# Research for a sustainable chemicals industry

Chemicals form the Europe Union's second largest manufacturing sector, just behind food, drink and tobacco in terms of production, and behind electrical engineering in terms of added value. The EU is also the world's most important producer of chemicals, accounting for 32% of the total global output. Its positive trade balance is bigger than that of the chemical industries in the USA or Japan. European industry directly employs more than 1.7 million people and has a turnover of more than €400 billion. Another three million employees work in sectors using chemical products as direct inputs.

European industry is fully committed to sustainable production and has made important progress over the past decade. However there is growing legislative pressure on the safety of chemical products. EU companies will also have to face up to major structural changes in the global industry as Europe moves even further away from basic commodity production to high technology specialities and life science products.

## Heterogeneous manufacture

The products and services of the chemical industry are instrumental in meeting many needs of mankind. They are present in all facets of life, from food and clothing, housing, communications and transport – through to leisure activities.

Chemicals manufacture is very heterogeneous in nature, mainly comprising the transformation of materials into diverse substances with new chemical and physical properties. This activity is divided into two ‘upstream’ segments: basic inorganics and petrochemicals (or basic organics). These two segments almost exclusively serve a variety of downstream sectors, whose principal products are:

- Fertilizers and nitrogen compounds;
- Basic plastics and synthetic rubber;
- Pharmaceutical and medical products;
- Speciality chemicals – including agrochemicals, and specially polymers;
- Paints, varnishes and coatings;

- Cleaning and polishing preparations;
- Perfumes and toiletries; and
- Man-made fibres.

Of the world's top 30 chemical companies, 15 have headquarters in the EU and a further three in Switzerland. However, while large companies predominate in petrochemicals, small and medium sized enterprises (SMEs) play a vital part in the industry as a whole. In fact, 96% of the 36,000 companies involved in Europe have less than 250 employees. These small businesses account for 40% of the total workforce and 30% of the industry's turnover.

**Good progress towards sustainability**

Overall, this diverse sector has demonstrated good progress towards sustainability. Following the Kyoto and Buenos Aires conferences on climate change, it is coping with increased pressures to reduce its contribution to the 'greenhouse' effect. Despite a 26% increase in production volume over the past few years, carbon dioxide emissions have remained stable – with an effective cut of 21% per unit of production since 1990. Furthermore, the industry has reduced its energy consumption by 8% over the same period.

Production-related factors are generally considered to be under reasonable control in the EU. Successes to date in achieving cleaner production result both from technology developments and from strong co-operation between industry, authorities and stakeholders at European and Member State levels. Through the industry's voluntary Responsible Care initiative, member companies are also committed to supporting a continuing effort to improve their health, safety and environmental performance.

However, the OECD[1] warns that a current lack of reliable information on the safety of chemicals on the market, as well as on the volume of hazardous substances being released into the environment during use and disposal of chemical products, will pose a major challenge to policy makers over the next two decades. The organisation expresses growing concern regarding chemicals detected in the environment that are persistent, can bioaccumulate and/or are toxic.

[1] Environmental Outlook for the Chemicals Industry (http://www.oecd.org/ehs)

## Changing global picture

The OECD also predicts that the future industry will look very different to that of today, with production 85% higher in 2020 than in 1995. By then, it is forecast that non-OECD countries will lead in the supply of high volume basic commodity chemicals, while the EU and other OECD nations will concentrate primarily on technologically advanced markets such as specialty and life-science chemicals.

Development and manufacture of the chemical products of the future will thus need to take greater account of consumers' needs, while the on-going drive towards sustainable technologies and the elimination of waste will require still higher levels of innovation. Today's mature chemical processes may no longer be acceptable in the increasingly environment-conscious world. And many industrial infrastructures, production sites, laboratories, storage facilities and distribution networks will have to be reorganised or transformed. All of this will lead industry, the Commission and national authorities to focus their efforts on appropriate research and development, education and scientific training.

## Range of European measures

Collaborative research programmes will continue at European level, not only between industries with similar characteristics (for example: the SUSTECH[2] and PRIMA initiatives for process industries such as food, steel and paper), but also with user industries such as transport and construction, and with computer software suppliers for greater use of information technologies.

Increased integration of the chemical industry into existing or future multi-sectoral initiatives such as task forces and clusters will allow better access to the various Community programmes and an optimisation of their results through improved co-ordination. Further focuses will be on greater flexibility in the development and revision of the Community-specific research and development programmes, and improved patent protection for products such as pesticides and biotechnological innovations.

Industrial initiatives aimed at improving young people's chemical education and the scientific training of workers will, together with the Community Leonardo da Vinci and SOCRATES programmes, the Fifth Framework Programme (FP5) – and even more so in

[2] Sustainable Technology (http://www.sustech.de/E_Index.html)

FP6 – and actions eligible for Structural Funds, strengthen the essential educational and scientific basis for an innovative chemical industry.

Under the FP5 GROWTH (Competitive and Sustainable Growth) programme, chemicals-related projects fall mainly within Key Action 1 ‘Innovative Products, Processes and Organisation’, as part of the modern factory targeted research action (TRA).

This TRA is stimulating new or better quality products in a fast-changing environment at reduced costs. It embraces waste reduction and the optimisation of resources in all phases of the product life cycle. In addition, it seeks to encourage the design, construction and operation of safe and sustainable industrial facilities – as well as the rehabilitation, upgrading and decommissioning of existing installations.

Further key goals are a significant improvement in working conditions, a reduction in environmental impact and enhancement of the quality of life for society in general.

At the same time, long-term research into broader issues relevant to the chemicals sector are treated under the Generic technologies: Materials and their technologies for production and transformation’ activity – and in particular under ‘Priority 5.3-Sustainable chemistry’.

**Building on ERA and FP6**

Looking ahead, the European Research Area (ERA) will provide an ideal environment within which to integrate these co-operative projects and use the individual strengths of Member States to resolve problems faced by the EU as a whole. The principal instrument for this will be FP6, which ranks a number of research areas linked to economic and societal issues that are especially important to the EU.

As a natural evolution from today’s research, FP6 will incorporate a socio-economic dimension into future research projects, and includes provision for the development of methods to measure sustainability. It will also embrace studies of the technologies and systems for optimal resource utilisation as identified by the Stockholm Council in May 2001.

To encourage multi-disciplinarity, FP6 will actively promote integrated projects, and promote the creation of centres of excellence integrating different RTD actors, users and disciplines. It will also ensure that on-going dialogue with Europe’s citizens and enterprises will maximise understanding of, and support for, the vision of sustainable development.