



# Life Cycle Inventory Analysis: Overview and Changes since WS2 - Production and EoL

Third eLCAr Workshop

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## Outline

- Life Cycle Inventory Analysis
- Production phase – overview
- Production phase – changes since WS2
- End of life phase – overview
- End of life phase – changes since WS2

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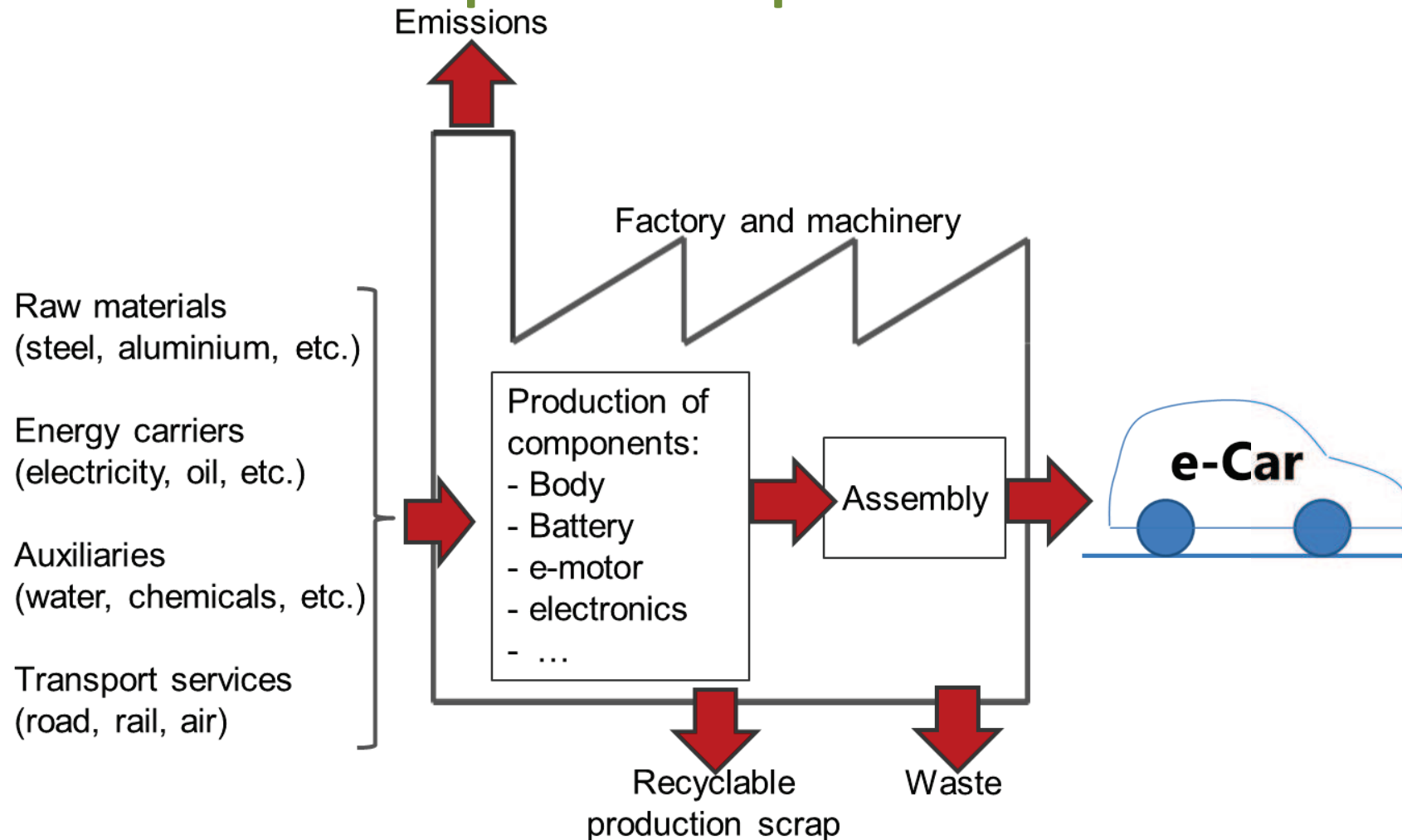
## Life Cycle Inventory (LCI) Analysis

- Identifying processes within the system boundaries
- Planning data collection
- Data collection
- Solving multifunctionality
- Modelling the system
- Calculating the LCI results

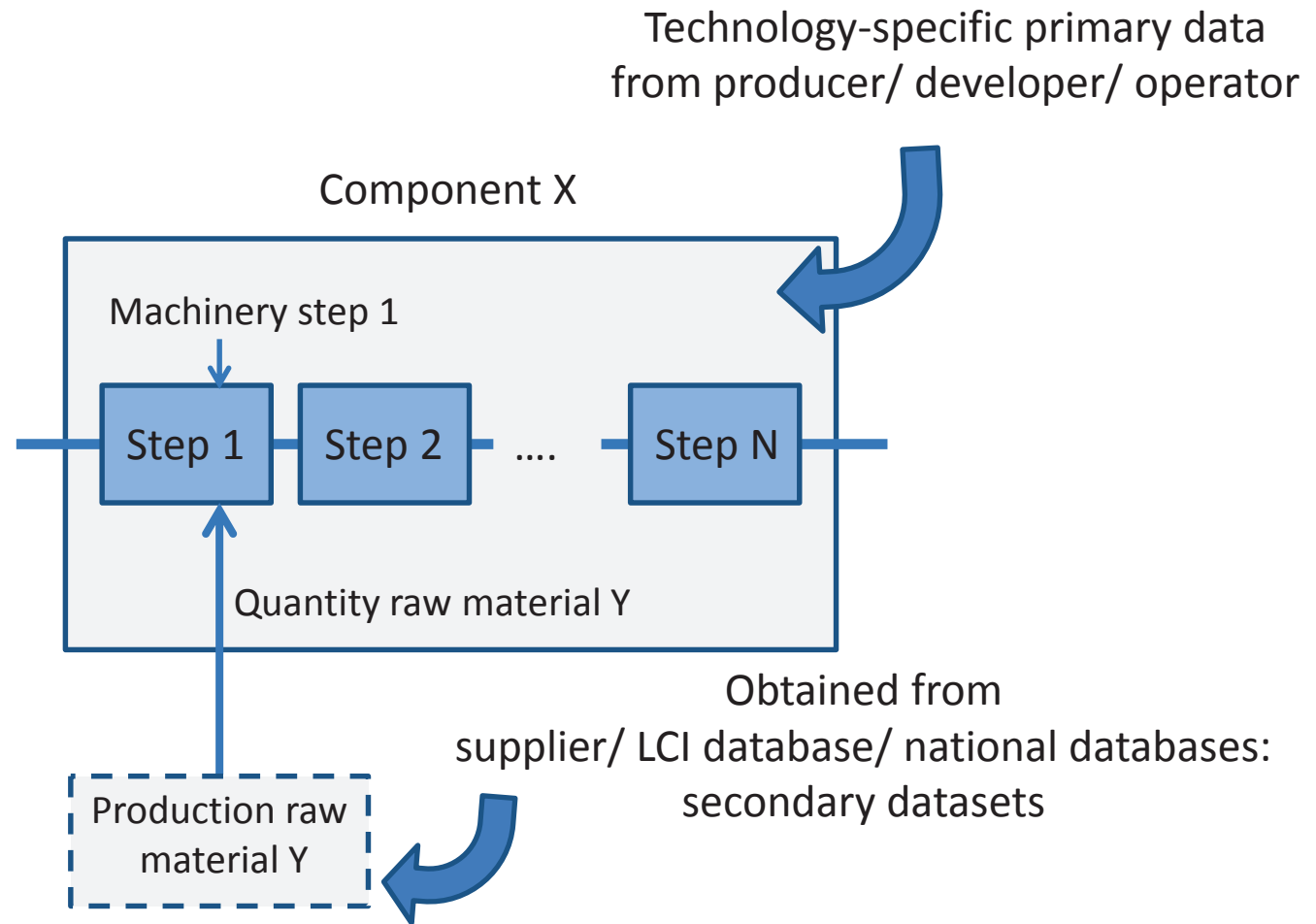
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## Identifying processes within the system boundaries: production phase

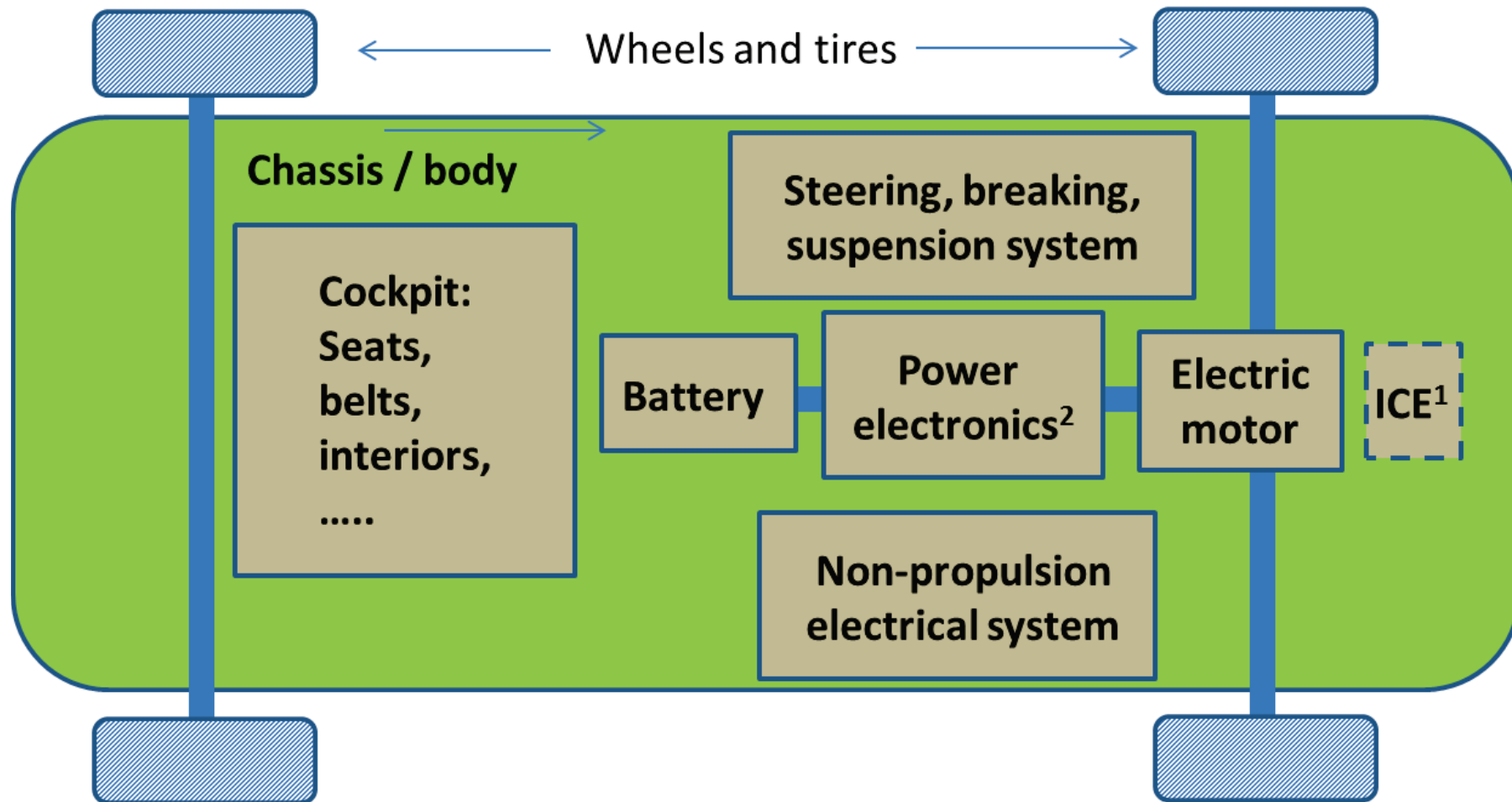


## Planning data collection: primary vs. secondary data





## Main components in the vehicle



1 for PHEV

2 Charger included in power electronics



## Component specific recommendations for modelling of production

- Battery production
- Body production
- Electric motor production
- SBSS, transmission and ICE for serial PHEVs production
- Production of tyres and wheels
- Production of modules within the cockpit
- Power electronics and and non-propulsion electrical system production

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## Battery production

- Comments in WS2 on battery life time and definition
- Addressed in chapter 4 (Technological context)!

## Foreground and background system

Three situations:

- Focus on a specific component  
(no interaction with rest of vehicle)  
→ only life cycle of the specific component
- Focus on a specific component  
(interaction with rest of vehicle)  
→ specific component: foreground  
→ influenced components: background
- Focus on the entire vehicle → vehicle: foreground

## Provisions

- Reduction of provisions
- Texts transferred to “LCI recommendations”

### 7.1.1.4 Overview: LCI recommendations for battery production

The provisions given in box 7.1.1.4 describe some of the key sub-components and processes which are part of typical, currently available batteries. In the LCI of a battery, important processes are typically the production of the electrodes, the acquisition of critical materials (e.g. Lithium), the production of the electrolyte, the production of the separator, the production of the case, the production of the battery management system and the assembly. Moreover, in terms of material inputs, some batteries require high quantities of copper which is used due to its good conductivity properties. However, the sulfidic tailings coming from the mining of copper cause substantial environmental impacts. It is important that this is taken into account in the LCI, at least in the secondary data used for the modelling of raw materials' extraction. The same holds for Lithium which is used in Lithium-Ion batteries and requires particular extraction techniques. Further, these may change in the future if the request for Lithium, due to a growth in the production volume of battery electric vehicles and, therefore, of Lithium-Ion batteries, should increase. Modern batteries are equipped with electronic battery management systems. For this sub-component of batteries, the same recommendations given for the high power electronics hold.

### Provisions 7.1.1.4: Overview: LCI recommendations for battery production

l— SHALL: Verify that the mining of copper and its sulfidic tailings and the extraction of Lithium are appropriately described in the LCI (at least in the secondary datasets describing the back-

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## General Process of EoL



### End of Life Process

- Recycling with specific recycling rates mandatory in the European Union
- Not a reverse of production and assembly
- All steps must be included that lead to secondary good.

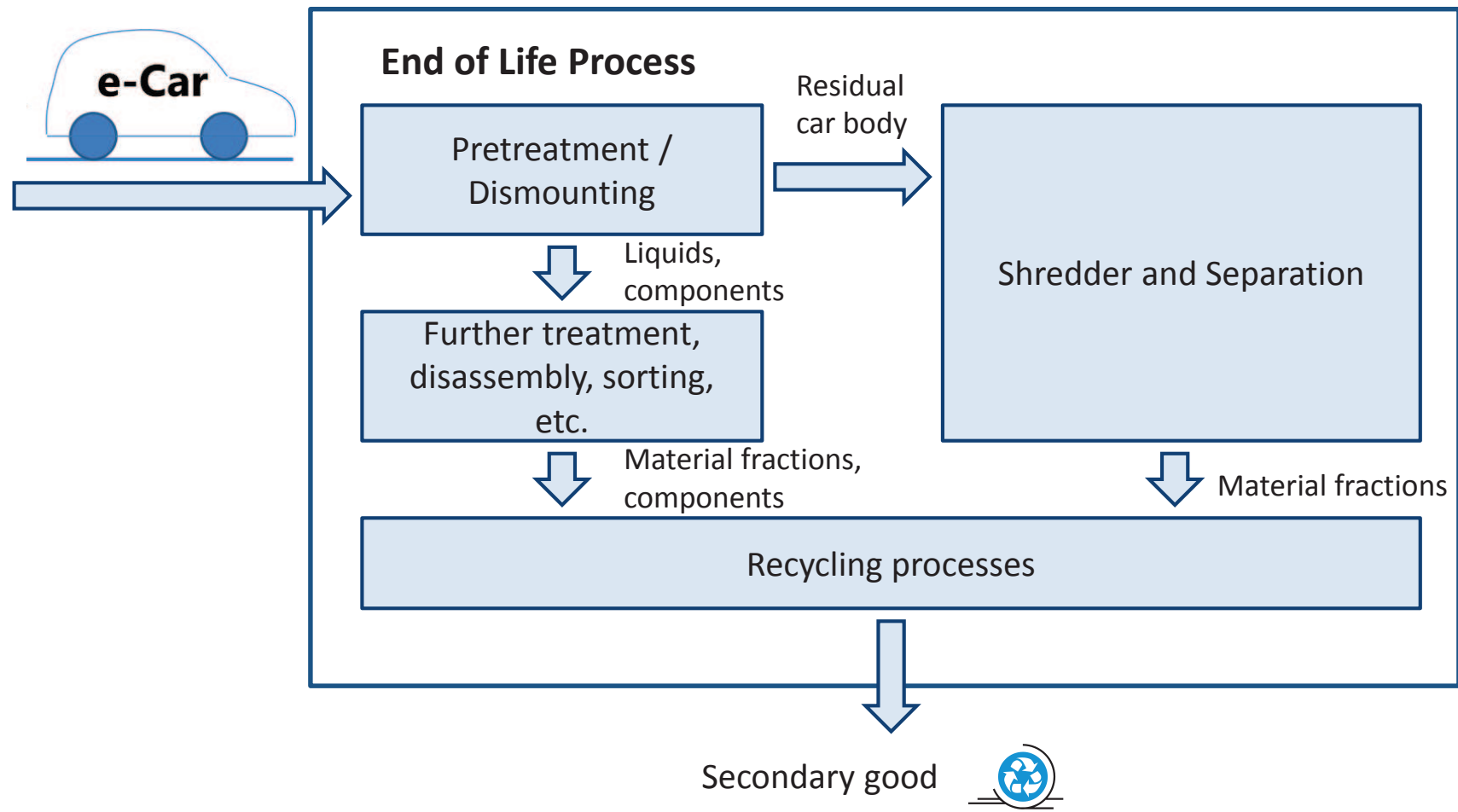


Secondary good





## Identifying processes within the system boundaries: end of life phase

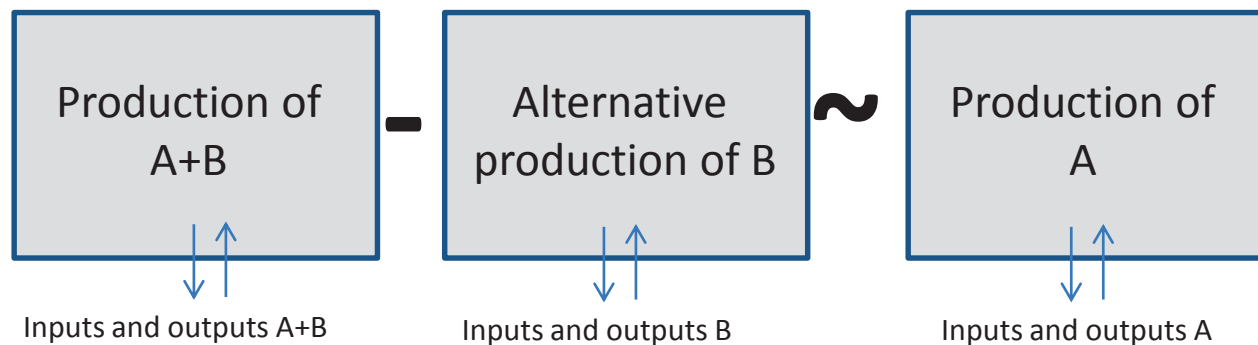


## Component specific recommendations for modelling of end of life

- EOL of batteries
- EOL of electric motors
- EOL of electronics
- EOL of tyres and wheels
- EOL of residual car bodies

## Multifunctionality

- 1<sup>st</sup>: Subdivision (including virtual subdivision)
- 2<sup>nd</sup>: **System expansion and substitution**
- 3<sup>rd</sup>: Allocation

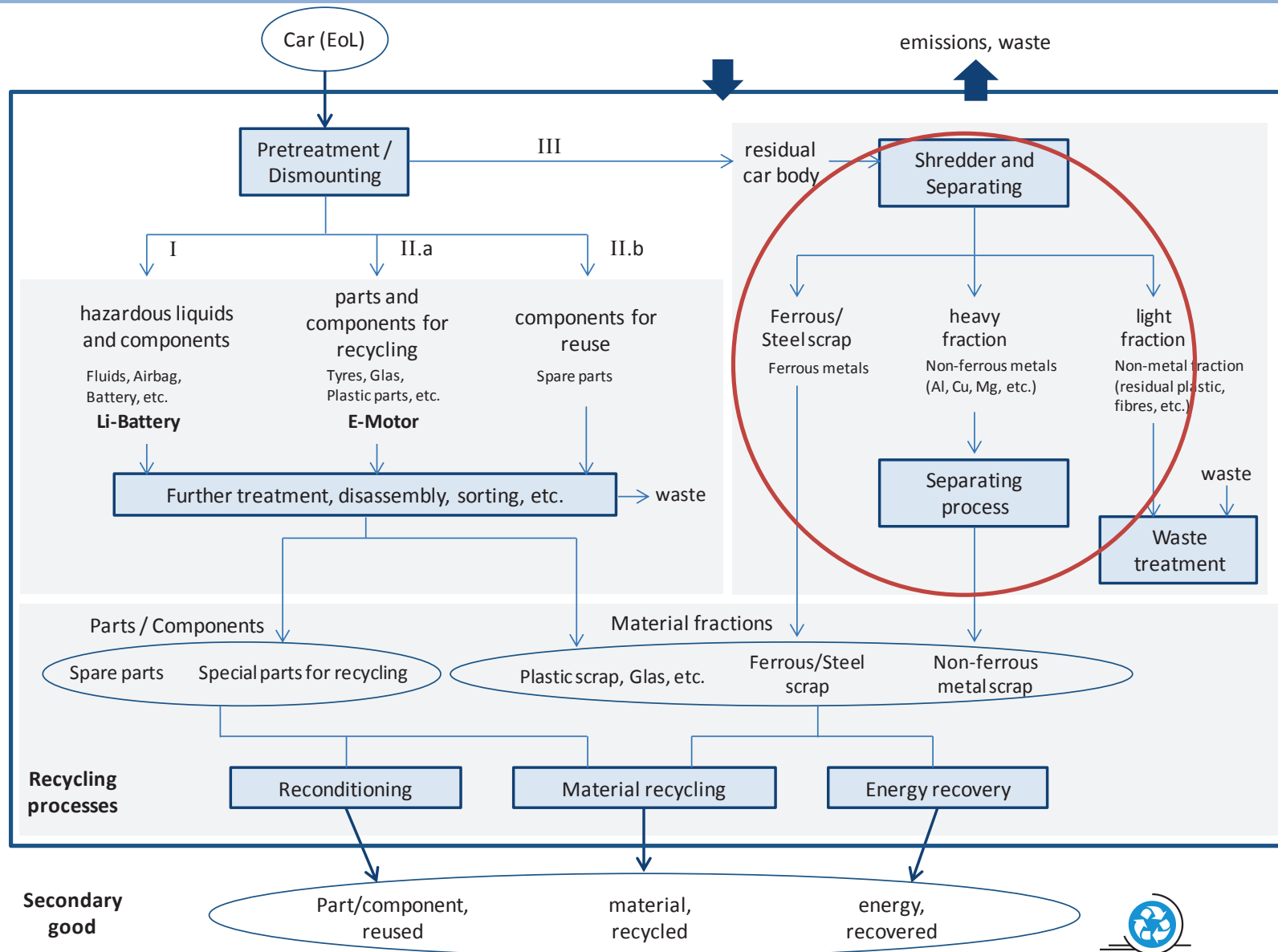


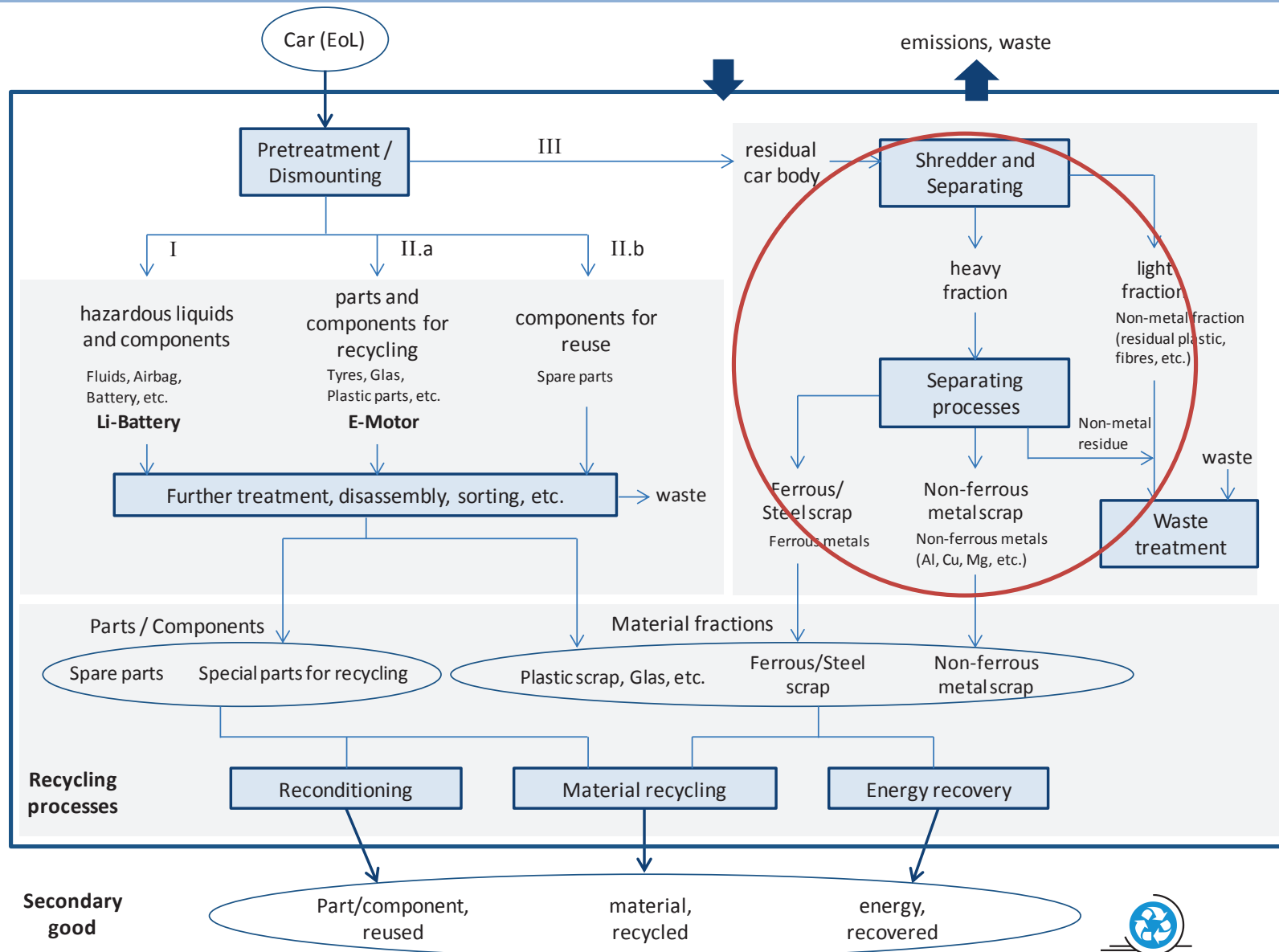
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## Changes since WS2 (EOL)

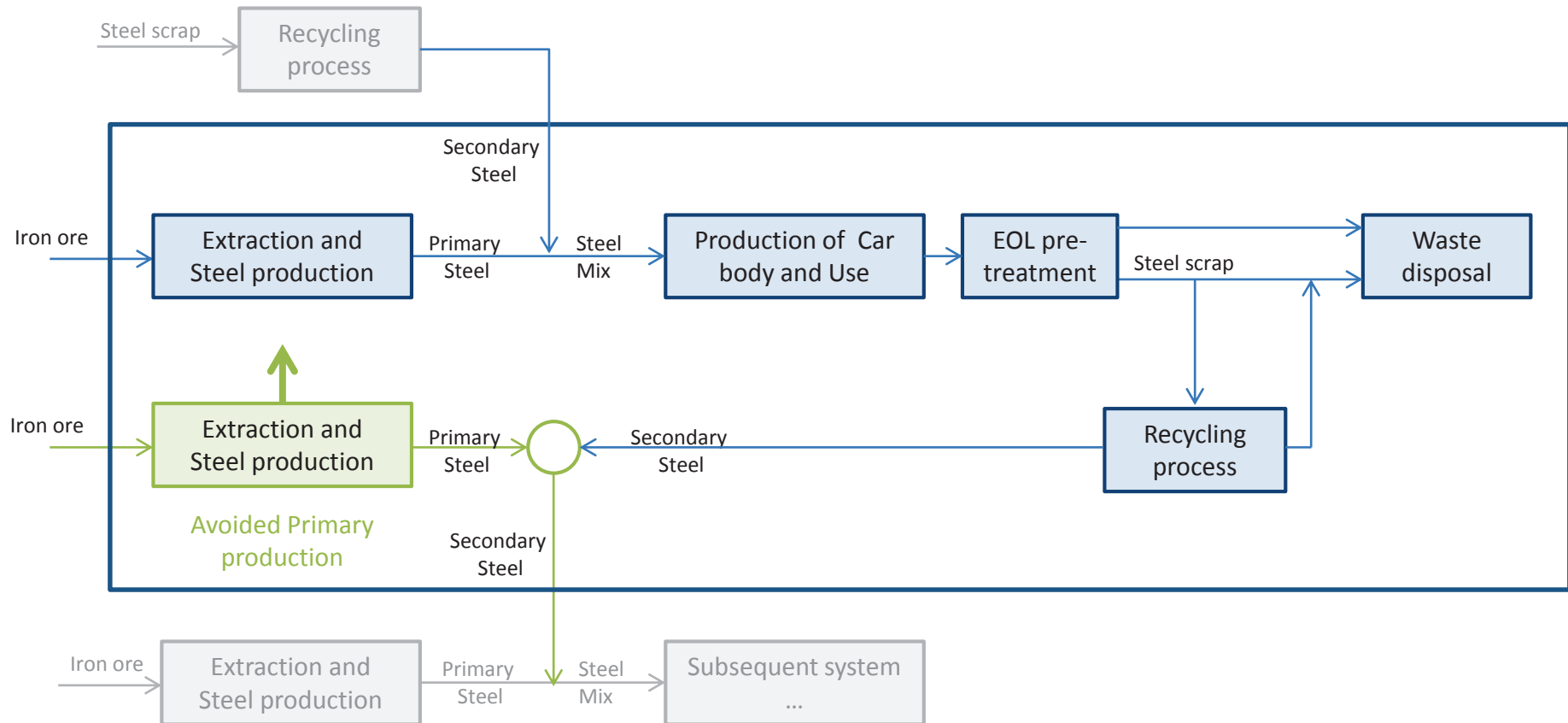
- Minor changes in provisions (battery)
- Graph – main processes of the end of life phase
- Graph – recyclability substitution approach



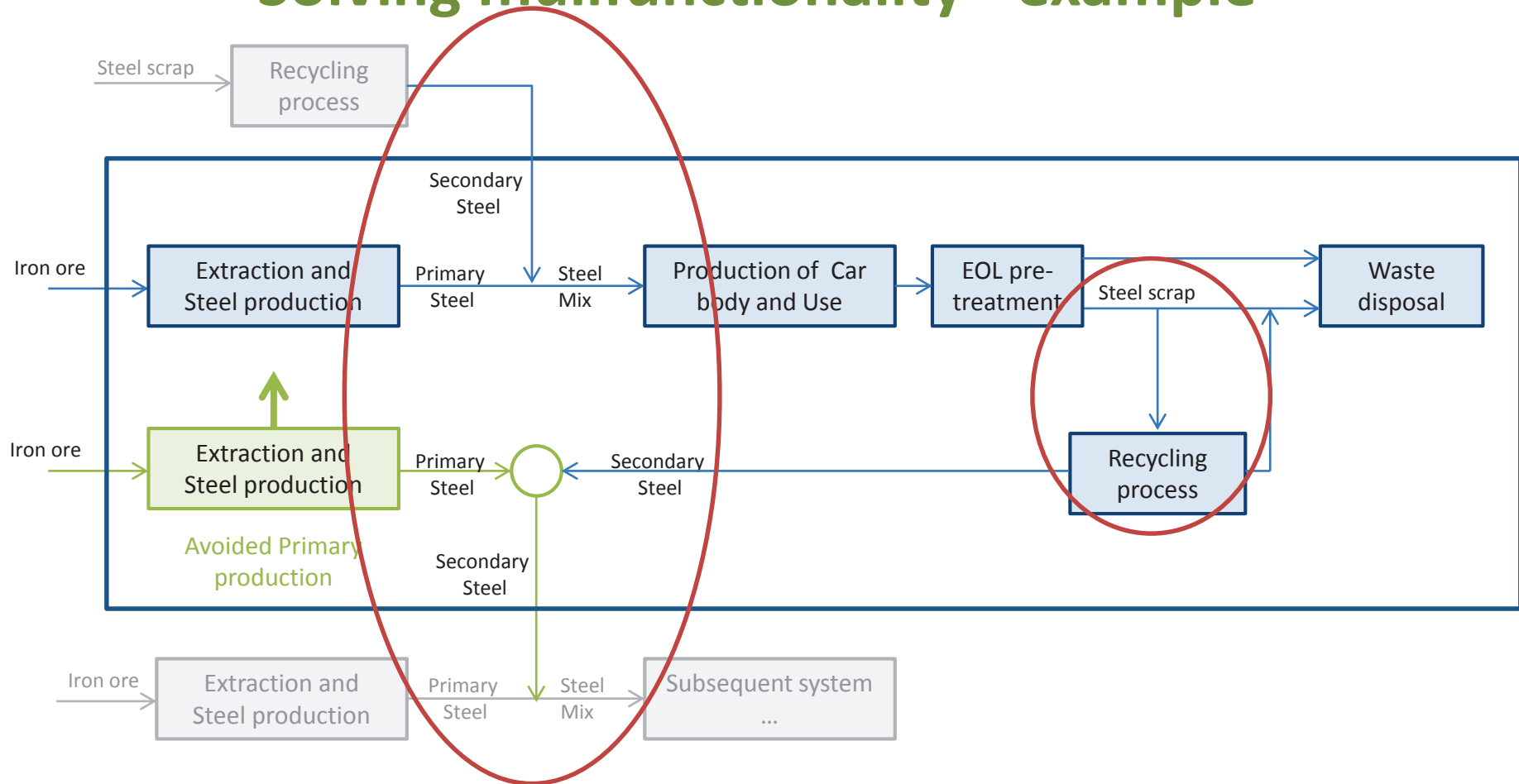


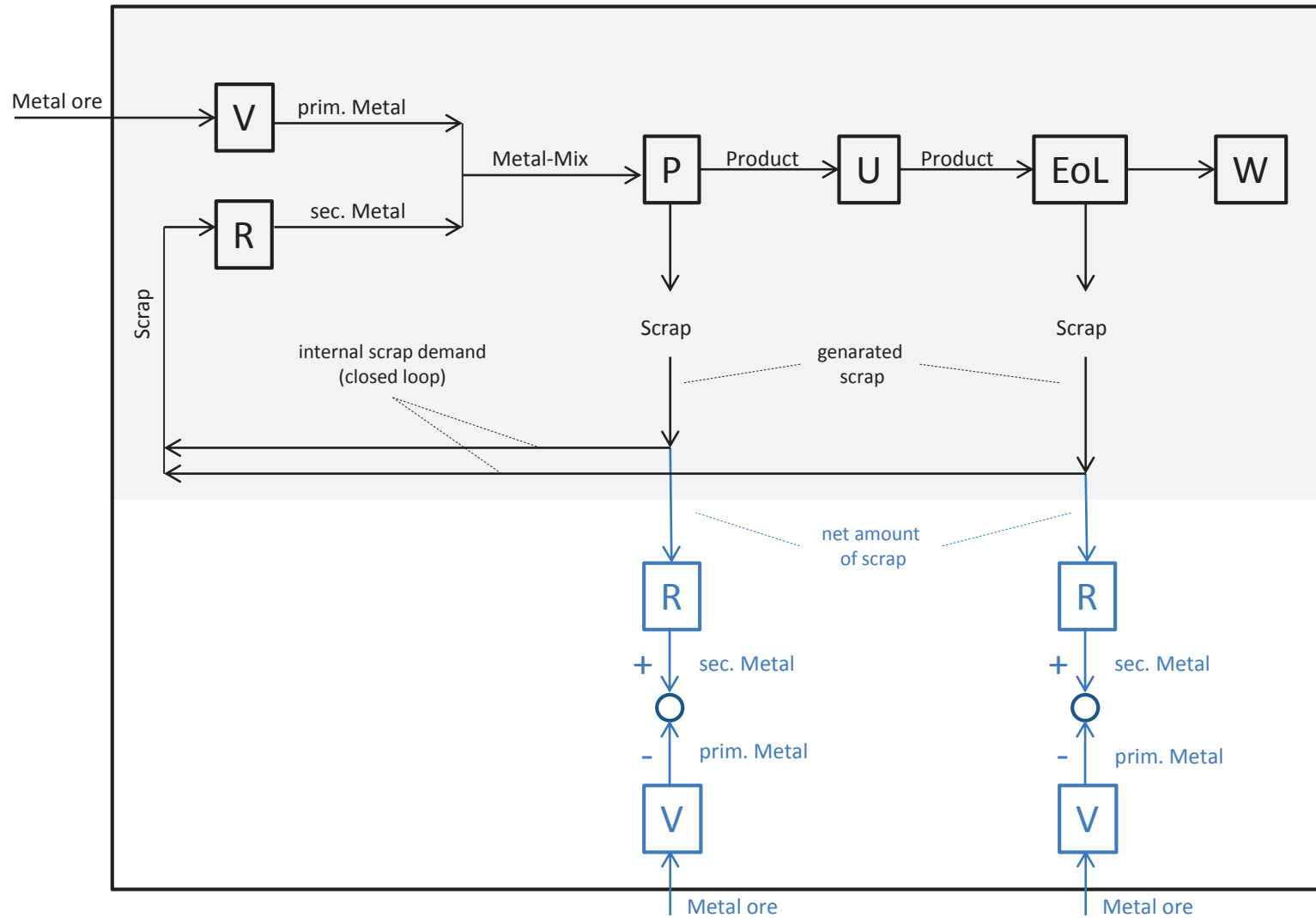


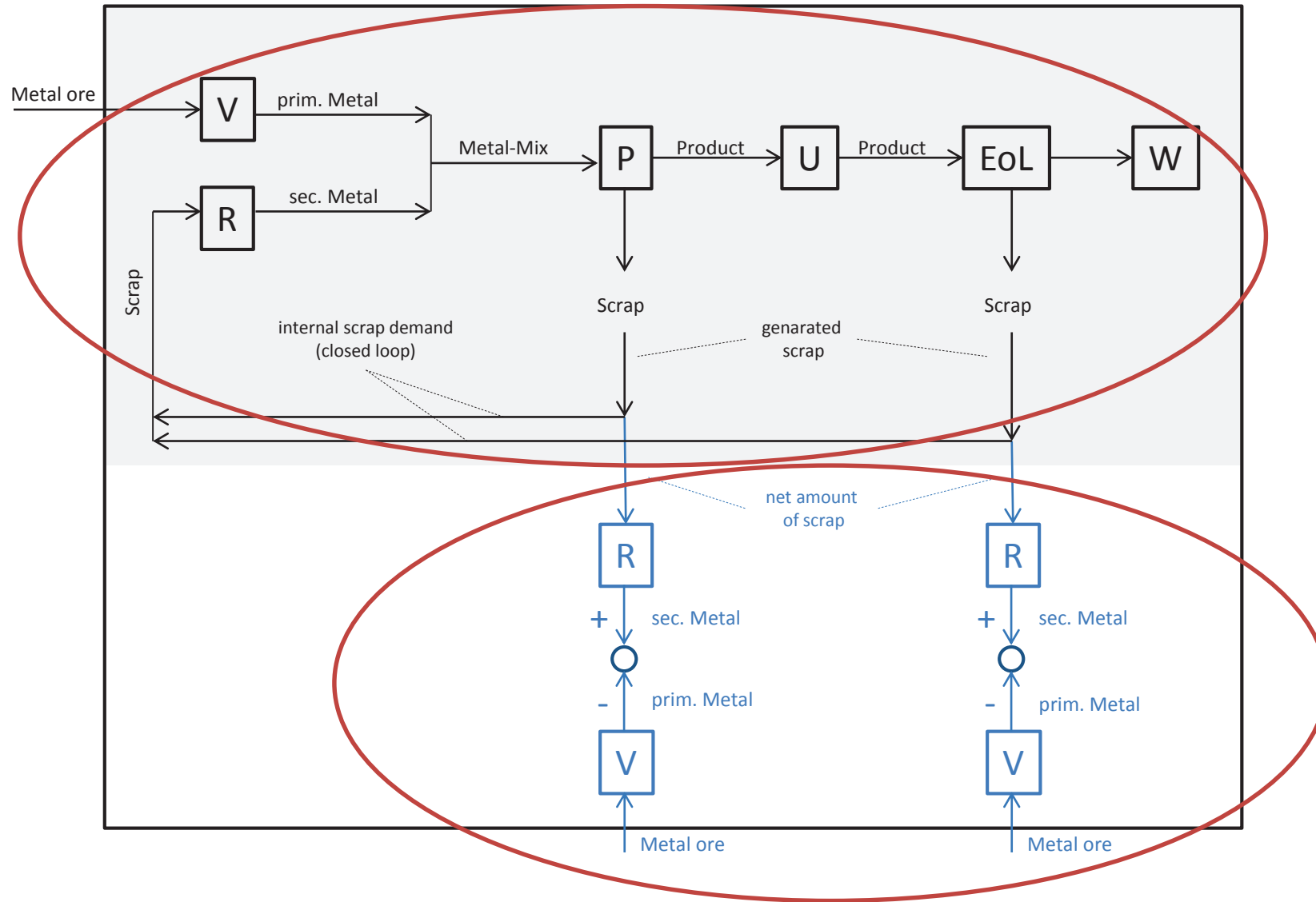
# Solving multifunctionality - example

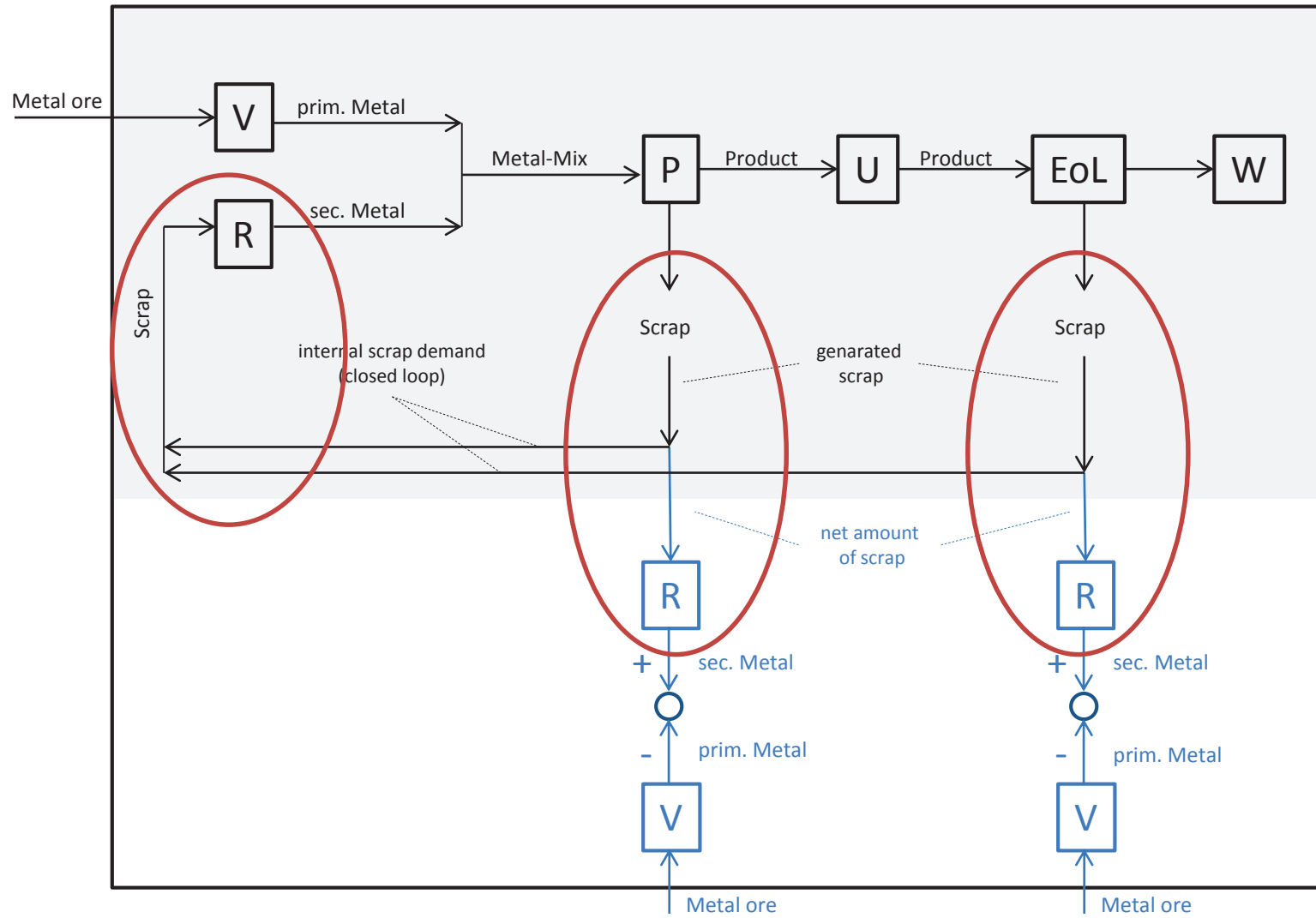


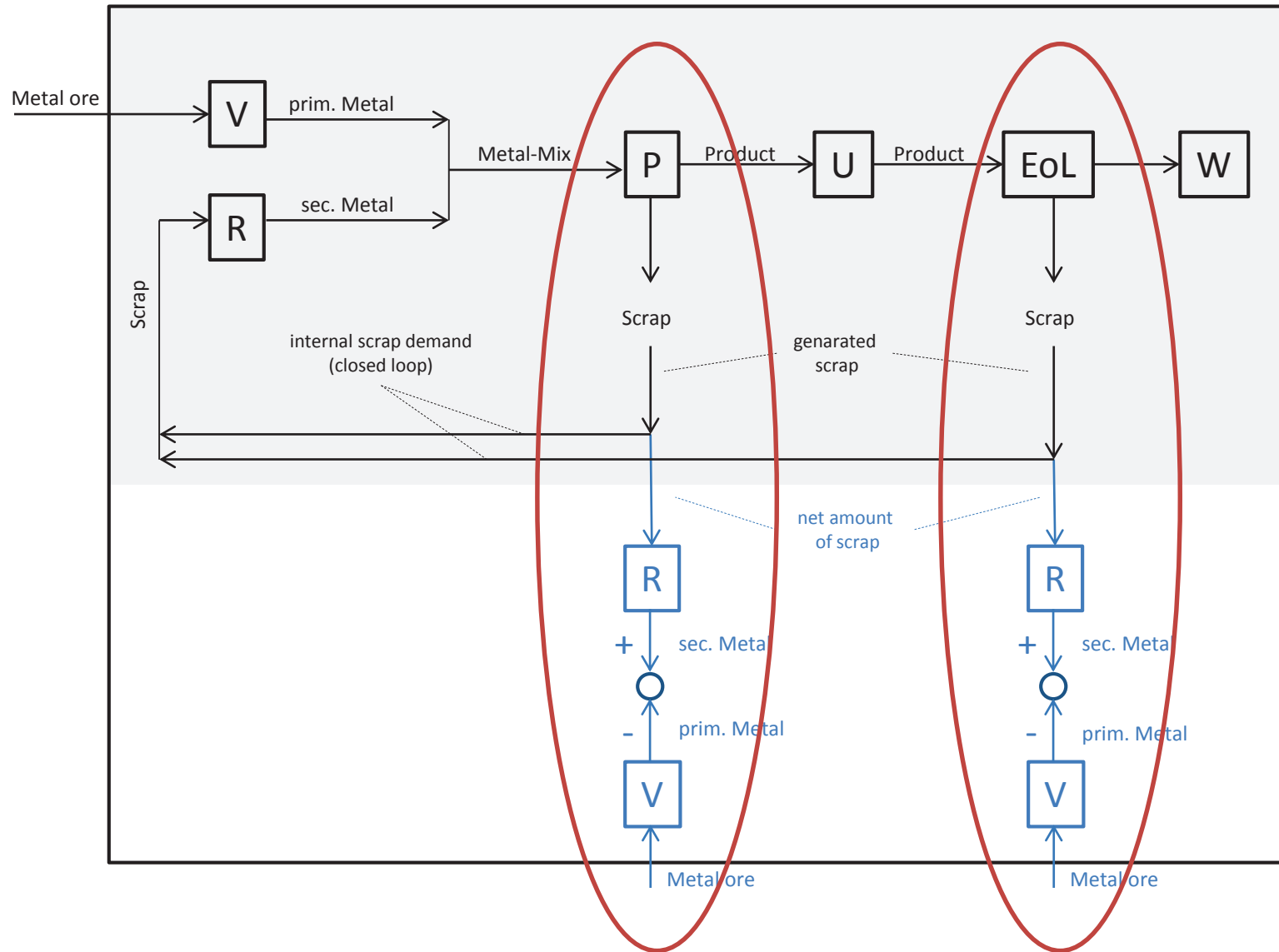
# Solving multifunctionality - example













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**Thank you for your attention!**

