

Policy Brief 3/2023

Lightweight construction in Austria

Status quo, trends, and policy options for the Austrian and European lightweight community

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What to find in this Policy Brief

- Current trends in lightweight construction in Austria, Europe and beyond
- Current and future research potential as well as a SWOT analysis of lightweight construction in Austria
- Recommendations to policy-makers in Austria for further action on lightweight construction

Key Messages

- Lightweight construction is a cross-cutting issue in research and development (R&D), and its importance has increased over time.
- Its main global drivers are the mobility, energy and industrial sectors. Austria is primarily a supplier to these industries, especially the automotive and aerospace sectors. As a niche player, Austria has specialized strengths in research (e.g. materials sciences) and has hidden champions in certain application areas.
- There is great R&D potential in additive manufacturing (especially 3D printing) and recyclable composites, as well as in the development of more sustainable lightweight materials. But there is also a risk that light weighting will remain small-scale if it is not integrated into holistic solutions.
- The Austrian lightweight construction communities are well networked within their thematic areas, but the different networks are poorly connected, which hinders interdisciplinary exchange.
- In Europe, only Sweden and Germany have formulated explicit lightweight strategies by 2022 and thus taken a clear political position on lightweight construction. Germany, Switzerland, the Benelux and Scandinavian countries as well as some eastern European countries are promising candidates for broadening and intensifying international collaboration.
- We recommend increased efforts to raise the visibility of lightweight construction, to further promote networking between actors and international exchanges, and to provide access to research funding, especially at lower TRL levels, to encourage the development of disruptive solutions.
- With deliberate and bold policy decisions that address both opportunities and risks, lightweight construction could play an important role in supporting the green and digital transition.

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This policy brief summarizes the main findings of the recently published study “Lightweight construction in Austria”. The study was carried out by the Austrian Institute for SME Research located in Vienna, together with the Institute for Innovation and Technology in Berlin.

The full study is available at

<https://mobilitaetderzukunft.at/en/publications/Leightweight-construction-in-Austria.pdf>

Status quo and trends in Austria, Europe and globally

The Austrian **research institutes, companies and other actors** active in the field of lightweight construction reflect well the cross-sectional nature of this construction method. There are a few actors that function similarly to clusters, linking actors in similar technological fields or actors in certain regions. However, within these cluster organisations, the topic of lightweight construction is often one among many, as there are only two with a specific focus on lightweight construction. The topic is also anchored in academic research in Austria, with (applied) universities in Upper Austria, Styria, Vienna, Tyrol and Carinthia either conducting research or offering post-secondary programmes in the field of lightweight construction. Companies active in lightweight construction are mainly manufacturers, but there are also service providers and a few material producers.

An **analysis of research projects** funded by the Austrian Research Promotion Agency shows that both the number of lightweight construction projects and the funding for these projects increased between 2009 and 2021. Most of the companies carrying out lightweight construction projects are active in manufacturing/production of goods or in research and development. From a regional point of view, Styria and Upper Austria are the hot spots for lightweight research and development in Austria. Steel, aluminium and carbon/carbon-fibre reinforced plastics were the most frequently used materials in R&D projects. Austria has a high level of competence and industrial capacity in the automotive, heavy vehicle and aerospace sectors, but also in other economic sectors and industries such as construction and medical technology.

Further research and development is needed in all segments of the lightweighting value chain: materials development, production of lightweight parts and products, production processes and methods, applications for lightweight components, and recycling and reuse of lightweight materials.

The **digital and sustainable transformation** of the economy are the two trends that have the greatest impact on lightweight construction, both in terms of research and development and in the use of lightweight solutions. Additive manufacturing (such as 3D printing), simulation and the recycling or reuse of polymers, metals and composites are among the promising areas for further research and development. In application areas where lightweight construction could already bring benefits, a still low cost/performance ratio often hinders the use of lightweight solutions.

Important lightweight materials are lightweight metals and alloys (e.g. aluminium, magnesium, but also titanium and high-strength steel), polymer

composites (e.g. carbon fibre as well as glass fibre reinforced plastics, CFRP and GFRP) and polymers (e.g. polycarbonate and polypropylene). The turnover of all lightweight material markets is expected to grow in the coming years. Interestingly, within the lightweight materials groups, the strongest growth is expected for steel in the next years, due to new steel grades/types being developed and the substitution of traditional steel (Fischer 2021). In addition, new steel based lightweight sandwich and laminate materials are being developed (Gauß et al., 2022).

Lightweight materials are of **essential importance for some industries**, especially the aerospace sector; therefore, this is the primary field of applications for lightweight construction. Due to the expected replacement of older and less fuel-efficient aircrafts in the next 20 years, the expected quantity of lightweight materials used in aeronautical will likely increase. The automotive sector however, has the largest share of lightweight materials in terms of revenue. In 2025, the revenue of lightweight materials in the automotive sector is estimated to reach more than € 83 bn (Fischer, 2021). Reiland et al. (2019), who estimate that 90% of total lightweight materials are used in the automotive sector, also highlight the importance of the transport sector for lightweight construction.

The analysis also underlines the **strong ties with Germany**, both as a research and development partner and economically, especially as a processor of automotive products. On a global scale, the automotive sector and, more generally, the transport sector as a whole, is the main purchaser of lightweight solutions. In Europe, however, other sectors such as energy, construction and electronics are also growing in importance and offering new opportunities for lightweighting applications. In addition to weight reduction, resource efficiency is another driver for lightweighting.

Lightweight construction activities can be observed to a greater or lesser extent in all European countries. These activities are particularly visible through networking, but are also increasingly becoming the focus of political attention. Definite **strategies and concepts for the promotion of lightweight construction** are only to be found in Germany and Sweden. However, lightweight construction is often integrated into other innovation strategies (e.g. in France).

In the past, established **conferences and symposia** were explicitly dedicated to specific sectors or materials, but in recent years the first events have emerged that address lightweight construction holistically, i.e. across all sectors and technologies. However, only Germany and Sweden have funding programmes with a holistic and explicit focus on lightweight construction, and these are nationally oriented.

Important European **funding programmes for R&D** in lightweight construction are the European Framework Programmes (currently Horizon Europe), the ERA-NET network within the Horizon programmes and EUREKA. Within ERA.NET there is the M-ERA.NET network, which is specifically focused on materials and battery technologies. Co-operation with European partners takes place mainly with Germany, Spain, Belgium and the UK. The Scandinavian and Eastern European countries are less involved in collaborative projects. This is partly due to their generally lower level of participation in Horizon projects. Considering the size of the countries, there is potential for development in the field of lightweight construction in these countries. Interesting partners for Austria in

promoting lightweight construction could be Germany and Switzerland, the Scandinavian and Benelux countries as well as the Eastern European countries Poland, the Czech Republic and Hungary. Lightweight construction hotspots outside Europe can be found in North America and Asia (South Korea, Japan, China).

A small number of **international networks** already exist in Europe with the aim of exchange and international cooperation. The most important European networks are the European Lightweight Network (ELN), the European Lightweight Association (ELA), the European Lightweight Clusters Alliance (ELCA) and Composite United (CU). Austria participates in three of these networks (ELA, ELN, CU).

SWOT-analysis

Based on the information gathered through desk research, funding data, expert interviews, and focus groups we defined **strengths, weaknesses, opportunities and threads** for lightweight construction in Austria. An overview of the results of this analysis is provided here (for more details see the full study¹):

¹ <https://mobilitaetderzukunft.at/en/publications/light-weight-construction.php>

	Strengths	Weaknesses
Austrian Lightweight Community	<ul style="list-style-type: none"> • Successful niche players and hidden champions • Strong innovative capacities and economic impact • Players along the entire value chain • Active lightweight construction 'community' • Lobbying opportunities via regional clusters • Specialized post-secondary degree programmes • Highly qualified engineers • Broad set of funding opportunities • Regular events with focus on lightweight construction 	<ul style="list-style-type: none"> • Too few major players, OEMs and manufacturers of products • Shortage of skilled workers • Relatively hard to access thematic funding programmes for explicit lightweight topics • Current technologies allow only for limited mass production and/or expensive production of lightweight components • Community somewhat fragmented by regions and themes
	Opportunities	Threads
Context and international Environment	<ul style="list-style-type: none"> • Lightweight construction as a cross-sectoral technology offers many application opportunities in areas of strengths of Austrian players • Increasing demand for lightweight solutions, especially in sectors such as aviation, energy (wind power), (e-)mobility, railways, construction, and sporting goods • Austria can build on an established knowledge base in new manufacturing processes (incl. 3D printing) and material sciences/materials engineering • Continuous development of innovative/new materials • Recyclable lightweight components and resource-saving solutions as new R&D fields and lightweight applications • Awareness that a transition towards a circular economy is needed within the community • Policy makers use the momentum to foster innovation activities by setting up thematic missions that include lightweight construction 	<ul style="list-style-type: none"> • Small-scale solutions that do not advance the transformation of the European economy and the competitiveness on a global scale • Current price regimes (externalities) discourage the development of highly innovative lightweight solutions • Rebound effects, emission-intensity and poor recyclability • Limited knowledge and technology transfer by too little networking • Dependence on foreign OEMs as a potential lock-in effect • Rising competition from overseas • Path dependencies through long innovation and investment cycles limit innovation opportunities • Increasing complexity in lightweight construction • Companies and research institutions might not be able to keep up with the technological development cycles due to little funding • High investments needed for starting a business with focus on lightweight construction • Too much focus on applied, too little focus on (oriented) basic research for radical solutions

By building on its strengths, reducing its weaknesses, exploiting its opportunities and avoiding its risks, Austria can improve its position among the European lightweight construction players. The following section highlights areas of importance for lightweight construction, taking into account possible future developments. For each area, we provide suggestions for policy makers on what steps could be taken to further build and nurture a highly innovative ecosystem for the lightweight community in Austria.

The way forward

The 'new paradigms', the Green Deal and the circular economy can support the political awareness of lightweight construction. If done right, lightweight construction can become an essential pillar of a circular economy and thus raise its political profile. Lightweight construction has the potential to contribute to several narratives and strategies that are important for the future development of Europe. Lightweight structures reduce the weight of vehicles and thus increase their range, helping to achieve the CO₂ reduction targets of the Green Deal. Lightweight production methods use less material than conventional production methods. The increase in efficiency and the reduction in material and resource consumption fit in with the European and Austrian circular economy strategies. Lightweight construction also offers economic opportunities, as the development, design and production of lightweight components usually requires specific knowledge and depends on a highly skilled workforce and highly innovative companies.

The following **recommendations** are presented in a condensed form, for the more detailed recommendations, please refer to the full study².

National level support

- *Future calls for proposals should focus on areas in which the ecological and societal benefits of lightweight solutions appear to be greatest or where the need for solutions to master societal and ecological challenges are highest. Therefore, Austria should pursue a thematic approach for lightweight construction that includes the most important sectors (industry, mobility, energy, medical engineering, and sports equipment) and technology fields (material sciences, production technologies, joining technologies, digital technologies) and targets the SDGs of the UN.*
- *Calls for tenders in R&D funding programmes need to take sustainability / circular economy criteria into account. The aim is to favour the development of lightweight solutions in different application areas, e.g. through specifications such as minimal resource use and in compliance with the objectives of corresponding Austrian strategies and action plans (e.g. aviation strategy, circular economy strategy, R&D strategy, R&I mobility strategy, national energy and climate plan).*
- *Focus on sustainable materials, energy-efficient production processes, and recycling / re-use capabilities of lightweight components. Another*

² Available at <https://mobilitaetderzukunft.at/en/publications/light-weight-construction.php>

important research field is the integration of functionality. This could be achieved in various ways, with support of new digital technologies (AI, simulation models, etc.). Another topic with high potential for lightweight construction in Austria is additive manufacturing.

- *Enhance the accessibility of R&D funding in the lower TRL levels (oriented basic research, industrial research) for lightweight topics with high economic significance in Austria and with an urgent need for action against the backdrop of the circular economy paradigm.*
- *Intensify the systematic monitoring of results from basic and applied research for their potential applicability for lightweight solutions in different domains, and ensure their easy accessibility via webpages (project databases of FFG, FWF, CDG, etc.) and in networking events.*
- *A comparable central information site like in Sweden is recommended for Austria to bring structure to the community, enhance information diffusion and create visibility for lightweight construction in the country and beyond.*
- *Rework apprenticeship trainings to meet the needs of interdisciplinary lightweight construction. Build on the successful examples and broaden the opportunities for graduate education immediately relevant for lightweight construction to meet the growing needs by industry.*

Addressing Global developments

- *Austria could either invest the time-intensive development of a lightweight construction strategy or in a less in-depth process, bringing together stakeholders from different sectors to facilitate knowledge and technology transfer, but supporting the goals derived from the other strategies already in place. Following the avenue of a strategy, Austria could implement a bottom-up process (similarly as in Germany), involving experts from all sectors, and like the Swedish strategy, a national strategy should be founded on the SDGs.*
- *Exchange at an international level is of utmost importance. An “umbrella approach” should be pursued to build on existing network structures, common interests, and a common representation. The current activities under the ELN are a useful first step at the political level.*
- *Building on already existing initiatives on the regional, national and European levels, support with other European countries a lightweight construction platform and mirror its organisational structure largely at the national level for being able to contribute and interact effectively.*
- *Initiate international projects supporting R&D, potentially modelled along the Horizon 2020 project AMULET. This should be based on a broad, holistic understanding of lightweight construction, for example with a view to expanding strategic value chains in Europe and the circular economy.*

Measures to facilitate networking and cooperation

- *Activities that lower transaction costs for SMEs and start-ups should be improved, e.g. competence landscapes, matchmaking options, networking events with a clear purpose, etc.*
- *Facilitate exchange between lightweight “frontrunners” and “newcomers”. One sector that offers huge but still underdeveloped potential is the construction sector. This could be achieved through the creation of a national platform, increased networking and low-threshold funding opportunities.*
- *Intensify partner-matching activities for lightweight projects (for SMEs) in the European and national programmes, partly for higher TRL levels for specific applications, and partly for lower TRL levels for more radical innovations.*
- *Explore possible collaborations within the framework of doctoral studies in the field of lightweight construction. Ideally, such activities are embedded in existing funding opportunities in the respective countries. An international PhD day within the framework of an international conference (established in the ELN network, for example) could facilitate early exchange and thus, international cooperation in the future.*

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