

2nd Edition

May 2019

European Polyurethane Industry Facts 2018

Socio-economic contribution of the
polyurethane industry to growth and jobs in Europe.

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Introduction

Polyurethanes are part of modern everyday life. No matter the form, be that flexible or rigid foams, elastomers, coatings, adhesives or various others, no matter the application. Polyurethane based products ease everyday life and perform, often not even noticed by the consumer, reliable and cost efficient.

Polyurethane materials are lightweight, strong and durable. All these properties make polyurethane a key ally to enhance the quality of our lives through the products we use daily. Be that mattresses, cushioned shoes or the insulation elements, that improve our homes energy efficiency. The industry behind this plays a remarkable role in the European economy. This report summarizes the value generated by the polyurethane industry and will highlight its substantial contribution to European wealth and job creation, showing the importance of this sector for a large range of applications and stakeholders.

This report highlights the key role, the polyurethane industry plays in the European economy, involving close to 244,000 companies throughout Europe and contributing €255 billion to the European economy. It also relates, directly to more than 360,000 jobs in the chemical industry and the subsequent value chain of PU product and component producers throughout the European Union. 4.7 million professionals regularly rely on the utility of PU products in their professions. Behind these figures stands a notable compound annual growth (CAGR) of the polyurethane industries economic contribution in Europe of 4.3 % since 2013/2014.

With the increasing awareness of environmental considerations, especially in terms of climate protection, the environmental impact of polyurethane products is just as noteworthy. Polyurethane saves 17.8 million tonnes of CO₂ in Europe each year, due to its application in building insulation and lightweight automotive components

alone. Therefore it is used as a resource-efficient solution by industry and other third-party stakeholders.

What are polyurethanes?

Polyurethanes, like all plastics, are polymers. They are produced by reacting isocyanates with a range of polyols. Isocyanates react residue-free within the process and therefore no longer reside in the resulting polyurethanes. Unlike other common plastics, polyurethanes are commonly thermoset materials. (With a few exceptions of specialized thermoplastic variants.) They are resistant, versatile and safe and have favorable heat resilience. Different end products can contain additional ingredients such as catalysts, blowing agents or flame retardants. Various combinations of isocyanates, polyols and additional ingredients can create a wide range of products: rigid and flexible foams, elastomers, coatings, adhesives and sealants, amongst others.

Different forms of polyurethanes combined with other materials build crucial parts for appliances that European citizens use daily. This includes domestic applications like mattresses, upholstered furniture or cushioned footwear but also technical areas of applications. The insulation of buildings (sandwich panels) and household appliances (refrigerator and freezer doors) depends on the favorable characteristics of polyurethane products. In wood-like construction panels or truck bodies, polyurethanes demonstrate their stability while saving weight and cost. Coatings based on polyurethanes protect surfaces, e.g. on steel constructions, or give a long-lasting, attractive appearance to numerous consumer goods, e.g. car bodies or car interiors. Polyurethanes are an indispensable component of modern day life.

About ISOPA

ISOPA is the European trade association for producers of isocyanates and polyols – the main components of polyurethanes. ISOPA promotes the highest standards of best practice in the

distribution and use of isocyanates and polyols in Europe and ensures that all stakeholders can easily access accurate and up-to-date information on these substances.

Therefore, ISOPA:

- Develops guidelines on how to use diisocyanates and polyols correctly and safely
- Produces statistics about the polyurethanes industry
- Sponsors initiatives on recovery, recycling and product stewardship of polyurethanes both in Europe and in other areas of the world
- Produces and tests procedures to respond to emergencies

ISOPA is based in Brussels, Belgium, and is a part of the European Chemical Industry Council, Cefic. ISOPA's members include Covestro, BASF, BorsodChem, Dow Chemical, Huntsman and Shell Chemicals.

About ALIPA

ALIPA, the European Aliphatic Isocyanates Producers Association, has been founded by the major European producers of aliphatic isocyanates and polyisocyanates. Aliphatic isocyanates are important basic materials and components for high-quality protective and decorative coating systems for modern adhesive systems and for specialties like elastomers.

Main objectives of ALIPA are:

- To maintain and improve a high level of technical understanding by identifying and initiating appropriate toxicological, environmental and other work programs;
- To monitor and support legislative developments in the areas of health, safety and environment relevant for the industry working with aliphatic isocyanates;

- To develop and communicate common industry positions to relevant audiences such as regulators, opinion leaders and the general public;
- To cooperate with other relevant industry organizations.

Aliphatic isocyanates have been manufactured and converted to coating materials, adhesives and elastomers for many years. They can be handled safely but the reactive nature of these substances may require certain precautions and controlled conditions in handling and during application.

Products based on aliphatic isocyanates are used in high performance applications where extremely high resistance to weathering, high solvent resistance and durable elasticity are needed.

Sources and Methodology

The data contained in this report has been compiled by an independent consulting company, picturing the situation for 2018, based on the most recent data available. It ties in with ISOPA's preceding report, published in April 2014, while expanding the focus in relevant areas. The methodology adopted for the study includes a mix of sources for the socio-economic modelling, such as:

- Eurostat
- Plastics Europe
- CEFIC
- National plastics producers' associations
- Statista
- EuPC
- Conversios internal databases and primary research

Employment and business growth rates were considered to adjust indirect and direct employment contribution. The modelling also took into consideration the employment generated across non-manufacturing activities, while delimiting the share of affected employees from total operations. Figures are rounded.

Executive Summary

Polyurethane materials are lightweight, strong, durable and they can resist to abrasion, weathering and corrosion: all these properties make polyurethanes a key ally to enhance the quality of our lives through the products we use daily.

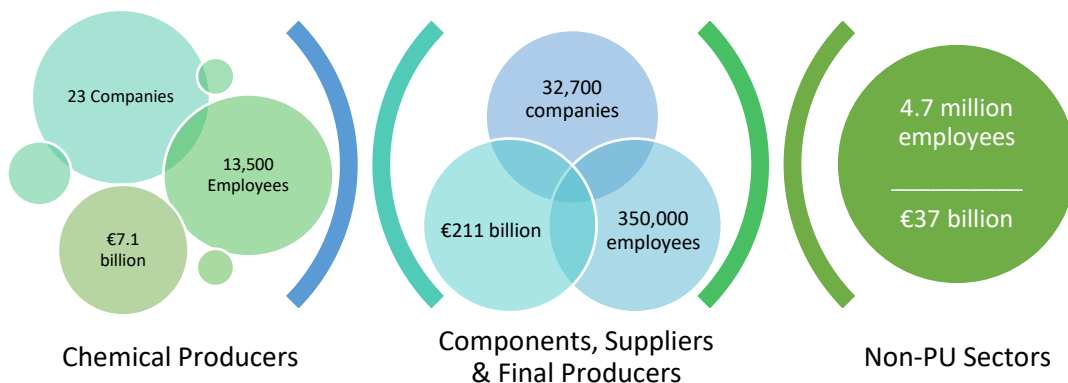
Considering global need for enhancing the fight against climate change, it is also interesting to note that polyurethanes contribute to resource and energy conservation. They are inherently durable and abrasion resistant and guarantee long lives to the products containing them. Tests and practice show that rigid insulating foams retain high insulation performance for 50 years or more. Automotive manufacturers count on the durability and lightweight characteristics of polyurethane materials to reduce the weight in modern car conceptions and reduce fuel consumption and therefor CO₂ emissions -only to highlight a few.

It does not come as a surprise, given the manifold applications of polyurethanes, that the polyurethane industry generates a substantial contribution to European wealth and job creation. Close to 244,000 companies throughout Europe

are creating a value of €255 billion every year. The production and use of polyurethane application ensures the employment of 5.1 million people throughout the European Union.

As is evident from the variety of its uses, the polyurethane sector is not limited to the sole producers of the chemical compound: their direct customers, the final producers of polyurethane-based products and the producers of the end-products; which include the various forms of polyurethanes, have to be taken into account, too.

350,000 employees directly contribute in terms of polyurethane production, including direct and downstream customers and their suppliers and subcontractors. In addition to those, close to 4,7 million jobs, related to polyurethane products and their application are found in the non-polyurethane sector. Therefore, in this report, an overview of the economic and social value of polyurethanes taken as a whole, will be presented. Where relevant, breakdowns of the value-chain to highlight the value polyurethanes pervade on the different stages of wealth creation in Europe, is provided additionally.



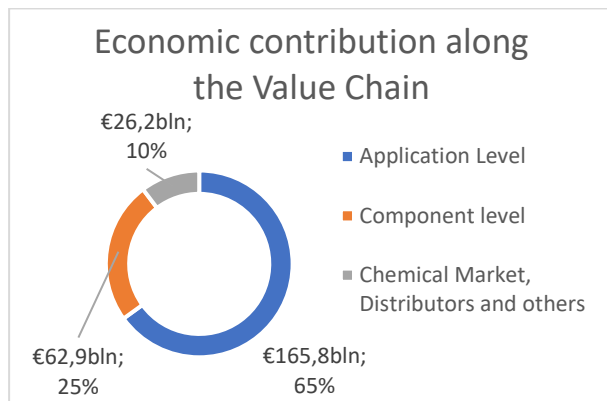
5,110,000

Total Employment

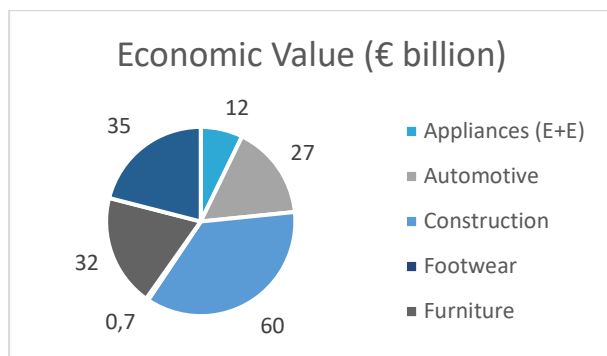
Economic and social value of polyurethanes for the European economy per sector

Polyurethanes materials are lightweight, strong, durable and they can resist to abrasion and corrosion: all these properties make polyurethane a key ally to enhance the quality of our lives through the products we use daily.

The following section is designed to provide an overview of the significant role polyurethanes play to enhance the quality and performance of products of our everyday life and the significant contribution in major sectors of European industries.



With an economic value of close to €60 billion, construction applications are the most important application for polyurethane products. This not only refers to insulating materials from rigid polyurethane foams, but also various types of building panels and other construction applications that are made from polyurethanes.

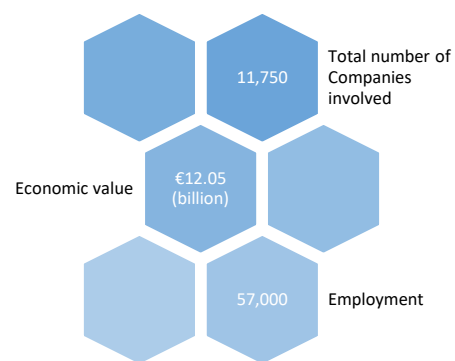


This is followed by the furniture and bedding sector with an economic value of more than €30 billion. With a market share of more than 60 %, mattresses from polyurethane flexible foam are the most common mattress in Europe. Together with countless different upholstered products, this makes polyurethane a key constituent in the furniture industry.

Another big sector impossible to imagine without polyurethane products is the automotive industry. From traditional applications as for example flexible foams upholstering car seats to innovative products for sound insulation and lightweight construction elements, as well as high performing coatings and adhesives. Polyurethanes have become indispensable for automotive engineering.

Appliances

Polyurethane rigid foam is an excellent insulator, which prevents unwanted movement of hot or cold air. In connection with its extremely lightweight and durable characteristics, it is the ideal material for insulation of cold appliances. Thus, almost all refrigerators and freezers produced in the world are insulated with polyurethane foam, where it preserves food at all stages of conservation and consumption in domestic kitchens.



Today, these appliances are designed to use less energy to help protect the environment and to reduce their cost of use. Polyurethanes help achieve ever stricter energy standards and have a visible impact on consumers' energy bills. For example: a modern refrigerator (2019) requires

only about 40 % of the energy comparable appliances from 2005 required¹.

More than **17,000 Europeans** are employed by chemical producers of polyurethane used in appliances, their customers, the producers of polyurethane-based finished appliances, and their suppliers and contractors. Together, they contribute for more than **€8 billion** to the European economy. With an **additional 83,000 jobs** generated by companies in the non-polyurethanes sector, a total of **57,000 jobs** in Europe can be linked to the polyurethane used in appliances.

Automotive

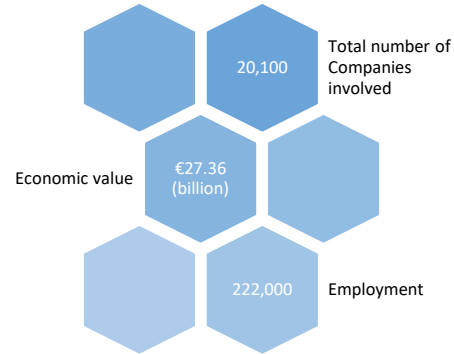
The utilization of polyurethanes in many automotive applications does not only guarantee comfort. Modern materials and innovative concepts help to enhance safety and efficiency.

Used in flexible foams in car seats, headrests and other components in the passenger cabin, polyurethanes not only make traveling more convenient but also greatly reduce the risk of injury in case of collision. Used for sound insulation, polyurethanes dampen vehicle noises by more than 50 % compared to traditional materials. Polyurethanes also cut down vibration, providing for a more pleasant and less tiring drive.

Polyurethane adhesives, sealants and especially coatings, an essential application for aliphatic based polyurethanes, are utilized for their durable and resilient characteristics on chassis of cars, ships and other vehicles for all-weather protection, bodywork sealing and maintenance work.

A key to successful automotive engineering and increasingly important to solve the upcoming challenges for the future of individual transport, is the reduction of weight. The use of polyurethane composite components allows to reduce vehicle weight by up to 30 % and, as a result, fuel

consumption and emissions into the atmosphere. This will gain an even greater importance in the currently growing e-mobility segment.



Therefore polyurethane is a strong ally of the European automotive industry, **generating 222,000 additional jobs** in the automotive sector **in 20,000 companies**. **€20 billion** of the value added from these components is found within their direct producers and users, for a total economic contribution of **€27.3 billion** in the European economy.

Construction

Construction applications have the biggest share in European demand for polyurethane products. It is widely used for construction in all types of infrastructure projects. However, its most significant role within this sector is building insulation. Polyurethanes reduce energy costs and make buildings eco-friendlier.

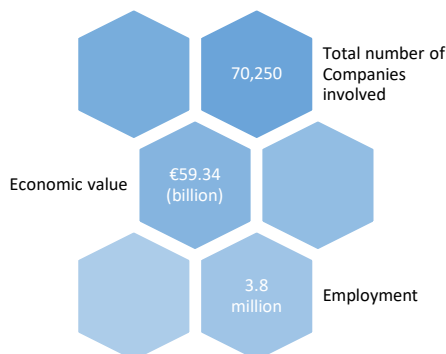
40 % of the global energy demand, correlating with one third of greenhouse gas emissions are linked to infrastructures like houses and buildings. Experts estimate that worldwide insulation of buildings to optimal standards could reduce global CO₂ emissions by 20 %.

Whether rigid foams in sandwich elements for new constructions, insulation blocks or spray foam for energetic modernization, polyurethane foams are

¹ For this comparison, a 90l refrigerator from 2005 with a power consumption of 392 kWh/pA has been compared to a similar 2019 A+++ model, consuming 157 kWh/pA.

the key to modern energy management. Using rigid composite panels made from polyurethane means using components that are light yet strong, weather-resistant and easy to install. Foams made of polyurethane provide high insulation value while being particularly versatile and cost-effective, and help cutting down on space requirements for walls and roofs. This helps to maximize building volume and is especially important when an existing building are being renovated to comply with better energy efficiency standards.

A different group of polyurethane products is also substantial for construction: coatings, adhesives and sealants. Surface coatings from polyurethanes are extremely durable and resist to abrasion and weathering influences. Polyurethane sealants are a durable and cost-efficient solution for installation purposes. Polyurethane is therefore highly appreciated by the construction industry: thanks to polyurethane, buildings last longer and require less maintenance.



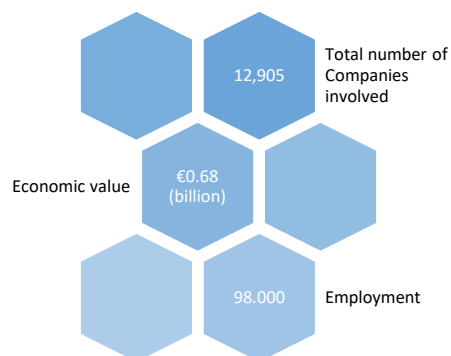
Many companies in the construction industry are SMEs with specific skills and experience in using polyurethane-based construction products. In Europe, there are more than **7,000 companies involved directly** in the production and use of polyurethane elements and finished goods. If you add this to the complete chain of value for these products and their final market uses, the number of companies impacted increases tenfold, for a **total of 70,250 companies**. In addition to the **wealth creation of €59.34 billion**, these products

create close to **3.8 million jobs** in the European economy.

Footwear

Less known, but not less significant is the value of polyurethane elastomers for the construction of modern footwear. Good shoes are comfortable, long-lasting, appropriate for usage –and sold at the right price. Polyurethanes help to meet all those targets. Polyurethane elastomers are used to create soles with perfect shock absorbing capabilities and therefore are ideal for hard-wearing shoe soles. They last longer than traditional materials, because they are light but highly abrasion resistant. Polyurethane soles are practical and keep water out but do not constrict the imagination of designers, enhancing innovation.

As a result, they are used for a wide range of footwear types. Even if they are best known for sports, outdoors and athletics shoes and boots, polyurethanes are also widely used for business and fashion shoes, as well as for durable footwear for work safety applications.



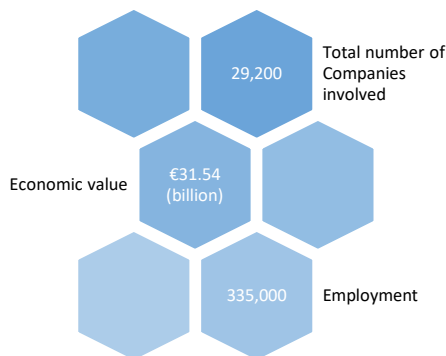
Additionally, adhesives based on aliphatic polyurethanes are state-of-the-art when gluing shoes. Especially on the sports shoe segment shoes can endure extreme mechanical stress because of this technology. Textiles based on aliphatic polyurethanes give unprecedented freedom to footwear designers and set standards with the impact on people and environment.

Out of the **98,000 European jobs** involved in the use of polyurethanes in footwear, close to 70 % are found outside of the sole polyurethane industry (i.e. chemical producers, polyurethane customers and producers of polyurethane-based finished products). Close to **13,000 companies** providing employment to more than **44,400 Europeans**.

Furniture and bedding

One of the probably best-known applications for polyurethane foams is to be found in most of Europeans homes. Modern homes, offices and communal buildings would be far less comfortable without polyurethanes.

Polyurethane flexible foams are soft yet provide support, are durable and keep their shape. They are the most common upholstery material for seating cushions in all types of upholstered furniture and build the core of most mattresses. (Polyurethane based mattresses hold a market share of more than 60 % further growing tendency.)



The versatility of polyurethane foams allows designers to use the full scope of their imagination. They provide comfort and adapt to and support the body. Thus, we feel better for longer and experience less fatigue when chairs and beds use polyurethane foams. When asleep, the human body loses water through perspiration. Combined with heat, this can stimulate micro-organisms to grow. Polyurethane foams help prevent such problems because their open cellular structure allows good absorption of humidity, ventilation and heat transfer.

More rigid, but nevertheless pliant, polyurethane elastomers are also used for making the armrests of chairs. Polyurethane mats have become a vital solution for carpet underlay while the use of polyurethane for profiles for furniture increase their durability. Some polyurethane foams are even used as artificial leather for sofas. Polyurethane coatings create attractive surfaces on furniture while adhesives are utilized to clogging aliphatic based polyurethane foams.

This diverse range of applications of polyurethanes in the furniture sector easily explains why this area holds the third-largest demand for polyurethanes in Europe.

Accordingly, numerous companies are involved in this sector: outside of producers and direct customers, more than **29,000 companies** are impacted using polyurethane in furniture and beddings; these companies provide over **335,000 jobs** and create an economic value of more than **€30 billion**.

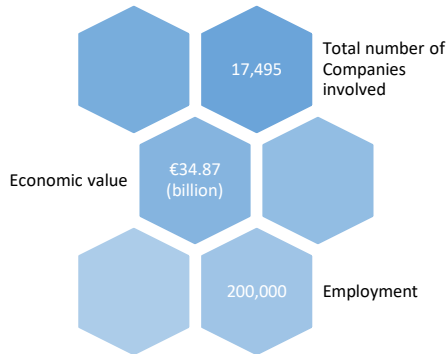
Industrial Goods

The great diversity of application ranges for polyurethanes also make them viable components for versatile industrial goods. The utilization of polyurethane products in industrial application extends to all types of polyurethanes.

Favorable isolating characteristics of both rigid and flexible polyurethane foams make them a preferred material for insulation of technical systems and piping. Polyurethane sealants are used to fill gaps thereby preventing air and water leakage. They are also used in conjunction with inorganic insulation, such as rockwool or ceramic fibers, for firestopping and to counteract smoke and hose-stream passage.

Polyurethane is also used in making solid tires, rolls and wheels. Industrial applications include forklift drive and load wheels, rolls for production lines and industrial carts. Electronic components are protected from environmental influence and

mechanical shock by enclosing them in polyurethane. The encapsulation of circuit assemblies or sensors is achieved by pouring two-part urethanes (resin and catalyst) on the component. When cured, the polyurethane coating makes for excellent abrasion resistances, good electrical properties, excellent adhesion, impact strength, and low-temperature flexibility.



In addition, the lesser known group of thermoplastic polyurethanes (TPU) are used as secondary insulating material for wire and cable applications, and in special cases it is also used as a primary insulator.

More than **200,000 Jobs** are linked to polyurethanes used in industrial goods, including their customers, the producers of polyurethane-based finished products, and their suppliers. More than **17,000 companies** contribute close to **€35 billion** to the European economy.

Economic and social value of polyurethanes for the European economy per type

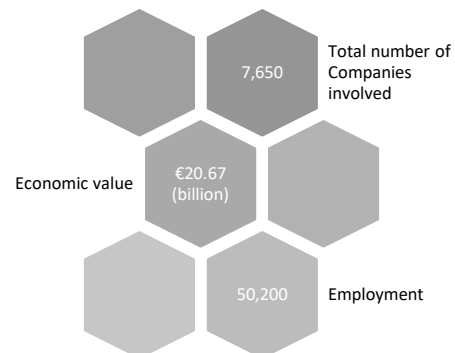
Polyurethanes are polymers with an impressive range of different forms. Depending on the synthesis process and the final formulation, different types can be created with various characteristics and near endless possible applications. After the preceding section of this report focused on the significance of those applications for the European economy, the following section shall give an impression of the

relevance of polyurethanes for European industries by type.

While flexible and rigid foams have by far the highest market share and allocate 70 % of polyurethane volumes in Europe, Elastomers, Sealants, Coatings and others add substantial values to the European economy.

Flexible Foams

The maybe most popular type of polyurethane products are foams. If a small amount of e.g. water is added to the reactive mixture of polyols and isocyanates, a reaction between water and the isocyanate creates CO₂, foaming up the resulting polyurethane. Flexible foams are foamed in place or rather commonly produced in big foam blocks that are subsequently trimmed to produce final applications.



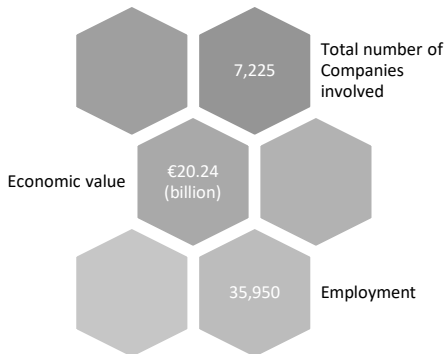
Flexible polyurethane foam affects our lives in many ways and new applications are introduced on a regular basis. It is used as cushioning for a wide variety of consumer and commercial products including furniture and bedding, carpet cushion, transportation, packaging and in other textiles. For its insulating features, it is utilized widely used as acoustic insulation. Also, its thermic insulation features are utilized in building applications and to insulate technical installations.

More than **7,650 companies** employing more than **50,200 people** in Europe are involved in the making and direct use of polyurethane flexible products, for a **contribution to the European economy of**

€20.67 billion. Flexible foams overall impact on the European economy concerns an additional **50,000 companies** creating close to **118,000 jobs**, adding **€8 billion to European growth**.

Rigid Foams

Similar in the creation process but with different densities and therefore other product characteristics, are polyurethane rigid foams. Rigid foams can be, just like flexible foams, produced in blocks and subsequently trimmed for final purposes. They are utilized for insulation but also other manifold applications, such as floating devices for example. In addition, they are available in aerosol cans to be applied directly. This is common for construction purposes. A far variety of additives is available to guarantee suitable quality features and characteristics of the final product, such as flame retardants.

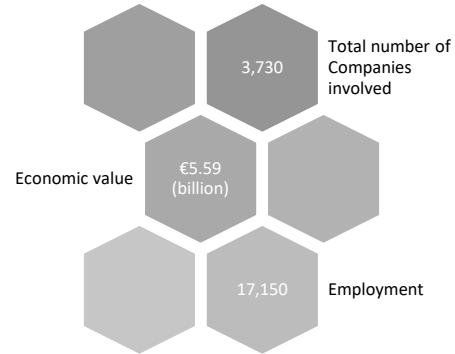


The uses of polyurethane rigid foams is well entrenched with a substantial value added to the European economy. The sectors directly in charge of producing and consuming the direct products of rigid foams account for more **7,225 European enterprises** and an employment count of close to **36,000 people**. Together they contribute to creating more than **€20 billion worth of economic value** for the European economy.

Elastomers

Elastomers are viscoelastic, thermoset or thermoplastic polymers. Polyurethane elastomers are used in a wide range of applications. Most of

these are found in the engineering field, thanks to their properties of durability, abrasion resistance and chemical and oil resistance.



These applications include rollers and belts for carrying minerals in quarrying operations, wheels for hospital trolleys, the rollers for printing processes and hoses and other components in automotive, ‘under-the-bonnet’, applications.

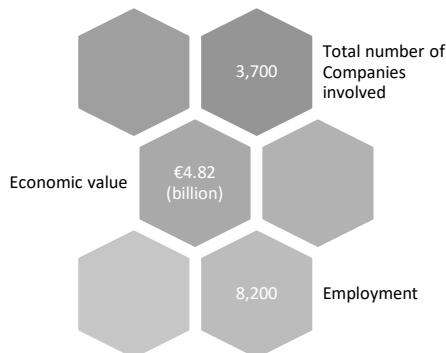
Anyhow, the use of polyurethane elastomers is not limited to technical applications. Beneath many other utilizations, they play a decisive role for the creation of footwear, mainly for soles, or leisure applications. For example, when processed to roles for rollerblades.

Close to **4,000 companies** employing more than **17,000 people in Europe** are involved in the making and direct use of polyurethane elastomers, for a **contribution to the European economy of €5.29 billion**. Their overall impact on the European economy concerns an **additional 35,100 companies** creating close to **107,000 jobs** and **adding €6.5 billion** to European growth.

Adhesives and sealants

Isocyanates and polyurethanes are versatile enough to be used as glues for materials like wood, rubber, cardboard or glass. These polyurethane glues are strong and resilient, which makes them the perfect product for construction projects, as well as for packaging and exterior furniture.

Polyurethanes adhesives can also help produce new, useful applications from used materials.

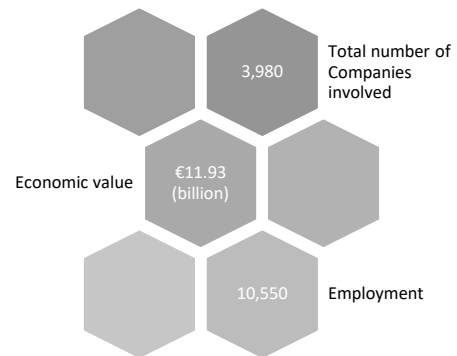


Sealants prevent liquids from entering or escaping through gaps and crevices, which is why polyurethanes are used, for example, in harsh climatic conditions to protect windows. Other sealant applications include for example concrete expansion joints in the construction sector, or pre-formed gasket seals in the automotive sector. In electrical and electronic equipment, sealants prevent moisture from entering the joints and switchgear.

The uses of polyurethanes as adhesive and sealant are so wide and diverse that their impact on the European economy can be numbered in terms of hundreds of thousands of jobs. The sectors directly in charge of producing and consuming the direct products of polyurethane account for more than **3,700 European enterprises**, employing more than **8,000 people**, who all together contribute to creating almost **€5 billion worth of economic value** for the European economy.

Coatings, paints & varnish

Coatings protect the exposed surfaces of many different products, making them last longer and look better. Due to their resilience and durability, polyurethane is an ideal choice for this type of application. Polyurethane coatings are one of the most essential applications for aliphatic based polyurethanes.



The durability, corrosion and weather resistance of polyurethanes make them suitable for coatings on surfaces ranging from steel and concrete to wood and other cellulose materials. Their applications range from infrastructure projects, such as bridges and motorway structures, steel railway carriages, to wagons, boats and other maritime applications as well as to wooden furniture and flooring.

Consequently, a large number of jobs is related to this particular use of polyurethane: More than **150,000 employees** spread across **40,000 companies** work with polyurethane coating products. Out of those, close to **4,000 are directly involved** in the production of polyurethane coatings, paints and varnish. Out of the **€15.4 billion** that polyurethanes as coatings contribute yearly to the European economy, **€12 billion are found directly** within the producers and direct users of polyurethane coatings, and their suppliers.

Economic and social value of polyurethanes for the European economy per region

In Europe, **23 companies from the chemical industry** are directly involved in the production of the main components for polyurethanes. Beneath them, Dow Chemical, Shell Chemicals, Covestro and BASF are the biggest suppliers of polyols with annual capacities of 200-500 kilo tons each. Covestro, BASF, Borsodchem, Huntsman and DOW Chemical lead the field for isocyanate production with each 300-600 kilotons (TDI and/or MDI) annually. **They supply about 6,500 companies** who

are their direct customers, and **more than 32,700 producers of polyurethane-based finished goods**. The highest number of companies involved as direct customers of polyurethane and producers of polyurethane-based products are found in Germany and Italy.

In terms of overall influence on national economies, the highest number of companies impacted are also found in those two countries, with around 44,000 companies impacted in Germany, and around 32,000 in Italy. A large number of companies are also impacted in other major European economies, with close to 19,000 companies impacted both in France and Spain, 16,800 in the UK, 15,100 and Poland. Overall, 244,000 companies, producing polyurethanes, products from polyurethanes or working with its applications are impacted throughout Europe. Also, European Neighbors embedded in cross-border work and trade, are impacted. 10,000 companies from Turkey as well as close to 8,000 companies from Russia add value at some point of the polyurethane value chain. From those, especially Russian markets for polyurethane processing and polyurethane products show considerable growth.

Many of the companies processing polyurethanes are SMEs: SMEs contribute 85% of all job creation in Europe. As a matter of fact, more than 808,000 German jobs and more than 650,000 Italian jobs depend directly and indirectly on the polyurethane industry. In France, Poland and Spain, these numbers oscillate between 400,000 and 600,000 jobs, for an overall total of 5,110,000 jobs in Europe.

This makes for a major economic contribution to European national economies, particularly in Germany and Italy where €54.09 billion and €32.41 billion economic value are added yearly to national GNPs. In France, Poland and the UK, the economic contribution of the sector is around €21 billion, for an **overall European economic value of €255 billion**.

In terms of total contribution, construction applications and furniture & bedding products hold the largest market shares throughout all European economies.

Germany

Germany is not only the business location of some of the major producers of polyurethane components, it also allocates the biggest markets for polyurethanes products in Europe.

Enterprises of all tiers from the German automotive industry are beneath the most relevant customers for polyurethane products. This positively impacts the demand of polyurethane foams, coating, adhesive and sealants, since German manufacturers progressively explore numerous materials to create modern and lightweight automotive components. More than 2,500 companies, employing 40,000 people and creating an economic value of more than €5 billion are part of the value creation automotive polyurethane applications enable. Out of all types, coatings are anticipated to emerge as the fastest growing product group for automotive applications.

Anyhow, automotive applications are not the biggest market for polyurethane products. Construction applications have by far the highest demand for polyurethane products in Germany. More than 7,000 companies are involved, generating an economic value of nearly €11 billion. Strong investments in infrastructure and construction projects, thereof in particular energy-oriented refurbishment measures, indicate that this sector will retain its dominant role in polyurethane application.

In total, close to **43,000 German companies** with more than **808,000 employees** add to the total economic contribution. This includes 4,200 enterprises directly involved as producers and direct- or downstream customers of polyurethane products. Additional 39,800 companies from the

non-polyurethane sector indirectly contribute to the **total value creation of €54.1 billion**.

France

France, as a major economic power in the heart of Europe, holds a strong and ever-growing demand for polyurethane applications. Improvements in overall socioeconomic conditions, as well as governmental efforts to boost property investments resulted in an increase in new housing projects. Coupled with a rising environmental awareness, the demand for energetical efficient insulation, especially in northern districts of France, is growing.

With it, the demand for polyurethane applications for the construction sector grows with a considerable CAGR of 4.5 % (2016-2025). Today, more than 10,000 French companies have a share in the value creation from polyurethane construction applications and provide jobs for close to 490,000 people. The construction sector for polyurethanes has an economic value of €5.3 billion.

Across all applications, 1,500 enterprises employing **22,000 people directly create or supply polyurethane products in France**. Together with related players from the non-polyurethane sector, **19,000 companies provide 609,000 jobs** and account for an **economic contribution of €22.3 billion**.

Spain

The Spanish economy is the fifth largest in the EU, based on nominal GDP statistics. After some years of recession, the regional economy witnessed a positive development and is gaining further momentum owing to the improving labor market, relaxing financial conditions, reduction in economic uncertainty and dropping energy prices. Polyurethanes therefor witness an increasing demand from several end-use industries as the economy improves.

Construction and automotive applications are increasingly realizing the importance of polyurethanes in its various forms, for providing insulation, protection, aesthetic appeal, energy savings and weight reduction. 400,000 jobs in the construction sector alone are related to polyurethane products. They generate an economic value of €2.9 billion.

When looking at the total contribution, **19,000 companies are involved**. 1,800 of them in the immediate production of polyurethanes or its applications, functioning as their suppliers or subcontractors. All in all, they **generate an economic contribution of €17.3 billion**.

United Kingdom

The United Kingdom's large and highly developed industry is amongst the most relevant markets for polyurethane and its products.

The E+E sector (in total) is worth about £16 billion per year to the UK economy. The UK has a 40% share of Europe's electronics design industry and has access to strong intellectual property rights. No wonder, E+E applications hold a strong demand for polyurethanes in the UK. About 8,000 companies producing or working with polyurethane products for the E+E industry.

A glance on the total contribution in terms of jobs and wealth creation illustrates the relevance of the United Kingdom's polyurethane industry. **460,000 people in 17,000 companies**, with 21,000 jobs in direct relation in terms of polyurethane production and products, contribute to a **wealth creation of €21.7 billion**.

Italy

With a demand of 710 kt in 2018 across all polyurethane types, growing at an estimated CAGR of 4.1 % to 2025, Italy is the second largest market for polyurethanes in Europe.

Key players driving this demand are to be found in the furniture industry, automotive manufacturers and construction business.

Manufacturing of high-quality furniture in contemporary design has a strong tradition in Italy. With more than 4,500 companies involved, furniture and bedding applications utilizing polyurethanes with a strong emphasis on flexible foams, account for a substantial contribution to Italian wealth generation. 60,000 employees generate an economic value of €3.5 billion.

This is only exceeded by the construction business. Close to 490,000 Italians create a total economic contribution of €6.6 billion. Investment projects of recent years, aiming to extend and modernize Italian infrastructure fostered the demand for various building applications from polyurethane products.

Across all applications, **32,000 Italian companies with close to 650,000 employees add to the economic success** of the polyurethane sector in Italy. This includes 3,300 companies with direct contribution in terms of production or customers of polyurethane products. **The total value creation levels around €32.4 billion** and accounts for 13 % of the total European contribution.

Netherlands

Not the largest market, but with an CAGR (2017-2025) of 4.5 % the fastest growing market for polyurethane products can be found in the Netherlands.

The most important application for polyurethanes with the concurrently strongest growth is the construction sector. Modern architecture and comprehensive infrastructure projects across the country create an extensive demand for insulation materials. With the ideal characteristics of polyurethane based insulation materials, these solutions are the number one choice. Polyurethane based construction applications relate to more

than 160,000 jobs in the Netherlands and constitute an economic value of €2.5 billion.

This is followed by polyurethane applications, mostly flexible foams, for furniture and bedding products. With companies involved accumulating more than 2,000 enterprises, this sector yields €1.3 billion.

In the Netherlands, **800 companies directly contribute, and 8,000 enterprises indirectly contribute** to the production and application of polyurethane based products. They allocate close to 217,000 jobs and create an **economic contribution of €17.7 billion**.

Poland

The Polish market for polyurethane products is predominantly affected by two thriving sectors. Comprehensive restructuring and modernization efforts make the construction sector the dominant end-use segment in Poland. The building segment recorded a growth of 8.5% since 2010. Increasing demand for energy efficient buildings in the country is positively influencing the demand for polyurethanes. This results in an economic contribution of €3.7 billion and related employment of close to 250,000.

On top of that, Poland is the fourth largest manufacturer of furniture in Europa. The furniture sector is one of the fastest growing economic sectors in the country. Especially the production of mattresses, with flexible polyurethane foams being one of the key elements, is well established. 4,000 companies are related to this sector and employ more than 45,000 people.

Taken all applications of polyurethanes into account, **15,000 Polish enterprises take part on the value creation of €21.7 billion** and create **employment for more than 360,000 people**. Of those, 1,400 companies with 24,000 employees directly contribute in terms of production or supplying polyurethane products.

Russia

The Russian market for polyurethanes is still limited, measured by the countries sizes and compared two major European economies. Economic and technical development of different regions within the country show wide disparities. Nonetheless, it's a rapidly evolving market in total, growing at a CAGR of 8.7 % (2017-2025).

The strongest driver for growth in the demand of polyurethane products is the construction sector. The Russian government introduces various programs aimed at modernizing and developing the countries transport, energy and social infrastructure, which has played an important role on fostering polyurethane demand as well. Increases in disposable personal income have also supported a steady improvement in residential construction. In this context, polyurethane based products are related to 3,500 companies, providing 136,000 jobs.

In terms of total contribution, an economic value of **€10.5 billion was created from the polyurethane industry** and its suppliers and subcontractors. **8,000 companies provide employment to 187,000 Russians** throughout all sectors.

Turkey

Strong economic ties connect Turkey to the European Union. Especially European automotive manufacturers cooperate closely with Turkish component suppliers. The production of automotive parts results in 12,000 jobs created by around 1,000 companies in the polyurethane related automotive sector.

The strongest demand for polyurethane products in Turkey however, like in many European countries, comes from the construction sector. Being a driving force of the countries' economy and wealth, a strong demand for polyurethane products can be found here. Despite overall recessive tendencies and surging interest rates, limiting investment and therefor the sectors overall

growth, polyurethane based construction applications create an economic value of €3.1 billion and are related to 170,000 jobs in Turkey.

In total, more than **221,000 Turkish jobs are directly related to polyurethane applications and 1,200 companies** produce or supply polyurethane products. All together with enterprises contributing indirectly to the value creation, an **economic value of € 22.5 billion** is created.

Appendix

Economical Terms Glossary

| Term | Annotation |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total contribution | The total quantitative contribution in terms of job or value creation along all stages of the value chain. |
| Direct contribution | Values created due to production of chemicals for polyurethanes or the manufacturing of PU based products. |
| Indirect contribution | Values created by the application of PU based products, considering the statistical share of concerned employees and value creation, delimited from total operations. |
| Sector/Application | Classification by branch or field PU based products are utilized for. A PU flexible foam, utilized to produce a mattress is categorized within Furniture & Bedding. |
| Type | Classification by the output form of polyurethanes. The type distinguishes the different classes of PU based components, such as flexible foams, elastomers, etc. |

Chemical producers

Companies of the chemical industry, providing basic materials to produce polyurethanes.

Suppliers & Final Producers

Enterprises manufacturing intermediate products (e.g. PU foam blocks) or final PU based applications (e.g. PU mattresses).

Non-PU Sectors

Businesses utilizing PU based products for their value creation while not ranking amongst chemical or plastics producers. E.g. façade engineers utilizing PU building foam.

Imprint

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