

AddRE-Mo

Value retention scenarios for the urban electromobility of people and goods through additive manufacturing and remanufacturing



Resource-efficient Circular Economy –
Innovative Product Cycles (ReziProK)

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With almost one million electric bicycles sold in Germany in 2018, sales figures rose by 36 percent compared to the previous year. However, what happens to electric bicycles at the end of their product life remains obscure. The “AddRE-Mo” project addresses this problem by researching the prototypical development of a value retention network for urban electromobility. The aim is to investigate the decentralized recycling of electric bicycles by combining additive manufacturing processes and remanufacturing.



Value retention networks for urban electromobility

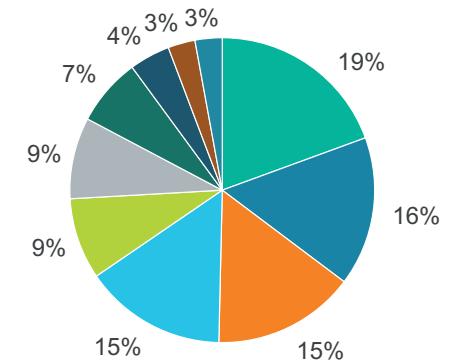
The amount of resources used per vehicle, e.g., energy or material, plays a central role in sustainable market development. For this reason, the “AddRE-Mo” consortium, which consists of companies and research institutions, aims to develop value retention networks for urban electromobility.

In the future, used products (cores) will be remanufactured using additive manufacturing processes and remanufacturing to enable closed product cycles in a decentralized approach. Remanufacturing increases resource efficiency over the entire product service life and creates the opportunity to produce more cost-effective, remanufactured electric bicycles.

Suitable business models and solutions for the return of components and their remanufacturing are being developed to recycle components efficiently. Simulations and scenario analyses will be used to analyze ecological, economic, and social effects on the future value network.

Conducted stakeholder analysis

The opinions of 513 users, 45 workshops, and 14 experts were collected for a comprehensive analysis of potentials and obstacles. In the process, important insights were gained for the future design of value retention networks. More than 80% of the users surveyed expressed interest in purchasing products with remanufactured components. The experts and workshops surveyed also see great potential in remanufacturing. Around half of the workshops stated that the motor is a suitable component for remanufacturing and that dam-



- Motor
- Accumulator
- Electronics
- Drive train
- Brakes
- Other
- Display
- Tires
- Gears
- Failed assistance-system

Percentage distribution of damage patterns according to workshop survey (n=44)

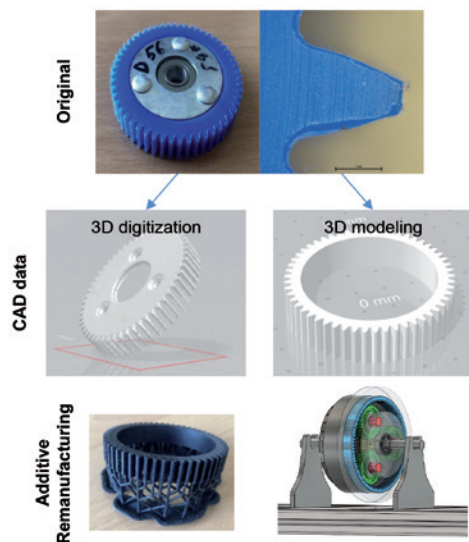
age occurs mainly in the two most cost-intensive components, the motor, and the accumulator.

The results of the stakeholder analysis were summarized in the study “Future trend sustainable electric bicycles? – Survey on the Circular Economy in the Electric Bicycle Industry”.

Design for additive Remanufacturing

The integration of additive manufacturing technologies into the remanufacturing process is essential for establishing a local and resource-efficient value retention network for electric bicycles. Based on the stakeholder analysis and the identified requirements for the design of future value retention networks, the project consortium evaluates selected components concerning their potential for remanufacturing using additive manufacturing processes.

The findings obtained cover the remanufacturing process, from creating a CAD file through the additive manufacturing process to comprehensive tests. The results will be incorporated into guidelines for the design of additive remanufacturing.



Exemplary process chain of additive remanufacturing

Competent Network

The “AddRE-Mo” project consortium bundles the know-how to form future value retention networks. The industrial partner Electric Bike Solutions GmbH contributes its expertise in converting and repairing electric bicycles. The industrial partner O.R. Lasertechnologie GmbH develops recommendations for “Design for additive remanufacturing”. The Wuppertal Institute and the Project Group Process Innovation of the Fraunhofer IPA focus on the implementation of additive remanufacturing. Their findings are taken up by the Cluster of Environmental Technologies Bavaria and disseminated to the public.

Funding measure

Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

As part of the FONA Field of action 6:
The circular economy – efficient use of raw materials, avoiding waste

Project title

AddRE-Mo – Value retention scenarios for the urban electromobility of people and goods through additive manufacturing and remanufacturing

Project duration

01.07.2019 – 30.06.2022

Funding reference number

033R234

Funding volume of the project

1.708.292 Euro

Internet

reziprok.produktkreislauf.de/en
addre-mo.de

Publisher and editorial office

Networking and transfer project “ResWiInn”

Design

PM-GrafikDesign

Picture credits

P. 1 above: Electric Bike Solutions GmbH & maxon advanced robotics and systems ag
P. 1+2: AddRE-Mo

Status

March 2021

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The project “AddRE-Mo” is funded within the funding measure “Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)”.

“ReziProK” is part of the research concept “Resource-efficient Circular Economy” of the Federal Ministry of Education and Research (BMBF) and supports projects that develop business models, design concepts, or digital technologies for closed product cycles.