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LIGHTer

elca European Lightweight Clusters Alliance

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White Paper "Lightweighting for Climate Action"

Lightweighting is a multidisciplinary and cross-sectoral technology field with a focus on saving materials and energy. It contributes dramatically to a decrease of resource consumption, to a lowering of the carbon footprint, and to the achievement of the EU Green Deal Goals through a reduced overall environmental impact along the entire value chain.

A core group of European countries are prioritizing lightweighting as a technology to achieve cross-sectoral resource efficiency, aiming at a significant reduction of their total materials and energy consumption, and promoting the creation of resilient secure circular industrial value chains. The European Lightweighting Network (ELN) is a joint initiative of public authorities from (as of today) Austria, Belgium, Germany, Slovakia, Spain, and Sweden, with the aim of developing a shared understanding of the potential of lightweight solutions in Europe, which will flow into a European lightweighting strategy.

By 2030, the estimated annual sales potential for lightweighting is expected to exceed 300 billion euros globally [McKinsey, 2012, Lightweight, heavy impact]. Austria has created a satellite account for lightweighting, which quantified its significant economic impact in terms of employment, innovation and gross national product in a comparable and standardized way. Currently, Germany and Sweden are developing corresponding concepts.

Achieving global leadership in this key technology, with its cross-sectoral impact on areas such as energy, mobility, construction, mechanical and plant engineering, and infrastructure, requires close cooperation between all stakeholders, strong networks, and continuous R&D efforts.

Contribution of lightweighting to climate targets

Lightweighting technology and construction is a means to promote climate action and resource protection, as well as to create highly qualified, sustainability-oriented jobs. Especially when combined with digitalization, artificial intelligence or bionics, it opens entirely new markets. Digital product development and cost-efficient production facilitate and foster responsible and sustainable use of resources and energy through weight optimization, recyclable design and advanced manufacturing processes and materials. The focus is on technologies, processes, and products that optimize material cycles, allowing for multiple life cycles and conserving natural resources.

Circular solutions based on smart lightweight design and technology for materials, products, and production provide beneficial results in terms of reducing greenhouse gas emissions and the consumption of primary raw materials. The positive impacts of lightweighting on sustainability have an even greater long-term effect if the technology is applied early in the development process of products and it is implemented in circular value chains.

Holistic lightweighting deals with all stages of the value chain: design, manufacture, use, recycling and reuse phases are all targets of material-efficient and sustainable lightweight design and construction. Vehicle design for the automotive, aviation, and maritime industries is often seen as a lightweighting pioneer. Beyond this, however, the scope for resource efficiency offered by lightweighting is also being harvested across many other industrial sectors. Construction, mechanical and plant engineering, rail transportation, energy technology, the furniture industry, and life sciences are examples of industries where lightweighting offers promise from an environmental, economic, and social perspective on sustainability.

How to make the most of the lightweighting potential?

To bring lightweight technologies to large-scale exploitation, it is crucial to facilitate and foster the exchange of views at a policy level on the contribution of lightweighting technologies to the European Green Deal objectives and to provide long term funding outlooks for European industry and the research community. Currently, Europe lacks a common framework which would enable stakeholders to align scattered lightweight technology initiatives. The proposed co-programmed partnership for Advanced Materials, M-ERA.NET, Eureka and at a policy level the “Coordinated Plan on Advanced Materials of the European Commission and Member States” need to be aligned to form a strategic approach to research policy on lightweighting which could drive cross-sectoral industrial innovation by supporting new applications across a number of industrial sectors. Lightweighting technologies should become an integral part of all initiatives to ensure systematic collaboration of developers, users, public authorities and citizens. With the European Lightweighting Strategy, such a strategic approach is offered.

European Lightweighting Strategy

Companies along the production value chain must analyze each stage of the life cycle of their products and incorporate the concept of lightweighting and sustainability from the beginning of the design phase. Holistic approaches and business models striving for more resource-efficient material loops which consistently respect an increased lifetime, reuse, remanufacturing, and recycling offer new business models. Where technologies to extend lifetime are combined with digital solutions such as generative AI for design and calculation models, advanced production processes, e.g. additive manufacturing, and traceability are essential for driving lightweight innovations as a sustainability catalyst in all contexts. Reliable and secure accessibility of big data and cybersecurity are crucial for

the transformation of data to enable circular value chains in line with the AMI2030 initiative and the proposed “Innovative Advanced Materials for EU” partnership.

A European lightweighting strategy offers a systematic approach to reducing greenhouse gas emissions and the consumption of primary raw materials across Europe. Lightweight solutions play to their strengths, particularly when combined with the concept of the circular economy. In addition, the successful development and implementation of the strategy will counter dependency on energy and raw material imports, strengthen industry's ability to innovate, and safeguard and create jobs in Europe. Thus, such a strategy can be considered as an instrument to strengthen economic resilience and technological sovereignty.

This white paper proposes a strategy, like a topical masterplan, that could be developed by the European Commission, DG Grow or DG Climate in cooperation with relevant stakeholders in a bottom-up process. It is advisable to flag up lightweighting as a political topic on the European level, and this paper can serve as an initial step to achieve this objective. The process should commence with the upcoming new European Commission, thus creating the political framework to push lightweighting into the public and political focus, addressing a comprehensive lightweighting agenda.

Further important areas of focus include: reducing dependencies on raw materials at the EU level by optimally complementing existing industries in EU countries; expanding value creation cycles by combining different national recycling strategies and industries; creating European research infrastructures for lightweight construction by granting European partners access to national centres; supporting the development of European standardization and regulation to improve market penetration and recyclability; and raising awareness for lightweight construction as a cross-sectional technology to promote further dissemination in member states and encourage R&D activities.

The role of the European Lightweighting Network (ELN)

The ELN works collaboratively to identify and implement activities in support of lightweight solutions, with a particular focus on contributing to the targets of the Green Deal. In a longer term, the focus of the ELN lies on establishing a contact point and responsibilities for lightweighting at European level within the European Commission and in collaboration with associations and clusters, as well as developing a European lightweight strategy based on national industrial lightweighting agendas. This white paper is an approach towards a European lightweighting strategy that must be set up in the next few years.

Additionally, a joint research agenda “Lightweight for a Sustainable Future” is a key element to realize the potential of lightweighting for achieving the Green Deal goals. It builds on national and regional strengths and expresses a common vision for the direction of European and national activities. The ELN has already initiated joint calls for the funding of bilateral or multilateral projects to implement its research agenda. ELN currently uses existing funding instruments such as Eureka but is open to setting up new ones to achieve a maximum of impact with the available resources.

The ELN is expanding and deepening areas of cooperation through delegation visits to connect research institutions and industrial partners from partner countries. Instruments to be developed further include R&D cooperation on thematic challenges and the establishment of an EU-wide PhD network to tackle the skilled workforce demand. ELN members organize and promote dedicated events, e.g. a side event on lightweighting at the UN GLOBAL summit, the Lightweighting Summit at the Hannover Messe in Germany, or the LIGHTer International conference in Sweden.