MATERIAL ECONOMICS

THE CIRCULAR ECONOMY

A POWERFUL FORCE FOR CLIMATE MITIGATION

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RE: SOURCE

SITRA

European Climate Foundation

eit Climate-KIC

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ELLEN MACARTHUR FOUNDATION

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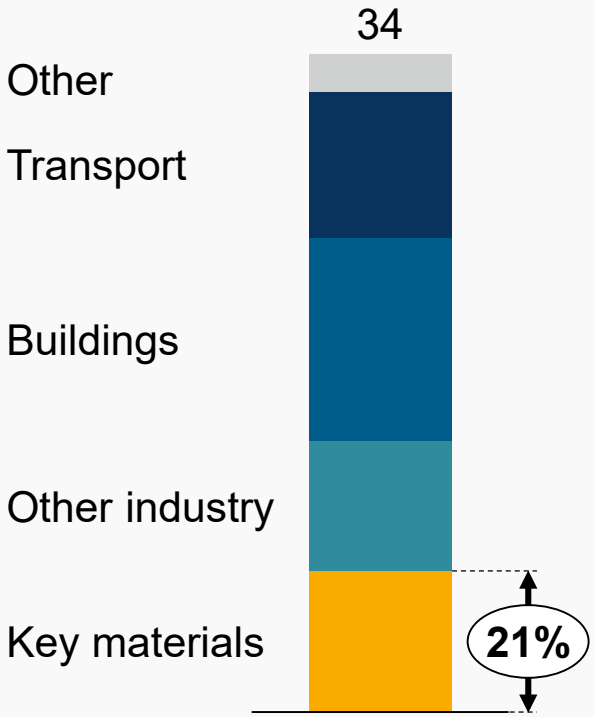
SUMMARY

1. **Materials production is 20-25% of CO_2 emissions, but have received little attention so far**
2. **These emissions from heavy industry are hard to cut on the supply side**
   - Emissions from high-temperature heat, process emissions, end of life incineration
3. **The demand side has significant promise**
   Potential to cut EU 2050 emissions by half, and bridge the gap to global carbon budget – moreover, much of the potential is economically attractive
4. **A more circular economy deserves a major role in industrial and climate policy**
   As much as we need energy efficiency, we need to use materials efficiently

WHY THIS STUDY – KEY MATERIALS ACCOUNT FOR 21% OF GLOBAL CO_2 EMISSIONS

CO_2 EMISSIONS FROM ENERGY AND INDUSTRY, 2014
Gt CO_2



- **Steel, plastics, aluminium and cement account for 21% of global emissions**
  - Steel and cement alone emit more than light-duty vehicles
- **Discussions to date focus on supply side – with significant challenges**
  - New processes, CCS, international competition, large investment, large energy needs
- **Demand side not in focus – but can be the missing piece of the puzzle**

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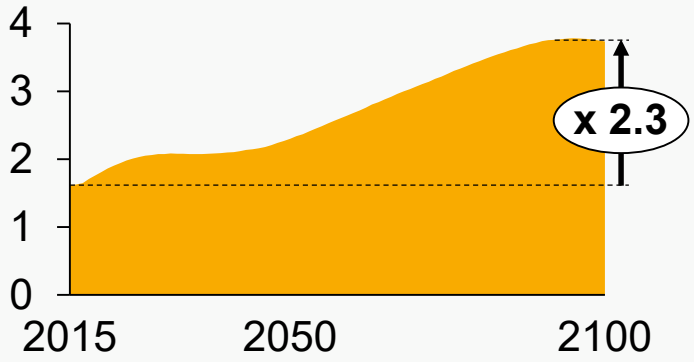
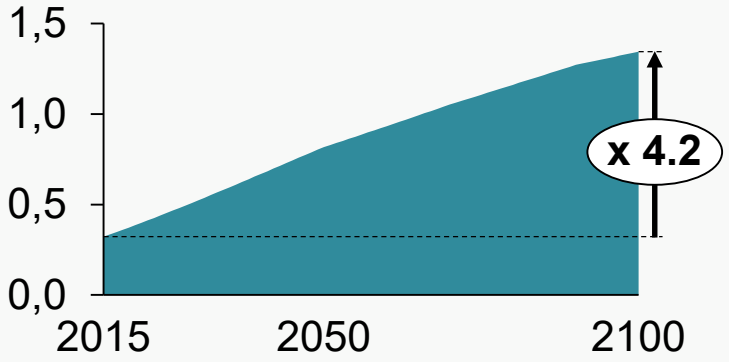
A MATERIALS HUNGRY WORLD: OUR CURRENT ECONOMIC STRUCTURE REQUIRES MATERIALS USE TO GROW 2-4 TIMES

RE: SOURCE

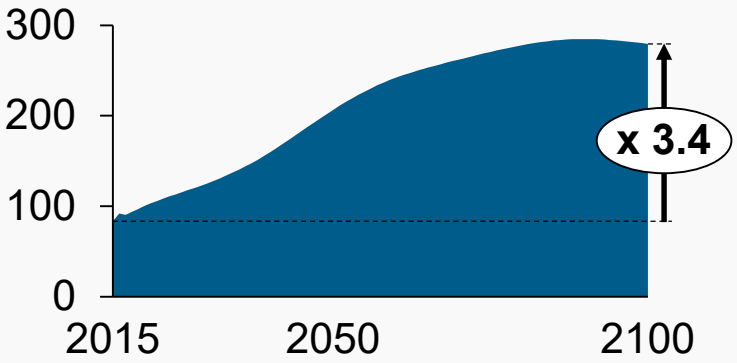
STEEL
Gt per year



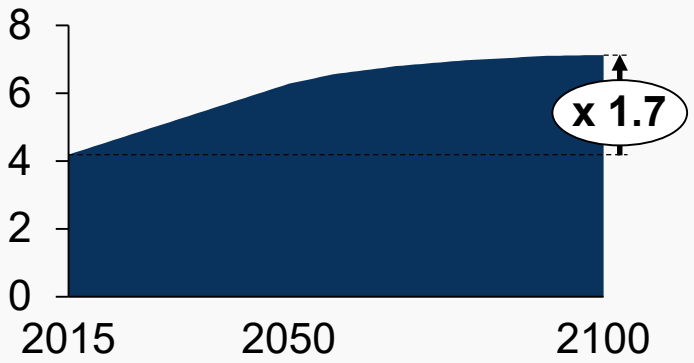
PLASTICS
Gt per year



ALUMINIUM
Mt per year



CEMENT
Gt per year



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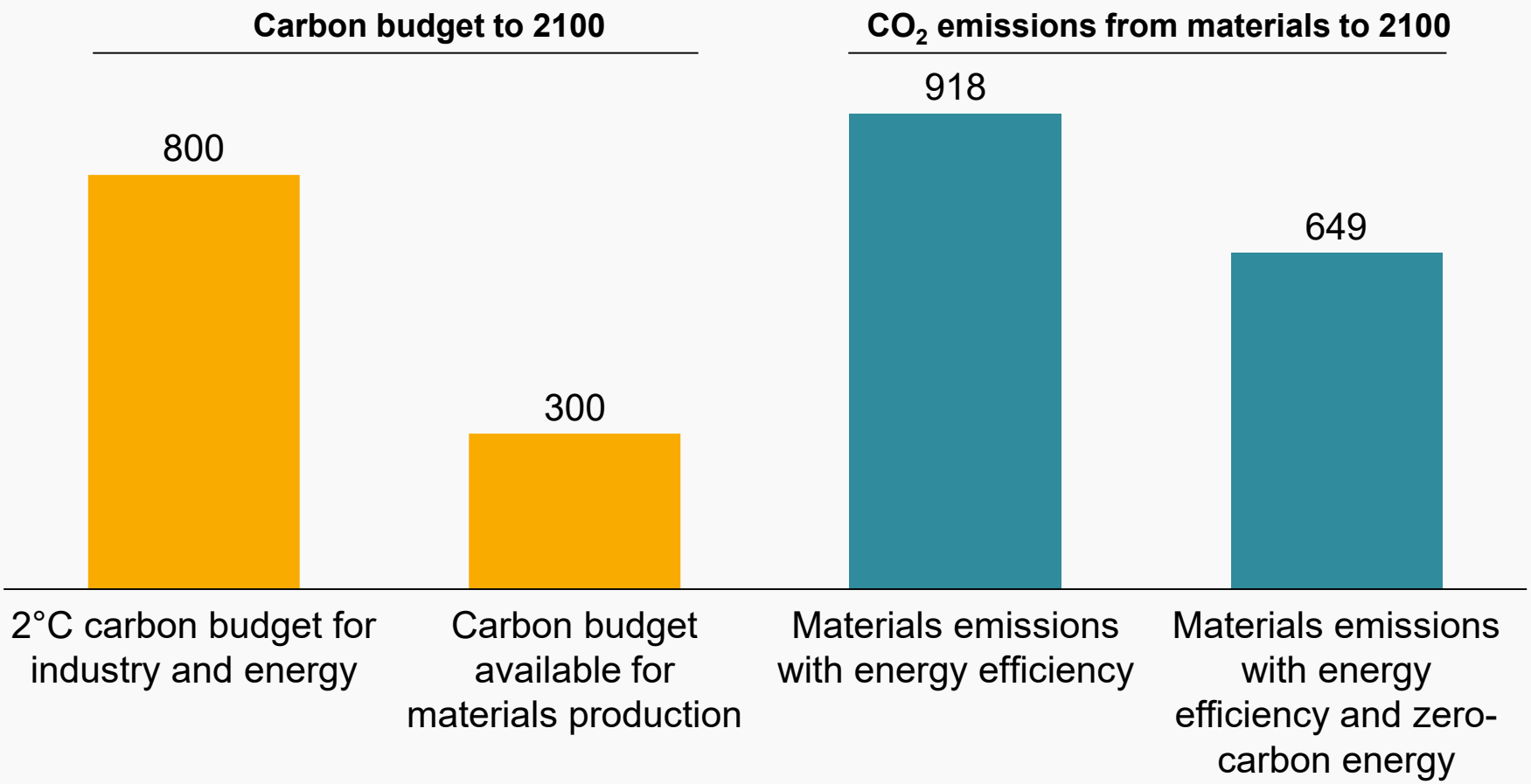
A LOW-CARBON ECONOMY MUST BE CIRCULAR – LOW-CARBON ENERGY WILL NOT BE ENOUGH TO MEET CLIMATE OBJECTIVES

RE: SOURCE

CO_2 EMISSIONS AND CARBON BUDGET

Billion tonnes CO_2



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HOW THE CIRCULAR ECONOMY REDUCES CO_2 EMISSIONS

RE: SOURCE

1 MATERIALS RECIRCULATION

$$\frac{\text{GHG}}{\text{MATERIALS}}$$

High-value recycling and less new material

High-value recycling
- Increased collection rates
- Design for disassembly and improved materials separation
- Less contamination and downgrading of materials

2 PRODUCT MATERIAL EFFICIENCY

$$\frac{\text{MATERIALS}}{\text{PRODUCT}}$$

Less material input for each car, building etc.

Improved production
- Less production waste
- Avoid over-specification

Reuse of components

Improved design
- High-strength materials
- New design principles
- Variation in size

3 CIRCULAR BUSINESS MODELS

$$\frac{\text{PRODUCT}}{\text{USEFUL SERVICE}}$$

Fewer products to achieve the same benefit

Higher utilisation
- Sharing of products
- Product as service

Longer lifetime
- Design for durability and disassembly
- Long lasting materials
- Improved maintenance
- Remanufacturing

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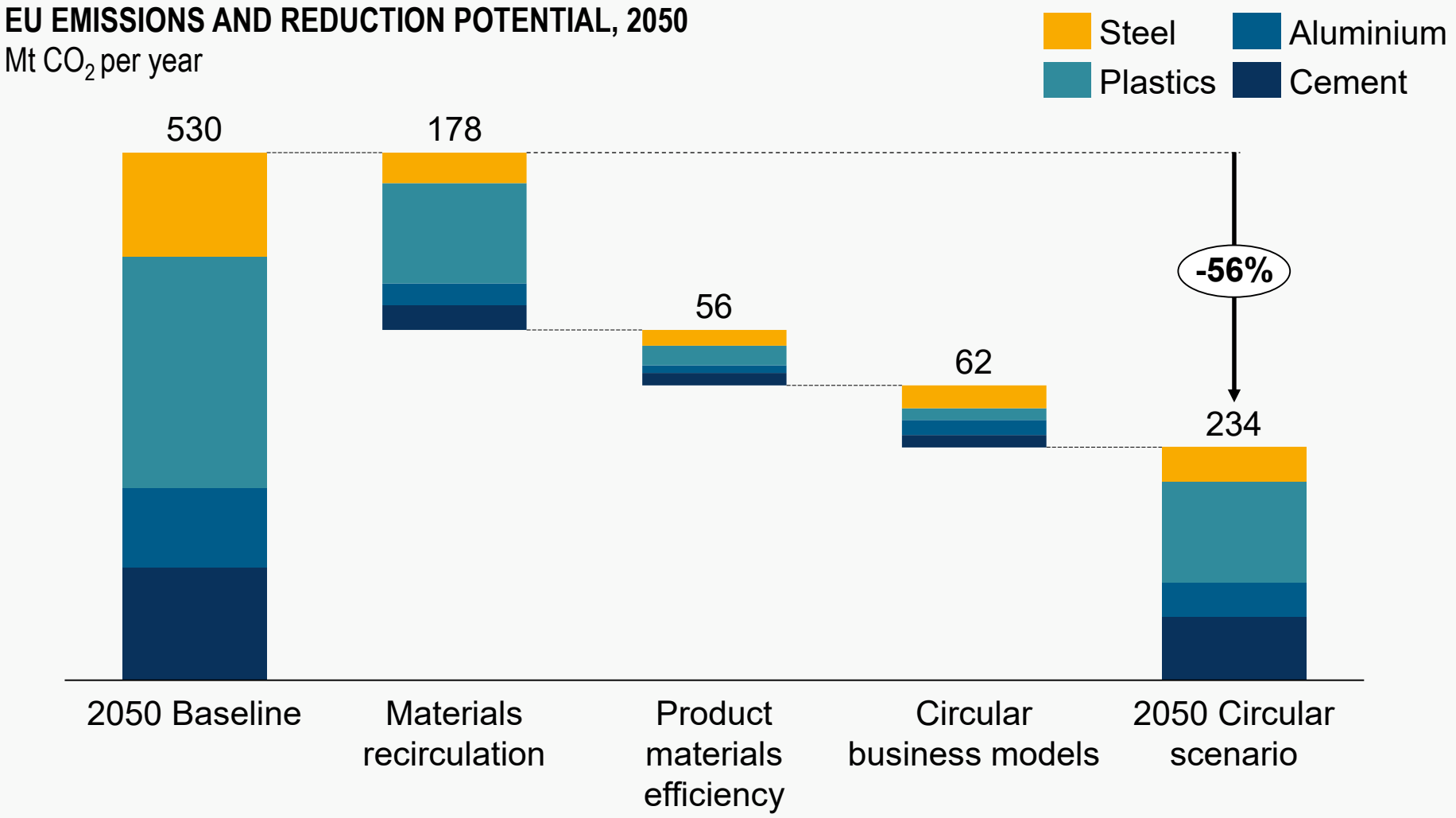
A MORE CIRCULAR ECONOMY CAN REDUCE EU EMISSIONS FROM MATERIALS BY 56%

RE: SOURCE



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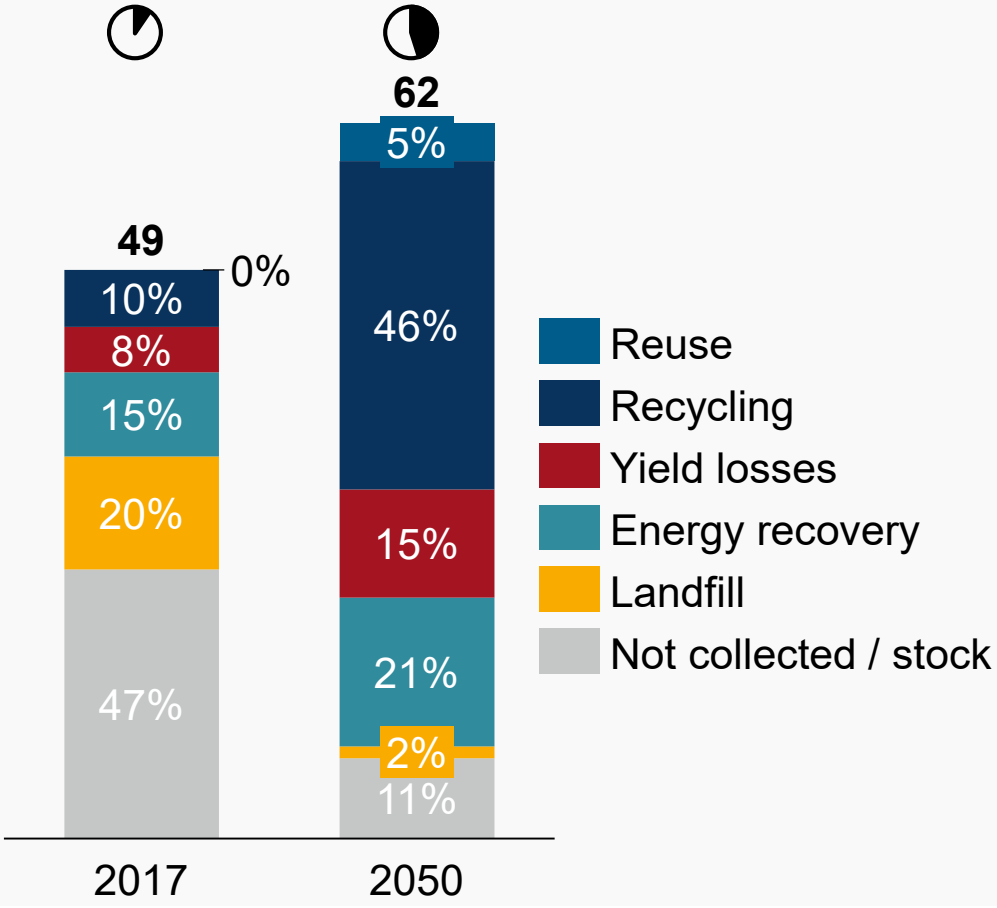
PLASTICS – HIGH-VALUE RECYCLING IS KEY PLASTICS IN A LOW-CARBON ECONOMY

RE: SOURCE

TREATMENT OF END-OF-USE PLASTICS, 2017 AND 2050

Mt, % of plastics demand



KEY ACTIONS AND ENABLERS

1. **Product design for recycling**
   - Major externality today
   - Plastics use may need to look very different
2. **Large-scale industry driven by materials value**
   - Clarity of ownership, investment, standards
   - Scale of operation and demand
3. **Major technology push**
   - Strong synergy with digitalisation: sorting, marking, automation

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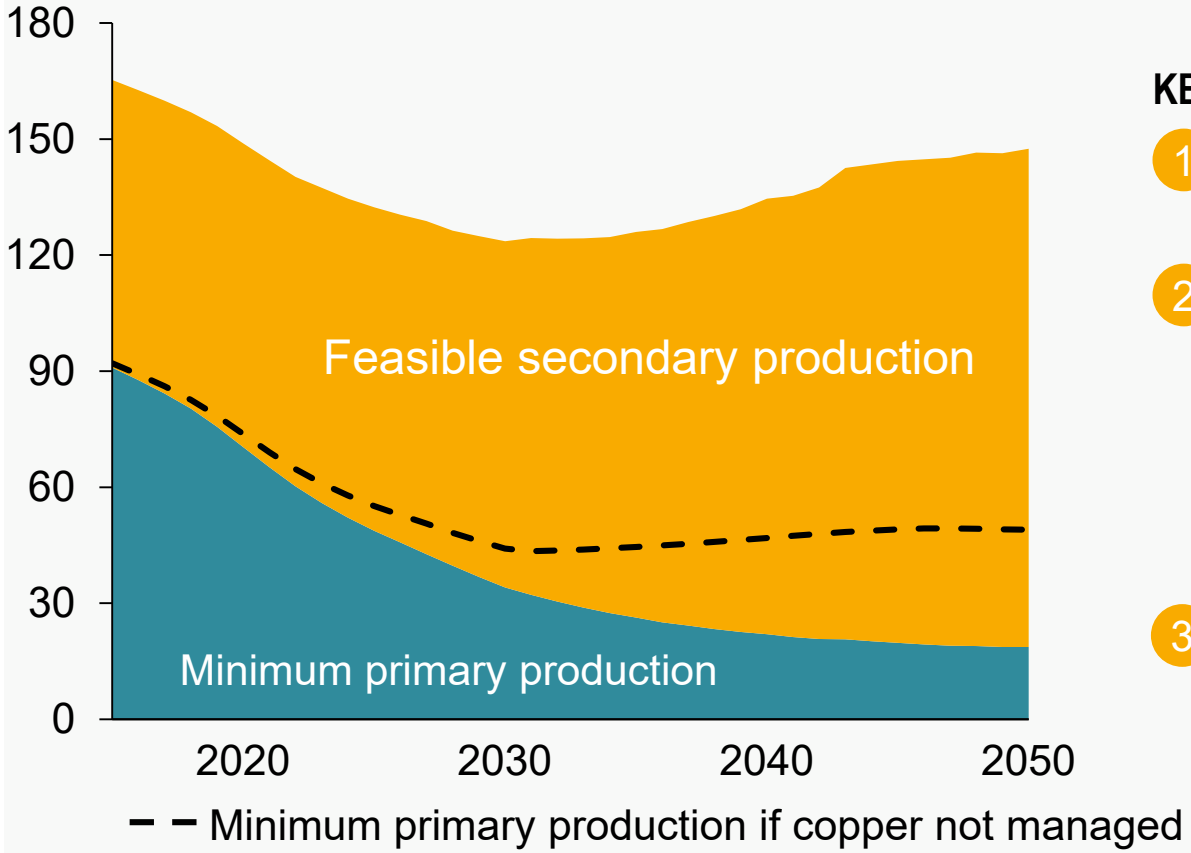
STEEL – SECONDARY METAL COULD MEET THE MAJORITY OF DEMAND BY 2050

RE: SOURCE

EUROPEAN STEEL PRODUCTION BY ROUTE
Mt steel per year, 2015-2050



KEY ACTIONS AND ENABLERS

1. **Reduce losses of steel**
2. **Enable high-quality secondary steelmaking**
   - Product design and dismantling
   - Controlled scrap flows
3. **Prevent copper pollution of steel stock**

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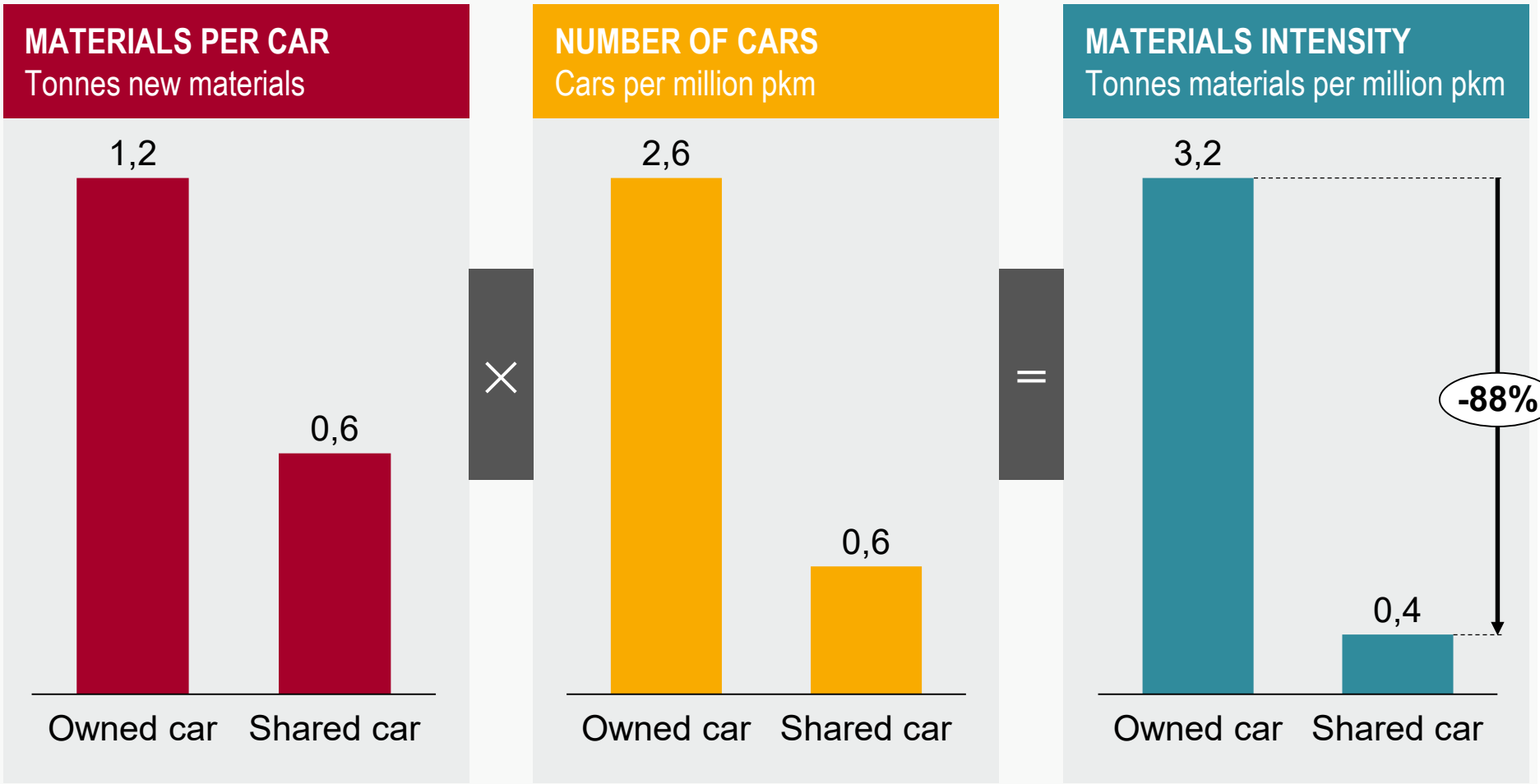
MOBILITY – CIRCULAR STRATEGIES JOINTLY REDUCE MATERIALS NEEDS BY 88%

RE: SOURCE



Note: pkm = passenger kilometre

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HOW TO GET THERE

1. **SET TARGETS AND CREATE CONVICTION**
   – ”what is the 2050 materials system”?

2. **ESTABLISH A CIRCULARITY POLICY AGENDA**
   – core part of EU climate and industrial policy

3. **DEVELOP NEW INTERVENTIONS**
   –’energy efficiency-type’ interventions will be required

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Thank you

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