EUROPEAN COMMISSION
ENTERPRISE AND INDUSTRY DIRECTORATE-GENERAL

Chemicals, Metals, Forest-based & Textile Industries
Chemicals

The state of the European Chemicals Industry –

a thoughtstarter for the

High Level Group on the competitiveness of the European Chemicals Industry

1. Introduction

Industrialisation progress in Europe has always been strongly connected to advances in chemistry and the development of the chemical industry. More than any other sector of manufacturing, this industry shapes other economic activities both in traditional sectors such as agriculture, construction, textiles and clothes, footwear and in technologically advanced industries such as automobiles, modern healthcare and electronics. While products built on innovations in chemistry surround us in our daily lives the chemical industry has a far lower profile in public perception than many industries which are less important in terms of employment and sales. To some extent this is due to the diversity of the industry and its products. The chemical sector consists of many industries – from basic petrochemicals to pharmaceutical ingredients, from fertilisers to cosmetics. Although technically and scientifically closely linked, the economics of these sub-sectors can be very different, even though in some cases the same enterprises operate in several sub-sectors. More than in the past investment decisions in this industry, with its close links also to energy production, energy use and energy savings, are influenced by a wide range of political decisions. These range from policies on access to, and pricing of feedstocks, to measures addressing climate change and sustainable development in general. As a consequence, the factors driving the globalised chemical industry are comparatively complex and their analysis tends to be left to a few specialists.

Commission européenne, B-1049 Bruxelles / Europese Commissie, B-1049 Brussel - Belgium. Telephone: (32-2) 299 11 11.
Office: N 105 01/25. Telephone: direct line (32-2) 2994860. Fax: (32-2) 2950281.

The High Level Group on the competitiveness of the European chemicals industry will explore ways to ensure a successful and sustainable future of this industry in Europe over a horizon of 10 to 20 years. A common vision of the future requires a common understanding of the present. The role of this thoughtstarter is to contribute to this. It provides, first, a situational analysis of the main features of the industry. This part is largely based on a very comprehensive contribution from CEFIC, the European chemical industry's representative body. The analysis of recent trends leads to the identification of the issues of relevance to the further competitiveness of the industry. This part of the analysis has been carried out by DG Enterprise and Industry with an input also from experts in the other DGs principally concerned.

It is not the function of a thoughtstarter to provide answers but rather to identify the most relevant questions and issues that require further discussion and should, therefore, find their place in the work programme of the Group. The main objective of the first session of the Group is to discuss its mandate and work programme, and this paper is intended to facilitate the discussions.

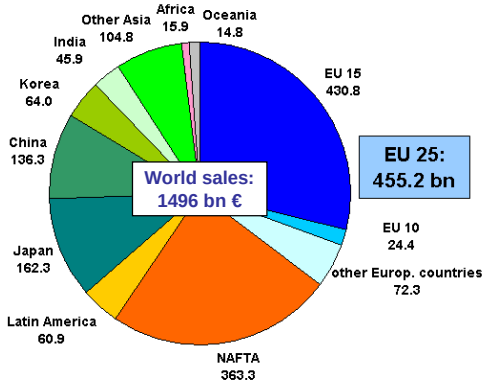
2. Some key features of the European chemicals industry

Sales

- EU chemicals industry sales are estimated at **455 € billion** in 2005. This is 30 % of the total world chemicals sales (excluding pharmaceuticals) which are estimated at € 1496 billion.

No. 1 chemicals producer worldwide

World chemical production* by Region, 2005



Source: Cefic, Global Insight, VCI *sales based on local production, excl. pharmaceuticals

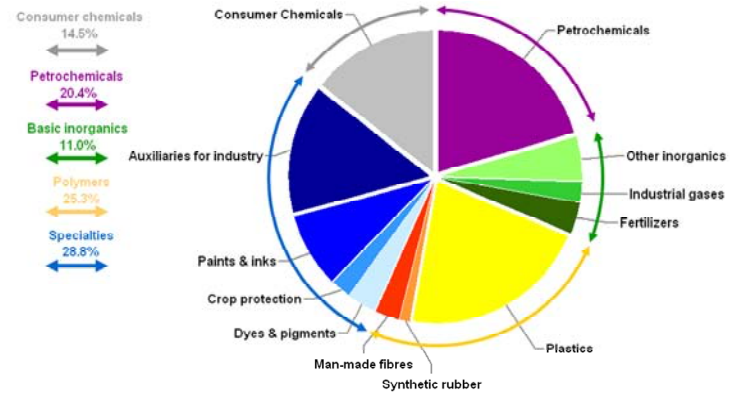
- The EU is still the world's largest chemicals producer, with a market share of 30%. This compares with a NAFTA share of about 25%, Japan's share of around 11% and China's share of around 9%.

Sub sectors

- For the purpose of this situational analysis the chemicals industry is broken down into 5 main sub sectors: Petrochemicals, Basic Inorganics, Polymers, Specialities and Consumer Chemicals.

5 important sub sectors in the chemical industry

Total EU chemicals production* in 2005: € 455 bn



Source: Cefic

*Sales based on local production (excluding pharmaceuticals)

- Petrochemicals and basic inorganics are produced in large volumes and sold to the chemicals industry itself or to other industries. Keeping costs under control is the main driver for the competitiveness in this sub sector. Petrochemicals and basic inorganics represent about 31 % of the total chemicals sales. Together with polymers, they form the group of base chemicals that account for almost 57 % of total chemical sales.

- Specialty chemicals are produced for specialised uses and in lower volumes than bulk chemicals. They include active ingredients and co-formulants for the pharmaceuticals industry, dyes and pigments, paints and inks, active ingredients and co-formulants for crop protection, etc. In practice this “sub-sector” is very heterogeneous as it consists of dozens if not hundreds of specific markets with very different market conditions. Altogether they account for nearly 29 % of total chemical sales.

- Lastly, consumer chemicals are sold to final consumers. Soaps and detergents, perfumes and cosmetics represent approximately 14 % of total EU chemicals sales.

- In recent years the highest growth rates and profits have been made in the base chemicals sub sectors despite the strong increase of raw material prices. The main reason is the enormous demand in Asia, especially China, for these basic chemicals. However, as Asia is rapidly building its own production facilities, coupled with an investment boom in the Middle East leading to further build up of capacity in petrochemicals, this benign economic

situation is not expected to last. Fine and speciality producers have recently had more difficulties to pass on higher raw material prices to their customers and the overall performance of these sub sectors has been less good due to temporary excess capacity built up some years ago. This shows that the drivers and dynamics in the different chemicals sub-sectors are sometimes very different and this means that the policy responses for these sub-sectors should be different also.

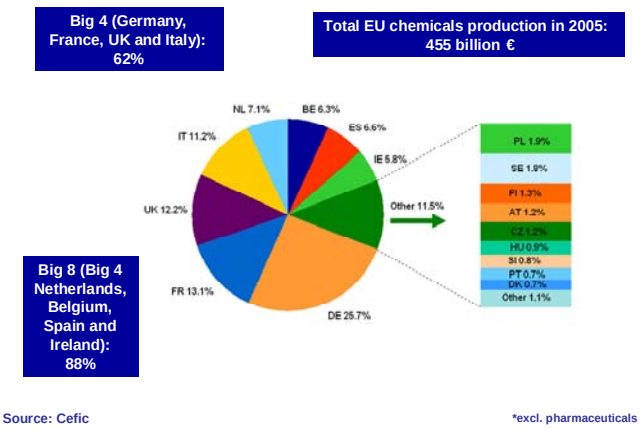
- It is sometimes argued that the EU should only focus on high added value chemicals (e.g. speciality chemicals) and accept that the production of basic chemicals will gradually and unavoidably move to other parts of the world (Middle East, Asia, etc.). However, the question could be raised whether such a scenario is viable in the longer run. In most cases the base chemicals industry provides the raw materials for the high added value sub-sectors, and it is the successful and close integration and interaction of these sub-sectors in clusters that contributes to the EU's competitiveness in the chemicals industry.

  Additionally, this 'clustering' is crucial not only within the chemicals industry but also in the manufacturing industry as a whole. It is arguable whether it is possible to have a thriving automotive, aerospace, etc. industry without a performing plastics industry that provides the necessary sophisticated materials for these industries.

Geographical distribution of chemicals production in the EU

- Four Member States generate almost two thirds of the EU's chemicals sales. Germany is the largest chemicals producer in Europe, followed by France, UK and Italy. Adding Spain, Netherlands, Belgium and Ireland raises the overall share to 88%. Poland makes the highest contribution among the new EU Member States, representing 1.9% of total EU chemicals production. The production of chemicals in the EU is largely concentrated in a few areas, most notably in North Western Europe.

EU chemical* sales by member country



- On the other hand, it appears that in 50 out of the 116 regions of the EU more than 10 000 people work in the chemicals and pharmaceuticals industry. Consequently, growth in these sectors can create jobs in a substantial part of the EU.

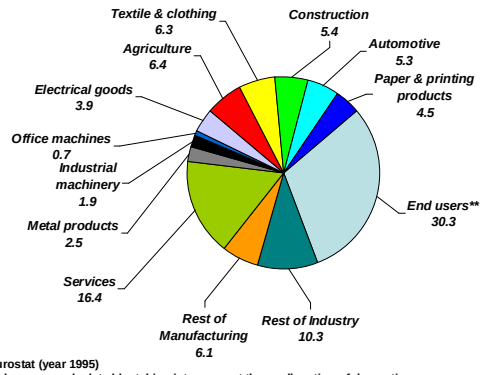
- The chemical industry in the 12 new Member States is structurally different from the EU15 chemical industries. For instance, base chemicals represent a much higher share than in the EU 15 and the new Member States have a large trade deficit in chemicals.
  It seems that the potential of these countries is still largely untapped despite good growth levels in the past few years. The restructuring and modernisation of the industry in these Member States is in many cases not yet fully complete.

Customer sectors of the chemicals industry

Innovation engine for downstream industries

Customer sectors of the chemical* industry

% of chemical domestic consumption



Sources: Cefic & Eurostat (year 1995)
Notes: Percentage shares are calculated by taking into account the re-allocation of domestic consumption to downstream customers of chemicals self consumption & consumption by rubber and plastic processing industries
*Including pharmaceuticals
** End users: Final Consumption = Final consumption in households + government consumption + non profit organisations

- Only 30.3% of the combined output of the chemical and pharmaceutical industry is sold to end users, while the rest is sold to other industries, services and agriculture.

- The EU chemicals industry supplies virtually all sectors of the economy. Its role can be better understood looking at its pivotal position in the value chain: raw materials and feedstock are transformed into tailor made solutions for customers from the chemicals industry as well as other industries, downstream in the value chain. In other words, technological breakthroughs in the chemicals industry spill easily over to its customer industries.

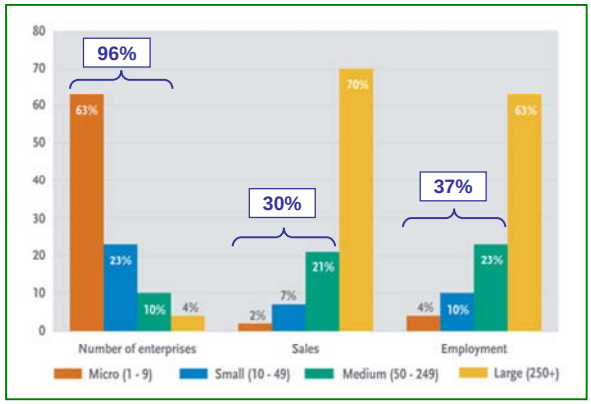
The chemicals industry is an innovation engine for many other sectors. As a consequence, maintaining a strong industrial base in Europe depends on using innovative chemical inputs in practically all downstream sectors, in particular those that are technology leaders.

Importance of small and medium enterprises

- Contrary to public perception, small and medium sized enterprises (SME's) represent a significant share of the EU chemical industry: 96% of all chemical companies have less than 250 employees and these are responsible for 30% of total sales and for 37% of total employment. In some sub-sectors and some geographical areas such shares are even larger and reach 50%.

Relevant presence of SMEs

Structure by employment size-class*



Source: Cefic, Eurostat (2001)

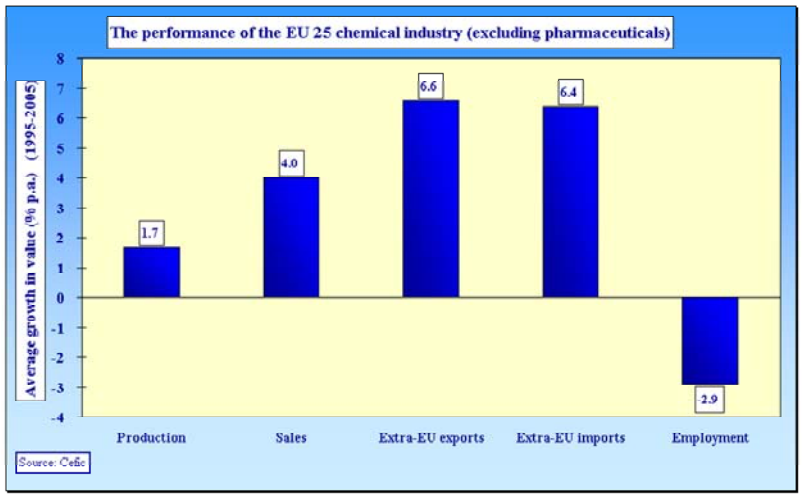
*excl. pharmaceuticals

- The importance of chemicals' SME's goes far beyond what the data suggests. Breakthrough inventions are regularly made by smaller companies and they also play a major role in transferring innovations created upstream down the supply chain to industrial users and consumers.

Performance of the industry in a global perspective

Key importance of external trade as a catalyst for growth

- Production, sales and trade have been increasing steadily over the last 10 years, while employment has been decreasing.



- Growth in production has matched that of industrial output generally over the last ten years, but growth in the second half of the period has been slower. The chemicals industry is no longer matching the growth rates of overall industry, and some chemical sub-sectors are faced with serious growth problems. As important downstream customer industries like - for example - textiles have moved out of Europe, manufacturing of products like dyes and fibres has followed.

- High levels of imports and exports of chemicals illustrate the global character of this industry. EU chemical industry is not only heavily intertwined with other EU industries, but is also heavily integrated at the international level. External trade is essential to the EU chemical industry. While open markets are critical to the future development of this industry, market access to some parts of the world, most notably big emerging countries like India, Brazil and China is still hampered by high tariffs or non-tariff barriers. Trade relations with industrialised countries would benefit from an increased convergence of regulation concerning chemical products; the Globally Harmonised System should facilitate this as far as classification and labelling of chemicals is concerned.

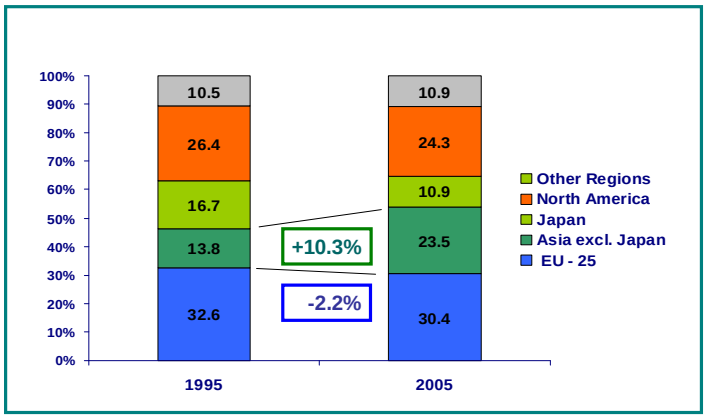
- In 2005 the European chemicals industry had a trade surplus of 38 € billion; this accounts for a quarter of the total EU manufacturing trade surplus. While Europe enjoys a trade surplus in all major chemical sectors and with all major regions of the world this surplus is no longer increasing. On the contrary the export/import ratio has been decreasing, which is a sign of strengthening

global competition. This is a consequence of new emerging competitors in the Middle East with regard to petrochemicals, and in Asia.

- Over the last decade, the EU has been losing market shares (-2.2 %) in favour of Asian emerging nations, especially China. These countries have considerably increased their share (reaching 23.5%, up from 13.8%) over the period. Japan has suffered even more than the EU (-5.8 %) while the effect on North America has been almost the same as the EU (-2.1 %).

EU Chemical Industry's share has been eroding

Regional shares in world chemical production*

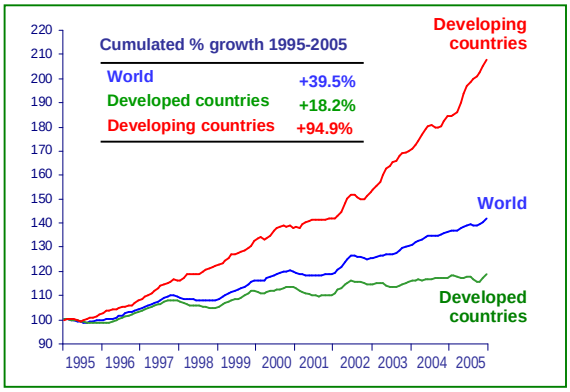


Data Source: Cefic, Global Insight and VCI, *excluding pharmaceuticals

- In a worldwide perspective, the global chemicals industry has not lost its capacity to grow dynamically. During the period 1995-2005, production increased by almost 40%. However, growth has been concentrated in developing countries (+95%). Demand for chemicals has been 'exploding' in these countries as a consequence of industrialisation and related consumer spending.

World chemicals are growing very dynamically

Chemical production growth* by region (index Q1 1995=100)

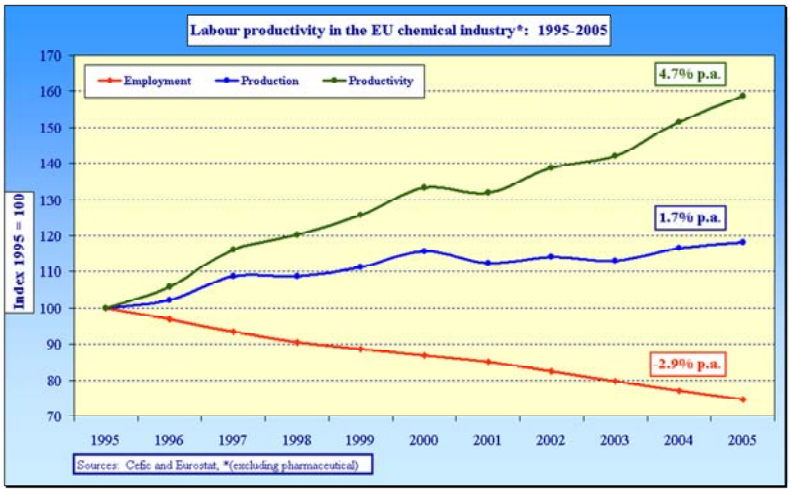


Source: Cefic, ACC *excl. pharmaceuticals

Productivity of the EU Chemicals industry

Strong productivity gains

- From 1995 to 2005 the average increase in labour productivity in the EU chemicals industry was 4.7 % per year.



- Mainly due to productivity improvements which largely exceed growth of sales, employment in the chemicals industry decreased on average 2.9 % per year which was higher than the EU manufacturing average (- 1 %) during this period. These figures do not take into account the outsourcing of activities (from kindergardens to logistic services), so the overall employment balance is less negative if indirect employment is taken into account. Nevertheless, an important reason for the reduction of employment are restructurings in order to cope with the competitive pressures from a more and more globalised market.

Investments in petrochemicals in the EU

- In the last 15 to 20 years there has been very little investment in the EU in the basic chemical sub-sectors. The last cracker, i.e. basic petrochemical plant, was built in the beginning of the nineties and since then only incremental capacity increases have taken place. The average cracker size in the EU is currently about 450 000 tons/year while the new, world scale crackers that are currently being built in Asia or the Middle East reach a capacity of more than 1.000.000 tons/year. The resulting economies of scale lead to a drastic decrease in the fixed costs base. Additionally, in the Middle East the variable costs, namely the price of raw materials, are also much lower. This makes the competitive situation of the European petrochemicals industry very vulnerable, especially as new capacities in the Middle East and Asia will come fully on stream in the next few years. In theory, a ‘scrap and build policy’ could offer a solution in Europe but this seems hardly feasible from a

financial perspective. A more modest approach could be considered which would lead at least to the upgrading and modernisation of facilities and to an improvement of the infrastructure for some locations. However, even that might be difficult given the rapid restructuring and change of ownership of many petrochemical plants in recent years. There are no indications that this rapid (financial) restructuring has come to an end.

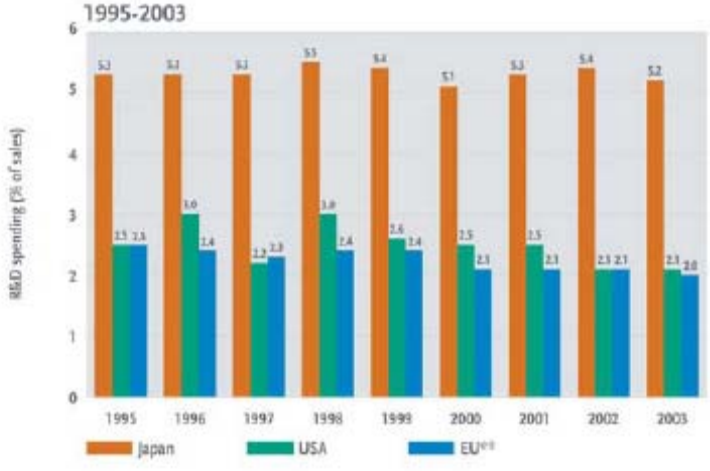
Research and development – Innovation

- Industrial research was born in the European chemicals industry and it illustrates the strong link between science, namely chemistry, and industrial innovation in this sector. The chemical industry presently accounts for 8 % of total EU manufacturing R&D spending.

- Analysing the ratio of R&D spending to sales of the chemical industry (excluding pharmaceuticals) it can be observed that the USA had a slightly higher ratio than the EU, but this has decreased to similar levels in recent years, whereas Japan has a ratio around twice as high as the other two major trading regions. Additionally, R&D in the chemicals industry is increasingly taking place in emerging countries, most notably in China and India. The reasons for that are lower cost and well-trained staff who are increasingly matching European skills. In addition, lead markets for some important innovative products in other industrial sectors (e.g. electronics) are heavily concentrated in Asia. It is currently intensively debated in the chemical industry in Europe and the US whether it is possible to increase the effectiveness of (industrial) R&D as a major study came to the conclusion that about half of the companies felt that their R&D spending is not yielding a positive return.

Chart 7.3: Chemical industry* R&D spendings in the EU**, the USA and Japan

1995-2003



Sources: Cefic and OECD
* Excluding pharmaceuticals
** EU11 covering Germany, France, UK, Italy, Belgium, Netherlands, Ireland, Spain, Sweden, Finland and Denmark

- The number of patent applications in chemistry can give an indication regarding the innovation capacity. From this perspective European leadership in innovation is still strong. The EU accounts for 38 % of all patent applications, followed by the US and Japan (both 26 %) and the rest of the world (10 %). However, patent applications do not give an indication regarding the commercial value of the underlying innovation. One issue to consider more generally are intellectual property rights to protect know-how and confidential business information.

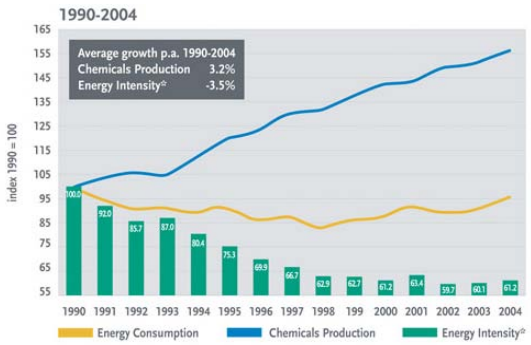
- In order to avoid the 'commodity trap', i.e. the fact that after some time highly innovative products become commodities where prices show little variation and thus costs are the determining factor for competitiveness, the EU chemicals industry will have to continue to innovate. Innovation in this context should be interpreted very broadly and entails not only product innovation but also process and service innovation (e.g. new business models). It is essential to the future of the EU chemicals industry to consider how its innovation performance can further be improved.

- The chemicals industry is well positioned when it comes to opportunities through innovation since it is very closely related to those areas that will shape economic and social progress in the 21st century such as biotechnology and nanotechnology. To address almost all major societal challenges such as energy efficiency and security, global warming, renewable raw materials, ageing of the population, recourse will have to be made to solutions provided by chemistry and developed by the chemicals industry.

Energy consumption and energy efficiency

- The chemicals industry is a big energy consumer; it accounts for 17 % of total manufacturing energy demand. Additionally, the main raw materials for the chemicals industry are oil and gas. Therefore, energy prices have a double importance for the chemicals industry. In some chemical sub sectors (e.g. fertilizers and petrochemicals) energy and feedstocks even represent the main cost element, in some cases representing more than 50 % of total costs.

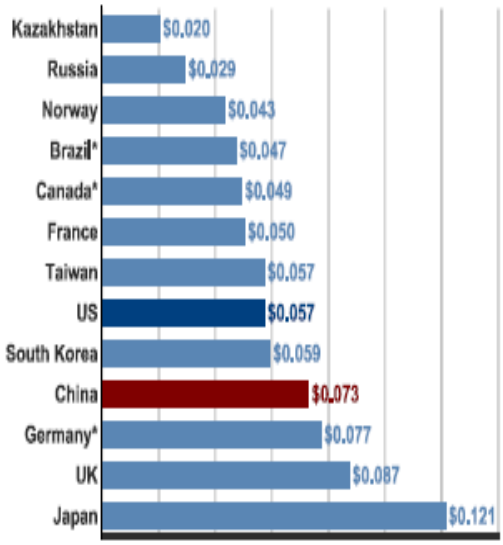
Continuously improving energy efficiency



Sources: Cefic and Eurostat
* Energy intensity is measured by energy input per unit of chemicals production

- Over the last 10 years energy consumption per unit of chemicals production has decreased by 25 %. Despite this positive evolution absolute energy usage is still slightly increasing.

Figure 10: Electricity Prices for Industry (USD per kilowatt-hour, 2005)



Source: EIA and CEIC from NDRC Price Monitoring Center, *2004 data,

- While energy prices are important and low energy costs are certainly a competitive advantage, alone they do not seem to be the main driver of chemical investment. For example China, despite its high electricity prices (see graph), is able to attract major investments in the basic chemicals sub sector. Cheap labour costs cannot in general offset this competitive disadvantage in this extremely capital intensive sub sector. Consequently, the drivers for such investments are probably related to other factors as well such as closeness to customer industries. Another possible explanation might be that investors expect that the electricity prices in China will become more competitive in the longer run since typically investment decisions are taken with a 30 to 40 years time horizon.

- Currently 8 % of the feedstocks used in the chemicals industry come from renewable sources (sugar, starch, ethanol, etc.) and most industry experts agree that this share will significantly increase in the coming years. The use of renewable resources offers a lot of untapped possibilities and intensive research is taking place in this area. However, because of the increasing competition with the energy and food sector, prices for some of these raw materials will undoubtedly rise. Such a development is already taking place. It will thus be critical to the competitiveness of the European chemicals industry to continue to have secure access to these renewable raw materials, at internationally competitive prices.

- On 8-9 March 2007 the European Council adopted ambitious targets regarding the reduction of emissions of Green-House-Gases, energy efficiency and the use of renewable energy. In addition, the recent Communication on the mid-term review of the EU's industrial policy (COM (2007) 374 of 04 July 2007) emphasised the need for industry to adapt to the challenges posed by climate change. While this new orientation will create important opportunities for industry, especially for the chemicals industry since it is closely related to most energy saving technologies (e.g. insulation, catalysts), is will be necessary also to avoid negative effects on investments in the energy intensive segment of the EU chemicals industry that is exposed to global competition (primarily basic chemicals).

- Innovations in the chemical industry enable other industries and private households to realise important energy savings. This is especially true for numerous products from more energy intensive chemical sub sectors such as plastics and technical gases. These may be one of the most important growth markets in the years to come.

Education

- Highly qualified human resources are vital to the chemical industry: 32% of its employees have attained third level education as compared to an average of 26% for all sectors (source: Eurostat). This gap even widens when compared to other manufacturing sectors. With such highly qualified employees, it is not surprising that the chemicals industry is one of the sectors with the highest value added per employee. Chemical companies are currently looking for more and more graduates because innovation requires a strong scientific basis: during the period 2001-2005, the share of graduates in employment in this industry rose by 5 %. The need to enhance innovation and the technological content of products even further will increase that demand. As a consequence, the availability of a sufficient number of well-prepared graduates in chemistry is critical to the sector's future development. The availability of skilled staff has also become a decisive factor in international competition and for the location of new investment in this sector. It is essential that Europe retains its comparative advantage in the area of skills.

- Modernising and developing the EU chemicals industry means offering a significant number of highly qualified jobs to the young generation. This is true not only in the sector itself, but also in advanced services connected with the industry – for example the management of chemical and environmental safety, as water treatment or pollution control are not possible without chemistry. Moreover, the fact of having many EU regions with a strong interest to develop their chemicals industry further, means that growth in this sector can generate high quality jobs all over Europe.

- The last decade has seen a drop in numbers of students taking chemistry at third level that poses a serious threat to the future of industry and science in Europe. This is a result of the limited interest young Europeans appear to have for chemistry and in science in general. Chemistry currently scores last among the most preferred subjects studied at secondary school. This result may be due in part to the poor quality of teaching, and the limited availability of chemistry laboratory facilities.

- The fact that the chemicals industry is based on a specific science suggests that actions are necessary in order to stimulate broader interest in taking up studies in chemistry and related subjects as well as to better match skills acquired at university with present and future needs of the chemical industry.

4. Conclusions and identification of the main issues

The European chemicals industry is facing a number of challenges to its leadership on the global market.

At the same time the chemistry of tomorrow, in particular developments in nanotechnology and biotechnology offer the chemicals industry a wealth of opportunities. In addition, the challenges facing modern society in particular as regards sustainable development and energy will require responses requiring strong contributions from chemistry and the chemical industry. This High Level Group should therefore examine how to ensure Europe is in a position to take advantage of these new opportunities first.

At world level, demand for chemical products will continue to grow dynamically while many chemical markets in Europe are mature. Emerging countries are the new drivers of growth of this industry, in particular Asia as the dominant manufacturing hub. European chemical producers benefit from these booming markets by exports and through direct investments. However, this requires adequate market access as well as the retention of a strong production base in Europe. The High Level Group should therefore look closely at trade policy and the impact of the evolving global division of labour in the chemical sector.

In order to remain competitive and to maintain a high level of employment Europe has to retain the ability to attract investments. Europe is still the most important producer of chemicals. However, since investment decisions tend to favour markets with a high growth potential, in particular if these markets offer, in addition, lower production costs such as many emerging Asian economies, Europe's lead position is at risk. In petrochemicals, new capacity is being established mainly in the Middle East which offers low cost of raw materials and an abundance of capital. Some of the smaller and older European plants are disadvantaged compared to the new large 'state of the art' facilities in a number of emerging economies.

It needs to be explored what Europe can do to modernise and keep existing capacities. Many basic chemicals but also a substantial part of the specialities can be characterised as commodities for which costs are the determining factor in competition. As margins are typically small, cost-efficiency matters. With its strong industrial infrastructure and its high level of political and social stability Europe rates favourably compared to many other regions in the world. However, additional efforts seem necessary to keep administrative and regulatory cost under control.

An improved customer orientation, and the ability to provide innovative solutions are often quoted as best response to an increasing commoditisation. There are numerous examples showing that such a strategy is successful, in SME's and large chemical companies alike. However, the challenge is to spread this best practice to a larger part of the sector. This approach requires a highly skilled workforce and management as well as a strong linkage between industry and science.

Finally, the development of new chemical solutions to address the energy and climate change problems depends largely on political decisions in Europe and other parts of the world. This does not mean that industry has not an important responsibility in this respect or that the competitiveness of the chemicals industry should become the overriding consideration in developing energy and climate change policies. But recent experience in the biofuels debate strongly illustrates the need to take into account the full consequences to industries such as the chemical industry when alternative sources of energy are promoted. This example can also be taken as evidence of the need of the private sector and the public sector to work together to ensure overall sustainability and the future competitive position of the European chemicals industry. This need is in the end the principal reason for the establishment of this High Level Group.

Annex

Further reading – reference material and key studies

- Evolution of the European chemical industrial sector over the last five years – Report of the Consultative Commission on Industrial Change prepared for the European Economic and Social Committee, 2007

- Chemical Industry 2015: Roads to the Future –Final Report – CEFIC 2004

- Innovating for a better future – Putting sustainable chemistry into action – implementation action plan 2006 – SusChem(European Technology Platform for Sustainable Chemistry)

- Chemicals and Long-Term Economic Growth – Insight from the chemicals industry (Ashish Arora, Ralph Landau, Nathan Rosenberg – Wiley-Interscience)

- Chemicals Week – May 24, 2006, p.19-26 – Chemical futures: The industry in 2020

- The Boston Consulting Group – Capturing Global Advantage – How Leading Industrial Companies are Transforming Their Industries by Sourcing and Selling in China, India and Other Low-Cost Countries – April 2004

- Employment in the Market Economy in the European Union – An analysis based on the structural business statistics – Eurostat – 2004

- The Future Belongs to Renewable Resources - Stefan Nordhoff – Journal of Business chemistry

- Changes in the Chemical Industry - Benjamin Niedergassel - Journal of Business chemistry

- Futuring in the European Chemical Industry - Klaus Heinzelbecker – Journal of Business chemistry

- Guide to the Business of Chemistry 2006 – American Chemistry Council

- China Energy – A Guide for the Perplexed – The Peterson Institute for International Economics

- R&D, innovation and competitiveness in the European chemicals industry (Fabrizio Cesaroni, Alfonso Gambardella and Walter Garcia-Fontes – 2004

- The Chemicals Industry at the Millennium: maturity, restructuring and globalization - Peter Spitz – 2003