

Strategic Materials for a Low-Carbon Future: From Scarcity to Availability
2-3 November 2017 – Session Summary

Breakout 3b: The reach of closed loop recycling and remanufacturing

Can full closed loop recycling and remanufacturing become a reality for some materials? With sufficient design, manufacturing and repair innovations, can the need to mine be completely eradicated for specific materials or metals? What new business model would facilitate such closed loop systems? What new business models would help form closed loops and help avoid waste ending up in the environment?

Andrew Clifton, Sustainability Manager for Engineering & Design, Rolls-Royce

Amir Rashid, Associate Professor and Head of the Manufacturing and Metrology Systems Division, Royal Institute of Technology, Stockholm

Walter Stahel, Founder - Director, Product-Life Institute

Moderator: David Peck, Manager, KIC EIT EU Raw Materials Programme, Delft University of Technology (TU Delft) & Manager, Leiden-Delft-Erasmus Centre for Sustainability (CfS)

- Andrew Clifton of Rolls-Royce began by outlining a challenge for the aerospace industry: currently, aircraft engines are made of easily dismantled and recycled parts and metals. 95% of an aircraft can be reused or recycled at the end of its life. The industry's 'power by the hour' business models incentivise modular engines that can be taken apart and repaired/ replaced for maintenance. However, growing demand for fuel-efficiency means redesigned engines that are made of lighter composite materials, and embedded and distributed propulsion systems which are hybrid-electric. These lower carbon footprint, but it becomes more and more complicated to maintain the kind of high levels of remanufacture and recycling seen with current engine design; there is no supply chain or business case for reprocessing and repair of new composite materials.
- Speakers discussed exploring carbon-efficiency and materials efficiency at the scale of the entire aviation system, from the airport at ground level to the aircraft and engine. They also noted that products with long lives and high innovation intensity, such as aircraft engines, were highly suited to testing resource-conservative manufacturing and business models, and that added value from products and designs, such as jet engines that can monitor and report flight data, may provide sufficient value to make circular business models more viable. However, better information management across the

course of a product's entire lifecycle is needed to facilitate recycling and remanufacturing.

- The speakers and audience agreed that public procurement policies can help drive recycling and remanufacturing, but policymakers need better understanding of the science and technology behind recycling and remanufacturing, before legislating materials efficiency requirements or developing public-procurement policies.