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Newsletter 8

Advancing Standards in Remanufacturing, Repurposing, and Recycling Energy Goods



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Closing the Standardisation Gap in Energy Goods Remanufacturing

A major challenge facing the sustainable remanufacturing, repurposing, and recycling of energy goods is the lack of comprehensive internationally accepted standards. Current standards do not fully support advanced digital and mechatronic technologies that enable efficient circular value chains. Closing this gap is essential to unlock the potential of innovations like additive manufacturing, laser cladding, digital product passports, and automated quality control to accelerate the transition to a circular economy in energy sectors.

Key Recent Progress and Recommendations

The R3-Mydas project has analysed demonstration cases across oil and gas crankshafts, electric vehicle batteries, and wind turbine gearboxes. The findings reveal critical gaps in current standards that do not fully capture remanufacturing-specific challenges. To overcome this, R3-Mydas proposes detailed recommendations to international and European standardisation bodies:

- **Laser Cladding and Welding Standards**

Current welding standards do not completely cover laser cladding processes used for repairing remanufactured components. New standards are recommended to define process qualifications, quality criteria, pre-heating and thermal management protocols, and non-destructive testing methods tailored to laser-clad surfaces with unknown service histories.

- **Additive Manufacturing Guidelines**

Existing additive manufacturing standards focus on new part production but lack adaptation for remanufacturing repair applications. Recommendations include developing design guidelines for repairable components, material qualification methods, especially for recycled feedstock, and digital integration protocols to enhance traceability and process control.

- **Digital Product Passports and Traceability**

To ensure transparency and trust in circular value chains, standardised digital product passports are proposed. These define data formats, blockchain verification methods, and integration with digital marketplaces to guarantee full lifecycle traceability—from original manufacture, through remanufacturing, to second life or recycling.

- **Battery Second-Life Standards**

As electric vehicle batteries are increasingly reused, consistent standards are needed for state-of-health assessment, testing protocols, and data sharing across their first and second life cycles. Harmonisation of these criteria supports safety, reliability, and regulatory compliance in battery repurposing.

- **Sustainability and Social Criteria Integration**

Incorporating environmental, economic, and social life cycle assessments into standards is crucial. R3-Mydas advocates for operational criteria for safety and sustainability by design across remanufacturing processes and materials.

- **Circular Marketplaces and Blockchain**

Clear standards for digital marketplaces in the circular economy are necessary to address data privacy, interoperability, and secure transactions. Best practices and implementation guides are recommended to foster trust in these emerging platforms.

Impact and Next Steps

These recommendations support accelerated industrial scale-up by providing robust quality and process frameworks. They also facilitate regulatory compliance and drive innovation in circular manufacturing technologies. The R3-Mydas consortium is actively engaged in contributing to international standardisation bodies, sharing technical insights, and piloting new frameworks to transition these recommendations into practice.

By addressing these critical standardisation gaps, the energy goods sector can achieve sustainable, digital, and traceable circular value chains that substantially reduce waste and extend product lifecycles with measurable environmental benefits.