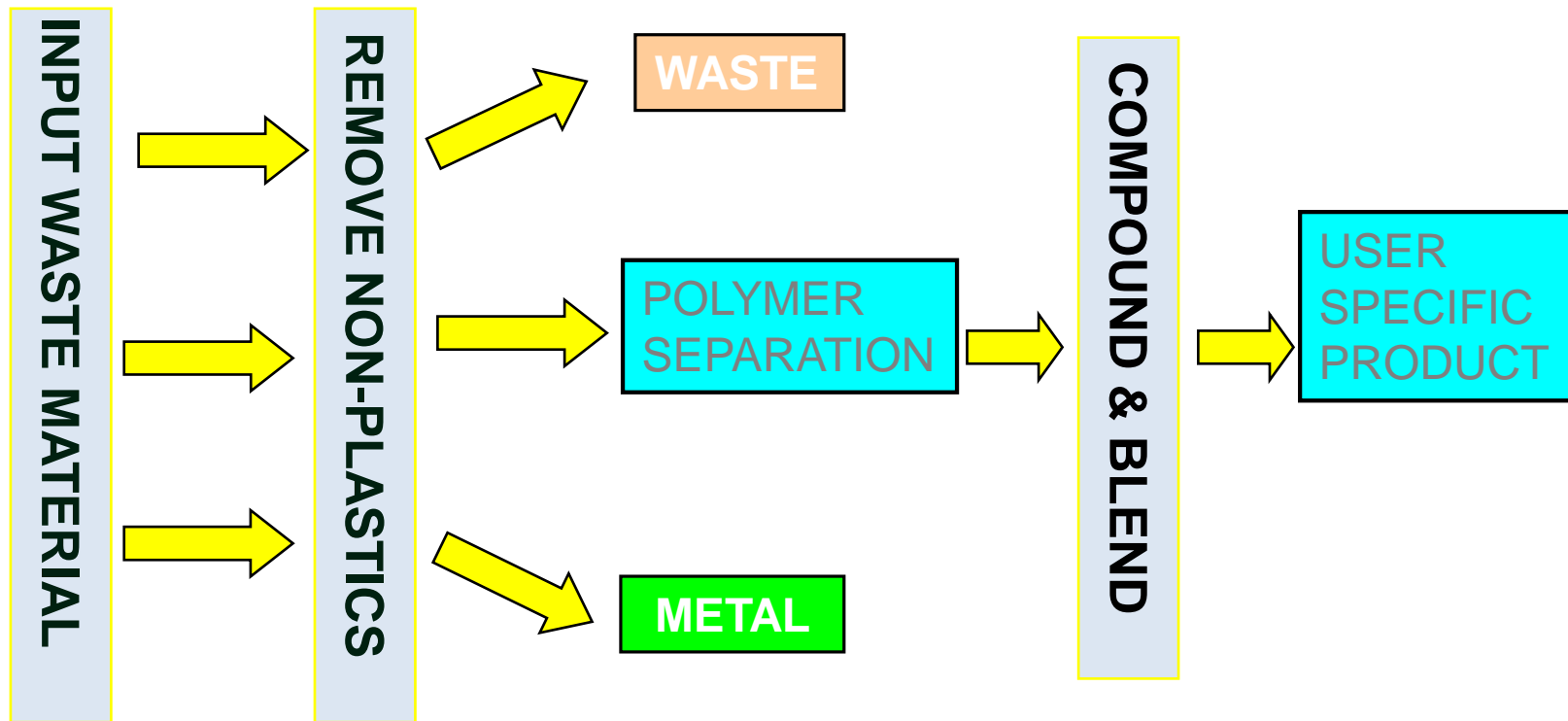


# Axion Polymers Salford



Advanced polymer recycling

# Axion Polymers Salford process



**20+ separation steps in full process**

# Output Product

- **Axpoly®**
- Polystyrene, polypropylene, ABS resin compounds,
- for injection moulding & extrusion





# Axpoly r-PP



Doc ref. MS05 r-PP5\* 1000. Issue ref. 3

## Product Information Sheet



# AXPOLY®

r-PP51 1000 Black copolymer polypropylene resin grade

### Description:

Axpoly® r-PP5\* 1000 polypropylene is a high performance polymer made from recycled automotive materials. The polymer has tightly controlled physical properties to meet the specific needs of end user applications such as moulded parts for motor vehicles.

### Environment:

Produced from 100% post industrial raw materials, this product fits closely with our other Axpoly® recycled resin grades and offers the same set of user benefits, including:

- Drop-in replacement for virgin resin

# Quality Tested

- BS 9001 – ISO materials testing
- REACH & RoHS compliant
- Consistent / Confident / Regular





# Auto Headlamp moulding – filled PP



# UK Retail Product Range







Auto air vent moulding – Axpoly PP51

# So... a Question....

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flat

healthy

**‘What shape is the plastics recycling industry in for End-of-Life Vehicle sector?’**

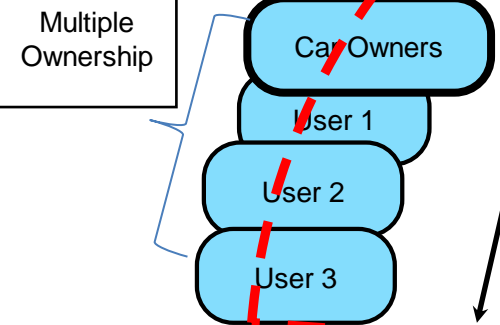
vibrant

struggling



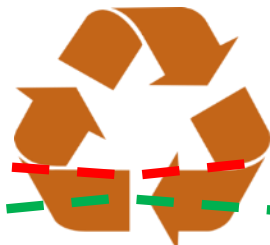
# Automotive Circular Economy

Multiple Ownership

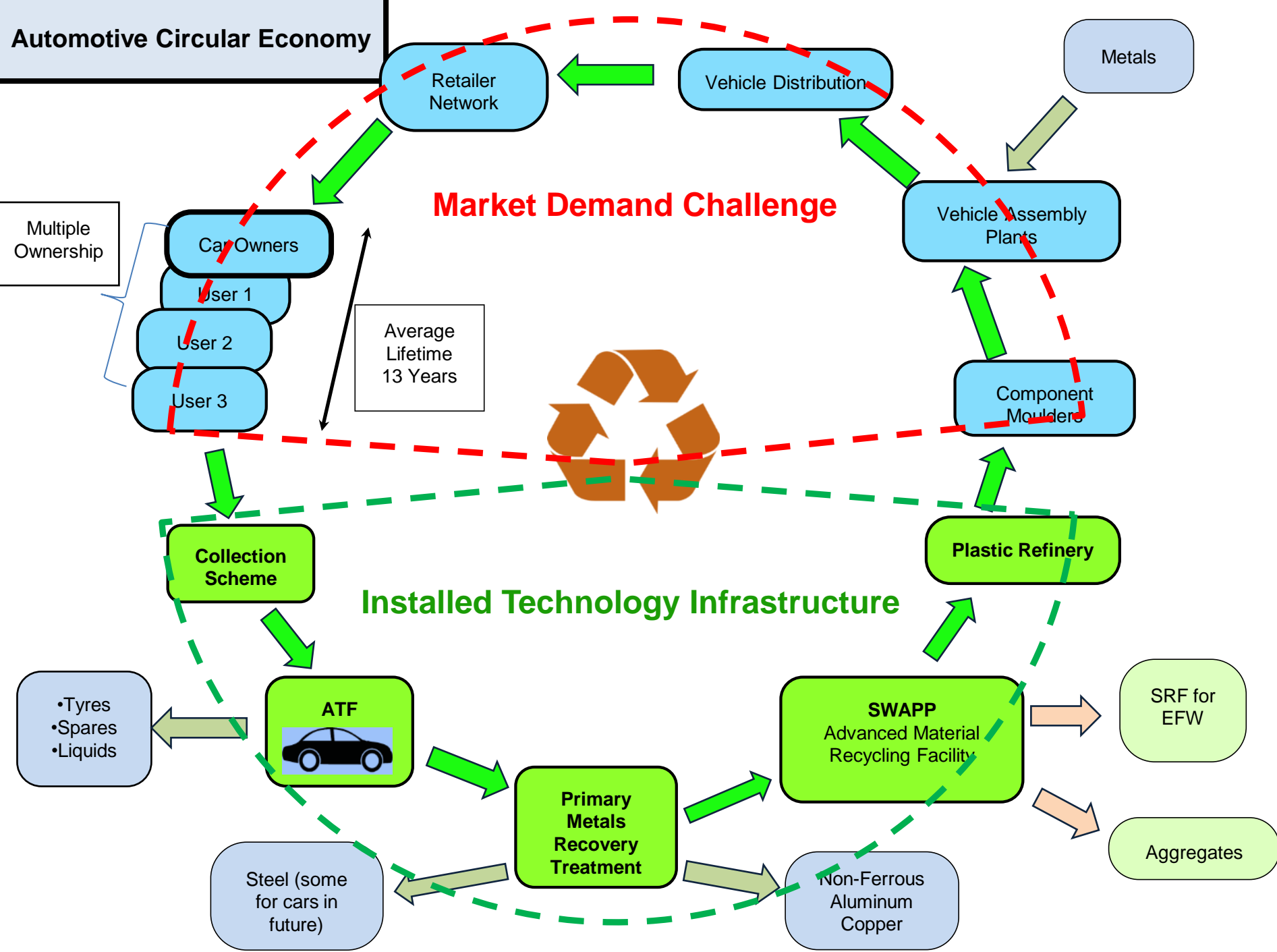


Average Lifetime  
13 Years

## Market Demand Challenge



## Installed Technology Infrastructure



## Existing Laws:-

- Landfill Tax increases – GBP £80 / tonne
- **Producer Responsibility** – ‘Polluter Pays’
- **ELV** – 95% Jan 2015 targets (10% recovery)
- Vehicle Recyclability 2003 – must be 95%
- ECO design guidelines
- European Waste Hierarchy:-
  - Reduce / Re-use / Recycle / Recover



# Product Lifecycle Dynamics

Product Type	Working Lifetime	EoL Fiscal Responsibility
Plastic Packaging	6 days - 6 months	Supply Chain Share
WEEE	6 mths – 16 yrs	Branded OEM's
ELV	13 years average	<del>Why?</del>

“Why Bother?”



# Compare 2 Bumpers....







## Which Bumper is ‘best’?

- Simple design,
- Mono-material,
- Unpainted finish,
- Releasable fixings
- OR a ‘*monstrous hybrid*’

**.....ask the Recycler!**



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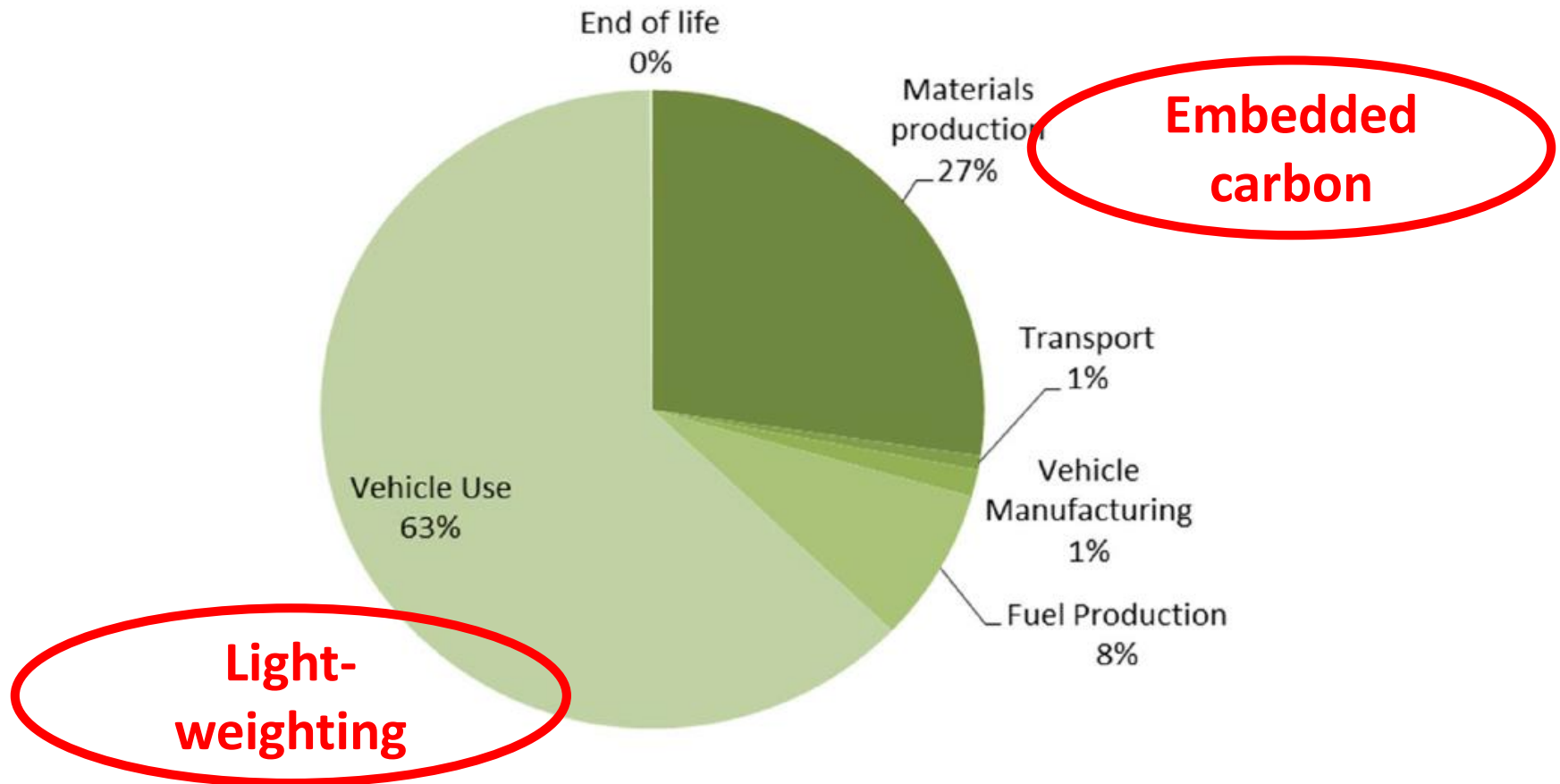
# The 3E's of Vehicle Design

**Sustainable Product design must be:-**

- Economic,
- Environmental and..
- Enable...

**a long-term, circular flow of materials.**

## JLR – Range Rover Global Warming Potential



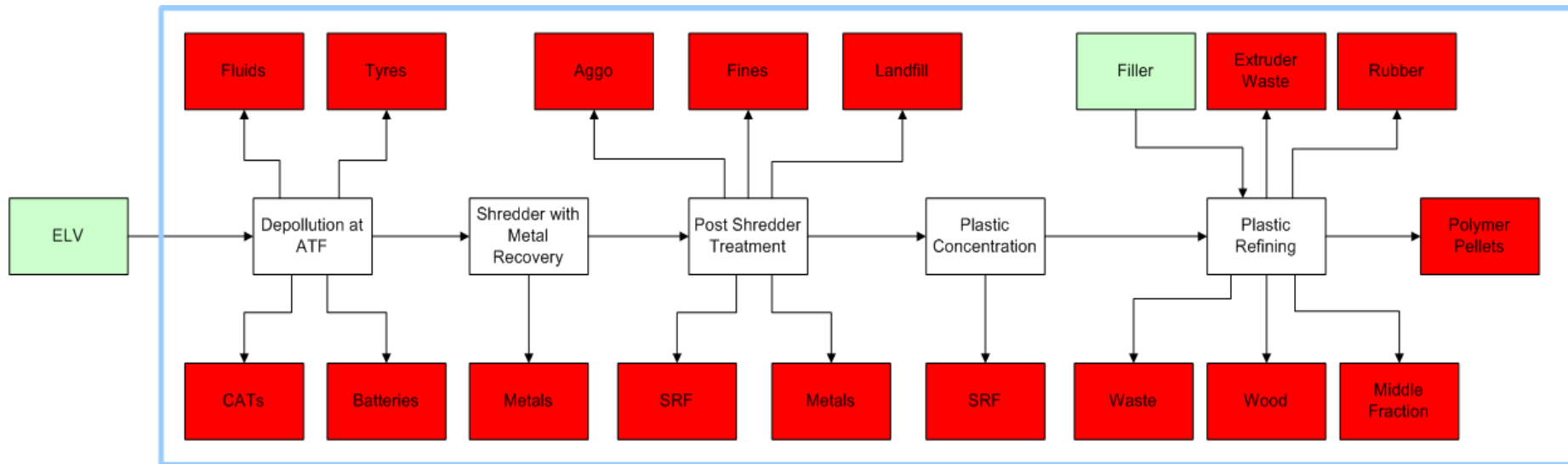


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## Vehicle Manufacturers

- Sustainable Sourcing as part of Corporate 'Plan'
- Materials supply - risk reduction
- Low Carbon Impact: 30-50% of virgin
- Enhance consumer product appeal
- Cost Savings – (often 10-20% lower)
- Insulated from Oil Price volatility

# Carbon Footprint – Recycling Process



ATF

Shredder

PST

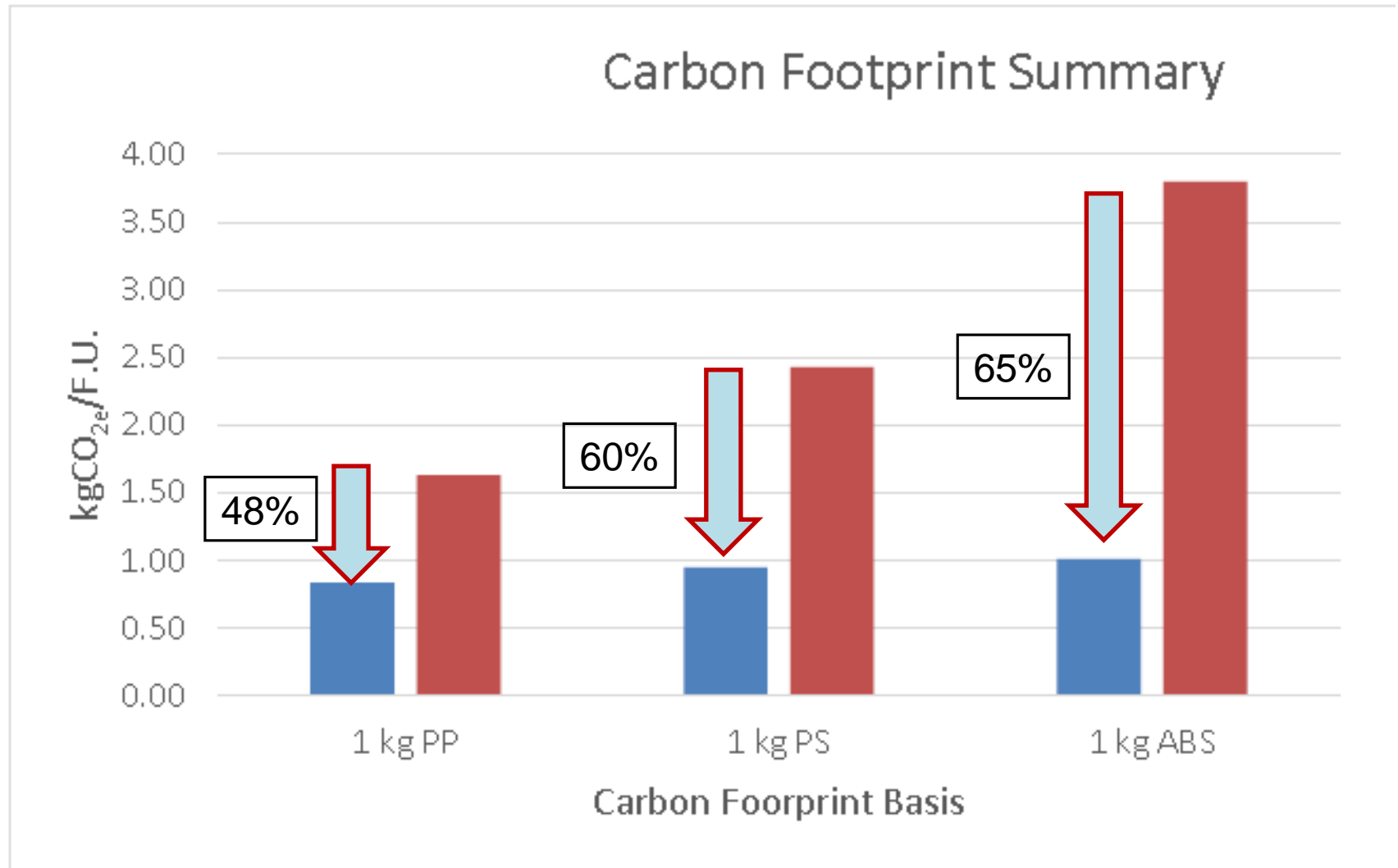
Plastic Sep'n.

Compound



# Lower Carbon Impact

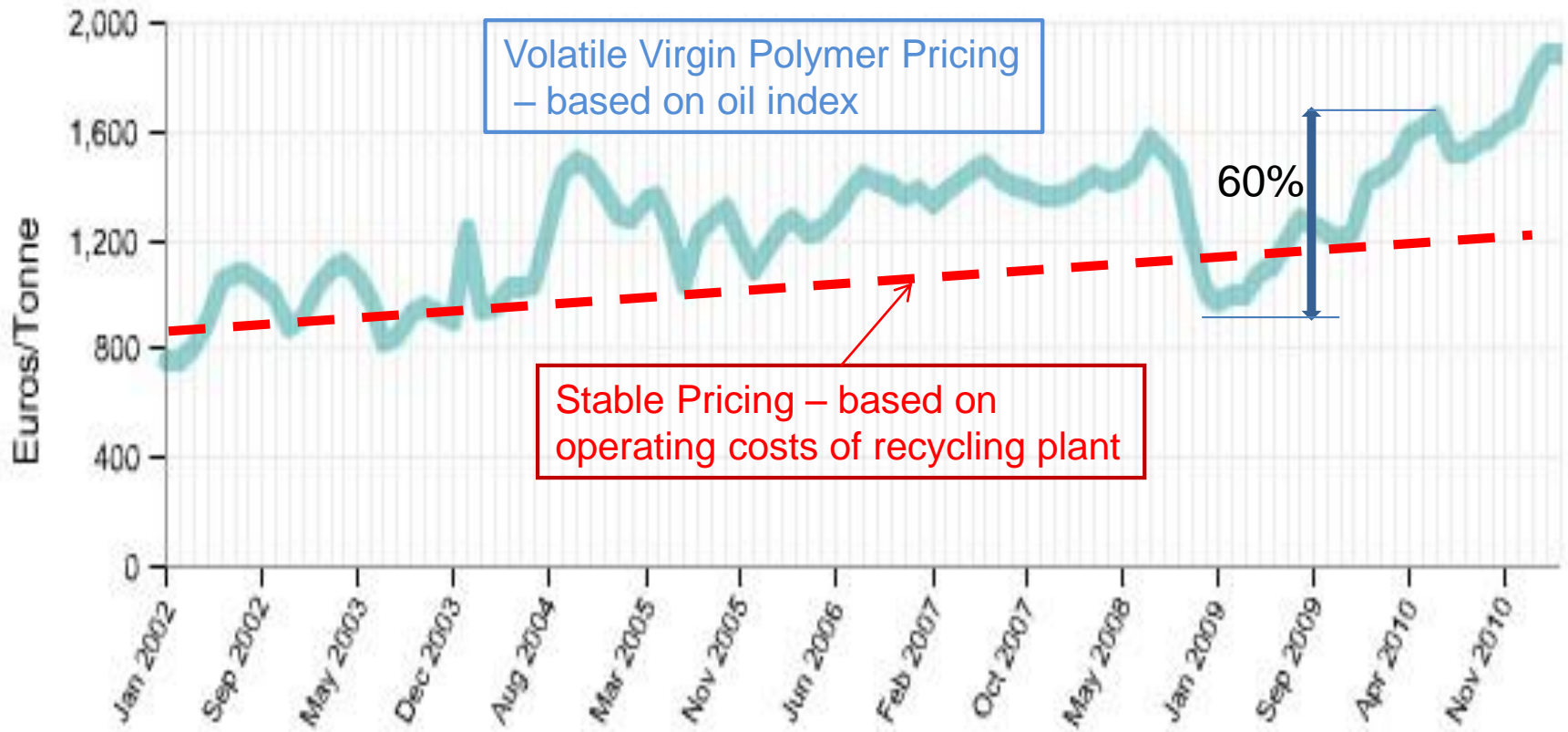
Figure 5 LCA study results



# Price Volatility

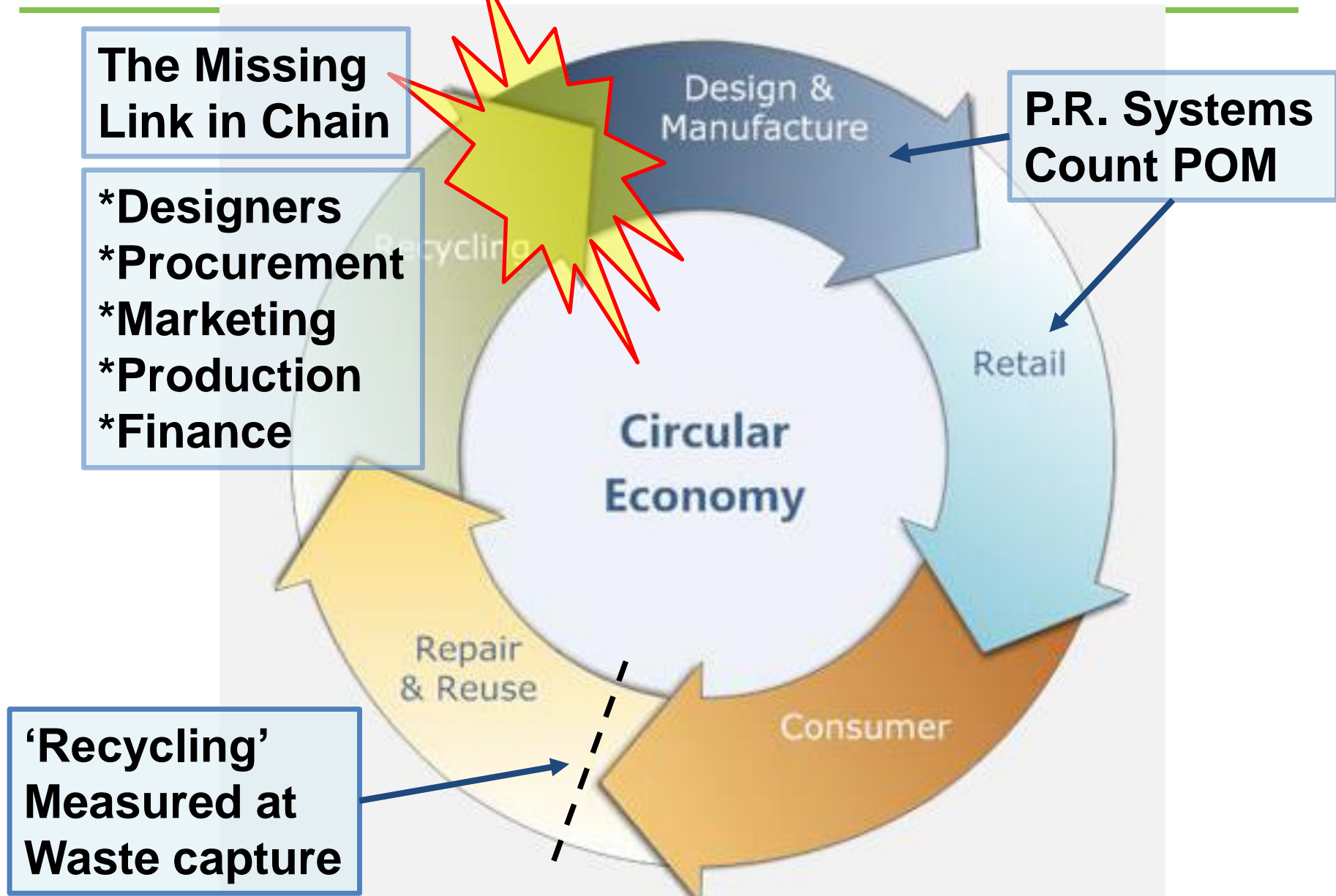
## Historical Resin Prices

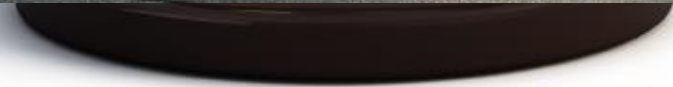
Resin: PS: PS General Purpose





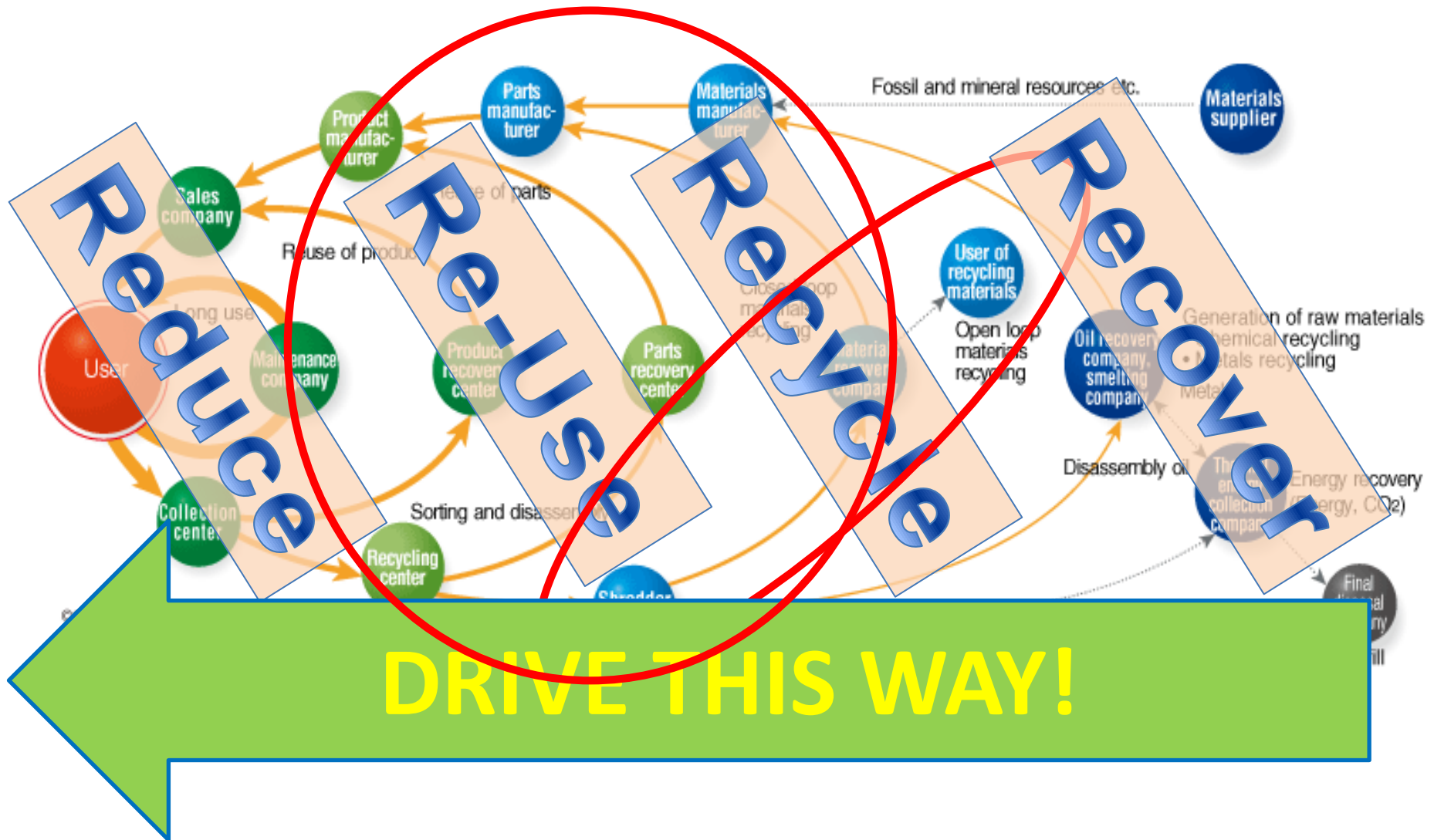
# Circular Materials Economy







# RICOH Printers – Comet Circle

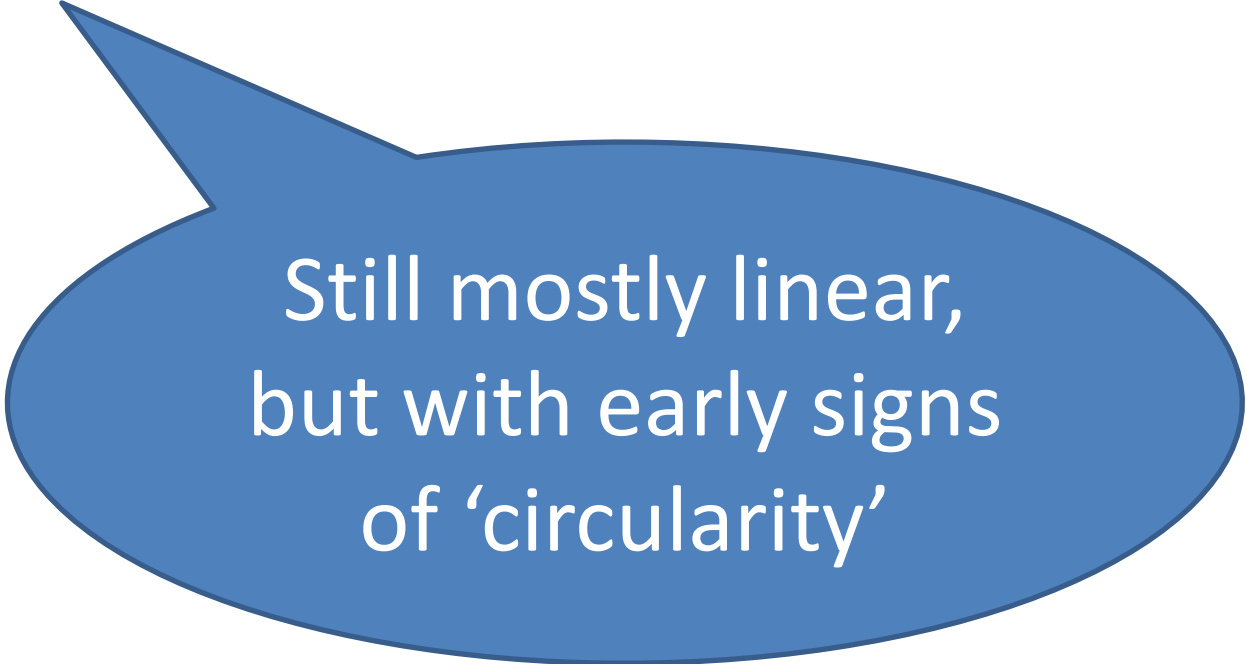


- Intelligence-based closed-loops
- Producers 'lifetime-linked' to products
- Monitor to optimise replacement time
- End-of-Life Collection:—
  - ordered / tracked / controlled
  - streamed by brand / design / model
- Knowledge based sorting
  - remanufacture or recycle
- High Yields of High Value materials

## Repeat the Question....

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**‘What shape is the plastics recycling industry in for the automotive sector?’**



Still mostly linear,  
but with early signs  
of ‘circularity’



## Low Carbon Vehicle - 2015



- Height – less than 1 metre = ‘LOW’
- Dominant Material = ‘Carbon’

Thank you for listening

- Keith Freegard
- Director of Marketing

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