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# Measuring Sustainability Life Cycle Assessment (LCA)



Cradle-to-Grave

Materials & Processes

Sustainability Impacts

Energy & Materials

Materials

Transport

Production

Stamping

Body

Paint

Trim

Transport

Vehicle Use

Fuel Production

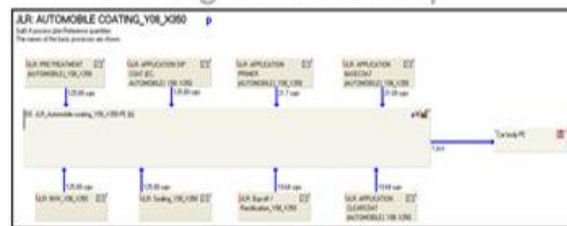
End-of-Life

Emissions & Waste

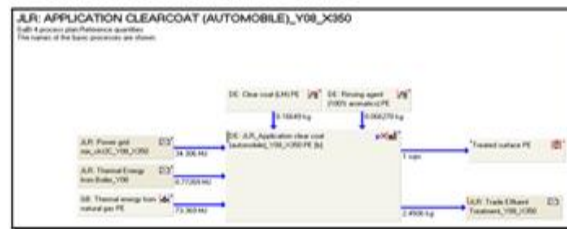
Level 1 e.g.: Manufacturing



Level 2: e.g.: Paint shop



Level 3: e.g.: Clear coat Process



Materials



Climate Change



Energy



Water



Eco-Systems



Health / Air Quality



# Measuring Sustainability Throughout the Supply Chain



Parts

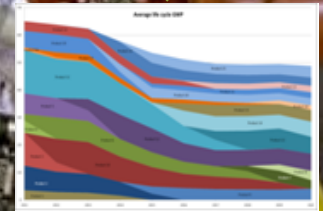
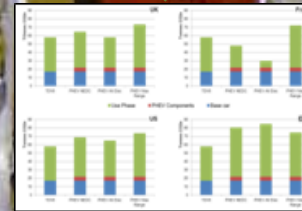
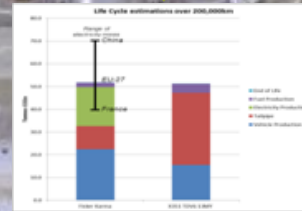
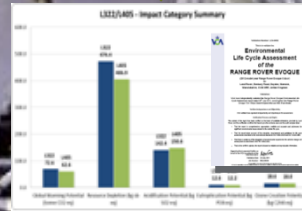
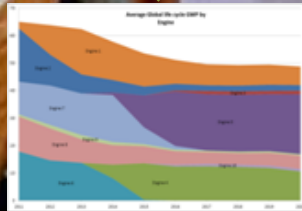
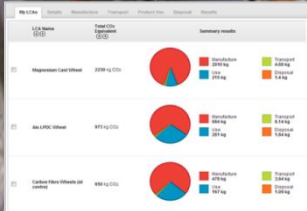
Systems & Supply Chains

Vehicles

Competitors

Concepts, Markets & Architectures

Corporate



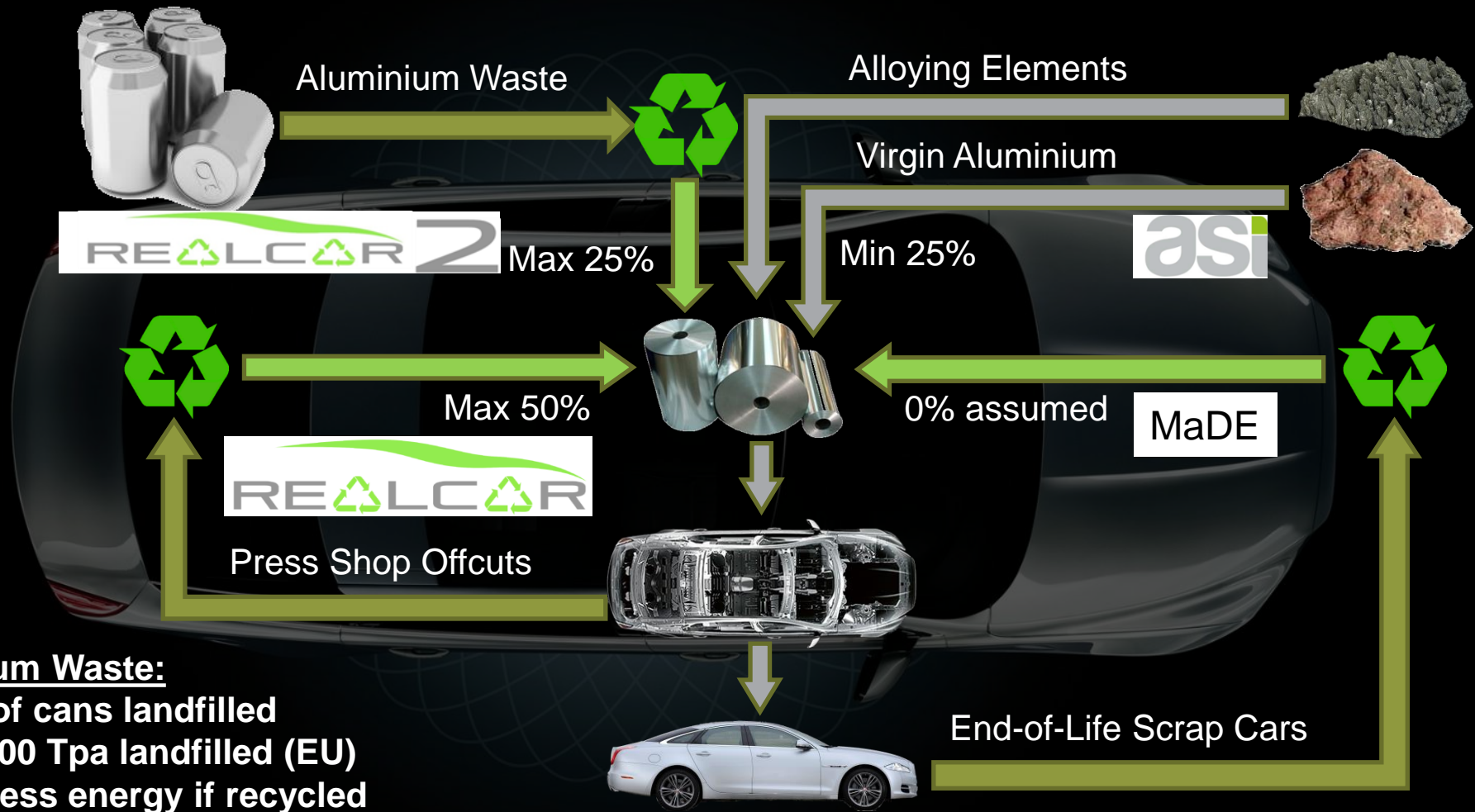
## Life Cycle Approach

Comprehensive, credible, data-backed

Tracking: Energy, materials, emissions, waste, processes and logistics  
– the root causes of costs

# Aluminium

## Closing the Loops



### Aluminium Waste:

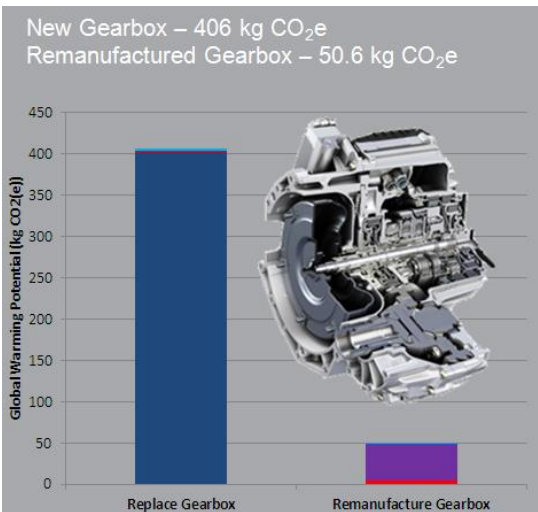
- 33% of cans landfilled
- 700,000 Tpa landfilled (EU)
- 95% less energy if recycled
- Waste separation is key

# Closing Supply Chain Loops LCA Win-win-wins!

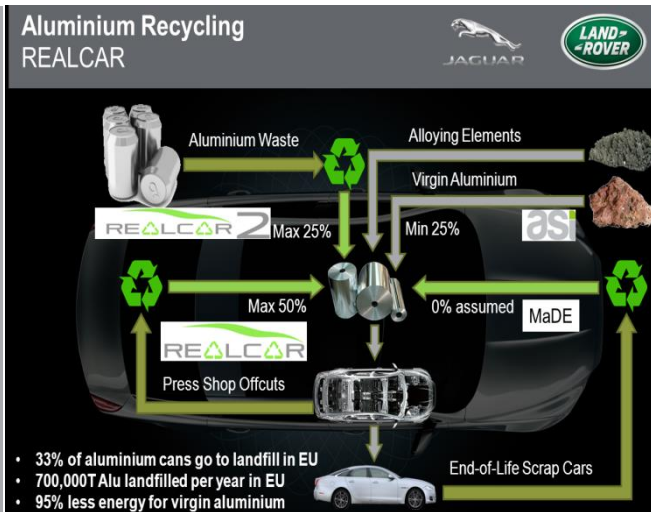


60% less CO<sub>2</sub> & Energy  
100% Less Raw Material

46% less CO<sub>2</sub> & Energy  
Independent by 2015



87% less CO<sub>2</sub>, Energy  
and materials



95% less CO<sub>2</sub> & Energy  
up to 75% less virgin material

## Sustainability Impacts

### Life Cycle Improvements

LCA-Managed

Reference Case

Climate Change



Energy & Materials



Acid Rain Potential



Eco-System



Heath / Air Quality



## Tailpipe CO<sub>2</sub>: Limitations

### Incomplete?

- GWP & LCA

### Inaccurate?

- Real-world

### Ineffective?

- Command & control

### Inflexible?

- Technological innovation

### Irrelevant?

- Zero emission cars

## Status Quo: Lose-Lose-Lose!

### Customer

- Gap to real world

### Environment / Climate

- Too little, too late

### Regulator / Taxpayer

- Arms race, lagging innovation

### Industry

- Compliance, not sustainability

### Investors

- Misallocation of capital

## CO<sub>2</sub> v LCA: The Complexity Barrier

### Output Chemicals

- 1 v 20+

### Impacts

- 0.8 v 6+

### Inputs & Supply Chains

- 1 v 1,000's

### Process Steps

- 1 v 30,000+

### Validation & Control

- NEDC/WLTP v PEF? 20 yrs?

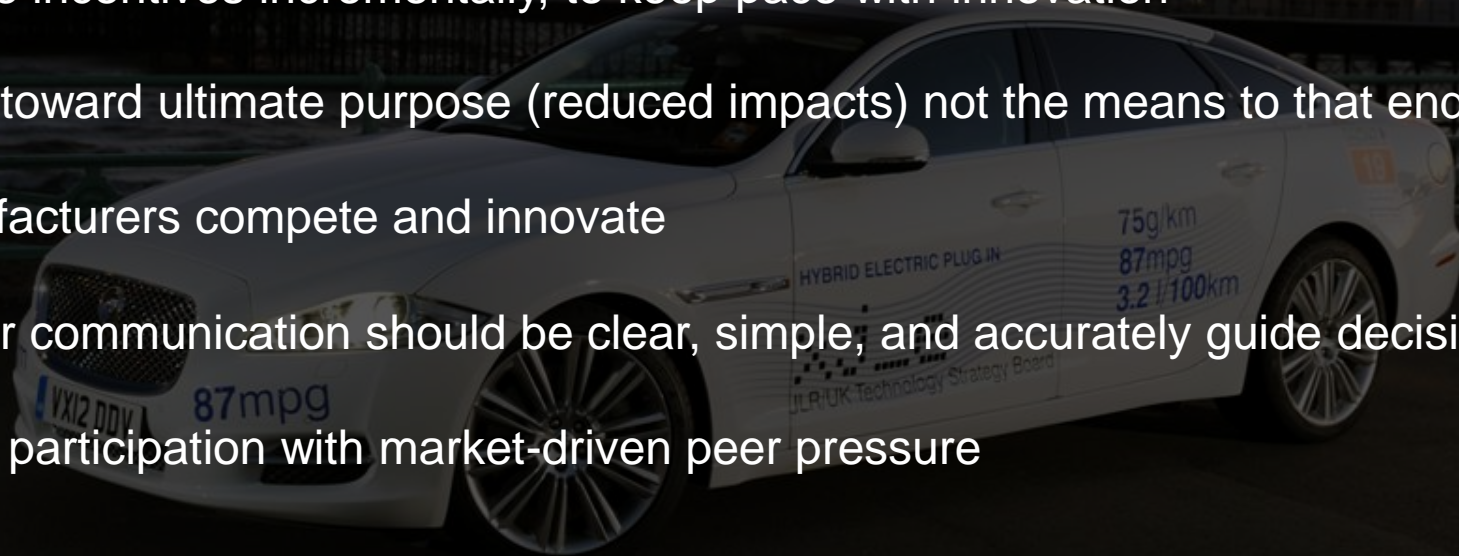
# Regulatory LCA: The New Tailpipe CO<sub>2</sub>?



# Suggestions for a Workable LCA



- End-to-end, not partial measures
- Manufacturers manage LCA complexity, locally – no need to standardise
- Use established LCAs to recognise & reward key factors (a la EuroNCAP)
- Evolve the incentives incrementally, to keep pace with innovation
- Legislate toward ultimate purpose (reduced impacts) not the means to that end (e.g. EVs)
- Let manufacturers compete and innovate
- Consumer communication should be clear, simple, and accurately guide decisions
- Voluntary participation with market-driven peer pressure



# Conclusions



## Risks

- LCA beats tailpipe CO<sub>2</sub>, but is much more complicated
- Business as usual will lead to lose-lose-lose
- Straight swap from CO<sub>2</sub> to LCA regulation is not feasible



## Opportunities

- Manufacturers already use LCA effectively - in their own 'enlightened self-interests'
- Develop policies based on existing LCAs, that align good business decisions to sustainable mobility
- Incentivise improvement of local LCA measures and performance
- Consumer clarity
- Foster innovation, but let the market decide the winners and allocate the capital efficiently
- Aim for – win-win-win outcomes – soon!





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