Lightweight solutions strengthen Swedish competitiveness and growth
– for a sustainable society
Our cross-industry lightweight agenda presents ways in which Sweden can develop new technologies and innovations to drive growth and tackle the most important challenges facing society. We identify the basic requirements that are needed and the areas Sweden should focus on to ensure that our investments result in lightweight, sustainable products.

Our national vision is “Lightweight solutions strengthen Swedish competitiveness and growth for a sustainable society”. By this, we mean that our technologies and solutions shall make a decisive impact on Swedish competitiveness and contribute to a sustainable society.

Roadmap now ready

To demonstrate the need for a long-term approach, the lightweight agenda will span two decades, from 2013 to 2033. A large number of companies, universities, colleges, institutes and other organisations have been involved in promoting the agenda and have formally expressed their support for it. Together we have a unique and powerful opportunity to promote future cooperation in lightweight solutions that is boundary-crossing, focused and effective.

During 2013, the lightweight project will be planned in greater detail. We are also seeking to collaborate with several innovation agendas and roadmaps that have lightweight as an intermediate target or are directed at a specific industry. Industries such as the automotive, aviation and marine sectors are obvious partners, as are the agendas for production, metallic materials, moulded products, etc.

We extend a warm welcome to any organisation that would like to contribute and benefit from this work. The first lightweight projects are already being implemented through LIGHTer, our national cross-industry lightweight arena. For the latest news on the agenda work, current projects, and everything else, go to www.lighterarena.se
LIGHT MUST BE LIGHT

The need for lighter products is governed by the major global challenges facing us today. The world’s growing population must learn to share our planet’s finite resources while agreeing on effective environmental measures. Designing lighter products is an obvious and quick way to reduce demands on resources and increase energy efficiency, especially within the transport industry.

Similarly, the benefits of lightweight are evident in products within energy generation and energy transport, such as wind turbines and insulators; within the construction and infrastructure sector with prefabricated building components and reinforcement materials; within the engineering industry with hand tools and robots; within the materials industry with all types of special materials and within healthcare with prostheses and aids.

In other words, Sweden’s ability to develop world leading expertise within lightweight technologies will be crucial for maintaining our future industrial competitiveness. Countries such as Germany, UK, France, USA, Korea and Japan are now undertaking major national research and development initiatives. So we can see that it is absolutely essential for Sweden to make a national concerted effort to promote lightweight solutions if we are to continue to see growth in our key strengths!

Our recommendations in brief

The lightweight agenda recommends measures within seven innovation mechanisms that we consider absolutely critical to success. Read more on pages 16–26.

1. Three selected strategic research areas
2. More cross-industry, industry-based development projects
3. Development of existing test and demonstration facilities
4. Exchange between small and large companies for growth
5. Broad competence development and enhanced expertise chains
6. Coordination at all levels: regional, national and international
7. Sustainable and cohesive management and financing structure

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Swedish lightweight solutions carry weight

Despite its size, Sweden is a strong industrial nation with several leading international companies producing cars, trucks, buses, aircraft, marine vessels, energy and engineering. Swedish industry also depends on major players in the supply chain, for example, in materials fabrication, processing, production equipment and automation as well as within the service sector. In all of these sectors, the demand for lighter products is constantly growing. Lightweight solutions provide competitive advantages for our major materials producers as well as companies manufacturing the final products. The field is therefore of vital importance for Swedish jobs and exports.

In order to strengthen the competitiveness of Swedish manufacturing companies, a rewarding customer and supplier relationship is required that can generate the right challenges. Large influential companies work in an international environment and inevitably choose the subcontractors and research partners that best meet their needs from an international perspective. A strong Swedish network of expertise and services creates strong national ties, regardless of the ownership of the companies concerned, and promotes the development of small and large businesses alike.

“Lightweight solutions provide competitive advantages for our major materials producers as well as companies manufacturing the final products. The field is therefore of vital importance for Swedish jobs and exports.”

The potential of lightweight technology is enormous. We estimate that at least half of Sweden’s exports depend on the development of lightweight solutions as sectors such as transport, electronics, machinery, iron and steel, metal, forestry and furniture already use lightweight technologies to gain a competitive edge or have niches with growth potential. Similarly, if we look at the largest export companies in Sweden, we can conclude that at least eight of the ten leading firms compete in markets that require lighter products. Another measure of the significance of lightweight development is described by the Swedish Welding Commission. They estimate that one third of Sweden’s overall GNP has content associated with welding. Welding and other joining methods are key technologies for Swedish industry and new joining expertise is one of the prerequisites for the introduction of new lightweight materials and designs.

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1) Source: Statistics Sweden (SCB), commodity areas share of total exports Jan-June 2012.
2) Facts about the Swedish Economy (the Confederation of Swedish Enterprise [Svenskt Näringsliv]), the ten largest export companies in 2011.

Lightweight agenda 2013

ACROSS DISCIPLINES AND SECTORS

In order to develop lighter products, and not merely reduce the weight of conventional products, the industrial and academic worlds need to think things through from scratch. We need to create a new structure for the way in which technologies are developed and amass skills that cut across various industries and disciplines. A new generation of lightweight solutions will need to combine the development of materials, processes and design in an integrated way. Research groups need to work with a common focus and chains of collaboration need to be strengthened at all levels – between companies producing finished products and their suppliers, between institutions and academia, and between authorities and stakeholders within the field.

“The value of lightweight

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“At least half of Sweden’s exports depend on the development of lightweight solutions”
FUTURE DEMANDS FOR LIGHTWEIGHT

The transport industry, which accounts for almost a fifth of global emissions of greenhouse gases, has a central role in worldwide efforts to improve the environment. Each mode of transport has its own national and international requirements and visions, all of which require lighter vehicles and marine vessels. Many sectors have light-weight requirements within environment and health, economics or technology.

LIGHT AND HEAVY VEHICLES

Europe has launched the world's toughest emission limits for passenger cars, EU law requires car manufacturers to ensure that, by 2020, their car fleets emit no more than 95 grams of CO₂ per kilometre. For manufacturers to ensure that, by 2020, their car fleets emit limits for passenger cars. EU law requires car manufacturers to ensure that, by 2020, their car fleets emit no more than 95 grams of CO₂ per kilometre. For manufacturers to ensure that, by 2020, their car fleets emit limits for passenger cars. EU law requires car manufacturers to ensure that, by 2020, their car fleets emit no more than 95 grams of CO₂ per kilometre. For manufacturers to ensure that, by 2020, their car fleets emit limits for passenger cars.

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AVIATION

Through ACARE (Advisory Council for Aeronautics Research in Europe), the aviation industry has set targets for 2020 that require CO₂ emissions to be halved and NOx to be reduced by 80%. And by 2050, CO₂ emissions must be reduced by 75% and NOx by 50%, compared with levels in 2000. In practice, weight targets for the aviation industry will result in a minimum 50% reduction in the weight of aircraft and aircraft engine components every 10 years.

MORE SECTORS

The development of lightweight technologies is also being boosted by major economic and technological incentives as well as working environment requirements. Lightweight solutions are being used to create products that are easier to use and cheaper to transport, handle and repair. These driving forces are clearly evident within energy, engineering, construction, automation, etc.

INFRATESTRUCTURE

The long-term strategies of the Swedish Transport Administration (Trafikverket) include energy consumption as a functional requirement in the procurement of infrastructure. For the construction industry, this now involves comparing lightweight designs that reduce the environmental impact, construction time and life cycle costs.

LIGHTWEIGHT CASE STUDIES

**Volvo Cars**

**150 KG LIGHTER CAR BODY**

In most EU emission standards in 2020 – so far the toughest in the world – the fleets of the entire automotive industry must be made lighter. Volvo Cars estimates that the body of a standard size family car must be made about 150 kg lighter. This requires, for example, the development of applications for new composite materials that are inexpensive to manufacture.

**Kockums**

**50% LIGHTER VESSEL SUPERSTRUCTURES**

Requirements for low-sulphur marine fuels in e.g. the Baltic Sea are accelerating the development of light vessels with lower fuel consumption. Kockums aims to reduce the structural weight of vessel superstructures by 50% and use lightweight materials to construct the entire hulls of small vessels.

**More lightweight case studies can be found at www.light4energy.eu**

**Lightweight agenda 2013**

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- Volvo Cars
- 150 KG LIGHTER CAR BODY
- 50% LIGHTER VESSEL SUPERSTRUCTURES

**GKN Aerospace Sweden**

Impact goal: 75% lower CO₂ emissions by 2050

Weight target: 10% lighter aircraft engine structures every 10 years

**Saab**

Impact goal: 75% lower CO₂ emissions by 2050

Weight target: 10% lighter wing structure by 2020

**WSP**

Impact goal: 50% LOWER ENERGY CONSUMPTION FOR LIGHTWEIGHT BRIDGES

The expansion of roads and bridges can be achieved more efficiently using lighter products. The environmental benefits can be gained in lightweight from shorter installation times with fewer traffic disruptions. An international survey shows that the energy consumption of a footbridge can be reduced by more than 50% during the bridge's life cycle.

**Gestamp HardTech**

Impact goal: 22% LIGHTER WITH A STEEL SANDWICH

Gestamp HardTech has developed press hardening of high-strength boron steel to a rational process that has already reduced the weight of car bumper by 20-25%. The next step in this development is to save a further 20% by using this unique process to produce sandwich structures.

**More examples of lightweight case studies can be found at www.light4energy.eu**

"Energy efficiency is now a functional requirement for new bridges and roads."
Lightweight trends throughout the world

The development of lightweight structures in Europe is largely driven by major manufacturers within the transport sector. This is true for both metals and composites and has contributed to strong growth in the supply chain. The current trend is for car manufacturers to form alliances with materials suppliers and other key suppliers. This is an attempt to reduce weight and increase productivity. For example, joint ventures between metals manufacturers and automotive suppliers have contributed to significant growth in the supply chain. The current trend is for car manufacturers to form alliances with materials suppliers and other key suppliers. The aviation industry also employs a risk sharing model.

Similar developments in lightweight technology have been taking place in Japan and the USA, where work has been conducted for decades on the development of high-tensile steel and light metals. In recent years, China and Korea have also made important strides in this area. Press hardening of high-strength steel is an example of methods that are spreading across the world, as it reduces weight and increases motor vehicle safety. Another example is the development of high entropy materials, with stable properties in tough environments. Taiwan is among the leading countries in this field.

Europe also has a head start on Sweden in terms of lightweight solutions in mixed materials. German manufacturers of heavy vehicles already use several different methods in series production to reduce weight by using the right materials in the right place. At present, the strongest lightweight trend in the European automotive industry is in the introduction of composite materials in cars. Manufacturers such as Audi and Mercedes have chosen to follow this route in the premium segment, while BMW is investing in electric cars where the entire chassis is made of composites. There is a pressing need for lightweight electric vehicles in urban traffic, as halving the weight of a vehicle generally leads to halving energy consumption and doubling the distance between charges.

Compared with the automotive industry, the world’s major aircraft manufacturers have made significantly more progress in using composites. Airbus has gradually increased the proportion of composite materials in their products to the point where half the structural weight is now made up of composites. The interweaving of environmental and economic requirements forms an extremely strong incentive. In addition to the environmental benefits, a weight reduction of 1kg for a commercial aircraft results in a saving of SEK 10,000 during its life cycle. Even the marine vessel and wind power industries are making more of their products using composites. Analyses of the payback period for composites in marine vessels shows that this can be as little as three years. This has led to a major boost for composites in ships in Northern Europe.

Significant research initiatives in the area of composite materials are being conducted in several countries around the world. The USA and Japan are focusing, for example, on the development of high-performance composites that use significantly cheaper raw materials and processes. A national strategy for the composite field has been prepared in the UK, resulting in a government investment of £25m in a new industrial centre in addition to the industrial centres that already established in the UK. Similarly, Germany is investing in the construction of industrial research centres in composite materials. Germany and the UK are also among the leading countries in research on mixed materials and joining.

Lightweight development initiatives in Europe are, naturally, creating demand for skilled engineers in the area of composite materials. Major training initiatives are therefore taking place in a number of countries. For example, some 40 universities in the UK are conducting research and training in composite materials.

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The current situation in Sweden

Our analysis of lightweight development in Sweden is based on three materials development areas – metals, mixed/innovative materials and composites. Drawing up an inventory of the size of the industry, supplier structures, lightweight technologies, research and skills provision, has helped us to create a picture of the current situation.

4-3 Superstructures, aerospace structures and engine components are primarily found in the transport industry. Among system suppliers, metallic lightweight solutions in metal are therefore relatively low. Sweden was among the first to manufacture high tensile steel and press-hardened products. For example, Sweden has a strong metal-based industry that includes many globally successful materials, tools and equipment manufacturers. The threshold for new conceptual solutions in metal is therefore relatively low. These new materials into products through moulding, finishing, joining, etc.

Sweden’s aerospace industry has used composite materials in its products for more than fifty years and has therefore built up a great deal of expertise within the field. The Swedish marine industry also leads the way with vessels made using carbon fibre composites. Both sectors use high quality materials and processes, but these are not sufficiently cost-effective or modified for use in industries with different pricing. Swedish industry, including the automotive sector, needs to concentrate its efforts significantly in the area of composite materials and thereby raise its competitive edge. New skills are required at all levels for companies to be able to design, dimension and manufacture composite components.

Sweden has a wide network of suppliers within the field of metals, but companies are restricted by uncertain future requirements, lack of industry certification and insufficient external competence networks.

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Mixed materials still in their infancy

The need for lightweight solutions that involve combining several different materials is affecting large parts of Swedish industry. Mixed and innovative materials represent huge areas of development, where joining technologies and many other skills are essential for Sweden to be part of the international elite. At present, the development of processes for the combination of mixed materials is largely being pursued in national and international research projects linked to the Swedish aerospace industry. The technology needed to be more cost-effective for it to be used in other manufacturing industries. Research and training in mixed materials are also limited and spread across several smaller initiatives. Swedish industry simply lacks the knowledge required to combat these new materials and processes through moulding, finishing, joining, etc.

Conclusions from analysis and lightweight case studies

• Welding, moulding and simulation of steel and metal products and their precursors are Swedish strengths that can be safeguarded for the future through a cross-industry focus on lightweight technology.
• Designs in which different materials e.g. metals and composites, are joined together, are a field of development with great potential.
• Composite materials are of great interest to a large number of sectors, yet Swedish industry suffers from a shortage of professionals capable of developing and manufacturing with new composite materials.

A greater understanding of the material properties of composites is required, and materials and processes need to be made more cost-effective.

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Sweden has a weak supplier structure in composite materials, with only a small number of exceptions (innovation-driven companies). Sweden’s aerospace industry has used composite materials in its products for more than fifty years and has therefore built up a great deal of expertise within the field. The Swedish marine industry also leads the way with vessels made using carbon fibre composites. Both sectors use high quality materials and processes, but these are not sufficiently cost-effective or modified for use in industries with different pricing. Swedish industry, including the automotive sector, needs to concentrate its efforts significantly in the area of composite materials and thereby raise its competitive edge. New skills are required at all levels for companies to be able to design, dimension and manufacture composite components. Major producers are also dependent on having a larger supply of subcontractors near them. With the exception of a few innovation-driven companies, the Swedish subcontractor structure in composites is weak.

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The lightweight agenda faces up to society’s main challenges by steering towards challenging goals regarding the environment, growth and innovation efficiency. In the next step, our goals will be refined further by the lightweight agenda’s management. This work will also include a plan for how we can best follow up the goals and thereby increase our understanding about which initiatives actually yield long-term effects.

- Swedish industrial firms meet or exceed national and international environmental targets linked to lightweight solutions.
- Thanks to its expertise within lightweight solutions, Sweden has a strong international profile regarding energy and the environment.
- Swedish lightweight exports are increasing by more than 10% annually.
- 6-10 Swedish start-up companies within lightweight technology have developed into established global companies.
- 100% increase in the number of engineers and researchers with degrees in lightweight technologies.
- More than 75% of lightweight technologies (materials, products, and services) that are developed as part of the lightweight agenda are industrialised.
- More than 50% of Sweden’s lightweight innovations are based on cross-industry technological development.
- Doubled staff mobility within lightweight between industry and academy/institutes (every 10 years).

Environment

Swedish lightweight products & services reach end customers.

Growth

Swedish lightweight solutions create growth in the economy.

Innovation efficiency

Creative structures for research and innovation give a greater return per krona invested.

- 75% lower CO2 emissions by 2050
- <95 g CO2 per km by 2020
- Doubling of Swedish exports
- A nation conducting outstanding research

TARGETS

A nation conducting outstanding research

Government

Swedish industrial firms meet or exceed national and international environmental targets linked to lightweight solutions.

Research bill 2012

"Lightweight solutions strengthen Swedish competitiveness and growth for a sustainable society."
THE LIGHTWEIGHT AGENDA

Our national lightweight agenda is based on the practical needs expressed in lightweight case studies produced by industries in many different sectors. The analysis has resulted in four distinct innovation themes. With these themes, we are able to link and define projects and areas of research enabling us to work towards our goals. Naturally, a project can lead to development within several themes. Each innovation theme is also a comprehensive objective that challenges and gets us to make use of the innovation potential in each project. (Percentages are used to show levels and should not be taken as exact figures.)

So what needs to be done and how do we want to work? This can be described in seven innovation mechanisms that we consider absolutely critical to success. Together they boost lightweight Sweden and create a better environment, competitiveness and growth.
INNOVATION THEMES:

50% LOWER COSTS FOR LIGHTWEIGHT STRUCTURES

Creating new lightweight structures requires a lot of work and involves a cost due to adjustments in production and higher material costs. Therefore, creating competitive products requires substantial cost reductions. Today, many companies are striving to streamline their processes in order to compensate for higher material costs. One example is when replacing carbon steel by developing new lightweight structures. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium. In the case of composite materials, the manufacturing processes and raw materials are both more expensive than the corresponding shell products made from steel. One of the objectives here is to develop efficient high-volume production of composite structures in order to reduce material costs through lower costs for mixed materials. AP&T has launched compact production lines for manufacturing processes and raw materials are both aluminium.

50% SHORTER DEVELOPMENT TIMES

The theme is strongly related to the development of new products in all global markets. Technologies and development methods must therefore be diversified in order to compensate for higher development costs. The ability to use the right material in the right place in a design without losing weight is a potential that is therefore an important part of the innovation theme for weight reduction. The challenge is to find structural joining methods that can handle material’s different thermal expansions, galvanic corrosion, etc. The problems become apparent with so many different materials such as steel and polymer composites, or when two steel alloys with different characteristics must be joined together. Properties must be lost in the joining process (e.g. welding) or in subsequent heat treatment. The objective of our innovation theme is to halve the development time, which in practice means that new manufacturing processes can only therefore be introduced in a business project when there are already established simulation methods available, help us to stick to the schedule. One clear example in the car industry, where it must be possible to test tomorrow’s composite car through simulation as effectively as for today’s cars. Replacing virtual verification with more extensive physical testing today is not possible due to increased costs and development times. Another example is the ability to simulate the effect of production processes and take steps on a product’s final geometry, for example in sheet metal forming, moulding or hardening of a polymer composite component. The challenge is to find structural joining methods in which the traditional virtual tool box must be developed in parallel with the physical one.

50% LIGHTER USING MIXED MATERIAL

There are many approaches for creating lighter components, which makes it important to work at an overall system level. Through improved material properties, the bulk thickness of a component can be reduced or the material be moved to the right place. There are also other non-mechanical properties that can help to lower weight, such as corrosion resistance. Metallic materials such as steel, cast iron and aluminium as well as polymer composites such as carbon and glass fibre have tremendous potential as lightweight materials. It is about improving properties locally and globally, but it is also about developing innovative materials or processes. One example is Lameras Hybrrix™, which is a hybrid material from steel and polymer composites. In Scania’s new truck engine, the producer developers have managed to improve the output and lower the weight using high-strength cast iron, CGI, as an extent that would not have been possible without the new material.
In order to continuously renew our competitiveness, Sweden must conduct world-leading research within a small number of selected areas. We know that the key to major technological breakthroughs is cooperation and sustainability. Successful research groups must therefore be coordinated and have the opportunity to conduct cutting-edge research within the selected areas for the next 20 years at least. Management by objectives and continuity are created by connecting the strategic research areas to LIGHTer’s innovation objectives and continuity are created by connecting the strategic research areas to LIGHTer’s innovation themes no to short-term needs.

To achieve excellence in lightweight requires interdisciplinary research projects, with a scalable proportion of active research by senior researchers. We need to build partnerships with leading international research groups in other words, leading researchers must be welcomed into Swedish research and our researchers must be given the opportunity to periodically work in prominent groups abroad. In parallel with this, we want to boost the recruitment of young researchers through graduate schools. Altogether, this will build a sustainable national network of researchers in lightweight technology of the highest international standard.

Our strategic research is focused on fundamental issues and methods that can be used across industry and be refined in our industry-driven projects, before subsequently being verified in test and demonstration facilities. Here, senior researchers at research institutes have a special responsibility to transfer mature technology to industry.

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All of our development projects are funded in ground-based research to create feasibility, market adjustment and power in Swedish lightweight development. The projects will form a bridge to quicker product development and commercialisation, both for companies with end products and companies focused on materials, manufacturing processes or services. The content of the projects is directed towards our four innovation themes and findings in the form of solutions, methods and skills should be introduced into commercial projects within five years. In order to do this, we need to demonstrate new technologies in relevant manufacturing or opening environments, i.e. project results moving from TRL4 to reach TRL5-6. This requires a multidisciplinary approach and sophisticated test environments. Development projects have a duration of 1-3 years and involve a number of industries and supplier levels. Projects may also be required to learn generic lessons from their activities and communicate them to stake- holders within the lightweight agenda.

Research institutes and industry will have leading roles in the project implementation, while universities participate selectively. Projects must have an economic scope covering the needs of multiple industries, inputs from multiple disciplines plus comprehensive exper-imental verification and demonstration.

Efforts within this mechanism require strong leadership at two levels. The first level is the focused management of individual projects while they are being conducted. The second level is to lead and develop the project portfolio so that the projects implemented during the period 2013 to 2033 meet the agenda’s goals as fully as possible with regard to the environment, growth and innovation efficiency.

Our three selected strategic research areas:

1. Modelling the links between materials microstructure, the manufacturing process and final properties for minimal weight

New lightweight materials require new understanding, models and verified methods. We need to understand and describe the relationship between a material’s composition and microstructure and the manufacturing process, and explain how this will affect the final product’s process- ability, properties and use.

2. Innovative methods for effective production of lightweight components

The challenge is to create efficient manufacturing and material processing of complex geometries with high material utilisation and enable customised develop- ment of the material’s microstructure and residual stress state. The research has strong links to Swedish strengths, such as welding, casting, sheet metal form- ing, powder technology and additive manufacturing. It also requires extensive research in order to shorten cycle durations for the manufacture of high-performance composite materials.

3. Development of new material systems with new properties for lightweight structures and systems

Sweden must develop new materials with radi- cally improved lightweight properties. These new materials allow comprehensive weight reduction with significantly improved mechanical proper- ties relative to density and increased function- ality. The research includes Swedish strengths, such as steel, powder technology, metal and multifunctional polymer film composites and nanocomposites.

Examples of industry-based development projects

LIGHTer is currently pursuing two projects: “ufoH – Development of joining methods for the combination of different materials for hybrid solutions” and “Tripple H – Rapid and low cost manufacturing of high performance composite components”.

The projects meet our description above and are on a scale of SEK 10-15 m per year including industry funding. Experiences from these projects form the basis for a number of our recommendations.
TEST AND DEMONSTRATION FACILITIES

New lightweight technologies and solutions need to be mature and verified in order to be considered for commercial projects. The global trend is that more and more technology development and certification takes place before product development begins in order to minimize business risks. Sweden’s ability to comprise requires work that is across industry, with shared resources, right up to demo level. By systematically focusing on TRLS 6-7 verification (testing in relevant environments) in our industry-based development projects, we create completely new opportunities for the commercialisation of new technologies. We can dramatically streamline the Swedish flow of innovation.

We therefore want to strengthen Sweden’s existing test and demonstration facilities in a cost-effective way. Facilities must uphold the relevant industry standards and have the right testing environments in order to attract many businesses and industries. Our innovative themes create the framework to determine which facilities need to be complemented. It then becomes important that graduate students and students in higher education and industrial training have access to resources for training purposes.

Examples of demonstration requirements that strengthen our innovation themes:

- Improved material properties
- Pilot scale material production
- Material analysis

More efficient development

- Modelling clusters: computing power, methods, material data and software

Reduced costs

- High volume production and assembly of composite parts

Testing

- Component tests in relevant operating environments

COMPETENCE DEVELOPMENT AND EXPERTISE CHAINS

Swedish industry has huge skills gaps in the lightweight field, especially within composites, and there is a lack of structure regarding how these gaps will be filled.

LIGHTer therefore wishes to create industry-adapted training in composite structure that is tailored for professional engineers at different levels. Even our industrial and research projects will generate training courses for a variety of lightweight themes. Projects are required to summarise generic knowledge from their activities and communicate this to all stakeholders.

We also need to strengthen the expertise chains within the lightweight field area using so-called frontier crossers. There are people who operate in more than one organisation, thus spreading expertise, utilising network and building networks. Frontier crossers can operate between small and large companies, SMEs and institutes, and between universities and institutes. It must also be an appealing career choice to become a frontier crossing model is developed in order to boost skills and provide access to the institutions’ development resources.

- A frontier crossing model is developed between research institutes and SMEs in order to boost skills and provide access to the institutions’ development resources.

- The proper resources are allocated so that more SMEs can receive support during qualification for specific industries such as the automotive or aerospace industries.

Swedish must take advantage of the innovation potential of our small business and create synergies with larger companies, so that we benefit from our combined expertise. While the lightweight agenda has been under development, a large number of stakeholders have discussed how best to do this. One of the conclusions is that the growth limiting factors for small and medium-sized businesses is different for innovation-driven business compared to manufacturing companies and service companies. We have taken this into account in our proposals.

We have identified four initiatives to increase the ability of Sweden to take advantage of the power of innovation and growth in small and medium-sized enterprises (SMEs).

- Shorter development efforts are directed toward SMEs without extensive administration. Targeted use of "proof of concept and process checks" for lightweight can help companies take the first step into the development project.

- Large companies become "prime customers" by procuring SME solutions (materials, processes or services) in higher level development projects. The smaller companies then have the opportunity to showcase their technology, while relevant delivery requirements are also set.

(The level of funding is high)

- A frontier crossing model is developed between research institutes and SMEs in order to boost skills and provide access to the institutions’ development resources.

- The proper resources are allocated so that more SMEs can receive support during qualification for specific industries such as the automotive or aerospace industries.
A sustainable and cohesive management with powerful resources is a prerequisite for generating success within lightweight. Government agencies, industry, academia and institutes must together invest heavily in time and money to genuinely leave an industrial footprint.

Our assessment is that coordinated investments are required totalling at least SEK 200 million per year, of which at least 50% is required from the authorities.

 LIGHTer has a management, structure and organisation that satisfies industry’s needs and future challenges. We have the models to create forums and coordinate national research, development and qualification initiatives.

 LIGHTer aims to develop technologies, people and more efficient innovation systems for lightweight solutions.

 LIGHTer has the organisation to lead this work. We are a national cross-industry lightweight arena commanding great trust and with broad support from many industrial branches, system suppliers and subcontractors, academia, institutions, trade associations and more. We will work effectively in close cooperation with the authorities and our main task is to create growth and competitiveness on behalf of Swedish industry through cross-industry collaboration.
Our recommendations

Lighter products and solutions possess huge potential. To succeed, Sweden must strengthen its efforts up the TRL ladder*, i.e. the stages new technology must clear before being launched onto the market. Our recommendations focus on sustainability, skills development and collaboration across disciplines and industries to accelerate the commercialisation of lightweight solutions. Together, the measures under each of our seven innovation mechanisms will raise Swedish competitiveness!

1. Strategic research areas

Sweden needs to invest in leading-edge research in three selected areas, using more interdisciplinary projects, a larger proportion of senior researchers and collaboration with the world’s elite.

2. Industry-based development projects

Sweden needs to conduct more cross-industry, industry-based development projects that generate new knowledge and bridge the gap between research and commercial business projects.

3. Test and demonstration facilities

Sweden needs to develop existing facilities with relevant test environments for verification (TRL5-6) of new lightweight technology.

4. Exchange between small & large companies

Sweden needs to take advantage of the power of innovation in small and medium-sized companies by using frontier crossers, “prototype checking”, higher levels of funding in development projects at demo level, support for quality certification, etc.

5. Competence & expertise chains

Sweden needs to educate people at all levels within lightweight, both in industry and in universities, and enable the addition of at least 100 new doctors within ten years.

6. Cooperation

For regional, national and international cooperation within lightweight, Sweden needs to develop existing research and testing facilities for nodes.

7. Management

Sweden must give LIGHTer the mandate to create a long-term, coherent leadership with responsibility for managing the portfolio of lightweight projects, growth-promoting initiatives, etc.

*TRL (Technology readiness level)

HUGE SUPPORT FOR THE LIGHTWEIGHT AGENDA

The process of developing the lightweight agenda took place in the autumn of 2012 and spring 2013. More than 90 organisations – companies, universities, colleges, institutes, government agencies and other organisations – took part in intensive workshops and meetings. At the time this document was printed, the following organisations had formally expressed their support for the lightweight agenda. However, efforts to establish the agenda are continuing, and if your organisation wishes to declare its support, you are welcome to contact us so we can update the list on www.lighterarena.se

AB Volvo

ABB Robotics

AECQ Dawson

Afnor

Benteler Engineering Services

Bosch

Bulten Sweden

CEG/DIAB Group

Chalmers University of Technology

Compraser

dockstavarvet

dynAmore Nordic

eeLCEE

Elbit Systems

Finnish Centre of Applied Research (UTE)

Festo

Gestamp HardTech

GKN Aerospace Sweden

Halmstad University

Innovatum

Ikea Industriljus

Innovator

Jernkontoret

Kockums

Konsult AB Trifol

KTH Royal Institute of Technology

Lamborghini

LEB Casting Technology

Lightwave by Design

Linköping University

Lund University

Luleå University of Technology

Mats Sweden

Mittuniversitetet

Nokia

Oxen

Patri Gruppo

Pentagon

Saab

SAPA

Scania

Semcon

SP Electrical Research Institute of Sweden

SpaQn

Swedish Composite Association

Swedish Foundation for Strategic Research

Swedish Aluminium

Swedish Foundry Association

Swedish Marine Technology Forum

Swerea

Swedish Welding Commission

Talent Plastics Göteborg

The School of Engineering, Jönköping University

Volvo Cars

VOS Kosgrove

Region Västra Götaland

WSP Sverige
A national cross-industry lightweight arena, www.lighterarena.se