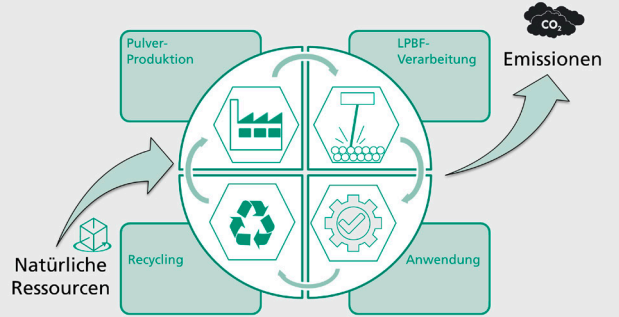




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## LIFE CYCLE ASSESSMENT (LCA) FOR LPBF PROCESS AND SYSTEM TECHNOLOGY

### Task

Additive manufacturing processes such as laser powder bed fusion (LPBF) allow the industry to produce near-net shape components on industrial scale with increased functional integration, while also reducing material usage. Additive manufacturing is, therefore, crucial for increasing the sustainability of future product developments and production chains. Although the production of components using LPBF often goes hand in hand with reduced material consumption, additional process steps – like the atomization of the needed powder – leads towards a shift in energy and resource consumption when compared to conventional manufacturing methods. For this reason, a life cycle assessment (LCA) of the entire LPBF process is necessary to evaluate its sustainability, regarding not only its final application, but also the variables influencing the upstream and downstream process steps.

### Method

So that the entire life cycle of an LPBF-manufactured component can be better understood, research must investigate the essential process steps such as powder production, LPBF manufacturing and post-processing, as well as application and recycling.

To this end, the process chain needs to be mapped in a digital model together with its input and output variables. However, since little reliable information is available, especially for the LPBF process in particular, these factors must be determined by means of experimental measurements on the systems.

### Results

The institute has successfully developed a process chain model for components produced with LPBF. In addition, it has recorded reliable energy and mass flows for the first aerospace components as part of the EU research program CleanSky2 and implemented them in the model. Further investigations into the influence of process parameters and manipulated variables will be added to the model in the near future.

### Applications

In addition to the high demand for LCA data in the aerospace sector, more and more industries are paying attention to the sustainability of their processes and products, for example the automotive industry. Furthermore, as a member of the “Additive Manufacturing Green Trade Association”, Fraunhofer ILT is also involved in studies investigating the sustainability of the LPBF process.

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- 1 Advantages of the additive process using the example of a guide vane cluster from MAN.
- 2 LCA model for the LPBF process chain.