European Commission

Joint Research Centre

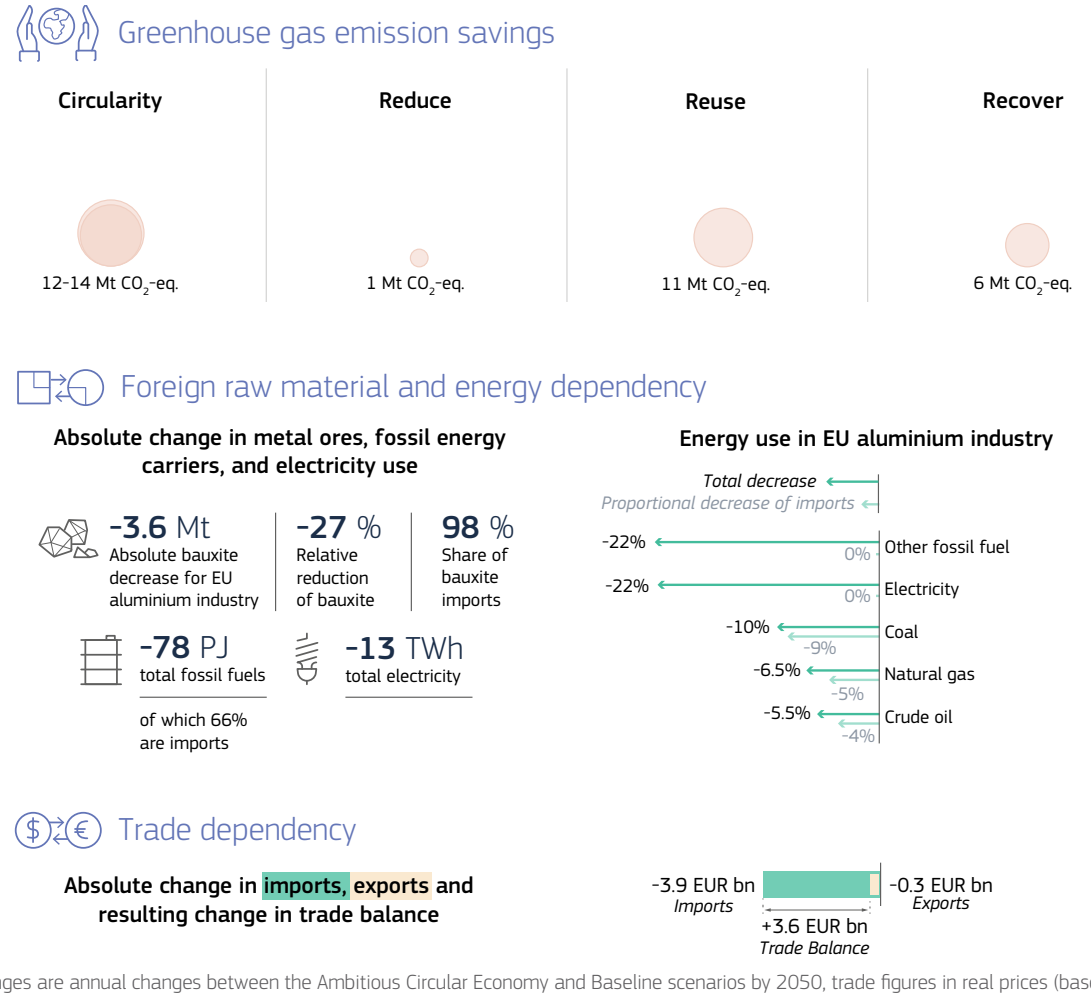
Capturing the Potential of the Circular Economy Transition in the EU Aluminium Industry

2025

HIGHLIGHTS

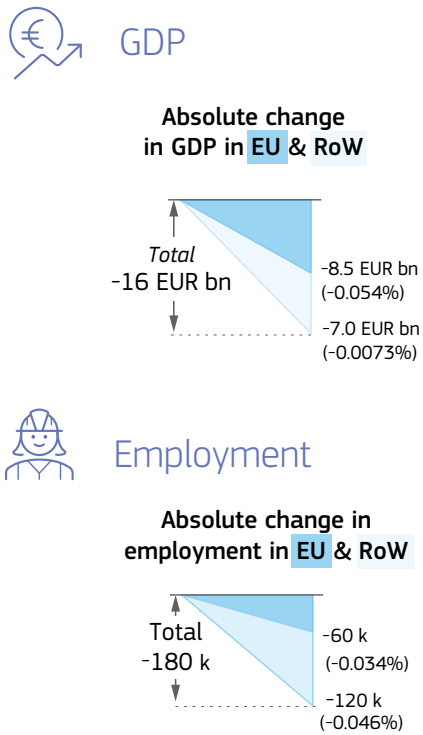
- **Climate Change Mitigation:** By 2050, Circular Economy strategies can save 12-14 Mt CO_2-eq. emissions annually in the aluminium sector, compared to relying solely on decarbonisation strategies
- **Reduced Resource Dependency**: They can reduce the direct input of bauxite for the EU aluminium industry by 27%
- **Lower Energy Demand**: These strategies can also decrease the EU aluminium industry's demand for fossil energy carriers by 9% and electricity by 22%
- **Higher Economic Security**: The EU's trade balance can be improved by EUR 3.6 billion through reduced imports

Figure 1 - Effect of circular economy measures in the aluminium sector in addition to energy decarbonisation



Note: All changes are annual changes between the Ambitious Circular Economy and Baseline scenarios by 2050, trade figures in real prices (base year 2015)
Source: JRC elaboration from [1], © European Union 2025

Figure 2 - Effect of circular economy measures in the aluminium sector on EU GDP and employment



Note: Change between Ambitious Circular Economy and Baseline scenarios by 2050, but there is still overall growth compared to the Status Quo scenario

Source: JRC elaboration from [1], © European Union 2025

Key insights for policy

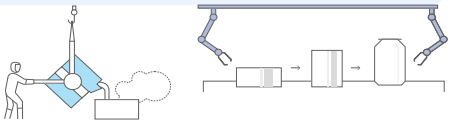
While recycling aluminium is common, there remains considerable room for increasing circularity. The key circularity levers to unlock the potential for climate change mitigation include:

- Extending Product Lifespan: Extending the lifespan of products through e.g. remanufacturing or repair in sectors like transport, construction, and consumer durables can save up to 11 Mt CO_2-eq. annually by 2050.
- Enhanced Scrap Management: Improving scrap aluminium collection, sorting, and closed-loop recycling can save up to 6 Mt CO_2-eq. This requires investments in collection and dismantling practices, as well as sorting technologies to keep different alloy families (wrought and cast alloys) separate and maintain their quality.

METHODS USED

The research design is structured into four scenarios that are assessed by four different assessment methods to identify environmental and socio-economic impacts of CE levers. The four scenarios are the Status Quo, Baseline, Compliance with selected Circular Economy Targets, and Ambitious Circular Economy. The Status Quo reflects current conditions, while the Baseline reflects a projection of the Status Quo to 2050 using a low-carbon energy mix by the Global Energy and Climate Outlook [2]. The Compliance and CE scenarios entail the additional implementation of selected CE policy targets and CE levers, respectively, in a decarbonising economy.

The methods used are characterised by either high granularity such as the Material Flow Analysis, Life Cycle Assessment and Life Cycle Costing, or high aggregation such as the Environmentally Extended Input-Output Analysis and dynamic macroeconomic modelling. The combination of the bottom-up (i.e. high granularity) and top-down (i.e. high aggregation) methods is necessary to understand product systems in detail, while concurrently capturing macroeconomic rebound and spillover effects.



References

[1] Albizzati, P. F., Walker, A. M., Milios, L., Besler, M., Piñero Mira, P. et al., *Environmental and Socio-Economic Impacts of the Circular Economy Transition in the EU Aluminium Sector,* Publications Office of the European Union, Luxembourg, 2025, https://data.europa.eu/doi/10.2760/5505344, JRC143128.

[2] Keramidas, K., Fosse, F., Diaz Rincon, A., Dowling, P., Garaffa, R., et al., *Global Energy and Climate Outlook 2023*, Publications Office of the European Union, Luxembourg, 2023, https://data.europa.eu/doi/10.2760/836798, JRC136265.

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CONTACT INFORMATION

European Commission — Joint Research Centre (JRC)
Contact: Paola F. Albizzati
E-mail: JRC-CIREMA@ec.europa.eu

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