



SUSTAINABLE MATERIALS

Opportunities and challenges for the automotive sector

PRESENTERS



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AGENDA

Introduction

The importance of circular and sustainable materials in the automotive sector

Case study: Demand-led materials innovation for the automotive sector

Next steps for automotive businesses

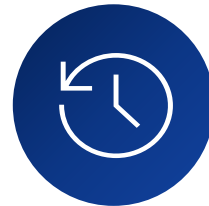
Questions



INTRODUCING RICARDO

A GLOBAL STRATEGIC, ENVIRONMENTAL AND ENGINEERING CONSULTING COMPANY

Our teams of consultants, environmental specialists, engineers and scientists support customers in solving the most complex and dynamic challenges to help achieve a safe and sustainable world.



Deep heritage of
108
years of
innovation



Located in
23
countries
worldwide



More than
3000
colleagues
worldwide



We have over
2500
live
projects

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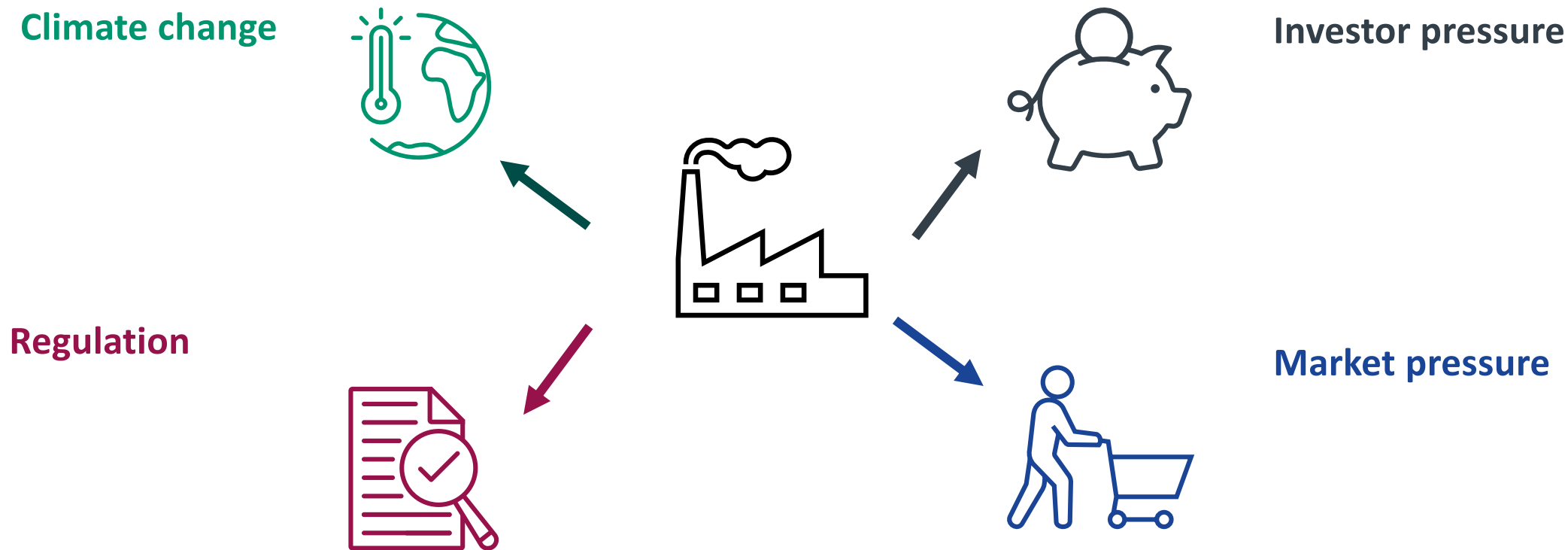
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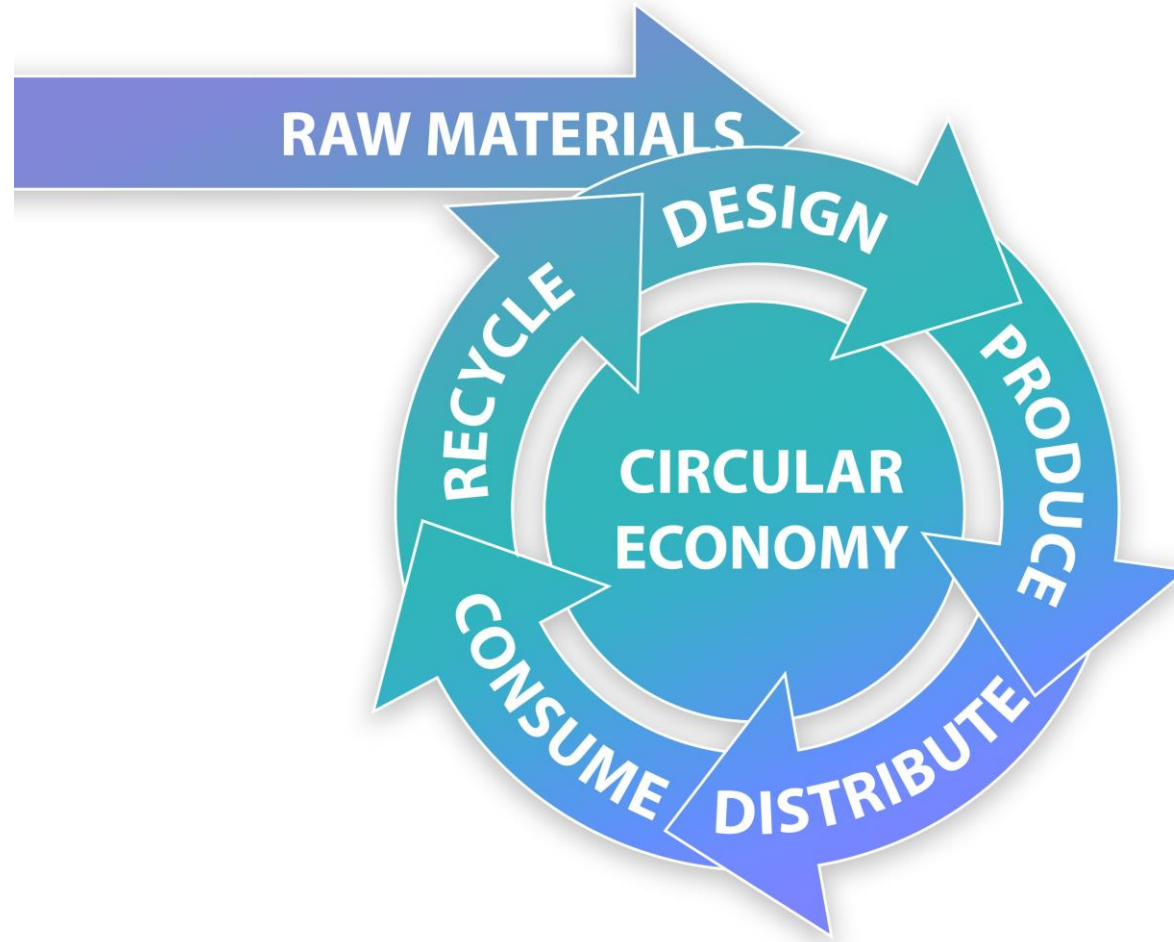
Questions

What is a circular economy, and why is it important to the automotive sector?

The automotive sector is a **pivotal consumer of foundation industry materials**, with an evolving landscape of material demands. Various factors are driving a for a circular automotive sector:



What is a circular economy, and why is it important to the automotive sector?



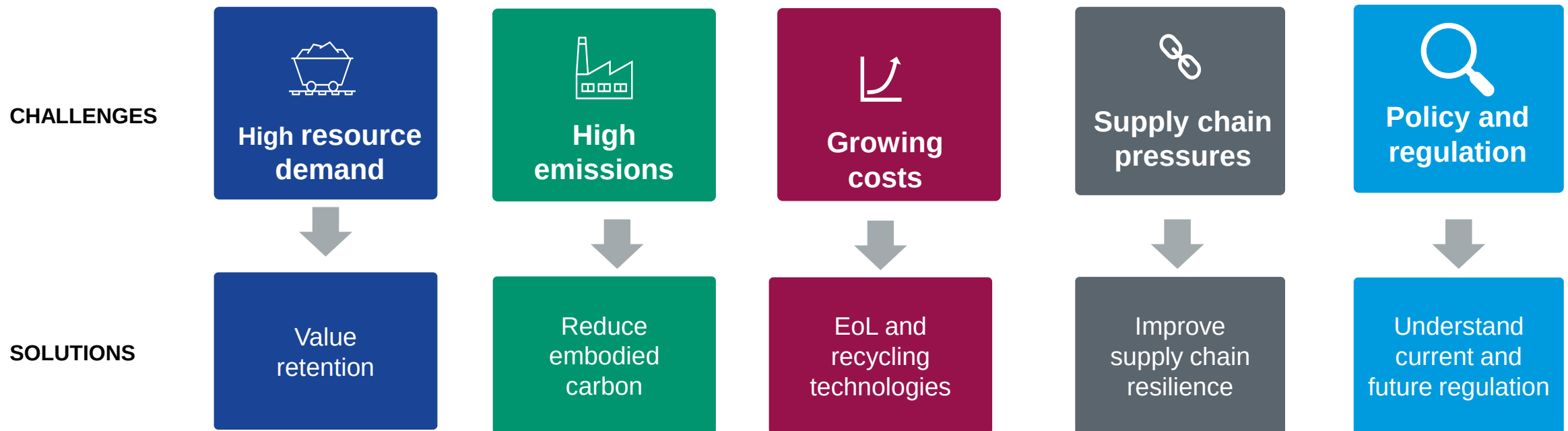
POLL

What do you see as greatest challenge with materials in transitioning towards a circular economy in the automotive sector?

1. High resource demand
2. Reducing carbon emissions from manufacturing
3. Growing costs
4. Supply chain pressures
5. Policy and regulation

WHY DOES THE AUTOMOTIVE SECTOR NEED TO MOVE TOWARDS A CIRCULAR ECONOMY?

SITUATION The automotive sector is currently undergoing a major sustainability transition. This presents several challenges as the landscape of automotive material demands evolves.

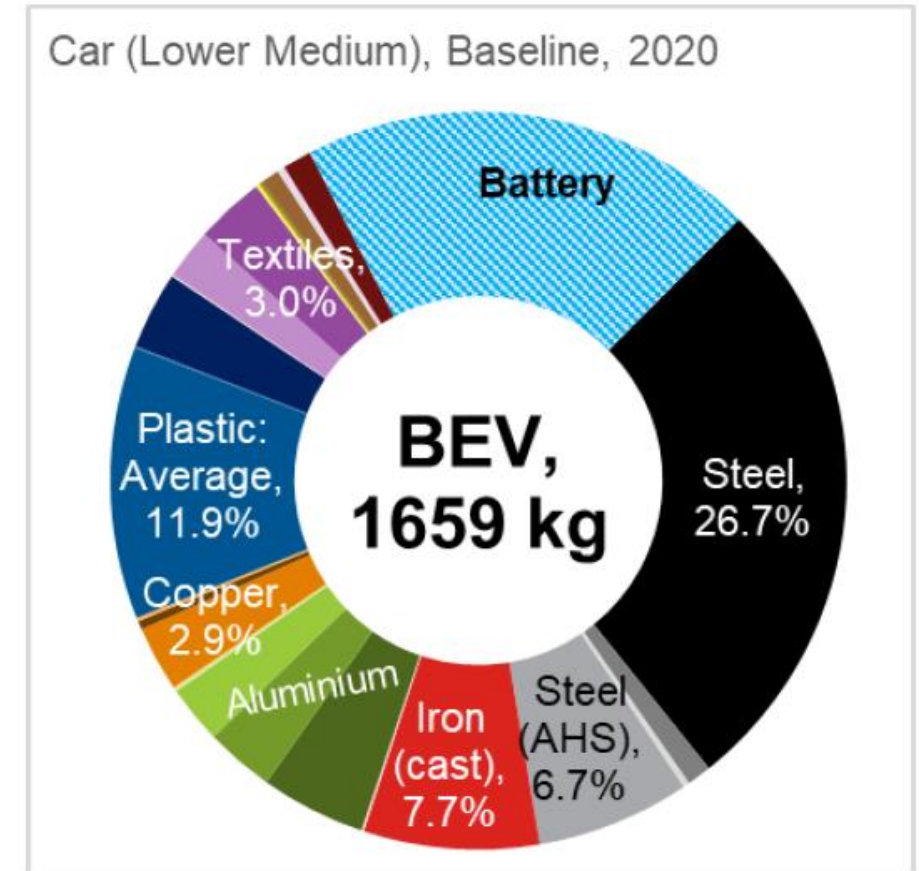


WHY DOES THE AUTOMOTIVE SECTOR NEED TO DEVELOP A SUSTAINABLE MATERIALS STRATEGY?

Material Innovation Specific Challenges

Of particular importance with the European Commission's proposed **End of Life Vehicle (ELV) Directive (2023)**

1. Vehicle lightweighting
2. Low-carbon materials
3. Recycled material availability
4. Cost reduction
5. Sustainability credentials of materials



An example breakdown (by weight) of automotive materials used in the manufacture of Battery Electric Vehicles (BEVs); Source: (Ricardo, 2020)

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DEMAND-LED MATERIALS INNOVATION FOR THE AUTOMOTIVE SECTOR

Materials Requirements In 2030 And Beyond: A study focused on UK automotive for Innovate UK

Ricardo was commissioned by Innovate UK as part of the Transforming Foundations Industries Challenge to engage with the **automotive sector** to understand its **material requirement challenges** to 2030 and beyond.



AIMS

- **Foundation industries** including metals, chemicals, and glass, are intricately linked with the automotive sector in the UK
- Both sectors face the challenges of **decarbonizing** their footprint and **increasing circularity**
- The study aimed to:
 - Understand **existing and future** demand and the **drivers shaping changes** in demand and requirements for automotive materials
 - Explore how **demand-led innovation** interventions could support **supply chain collaboration** between foundation industry material producers and automotive end-users



STUDY LOGIC



DESK-BASED RESEARCH

- Identify literature trends
- Key materials of interest
- Quantify current and future demand



STAKEHOLDER ENGAGEMENT

- Validate literature findings
- Draw out additional detail
- Discover innovation challenges



FINDINGS AND RECOMMENDATIONS

- Consolidate activities
- Recommendations on future activity
- Create engaged community

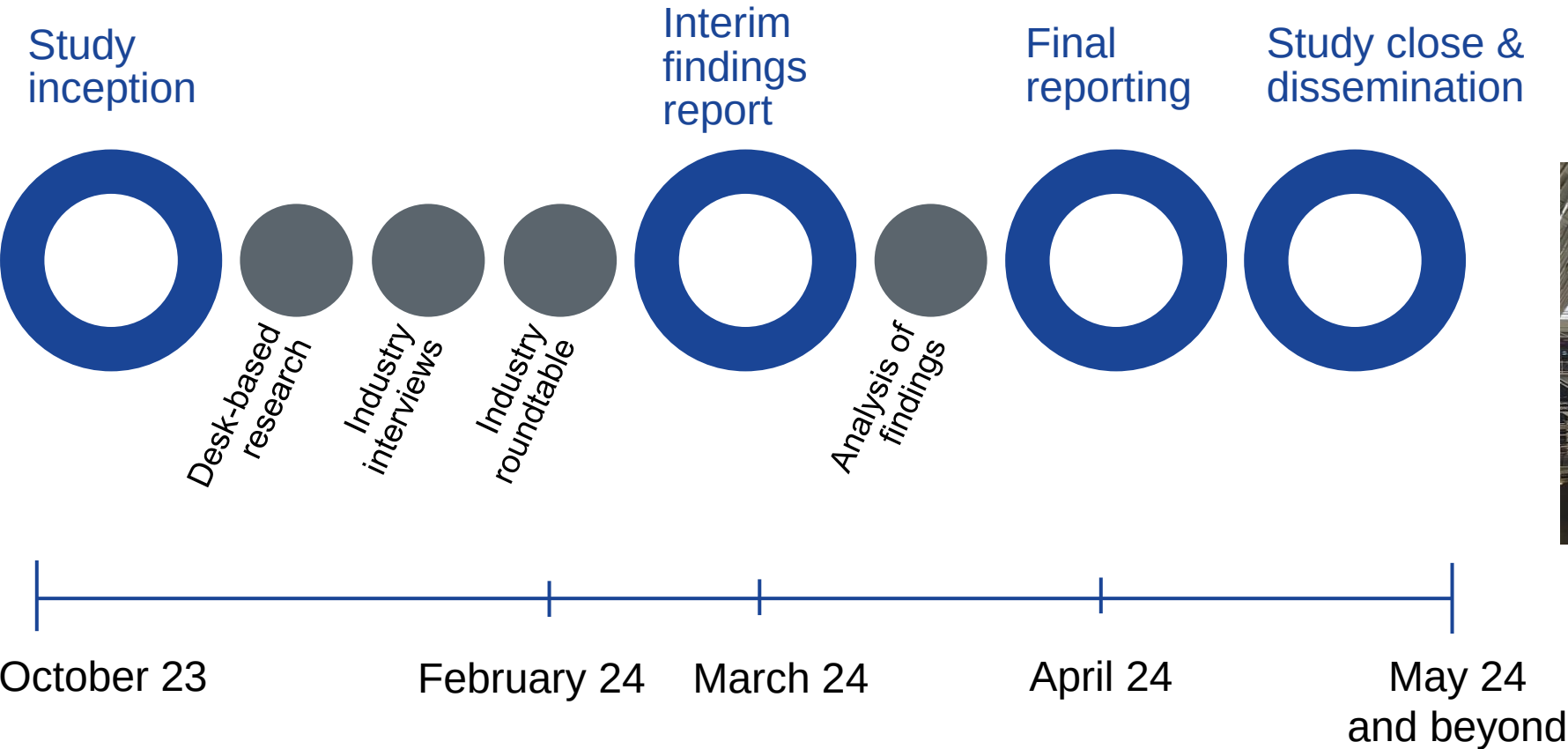
INDUSTRY 1:1 INTERVIEWS



INDUSTRY ROUNDTABLE EVENT

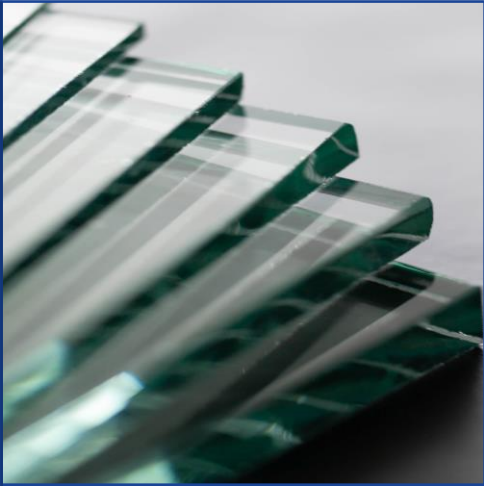


STUDY TIMELINE



Presented at Materials Research Exchange (MRE) conference, London, 24th April 2024

KEY MATERIAL GROUPS FOR AUTOMOTIVE DEMAND-LED INNOVATION

				
STEEL AND CAST IRON • Makes up 40-65% of vehicle mass • Easily recycled but high grades needed • Low-carbon production is being commercialised	ALUMINIUM • Lightweight alternative for vehicle structures • Easily recycled, established supply • Low carbon production possible	PLASTICS, POLYMERS AND COMPOSITES • Lightweight, 20% of vehicle mass • Fibre reinforced composites strong • Difficult to mass produce and recycle	COPPER • EVs require 3 times more copper than conventional vehicles • Easily recycled • Low-carbon production methods	GLASS • No alternative • Demand expected to be constant • Automotive glass recycling challenging due to contaminants from plastic

The scope of this study excluded battery-specific materials which were considered in other work

THREE KEY MATERIAL INNOVATION CHALLENGES



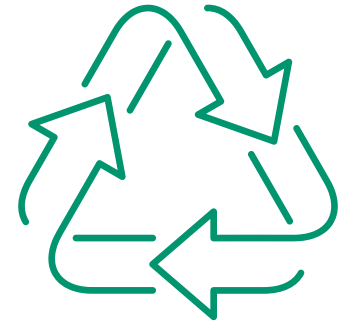
LIGHTWEIGHTING

- Reduce vehicle mass to reduce GHG emissions or increase range
- Use of aluminium, high-strength steels, and non-metal composites in place of cast iron & steel
- Vehicle design for lightweight materials



LOW CARBON MATERIAL OPTIONS

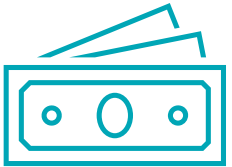
- Reduce embedded GHG
- Lower-carbon material production methods
 - For example, using renewable energy sources
- Alternative materials with a lower carbon footprint



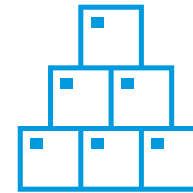
INCREASE CIRCULARITY

- Improve availability and suitability of recycled material options
- Ensure high recyclability of the vehicle at end-of-life
- Closed-loop supply chains
- Designing vehicles for ease of recycling

FOUR CROSS-CUTTING CHALLENGES FOR MATERIAL DEMAND



A need to identify solutions to improve **cost-effectiveness** or affordability of innovative materials



A need for a **dependable supply** of innovative materials of suitable performance (grade)



A need to identify solutions to improve and validate the **sustainability** of materials



A need for **capacity building and upskilling** to adapt to new processes associated with innovative materials

POLICY AND STANDARDS DEVELOPMENT TO SUPPORT INNOVATION IN AUTOMOTIVE MATERIALS



Standards to certify the performance properties of recycled materials



Standards to compare environmental impacts of materials through evaluating on a life cycle basis



Increase targets for the recycled content in and recyclability of vehicles



Support new material recycling facilities in UK by minimising export of waste



Support for localised cost-effective renewable electricity production or procurement



Investing in hydrogen economy for both industry and hydrogen vehicles



Expediate development process for brownfield sites for new recycling and recycled material facilities

POTENTIAL INTERVENTIONS IN FUNDING FOR RESEARCH AND DEMONSTRATION PROJECTS

Stakeholders identified that:

- Development of materials/production methods is needed
- Challenges cross industry boundaries
- Lack of confidence/experience with new materials and associated vehicle design changes is a barrier

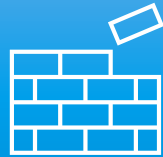
Research funding can help link material recovery to automotive manufacturing

Demonstrator projects build experience with, and set precedents for, more integrated supply chains

MATERIAL SEPARATION TECHNOLOGIES	VEHICLE DESIGN THAT FACILITATES DISASSEMBLY	ADOPTING LIGHTWEIGHT AND/OR HIGH RECYCLED CONTENT MATERIALS	CROSS-SECTOR CLOSED-LOOP INNOVATION	MATERIAL INNOVATIONS
• Deliver suitable grades of aluminium, steel, and polymers • Increase recycled content	• Increase recyclability • Challenges of embedded copper & painted plastics • Complexity of hybrid structures and lightweight materials	• Demonstrate feasibility and potential benefits • Effective design and manufacture processes • HGV structures are particularly challenging	• Link vehicle end-of-life and recycling to manufacturing • Showcase sustainable material utilisation	• Develop low-carbon or recycled and recyclable materials that can meet automotive performance needs • Explore how they can be applied

POTENTIAL INTERVENTIONS IN CAPACITY BUILDING

Meeting the pace of change needed in material adoption means equipping industry to produce and utilise **lightweight** and/or **low-carbon** rather than traditional materials



Capacity building within industry

Training for new **forming and assembly processes** in lightweight materials to increase workforce flexibility and resiliency to changing material demands and needs

Training and upskilling within the steel industry to develop **low-carbon steel products and supply chains** suited automotive sector demands

POTENTIAL INTERVENTIONS IN COMMERCIALISATION SUPPORT

Addresses challenge of innovative materials reaching **sufficient scale** and **reducing costs** to be competitive with traditional materials



Commercialisation support for innovative materials

Low-cost loans or other financial support could:

- **Facilitate investment** in larger, smarter, and more efficient facilities
- Help to attract **private investment**
- Target support to **scale up production** of key innovative materials such as carbon fibre-reinforced plastic or high recycled content high-grade metals

ADDRESSING CROSS-SECTOR CHALLENGES THROUGH A STAKEHOLDER COMMUNITY

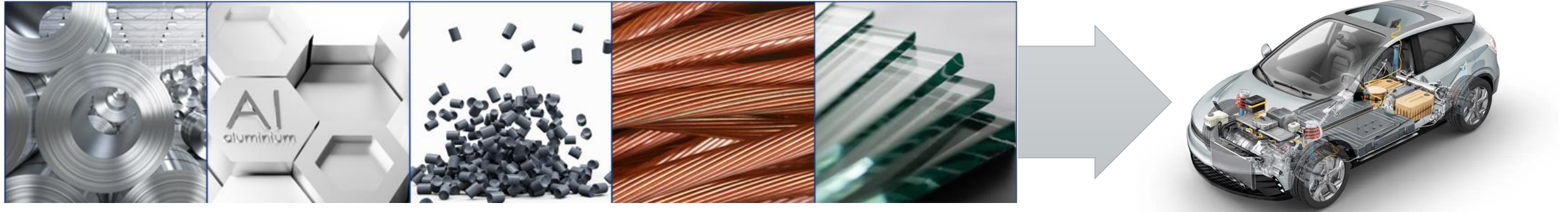
Stakeholders recognised that innovation challenges cross sector boundaries requiring greater collaboration and alignment of discussions across the relevant sectors



A cross-sector **stakeholder community** can help overcome barriers to innovative material adoption

An outcome of this study is a proposal to establish a stakeholder community across the foundation and automotive industries led by the **Transforming the Foundation Industries Challenge**

PROJECT OUTPUTS



- Visit the project web page for the **reports**:

Preliminary report **Unveiling insights into future automotive material demands**:

- Findings of the literature review
- Analysis of material use and future demand
- Initial findings

Final project report to be made available soon:

- Captures stakeholder/industry insights
- Explores industry innovation challenges
- Develops **potential interventions** to overcome challenges

<https://www.ricardo.com/en/news-and-insights/insights/unveiling-insights-into-future-automotive-material-demands>

- A **community of stakeholders** to be established across the foundation and automotive industries

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KEY ELEMENTS OF A SUSTAINABILITY AND MATERIALS STRATEGY



CASE STUDY: AUTOMOTIVE RECOVERABILITY AND RECYCLABILITY ASSESSMENT

Customer Challenge

- US automotive OEM – sustainability transition.
- Future sustainability strategy.
- Require baseline vehicle recyclability.

Ricardo Solution

- Review vehicle components.
- Apply ISO-2268 assessment.
- Evaluate output for next steps.

Customer Benefits

- Baseline - vehicle recoverability/recyclability.
- Input to sustainability strategy.
- Effective progress monitoring and target setting.

INTERNATIONAL
STANDARD

**ISO
22628**

First edition
2002-02-15

**Road vehicles — Recyclability and
recoverability — Calculation method**

Véhicules routiers — Recyclabilité et valorisabilité — Méthode de calcul

CASE STUDY: COMPARATIVE LCA FOR US AUTOMOTIVE OEM (ICE AND EV)

Customer Challenge

- Major US automotive OEM wishing to communicate the benefits of switching from internal combustion engine (ICE) vehicles to electric vehicles (EVs).

Ricardo Solution

- Policy and Best Practice Review.
- Comparative LCA.
- Review of GHG impacts of material types and battery recycling technologies.

Customer Benefits

- Client able to identify key lifecycle hot spots.
- Tool provided enhanced internal LCA capacity.
- Client confidently able to encourage uptake of EVs.



HOW RICARDO CAN SUPPORT YOU



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and reuse



Carbon strategy
and reporting



Implementing energy
and carbon projects



Product life cycle
assessment



Sustainable
packaging



Social
value



Compliance and
policy review



Waste
management



Transport
decarbonisation

QUESTIONS?



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