DG CONNECT Summer School

RESOURCE-EFFICIENT BATTERY LIFE CYCLES:

DRIVING ELECTRIC MOBILITY WITH THE DIGITAL CIRCULAR ECONOMY

Tilmann Vahle
Lead, Circular Mobility Solutions
SYSTEMIQ

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THE SETTING: WE NEED TO MOVE THE NEEDLE ON BOTH DECARBONIZATION AND WIDER RESOURCE IMPACTS TO KEEP AN ENVIRONMENT SAFE FOR HUMANS

The Commission will also propose to revise the rules on end-of-life vehicles with a view to promoting **more circular business models** by linking **design issues to end-of-life treatment**, considering rules on **mandatory recycled content** for certain materials of components, and **improving recycling efficiency**.

"A new Circular Economy Action Plan: For a cleaner and more competitive Europe",
European Commission, March 11th, 2020

What **happens in the next 10 years will likely determine the state of the planet** we hand over for future generations. We need to get serious about stabilizing our planet: First task, we **need to cut global emissions by half by 2030** (…) This means **decarbonizing the big systems** that run our lives: energy, industry, transport, and buildings. (…) The good news is, we can do this.

"10 years to transform the future of humanity – or destabilize the planet"
Johan Rockström, Ted Talk (Countdown), October 10th 2020

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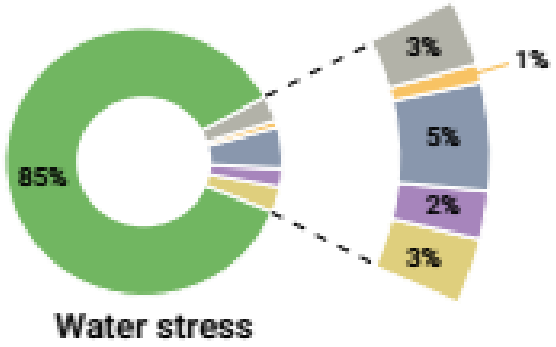
WHAT SCIENCE TELLS US ABOUT RESOURCE CONSUMPTION (1/2)

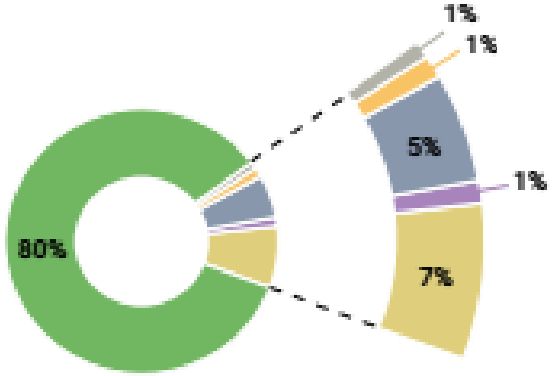
Resource extraction and processing cause

- ***90%*** *of global biodiversity loss and water stress*
- ***50%*** *of global climate change impacts*
- ***1/3*** *of air pollution health impacts*

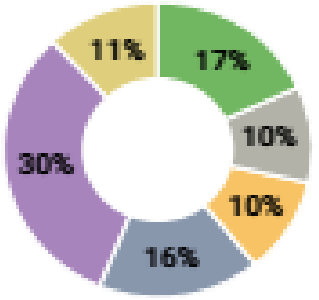
International Resource Panel



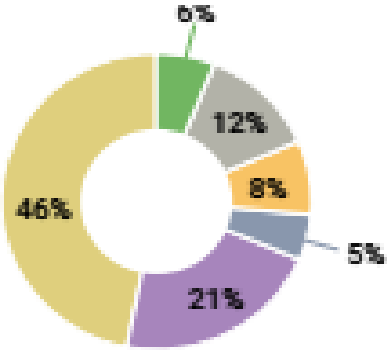
Water stress



Land-use related biodiversity loss



Climate change impacts



Particulate matter health impacts

Source: UN International Resource Panel (2019). Global Resources Outlook

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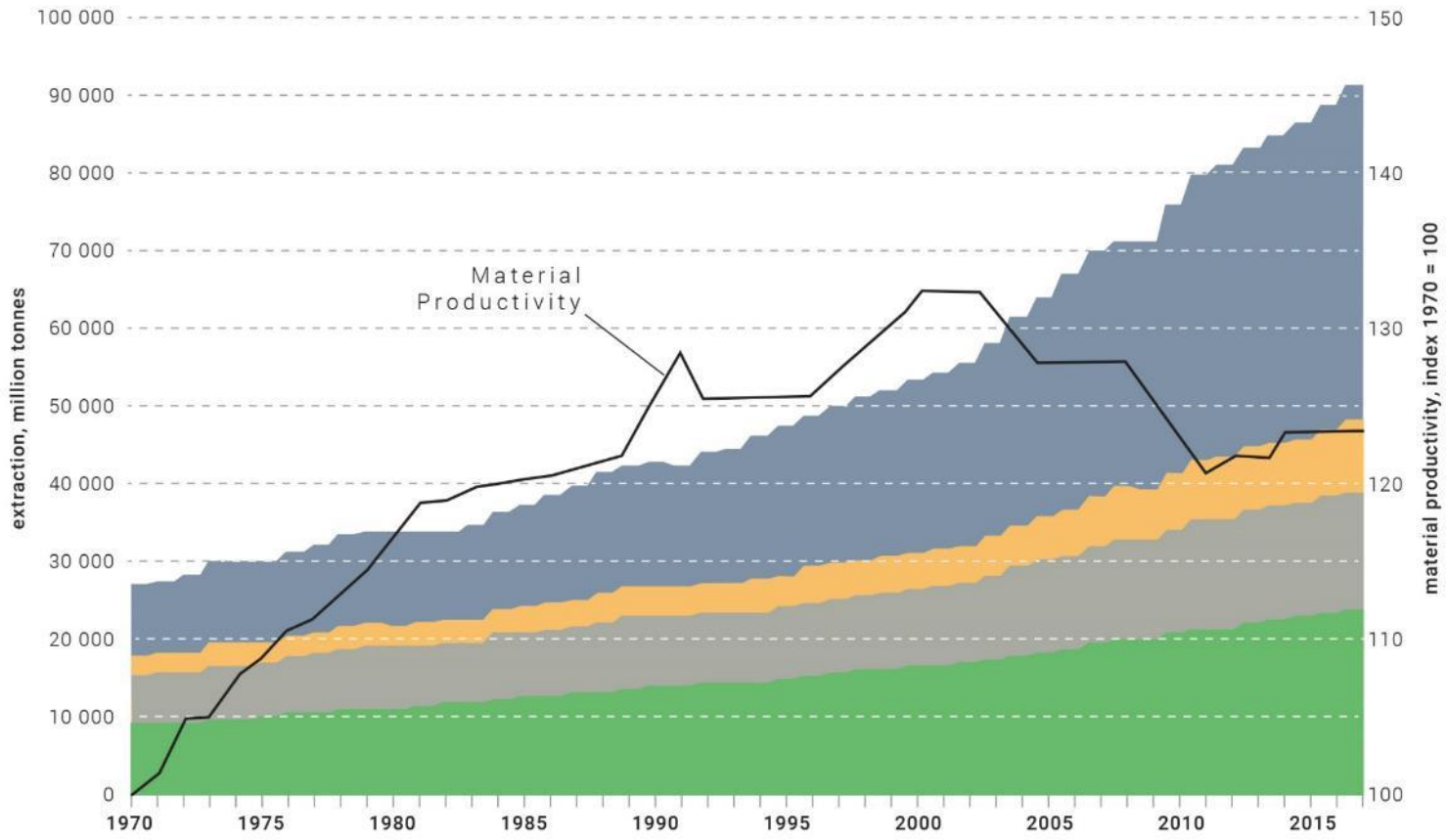
WHAT SCIENCE TELLS US ABOUT RESOURCE CONSUMPTION (2/2)

If trends continue, global resource extraction will double by 2060

Global material extraction and material productivity, 1970 - 2017



International Resource Panel

- Non-metallic minerals
- Metals
- Fossil fuels
- Biomass

Source: UN International Resource Panel (2019). Global Resources Outlook

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MOTORISED PRIVATE TRANSPORT IS THE MAIN DRIVER OF TRANSPORT-RELATED CO_2 EMISSIONS - BUT CO_2 IS ONLY PART OF THE PROBLEM

Transport is responsible for >1/3 of EU-28 CO2 emissions, especially motorised private transport contributes to this with 15% of the total

Direct emissions = emissions from the combustion of fossil fuels

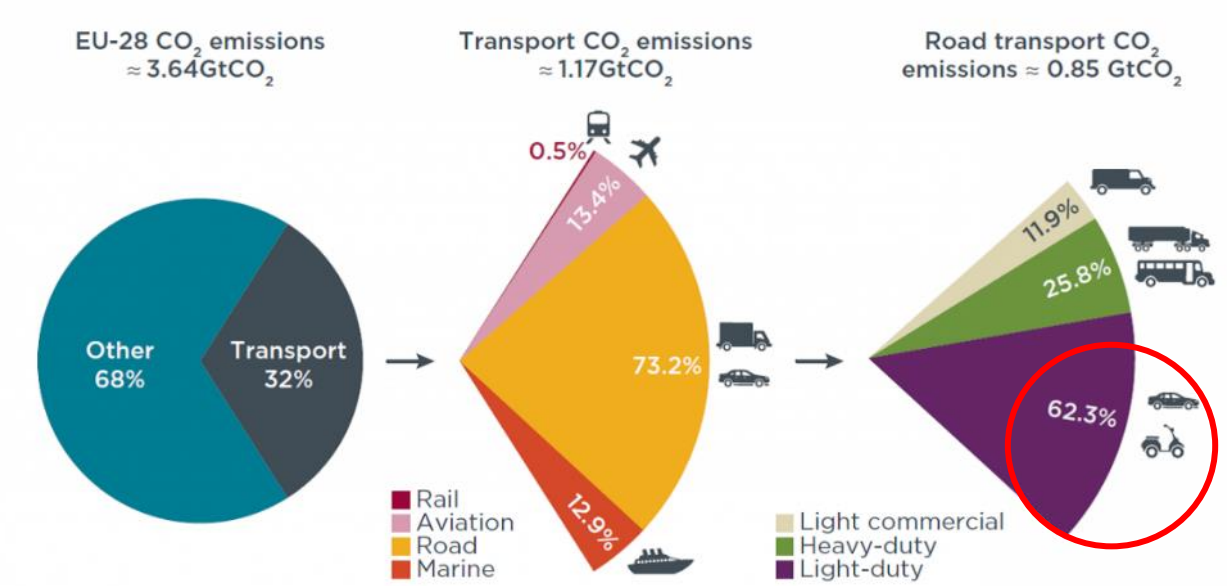
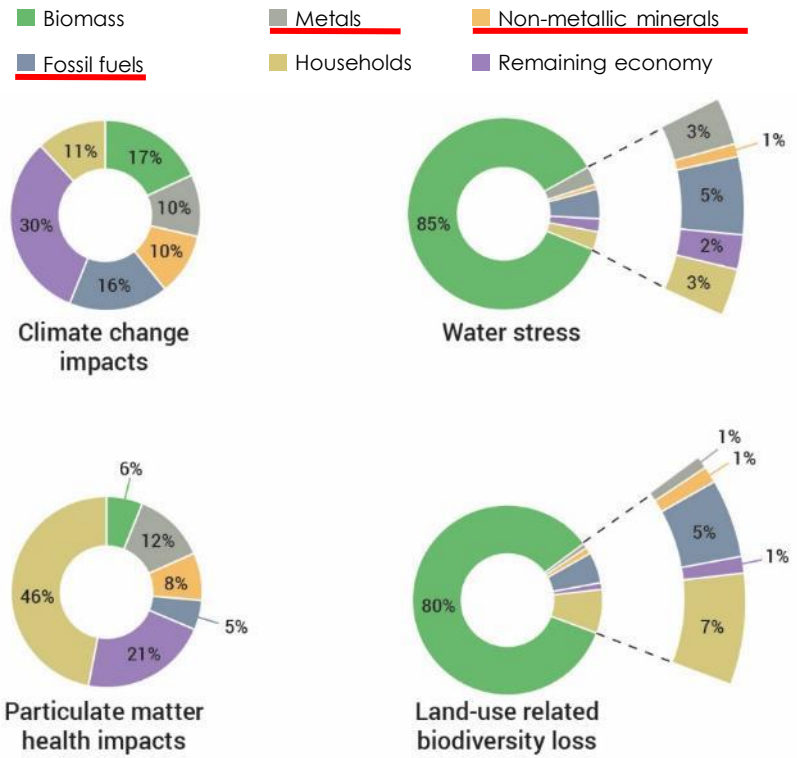


Figure 2. Distribution of total ETS and non-ETS direct CO_2 emissions in the European Union in 2015.[8] GtCO$_2$: gigatonnes of carbon dioxide

But also indirect emissions and other environmental impacts from resource use are significant.



Sources: https://www.cleanenergywire.org/factsheets/road-freight-emissions-germany; UN IRP, Global Resources Outlook

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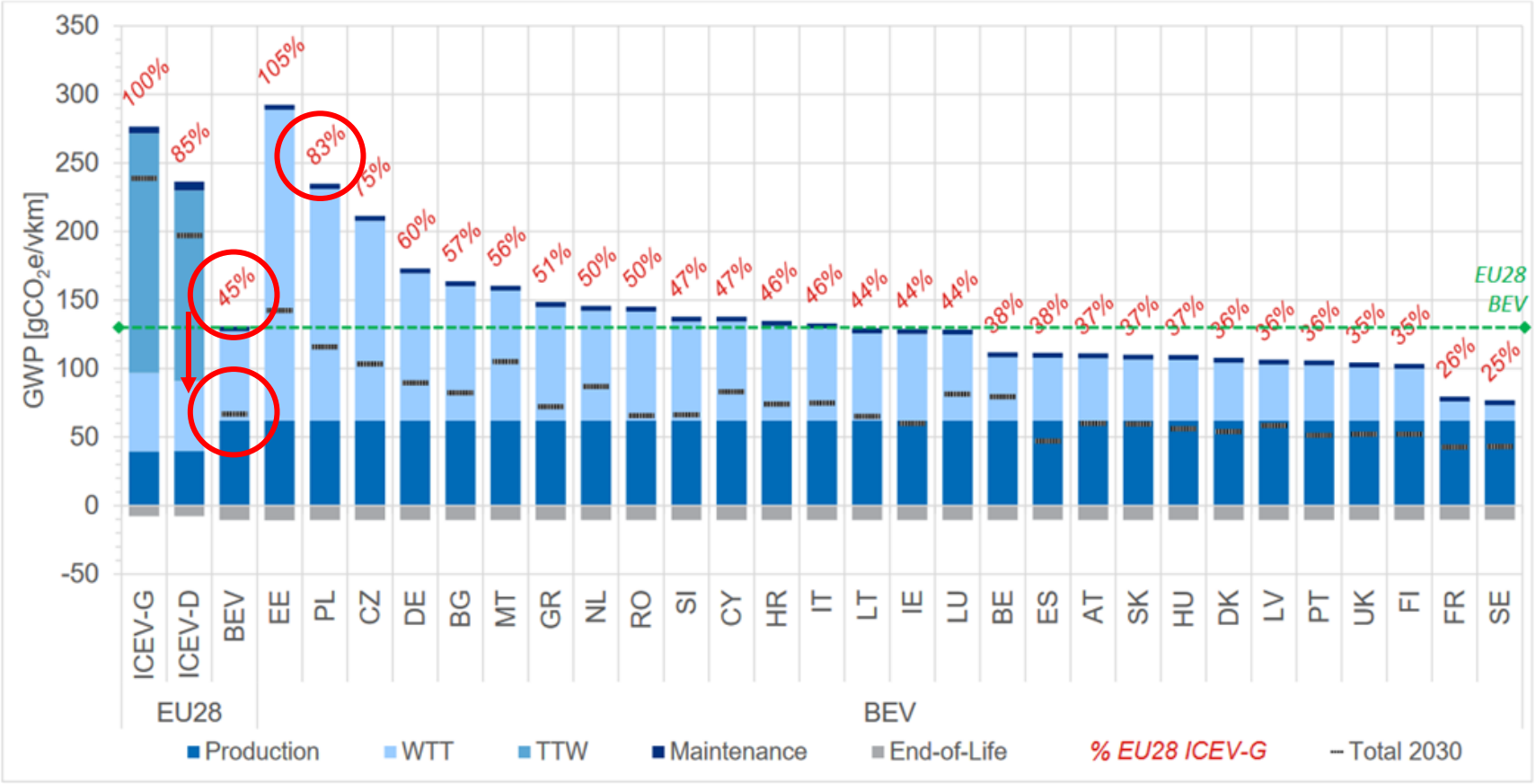
ELECTRIC CARS: THE BEST OPTION ALREADY TODAY

- "xEV powertrains have significantly lower environmental impacts across all vehicle types and most impact categories, with **BEVs consistently performing better than all other powertrains**."

- For further improvements:
  - More renewables in use
  - More renewables in production
  - Responsible sourcing
  - **Circular economy**

Figure ES5: Comparison of Lower Medium Car lifecycle GWP impacts for conventional gasoline/diesel ICEVs and BEVs for different EU countries, Baseline scenario. Breakdown shown for new 2020 vehicles, and the total only for new 2030 vehicles.



Source: EU Joint Research Centre, IFEU (2020). Determining the environmental impacts of conventional and alternatively fuelled vehicles through LCA. https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/2020_study_main_report_en.pdf)

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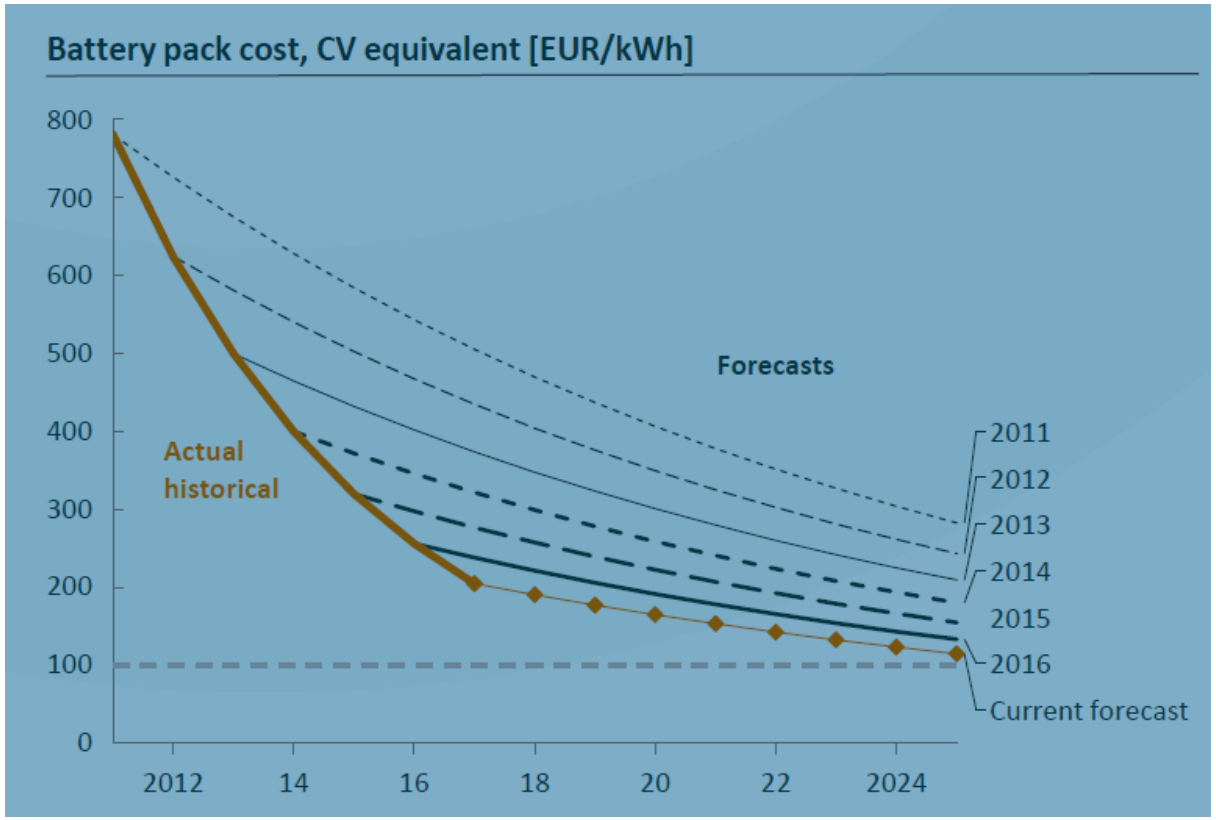
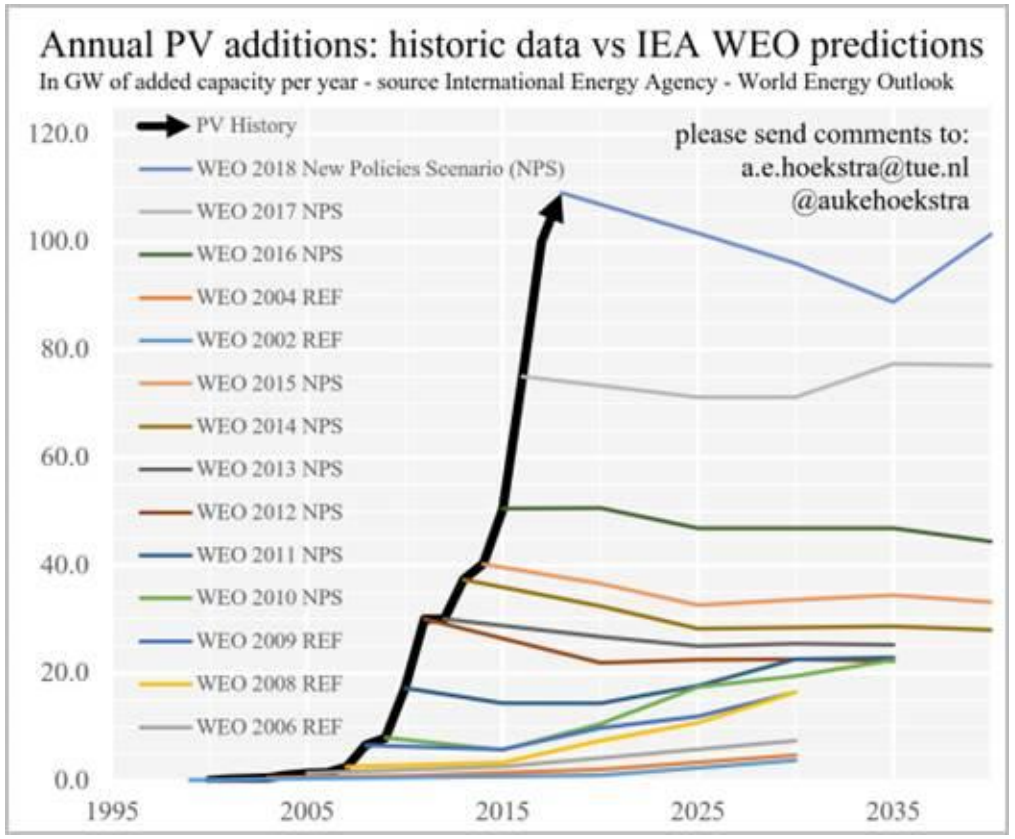
… AND WILL SCALE FAST – FASTER THAN MOST FOLKS TELL US





Sources: Hoekstra | team analysis

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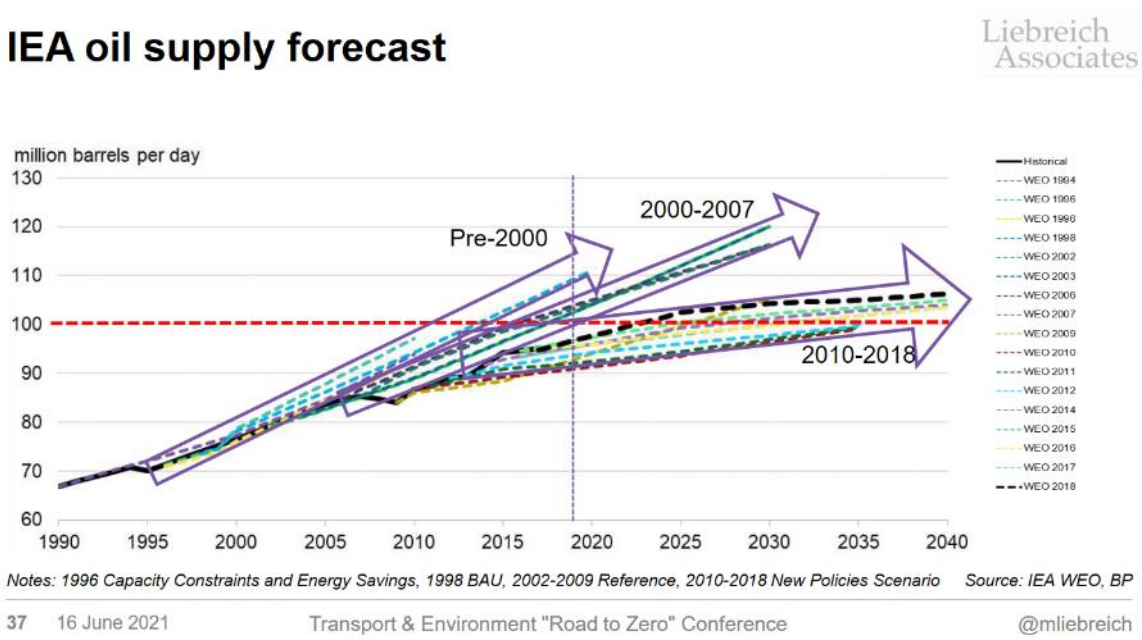
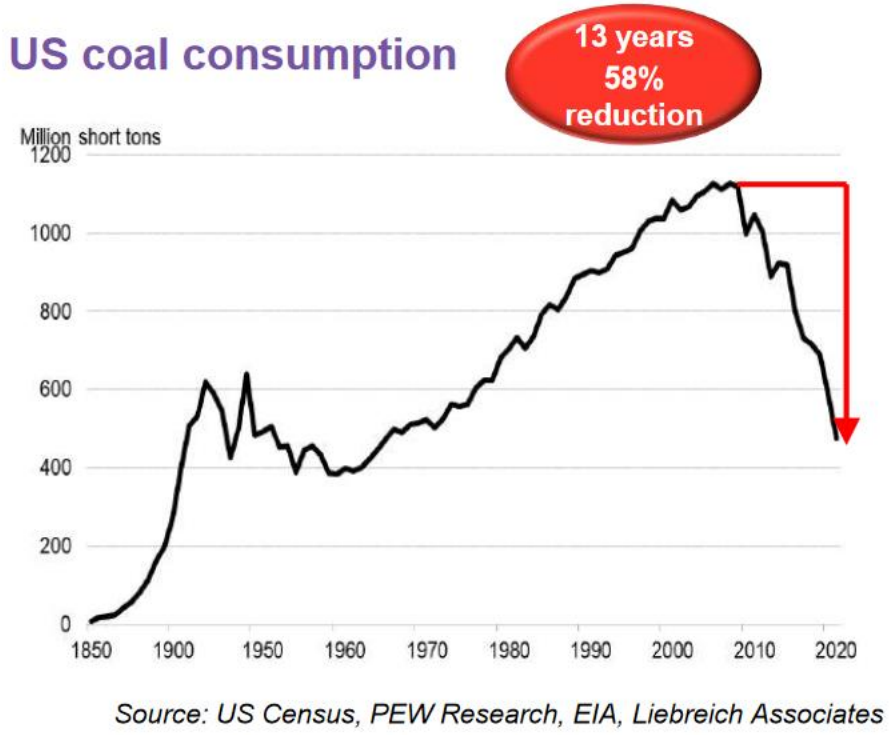
(MEANWHILE, BETTING ON LEGACY INDUSTRIES IS RISKY…)





Source: Transport & Environment

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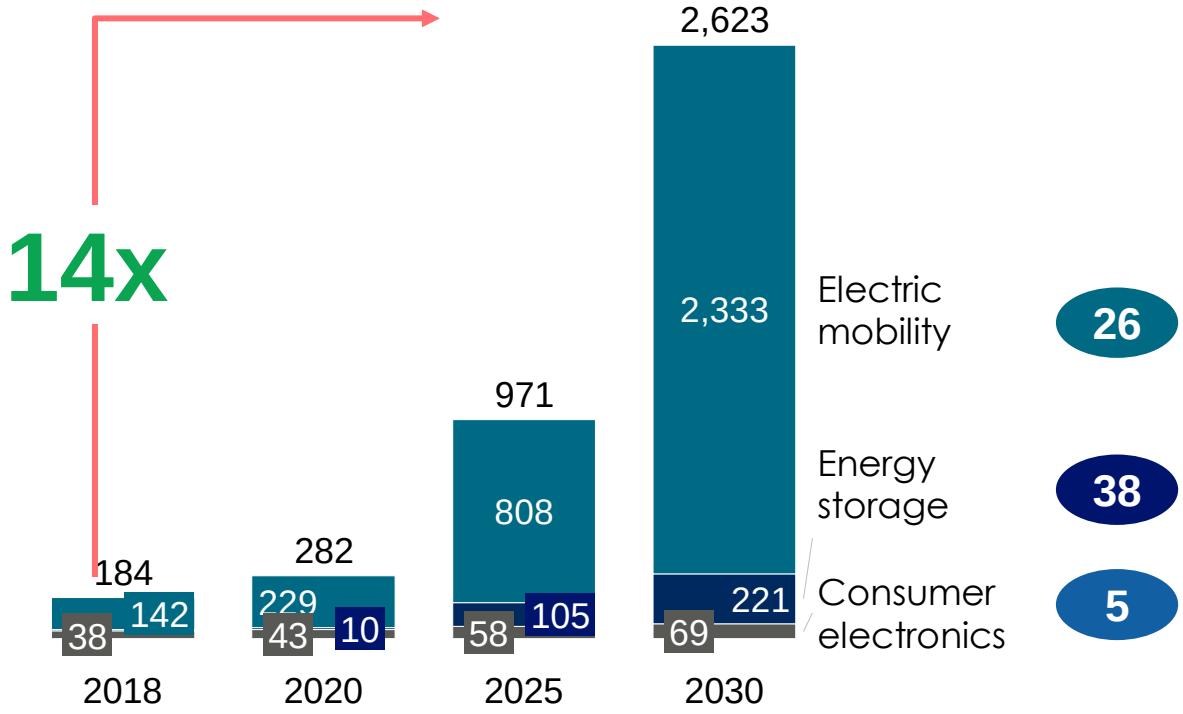
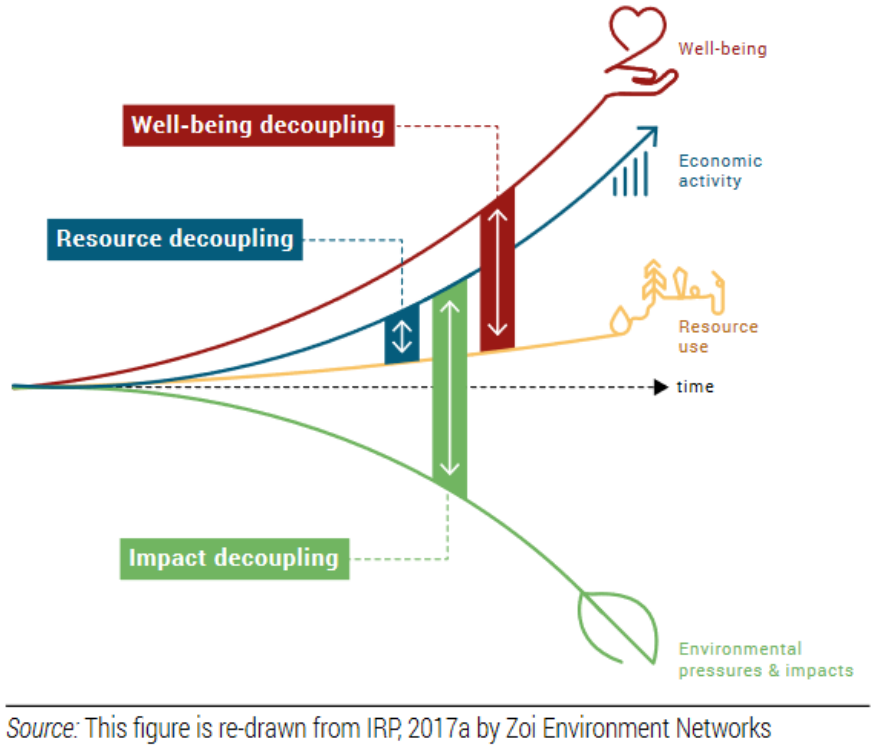
LI-ION BATTERIES AS A NEW AREA OF GROWTH FOR THE EUROPEAN ECONOMY NEEDS ADEQUATE RESOURCE MANAGEMENT

Global battery demand by application
GWh in 2030, base case



Decoupling environmental effects to secure planetary boundaries (safe operating space)



Source: This figure is re-drawn from IRP, 2017a by Zoi Environment Networks

Sources: World Economic Forum, McKinsey, and SYSTEMIQ (2019); UN International Resources Panel (2020)

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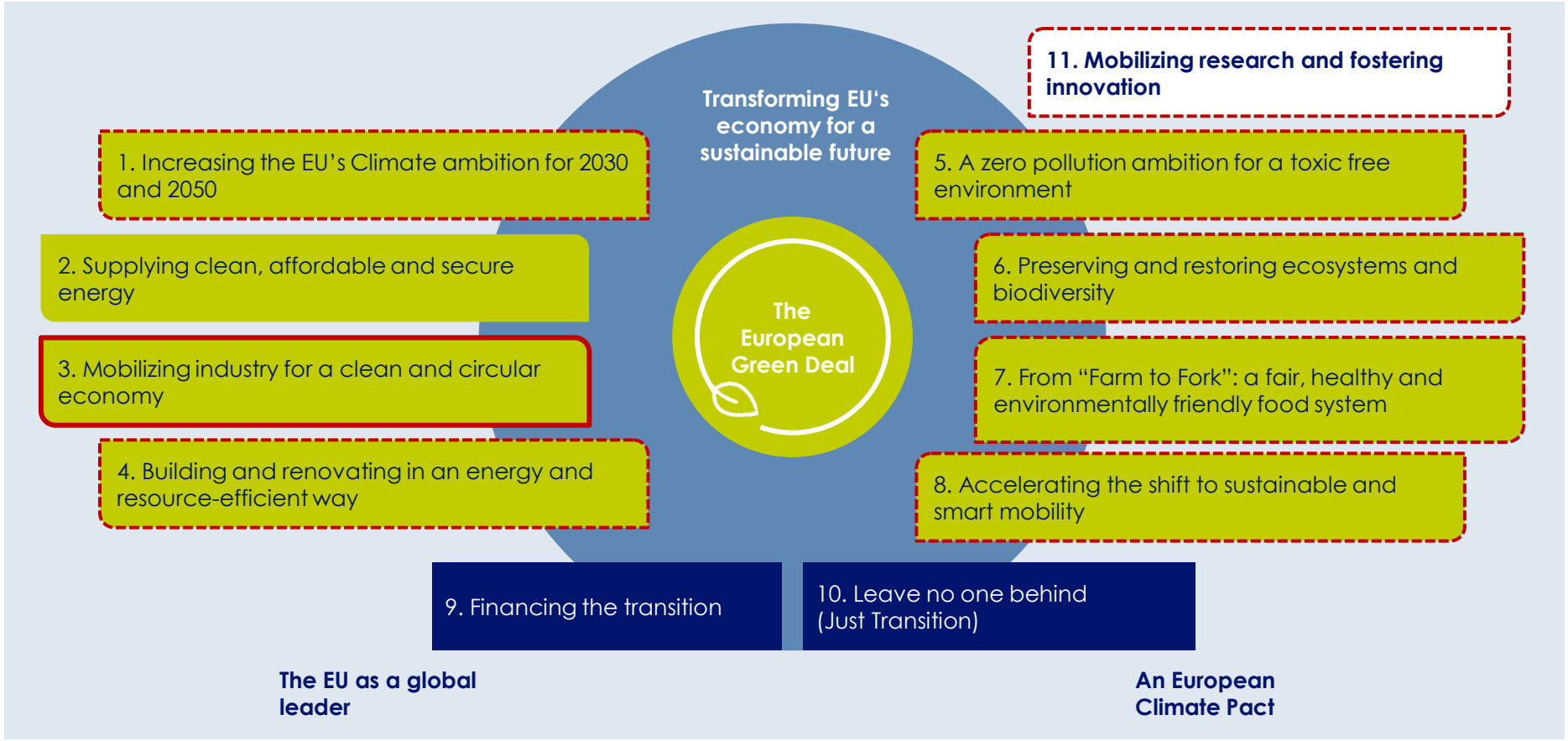
CIRCULAR ECONOMY HAS ARRIVED IN EU POLICY AS AN EFFECTIVE MEASURE FOR CLIMATE AND RESOURCE PROTECTION

Overview of the European Green Deal (EGD)



Source: European Commission (2020)

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CIRCULAR CARS INITIATIVE WORKS ON UNLOCKING CIRCULARITY FOR THE AUTOMOTIVE SECTOR AT LARGE – REPORT JUST LAUNCHED

"The Circular Cars Initiative EU policy action roadmap provides a timely and compelling synthesis of the policy ideas that will inform and inspire EU-level policy-making".
Adina Valean, European Commissioner for Transport

Source: https://www.weforum.org/reports/paving-the-way-eu-policy-action-for-automotive-circularity

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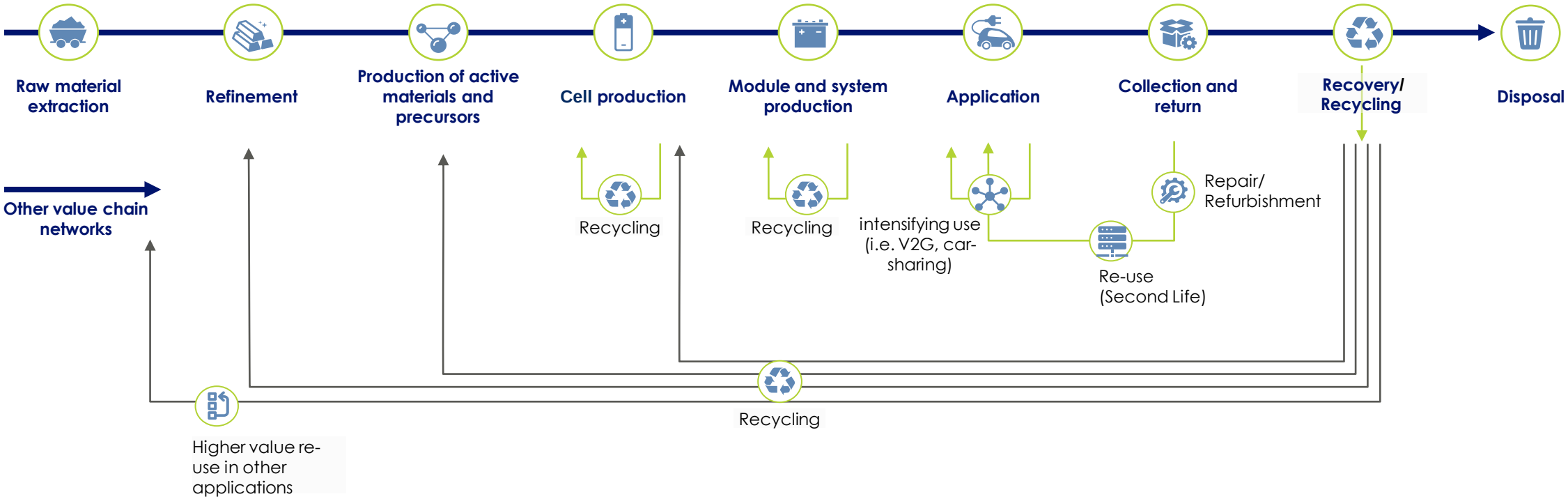
CIRCULAR ECONOMY AS A SOLUTION FOR DECARBONIZATION AND RESOURCE DECOUPLING IN THE BATTERY VALUE CHAIN



Source: Circular Economy Initiative Germany, based on figure from World Economic Forum (2019)

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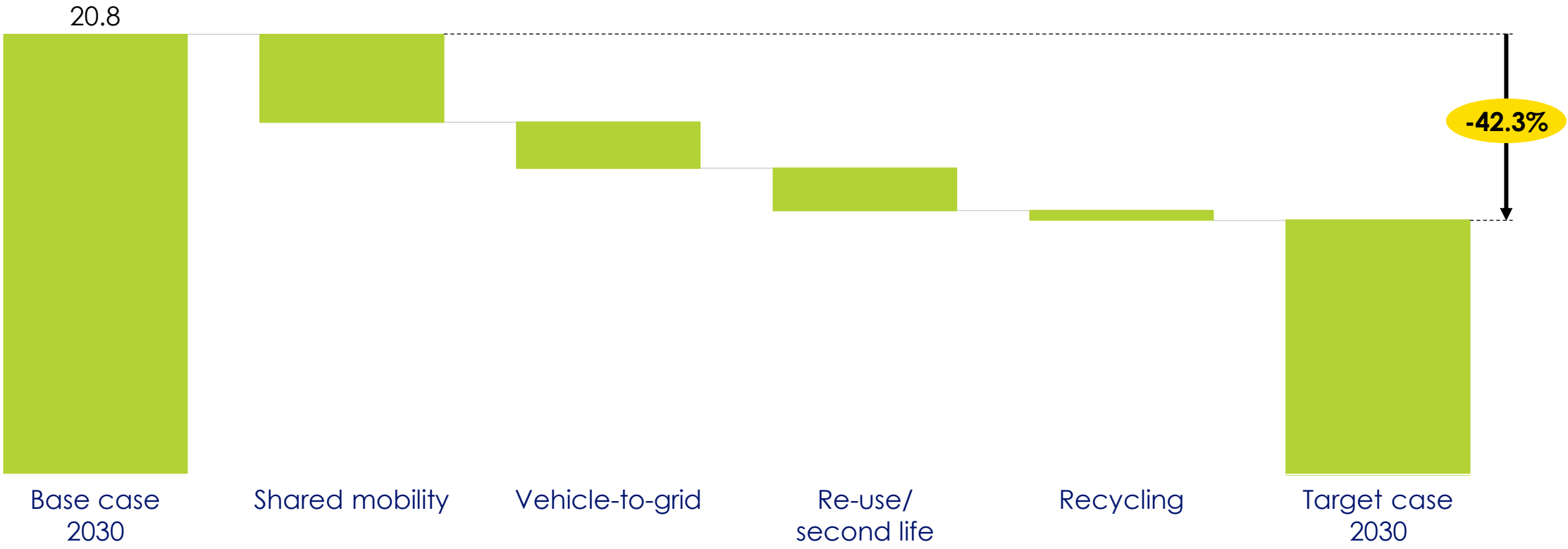
BACK TO BATTERIES: CIRCULAR ECONOMY ENABLES A SIGNIFICANT REDUCTION OF THE LIFE CYCLE FOOTPRINT

2030 Lifecyle GHG emissions for medium size (C/D) vehicles in China



Source: World Economic Forum, McKinsey, and SYSTEMIQ (2019)

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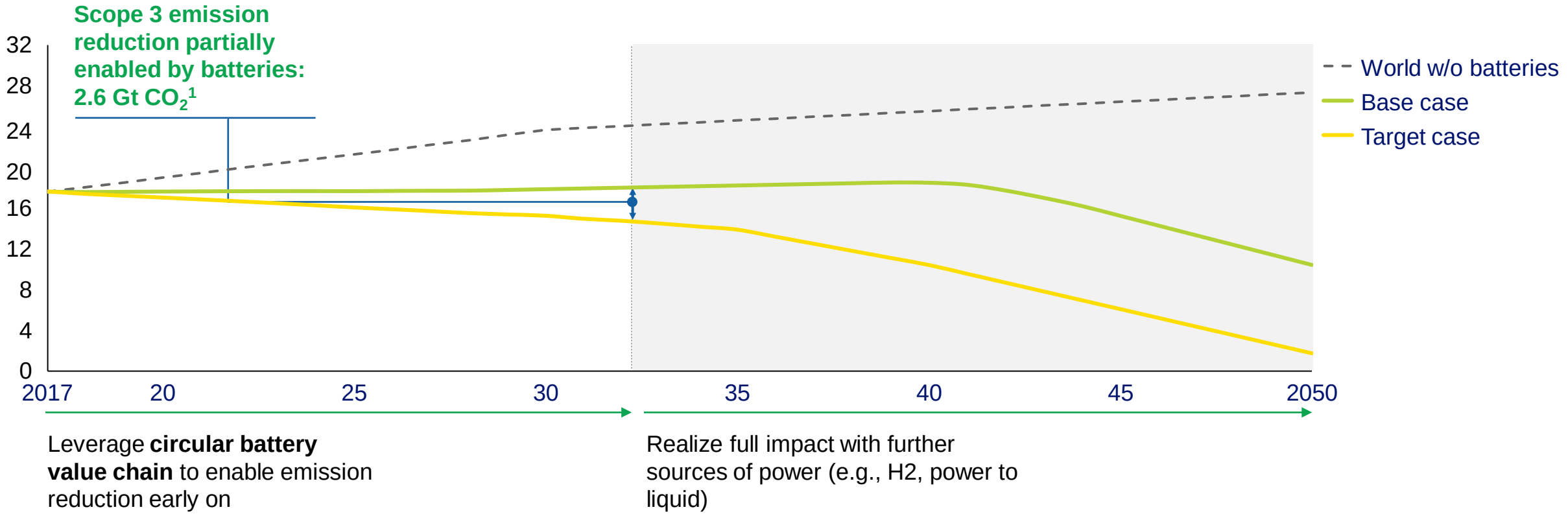
CIRCULARLY MANAGED BATTERIES ENABLE SUBSTANTIAL CO_2 SAVINGS IN TRANSPORT AND ALSO ENERGY SYSTEMS

Global annual emissions from transport and power

Gt CO_2 p.a.



[1] 1.0 Gt out of 2.6 Gt of reduction directly or indirectly enabled by batteries

Source: World Economic Forum, McKinsey, and SYSTEMIQ (2019)

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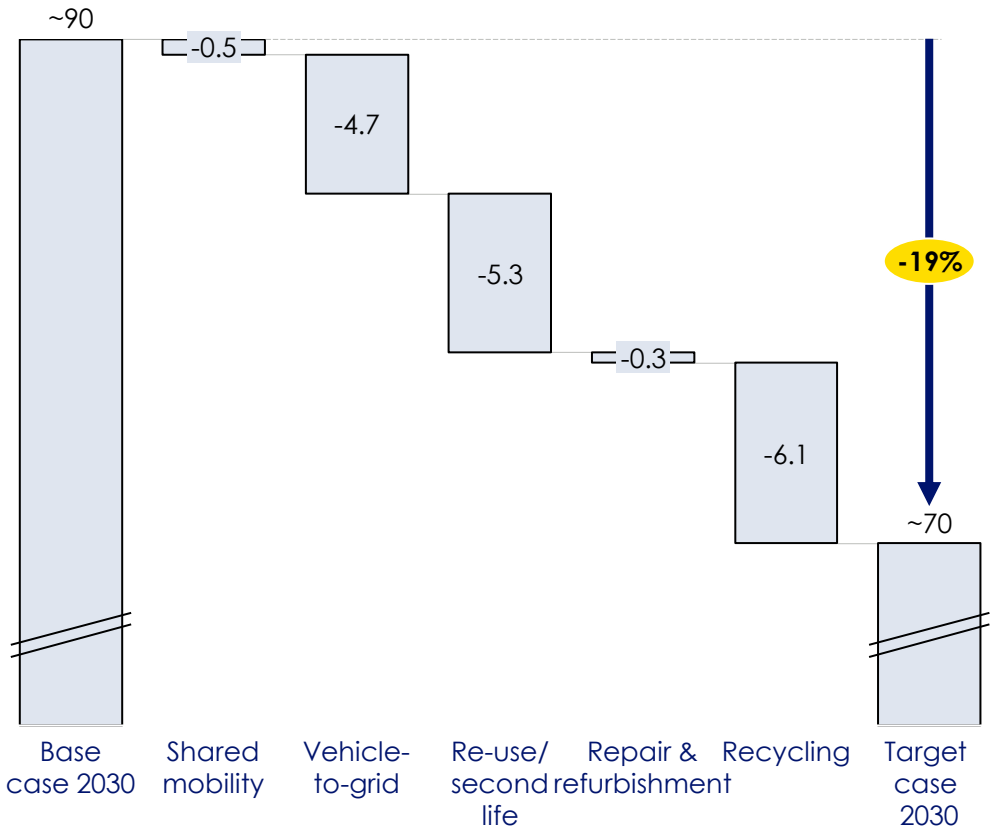
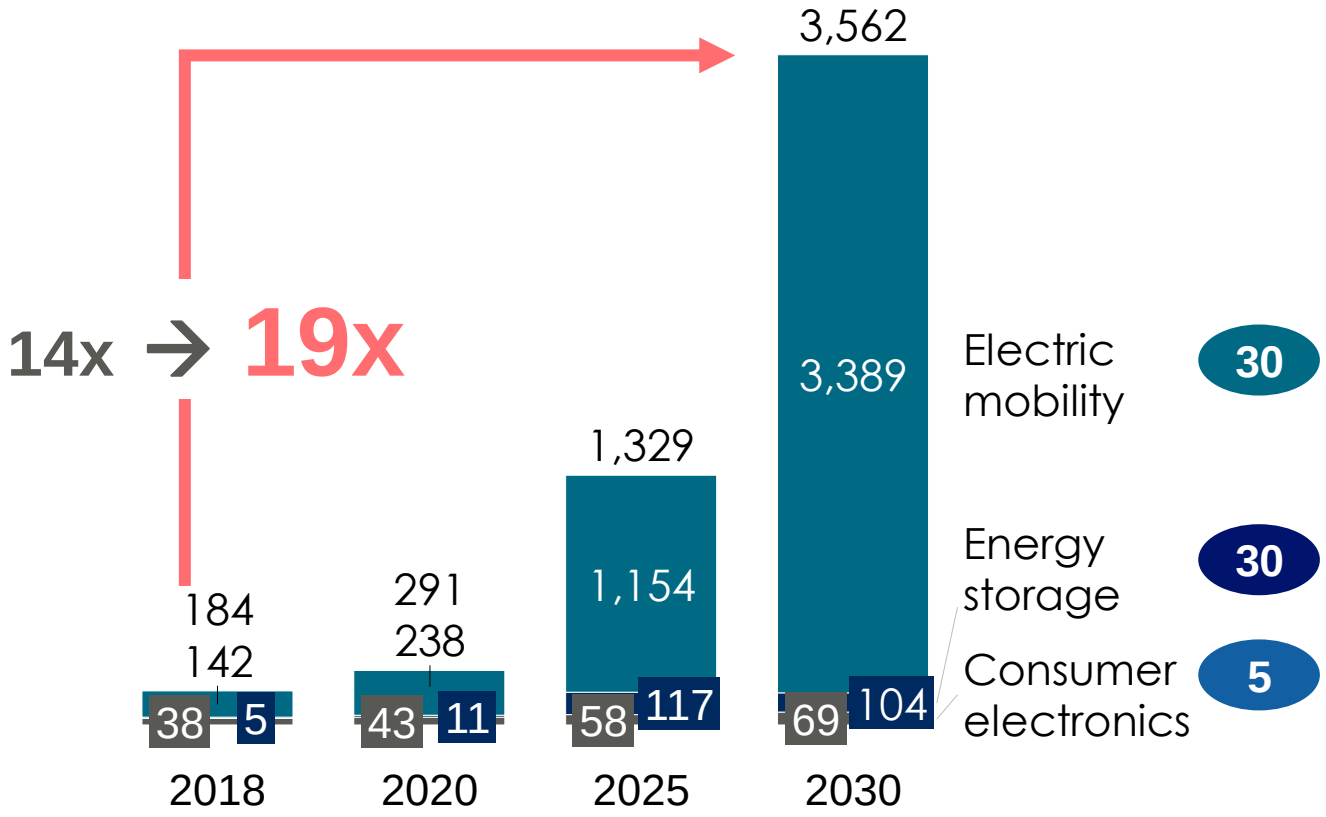
LIFE CYCLE COST REDUCTION FROM CIRCULARITY COULD IMPROVE PROFITABILITY AND LEAD TO AN INCREASE IN MARKET RAMP-UP

2030 Ex. passenger car, average battery cost
USD/kWh



Global battery demand by application
GWh in 2030, target case

CAGR
% p.a.



Source: World Economic Forum, McKinsey, and SYSTEMIQ (2019)

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DIGITAL IS KEY: BATTERY REGULATION WILL COMPREHENSIVELY PROMOTE AND REQUIRE CIRCULAR BATTERY MANAGEMENT

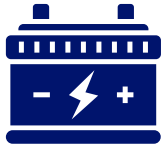
1 Assessment of hazardous substances

2 Mandatory CO2 footprint

3 Minimum quotas of recycled materials

4 Mandatory human rights due diligence

5 Recycling efficiencies and material recovery targets



6 Support of second life applications

7 Improvement of data availability (incl. battery passport)

8 Green public procurement

Source: European Commission (2020)

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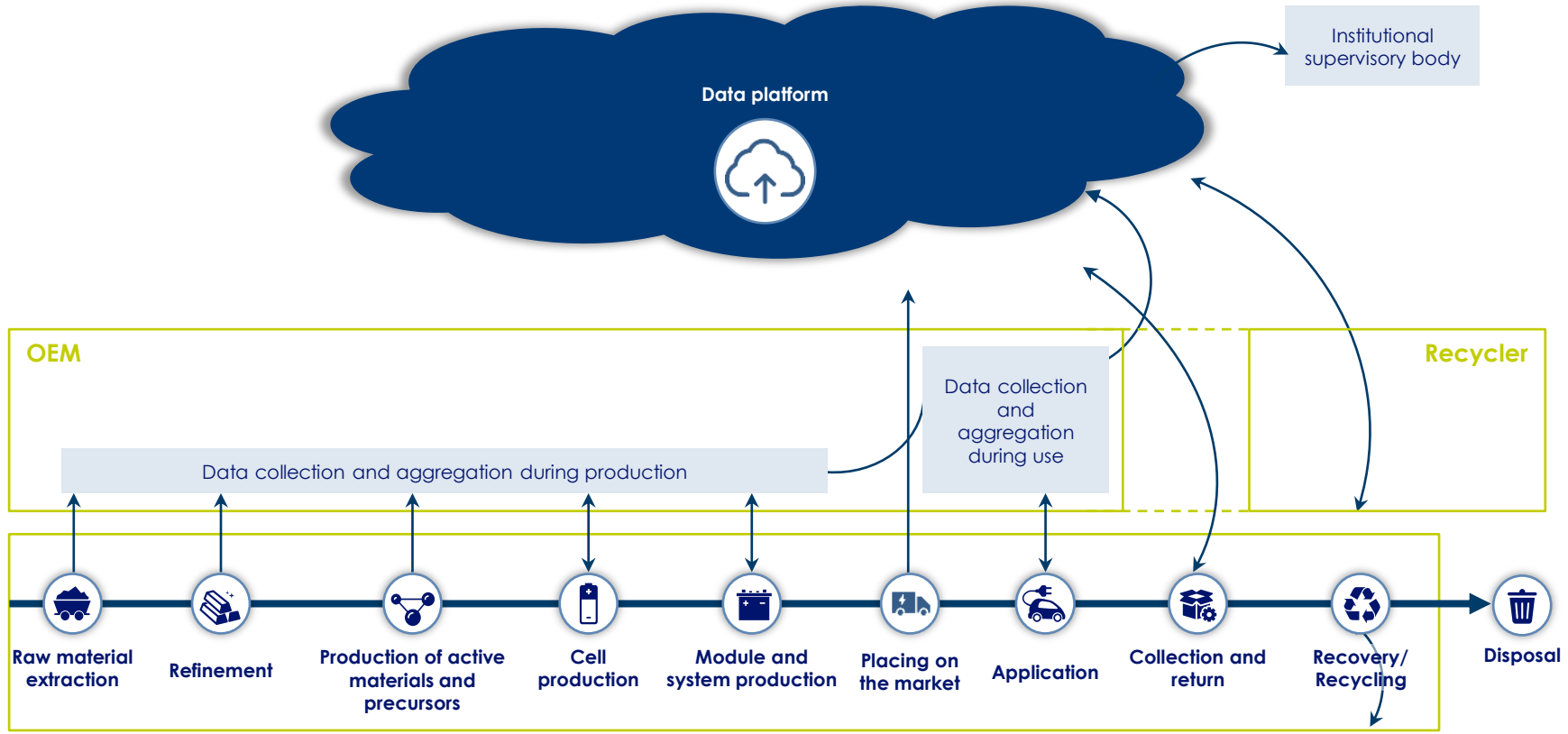
THE AVAILABILITY OF DATA AND DIGITAL TOOLS IS CRITICAL TO ENABLE THE SMART CIRCULAR ECONOMY – ESPECIALLY FOR LARGE BATTERIES



Source: Circular Economy Initiative Germany, based on figure from Global Battery Alliance (2019)

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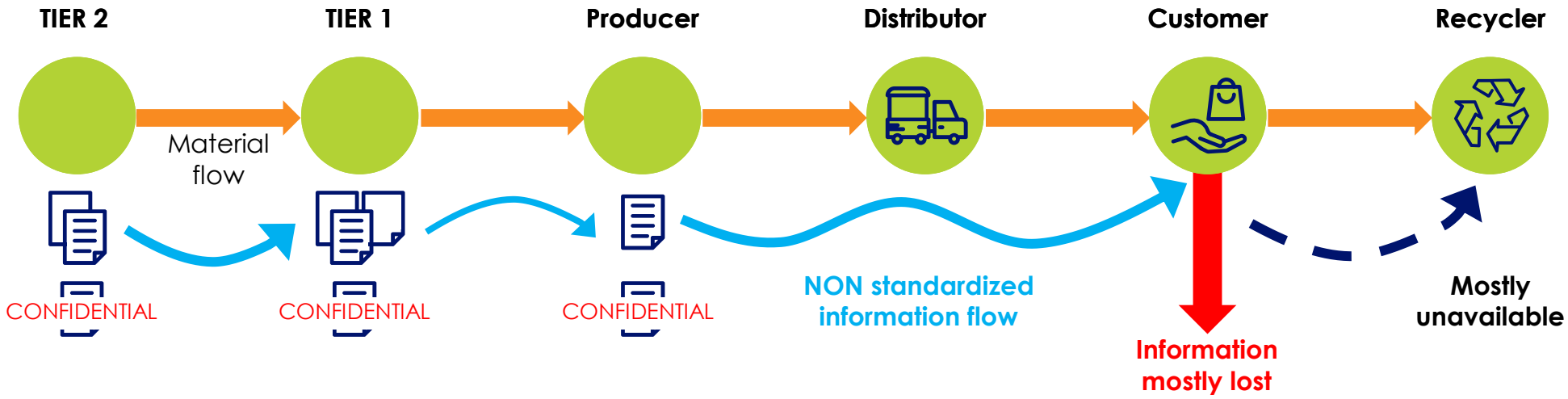
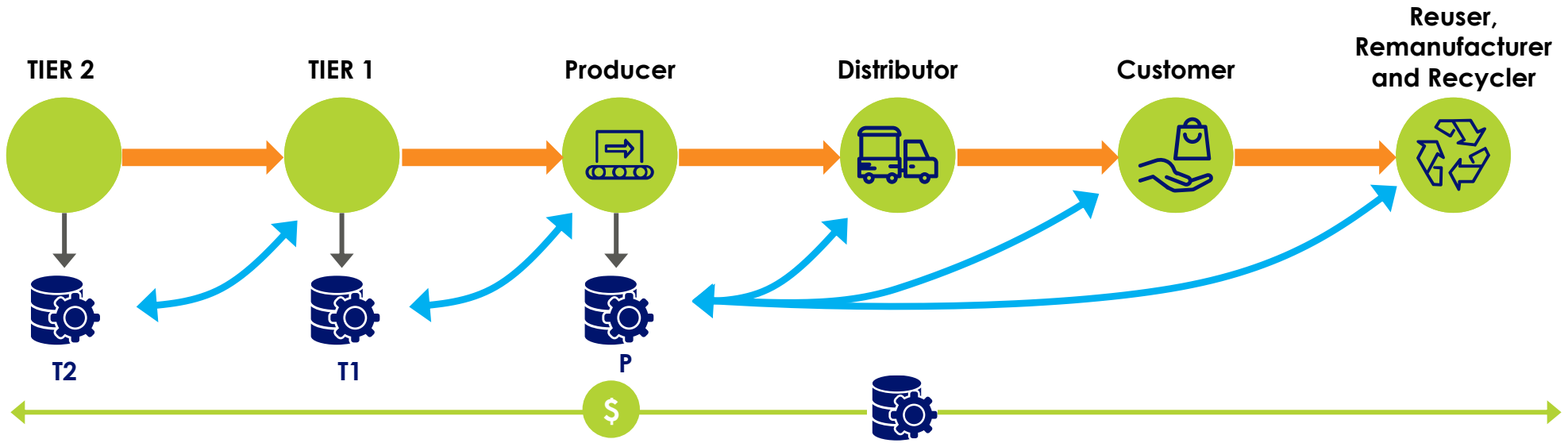
WHY DIGITAL PRODUCT PASSPORTS, SUCH AS BATTERY PASSPORT?

Information flow in a linear economy



Information flow in a circular economy, enabled by digital product passports



Source: European Commission (2020)

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BATTERY PASSPORT: VALUE AT STAKE FOR INDUSTRY AND SOCIETY

Manufacturers

- Cost reduction of EoL **safe handling**
- Clarification of transfer of **liability**
- Tracking of raw material flows & **responsibility**
- Potential for **monetization of battery data**
- Improvement of **secondary market** for batteries

Logistics providers

- Cost reduction through **safety-relevant information** ("green labeling")
- **Planning security** through market transparency

Second hand users

- **Safety and value assessment** through State of Health Report
- **Reliable CO2 measurement** for further use and, if necessary, accreditation

Recyclers

- **Facilitate investments and plant design** through information on expected and current material flows
- Cost reduction in **handling** of batteries through safety protocols and technical information

Public

- Increase **of raw material independence** and transparency over the whole system for key industries
- Data basis for efficient activities including **market creation**
- Cost reduction for **(de-) registration** (digital/harmonized)

Non-exhaustive; see CEID report for further details

Source: Circular Economy Initiative Germany (2020). Resource-Efficient Battery Lifecycles: Driving Electric Mobility with the Circular Economy

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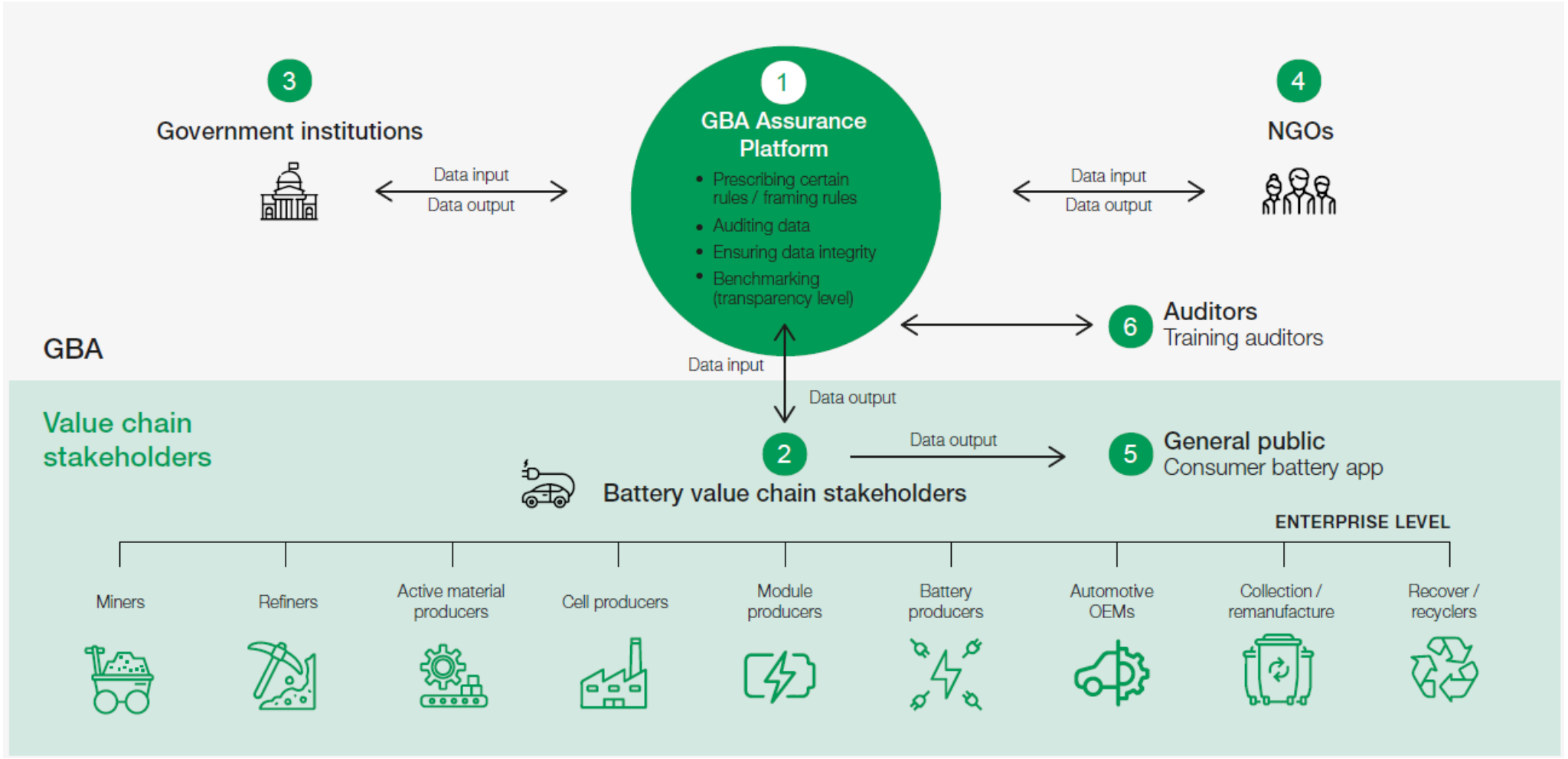
THE GLOBAL BATTERY ALLIANCE HAS PRESENTED A CONCEPT FOR A BATTERY PASSPORT; NEXT STEP IS COOPERATIVELY IMPLEMENTING IT



Source: Global Battery Alliance (2020)

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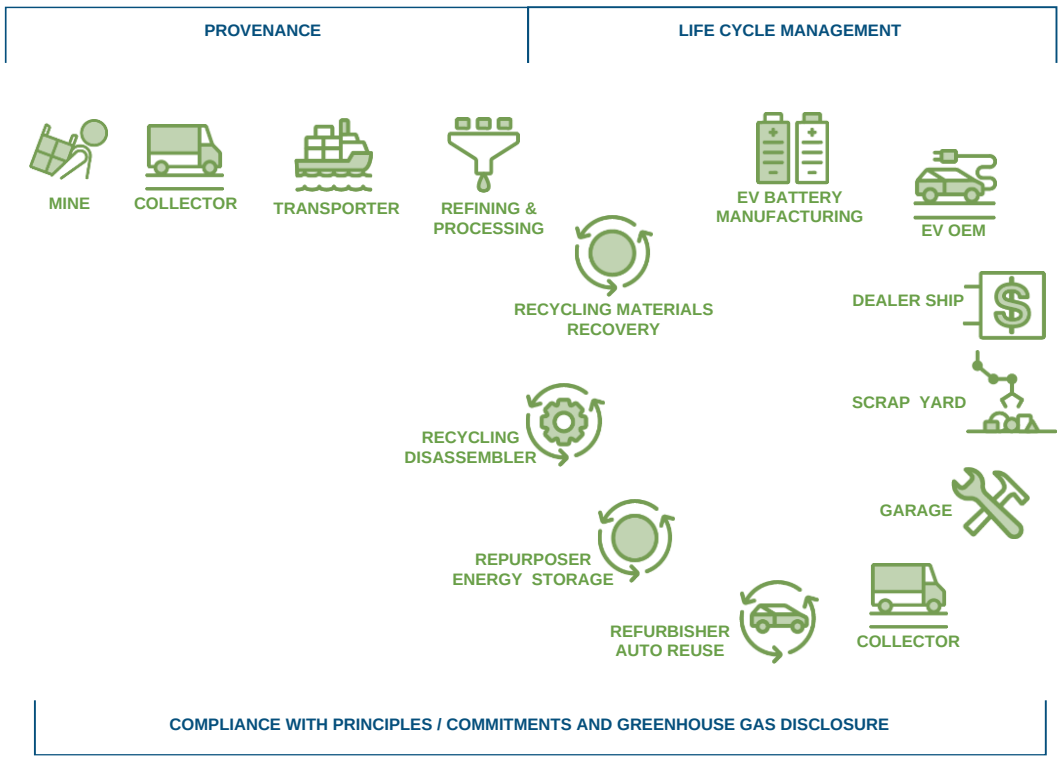
THERE ARE COMPONENTS UNDER DEVELOPMENT – E.G. CIRCULOR

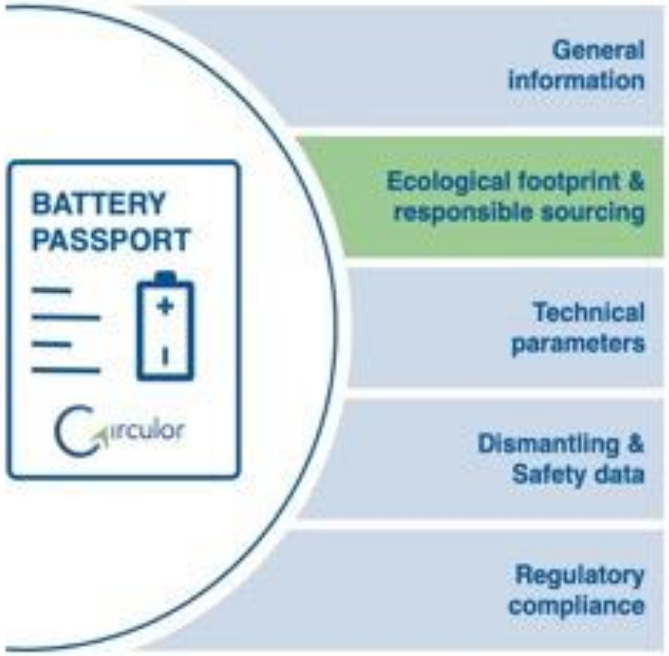


Secure Data collection, provision, and analysis from mine to recycler

Source: Circulor

Full transparency through

- **Permission-based access to relevant battery information** for economic operators
- Possibility to **add further lifecycle data** over lifetime
- Proof of **adherence to principles and standards**



- **Full transparency into the ecological footprint and responsible sourcing** of every battery through data from different value chain participants
- **Easy merging with further parameters** like technical battery parameters, dismantling and safety data and regulatory compliance checks

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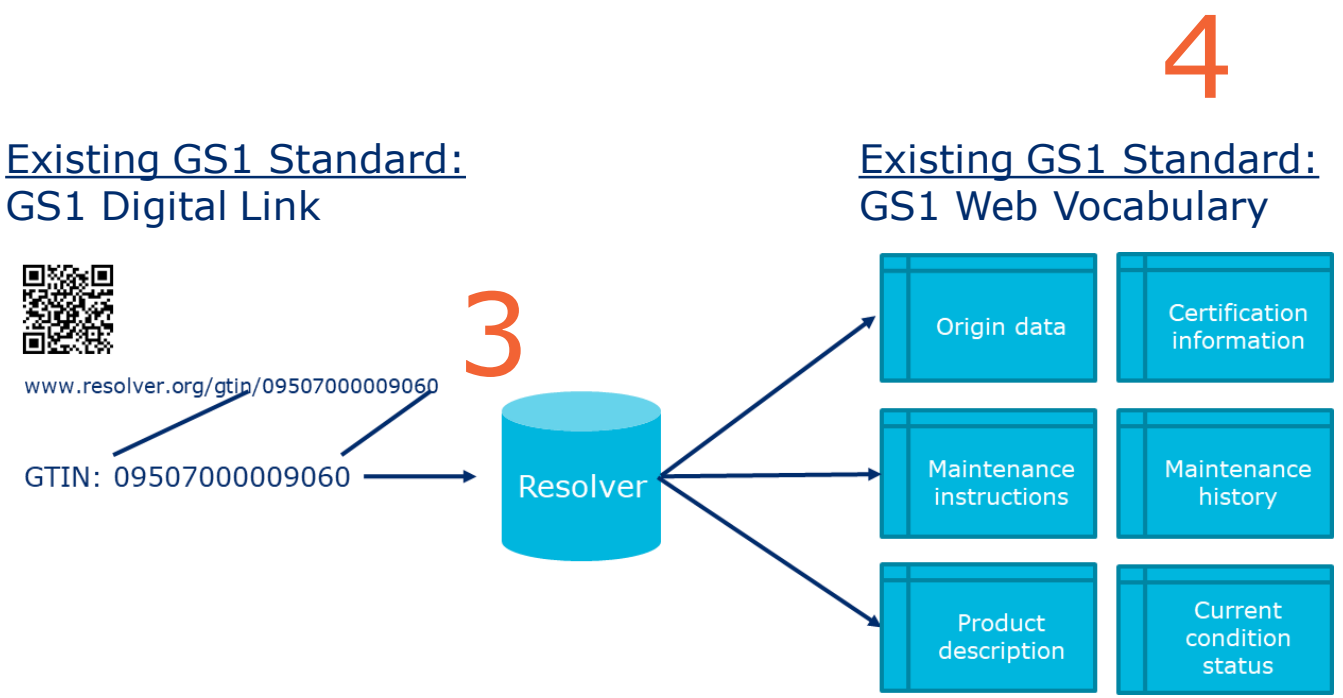
GS1 HAS JOINED COALITIONS THAT DEVELOP A HARMONIZED DATA STANDARD FOR BATTERY PASSPORTS

GS1 involvments

1. Business need for unique identification
2. Business need for QR code or similar that can be engraved on metal
3. Business need to link unique identity to multiple data sources
4. Business need to define the data needed



Source: GS1

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WITH THE CIRCULAR ECONOMY INITIATIVE GERMANY, WE HAVE SET THE GROUND FOR THE BATTERY PASSPORT. NEXT: IMPLEMENTATION

Politics

Bundesministerium für Bildung und Forschung
Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit
Bundesministerium für Wirtschaft und Energie

Coordination

acatech – Deutsche Akademie der Technikwissenschaften
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Industry

ALPLA, BOREALIS, DAIMLER, CLARIANT, cirplus, FIWARE, AfB social & green IT, ACCUMOTIVE, SCHWARZ, covestro, Henkel, Hochland, interseroh, RLG, BMW, TRUMPF, PEM MOTION, pacoon, GEMEINSAMES RÜCKNAHME SYSTEM, SIEMENS, RECENSO, SAP, SIEGWERK, umicore

Science

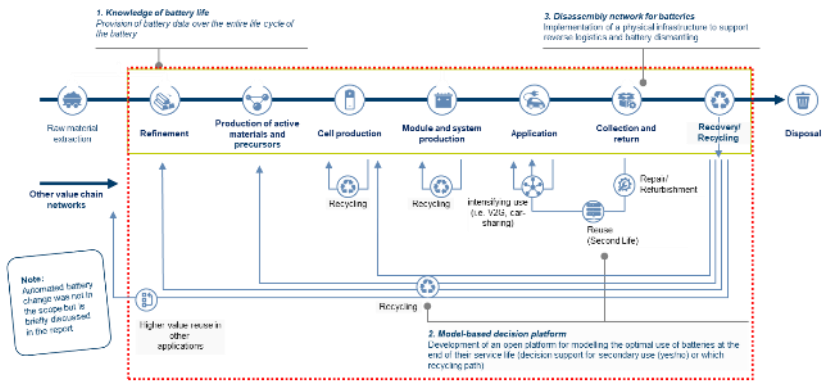
Fraunhofer ICT, Fraunhofer UMSICHT, Technische Universität Braunschweig, Öko-Institut e.V., KIT, Fraunhofer IPK, TU Clausthal, TECHNISCHE UNIVERSITÄT KAISERSLAUTERN, Technische Universität München, ETH Zürich, JKU Johannes Kepler Universität Linz, ESCP Europe, HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF, TECHNISCHE UNIVERSITÄT CHEMNITZ, hhu, Borderstep Institut für Innovation und Nachhaltigkeit, Wuppertal Institut, Universität Bonn, RWTH AACHEN UNIVERSITY, TECHNISCHE UNIVERSITÄT DRESDEN, Technische Universität Berlin

Civil Society & further Institutions

WWF, European Climate Foundation, Agora Verkehrswende, Energiesysteme der Zukunft, WORLD ECONOMIC FORUM, KLiB, NPM, SUN Institute

Working Group Traction Batteries

Focus



Source: own figure, based on World Economic Forum 2019

Members

Industry: ACCUMOTIVE, BMW, covestro, interseroh, DAIMLER, PEM MOTION, RLG, SAP, SIEMENS, TRUMPF, umicore

Science: Fraunhofer IPK, KIT, RWTH AACHEN UNIVERSITY, Technische Universität Braunschweig, HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF, Öko-Institut e.V., Technische Universität Berlin, TU Clausthal

Civil Society & further institutions: Agora Verkehrswende, GEMEINSAMES RÜCKNAHME SYSTEM, Dr. Michael Krausa, Geschäftsführer von KLiB, NPM

EU Battery Passport

Made with Germany

Made together

Source: Circular Economy Initiative Germany (2020). Resource-Efficient Battery Lifecycles: Driving Electric Mobility with the Circular Economy

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SUMMARY: CIRCULAR ECONOMY FOR A SUSTAINABLE, COMPETITIVE BATTERY INDUSTRY

- Critical for **electric mobility**: improving the economic and environmental footprint of **traction batteries** and securing the **raw material base**
- **Circular Economy:** central pillar of sustainable prosperity in the 21st century
- **Digital tools and data** as crucial levers to maximize value of traction batteries – "**battery passport**" and "**dataspace**" as central elements
- **Battery regulation as a milestone**: central regulatory driver – **must now be adopted as regulation and in an ambitious configuration**
- **Standards, frameworks, and technology:** development by companies and consortia must now be accelerated to put battery passports into practice

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THANK YOU!

LOOKING FORWARD TO OUR DISCUSSION

Tilmann.vahle@systemiq.earth
www.systemiq.earth

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