INDUSTRY DATA

EUROPEAN DIISOCYANATE & POLYOL PRODUCERS ASSOCIATION

Socio- Economic Information on the European Polyurethanes Industry

INTRODUCTION

This publication summarises the value of the polyurethanes industry, based on aromatic diisocyanates and associated polyols, to the European economy. The data contained in it has been produced by an independent consultant during the first half of 2003 looking back at the status of the industry in 2002.

This project was commissioned by ISOPA so that it could communicate the contribution of the industry to a range of stakeholders. The consultant's brief included the investigation of the industry along the entire value chain from the chemicals suppliers to their direct customers and then to the final producers of consumer goods. In addition, the study includes the associated but indirect industry including service providers such as the logistics and maintenance companies.

SUMMARY

This publication shows that, starting from a modest number of chemical suppliers, a vast range of European industry is served and it, in turn, provides, essential goods and articles for consumers in Europe and, through exports, to consumers further afield. The aromatic diisocyanates and polyols industry serves nine major sectors and information is given for each of these. There are additional sectors, such as toys and leisure applications, which are not explicitly in this publication. Some of these are of greater significance in other manufacturing centres such as China.

Summarising the key parameters for the industry value chain based on aromatic diisocyantes and associated polyols

- Involves more than 23,500 companies most of which are SMEs
- Employs well over 800,000 workers
- Generates a market value of nearly €130 billion.

In addition, the associated but indirect activities involve more than 71,000 companies employing about 2,040,000 people.

It is important to note that the majority of companies in the polyurethane industry are small and medium-sized enterprises (SMEs).

The significant end-use applications include infrastructure and building products such as insulation panels, coatings and adhesives plus binders for forest products. Polyurethanes are key components for refrigerators and freezers automobiles, furniture and shoes.

The key property of polyurethane chemistry is its extreme versatility and the end properties include superb insulation, extreme adhesion, high comfort and a durability that surpases most other synthetic or natural materials.

A summary of the key parameters for each stage in the value chain is given in the table below:

Parameter	Chemical Producers	Polyurethane Converters	End-use Producers	Indirect Industry	Total Industry
Number of companies	390	1495	21,700	71,100	94,700
% which are SMEs	< 50	> 50	> 70	> 90	> 80
Total number of workers	13,900	88,500	715,000	2,204,000	2,862,000
Average number per company	36	60	33	33	30
Volume (k tons)	3,350				
Market value (€ billion)	3.4	125			
Export market value (€ billion)	0.69	2.4			

A note on ISOPA

ISOPA, the European Diisocyanates and Polyol Producers Association, was founded in 1987 and it provides a forum for the industry's stewardship of the development and use of raw materials which are fundamental to the manufacture of polyurethanes. It is committed to encouraging dialogue with European institutes and government and to explaining the industry and polyurethanes' social environmental and economic contribution to modern life.

ISOPA's approach is based on combining the extensive technical and scientific expertise of its members together with those of the International Isocyanate Institute (III). It uses these skills and knowledge to continuously improve the environmental, health and safety standards relating to the use of aromatic diisocyanates and polyols and provides quality information to the industry and its products to all stakeholders.

ISOPA is a non-profit making association and is an affiliated organisation of the European Chemical Industry Council (Cefic) – which in turn represents the wider chemical industry at European level.

ISOPA's members are Bayer, Dow, Elastogran (BASF Group), Huntsman, Repsol and Shell.

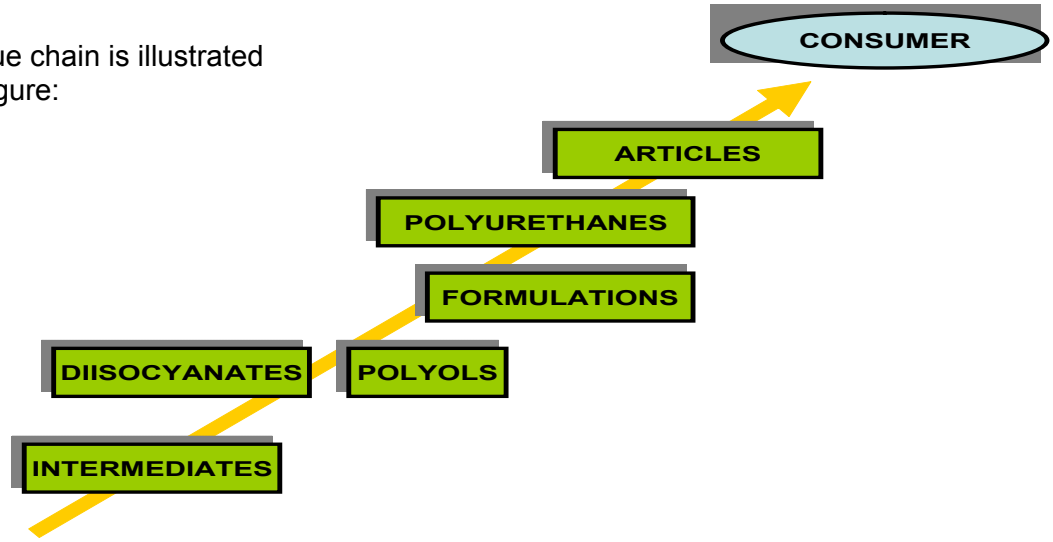
The Chemical Producers

The polyurethane value chain starts with the comparatively few major suppliers of the aromatic diisocyanates, MDI and TDI and/or associated polyols. The manufacturers of MDI and TDI in Western Europe are all members of ISOPA as are the largest producers of polyether polyols. Some of the ISOPA members also manufacture polyester polyols. Many of these producers are also back-integrated and produce the intermediates for making the diisocyanates and polyols.

There are also other manufacturers of polyols, both polyethers and polyesters, plus two aromatics diisocyanate manufacturers, one in Poland and another in Hungary.

Most of the ISOPA member companies also operate systems houses whose role is to produce tailor-made formulations. There are also a number of independent system houses who produce formulations and prepolymers (diisocyanates) which are aimed at specialist applications. Some of the system houses produce prepolymers and formulations which are tailored for specific sectors such as adhesives or coatings.

The value chain is illustrated in this figure:



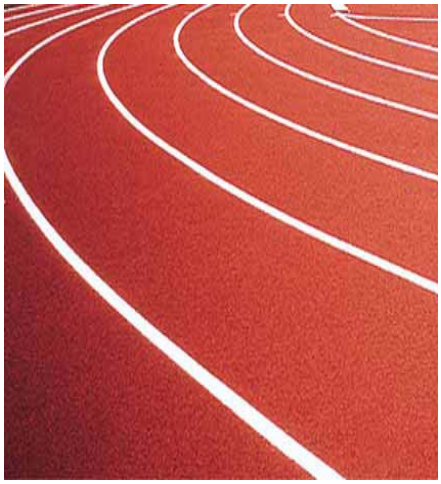
The table below includes all the aromatic diisocyanate and polyol producers as well as the system houses.

Key data for the chemical producers

Parameter	Data
Number of companies	390
% which are SMEs	< 50
Total number of workers	13,900
Average number per company	36
Volume (k tons)	3,350
Market value (€ billion)	3.4
Export market value (€ billion)	0.7

Sector Snapshot – Adhesives and Sealants

Adhesives



Diisocyanates and polyurethanes are so versatile that they are also available as top quality glues that can bind together quite different materials such as wood, rubber, cardboard or glass. Construction projects benefit particularly from these qualities of the products. Packaging and exterior furniture, which need resilience and strength, often rely on polyurethane adhesives.

Diisocyanates and polyurethanes help produce new, useful applications from used materials. For instance, end-of-use vehicles tyres can be made into children's playgrounds, sports tracks or stadia surfaces thanks to polyurethanes' adhesive qualities.

Sealants

Sealants prevent liquids from entering or escaping through gaps and crevices. Polyurethanes are tough and used, for example, in harsh climatic conditions to protect windows or in the construction sector on concrete expansion joints and as pre-formed gasket seals in the automotive sector. These are also used in electrical and electronic equipment to prevent moisture entering items such as joints and switchgear.

Parameter	Chemical Producers	Polyurethane Converters	End-use Producers	Indirect Industry	Total Industry
Number of companies	40	73	1,100	6,200	7,400
% which are SMEs	10	25	70	90	85
Total number of workers	760	14,800	61,500	193,000	270,000
Average number per company	19	200	55	31	36
Volume (k tons)	267	1,242			
Market value (€ billion)	0.71	2.24			

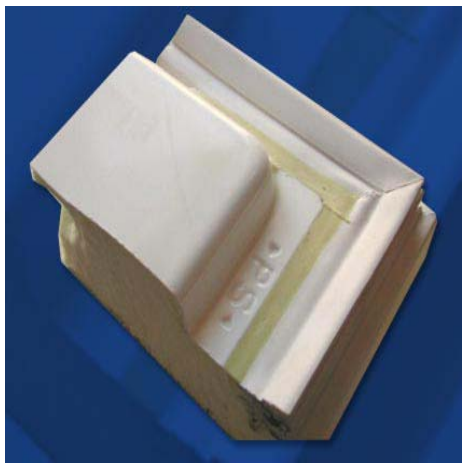
Sector Snapshot – Appliances

Polyurethane rigid insulating foam makes a major contribution to preserving food through the food chain from production, to distribution and finally to the domestic kitchen. The domestic refrigerator and freezer is an essential appliance today.

Polyurethane rigid foams are excellent insulators, inhibiting the unwanted movement of heat or cold while being light and needing little space. Almost all refrigerators and freezers produced in the world are insulated with these foams and this enables the amount of food stored to be maximized.

These appliances are now designed to use less energy, thus benefiting the environment and cost less to operate. The contribution of the insulating foam means that ever more stringent energy standards can be met and the benefits passed onto the consumer.

The processing versatility and the strength of polyurethane rigid foam results in appliances which are can be automated processes and are light and strong.



Parameter	Chemical Producers	Appliance Makers	Wholesale & White Goods Professionals	Indirect Industry	Total Industry
Number of companies	42	35	820	1,200	2,100
% which are SMEs	10	0	70	90	80
Total number of workers	1,000	2,460	8,800	31,000	43,000
Average number per company	24	120	11	11	26
Volume	177 k tons	20 million units			
Market value (€ billion)	0.22	9.5			

Sector Snapshot – Automotive

We drive more safely and comfortably today thanks to polyurethanes. As foams for car seats, headrests and other components in the passenger cabin, polyurethanes help reduce injury in case of collision. As sound insulation they dampen vehicle noise by 50% more than traditional materials such as bitumen sheet or felt fibre. Vibration is cut down by polyurethanes too, giving a more pleasant and less tiring drive.

In use, polyurethane applications reduce vehicle weight and, consequently, fuel consumption and emissions to the atmosphere. At end of life, polyurethane components can be recycled, helping to conserve resources.

Parameter	Chemical Producers	Polyurethane Converters	End-use Producers	Indirect Industry	Total Industry
Number of companies	36	67	110	10,700	10,900
% which are SMEs	10	25	10	90	88
Total number of workers	2,100	25,500	101,000	322,000	450,000
Average number per company	58	384	900	30	41
Volume (k tons)	560	570			
Market value (€ billion)	1.4	40			

Sector Snapshot – Binders

The binding qualities of diisocyanates and polyurethanes have opened up new opportunities to use different types of materials together. As highly versatile glues, they can bind together wood, rubber and recycled materials easily and safely in imaginative ways.

Applications include high quality boards to make cupboards, work surfaces and kitchen floorings. Similarly, diisocyanates can be used to bind together used foam crumbs to make carpet underlays. The steel industry uses diisocyanates as the basis for binders to make moulds for casting.

Parameter	Chemical Producers	Product Makers	End-use Producers	Indirect Industry	Total Industry
Number of companies	42	106	1,700	2,500	4,300
% which are SMEs	10	10	10	90	55
Total number of workers	700	5,000	37,000	107,000	150,000
Average number per company	17	48	22	44	35
Volume (k tons)	181	2,860			
Market value (€ billion)	0.3	42			

Sector Snapshot – Building & Construction

The construction industry uses polyurethane rigid foams (PUR) extensively in residential, commercial and institutional buildings. The most important application is insulation to prevent heat transfer, which equally means, for example, keeping heat in buildings in cold climates, keeping heat out in warm climates or keeping food stores cool.

Buildings last longer and with less maintenance because of PUR's durability. Rigid composite panels with PUR cores are light but strong, moisture-resistant and easy to install.

Due to its insulation value, PUR reduces space requirements for walls and roofs and, hence, maximises internal volume. This is especially important when existing buildings are being renovated to improved insulation standards. PUR spray foam is particularly versatile and efficient for the upgrading of existing buildings

PUR is a superb insulator. In buildings PUR can reduce fuel costs and help conserve energy. It is estimated that insulation of buildings to optimal standards could reduce global CO_2 emissions by 20%.

Many of the companies in the construction industry are SMEs who have particular skills and experience in using polyurethane-based construction products

Parameter	Chemical Producers	Component Makers	Building Companies	Indirect Industry	Total Industry
Number of companies	60	190	1,600	10,000	12,000
% which are SMEs	10	70	70	90	86
Total number of workers	3,000	9,950	100,000	282,000	396,000
Average number per company	50	52	64	28	28
Volume (k tons)	585	1,100			
Market value (€ billion)	1.7	4.1			

Sector Snapshot – Coatings

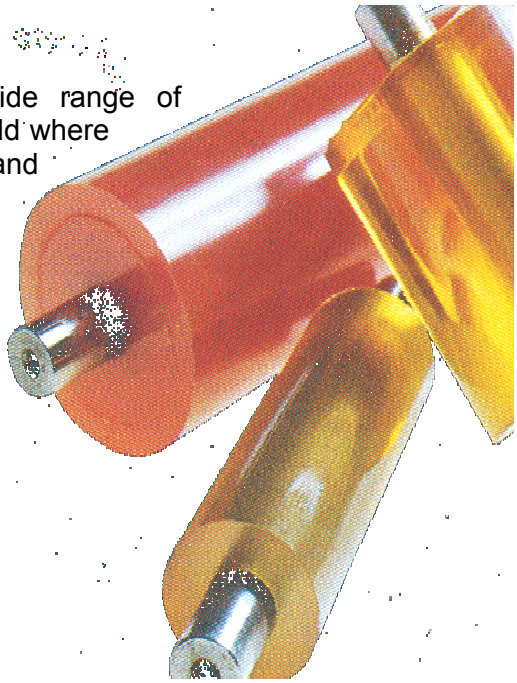
Modern coatings protect the exposed surfaces of many different products, helping to make them last longer and look better. The durability, corrosion and weather resistance of polyurethane make them suitable for coatings on surfaces of all kinds - from steel and concrete to wood and other cellulose materials.

The applications range from concrete constructions such as bridges and motorway structures to steel railway carriages and wagons to wooden furniture.

Parameter	Chemical Producers	Coating Makers	End-use Processors	Indirect Industry	Total Industry
Number of companies	38	335	4,500	7,500	12,400
% which are SMEs	10	70	90	90	58
Total number of workers	1,150	16,300	73,000	226,000	316,000
Average number per company	30	49	16	30	36
Volume (k tons)	560	1,200			
Market value (€ billion)	1.7	7.2			

Sector Snapshot – Elastomers

Polyurethane elastomers are used in a very wide range of applications. Most of these are in the engineering field where their properties of durability, abrasion resistance and chemical and oil resistance are needed.



The applications include rollers and belt for carrying minerals in quarrying operations, wheels for roller-blades and hospital trolleys, the rollers for printing processes and hoses and other components in automotive, under-the-bonnet, applications.

Parameter	Chemical Producers	Elastomer Makers	End-users	Indirect Industry	Total Industry
Number of companies	37	48	1,200	3,000	4,300
% which are SMEs	10	60	90	90	89
Total number of workers	1,150	2,000	31,500	86,000	121,000
Average number per company	31	42	25	29	29
Volume (k tons)	202	202			
Market value (€ billion)	0.9	1,7			

Sector Snapshot – Footwear

Good footwear is comfortable, long-lasting, appropriate for usage - and sold at the right price. Polyurethanes let designers meet all these objectives.

Light but highly abrasion resistant, polyurethanes are perfect for hard-wearing shoe soles which last longer than traditional materials. Polyurethane soles are practical and keep water out but do not constrict the imagination on design.

Within the sector polyurethanes are used for a wide range of footwear types.

Perhaps best known for sports and athletics shoes and boots, they are also widely used for business/fashion shoes soles and for durable footwear for work safety applications.

Parameter	Chemical Producers	Direct Moulders & Unit Sole Makers	Shoe Makers	Indirect Industry	Total Industry
Number of companies	37	270	4,100	18,000	22,000
% which are SMEs	10	60	90	90	90
Total number of workers	1,070	8,400	84,000	234,000	327,000
Average number per company	29	31	20	13	36
Volume	250 k tons	247 million pairs			
Market value (€ billion)	0.7	5.3			

Sector Snapshot – Furniture and Bedding

Modern homes, offices and communal buildings would be much duller and far less comfortable without polyurethanes.

Polyurethane flexible foams are soft yet give support, are durable and keep their shape. They are an excellent filling material for seating cushions and mattresses and can be produced to the density the manufacturer requires. Their versatility allows the designers to use the full scope of their imaginations.

Polyurethane foams adapt to and support the body. This is why we feel better for longer and experience less fatigue if 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. For this reason, hospitals recommend polyurethane mattresses.

More rigid but still pliant polyurethane elastomers are used for the armrests of, for example, office and institutional chairs.

Parameter	Chemical Producers	Foamers & Moulders	Manufacturers	Indirect Industry	Total Industry
Number of companies	60	370	6,700	12,400	19,500
% which are SMEs	10	50	50	90	75
Total number of workers	3,000	3,900	219,000	564,000	789,000
Average number per company	50	11	33	46	40
Volume	570 k tons	45 million units			
Market value (€ billion)	1.9	14			

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