

The future of the petrochemical industry in Europe

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A recent study by CEFIC, the European Chemical Industry Council, concluded that the chemical industry in Europe is at risk and that to secure the industry's long-term competitiveness, decisive action by both the industry and the authorities, is required to steer the critical drivers in the right direction.

After a series of reorganisations in the 1980s and 1990s, the changes in the European chemical industry have indeed continued: DSM's petrochemical operations were acquired by Sabic, Solvay sold its polymers to BP, Bayer split up Lanxess, Total is making Arkema independent, BASF announced it will cut its workforce at Ludwigshaven by more than 10% and with Innovene, Basell and Polimeri are or were 40% of the European petrochemical industry for sale (Fig. 1).

This is undoubtedly the consequence of the long down cycle between 1998 and 2003, but also of the shift in production from the traditional regions like Europe, the United States and Japan to the rest of the world, especially Asia. In 10 years, Europe's share of the world production of chemical products fell from 31 to around 27%, as Asia's rose from 13 to 23% (Fig. 2).

1. Globalisation

This globalisation is the consequence of a number of relatively recent events, such as the fall of communism, the exponential growth of information and communication technology and the increased mobility of world capital. Over the last 15 years, global trade has grown two times faster than the world GDP (Fig. 3). An important part of this growth is linked to the split of the supply chain, always looking for the best place for every part of the process. By the end of the 1990s, 30% of the international trade was realised within global production networks.

The first and foremost driver, however, continues to be the will of national governments to create employment and improve prosperity in their country. To realise this, they turn to the capital, the technology and the know-how of western companies, which in turn identify a unique means of continued growth. The political and economical risks have hereby to be balanced by the potential gains.

One of the most important incentives is undoubtedly the cost of salary. While also important in the chemical industry, this principally acts as a magnet for its customers. Textiles, electronics, packaging and automotive – which together consume more than 50% of all chemical products – are relocating en masse (Fig. 4). Chemical companies must inevitably follow this relocation to prevent the supply being taken over entirely by the local companies.

A second major incentive is the availability of competitive raw materials and cheap energy.

Fig. 5 provides an example of the cash cost for the production of ethylene. In Europe, ethylene is produced from naphtha and so is tied to the oil price. In the Middle East, ethylene is not only produced with an energy cost that is five times lower than in Europe but it is also based on ethane, which is a by-product of gas extraction and as such cheap.

The consequences are obvious. In 1990, the Middle East produced just under 3 million tonnes of ethylene, good for less than 5% of world production, compared with Europe's 30%. Thanks to the cheap ethane, this rose to 12 million tonnes in 2005. With all the units that are soon to go on-stream and all the gas fields in development, the projection is that the Middle East will overtake Europe in 2015 (Fig. 6).

This has fundamentally changed the world's trade flows. Within a short period, Europe's status has changed from net exporter to net importer, despite the local overcapacity (Fig. 7).

This rationale is not restricted to base products like ethylene and polymers. It also goes for finished products. As Fig. 8 shows, Asia is now the only region in the world to export plastic bags. All the other regions import them,

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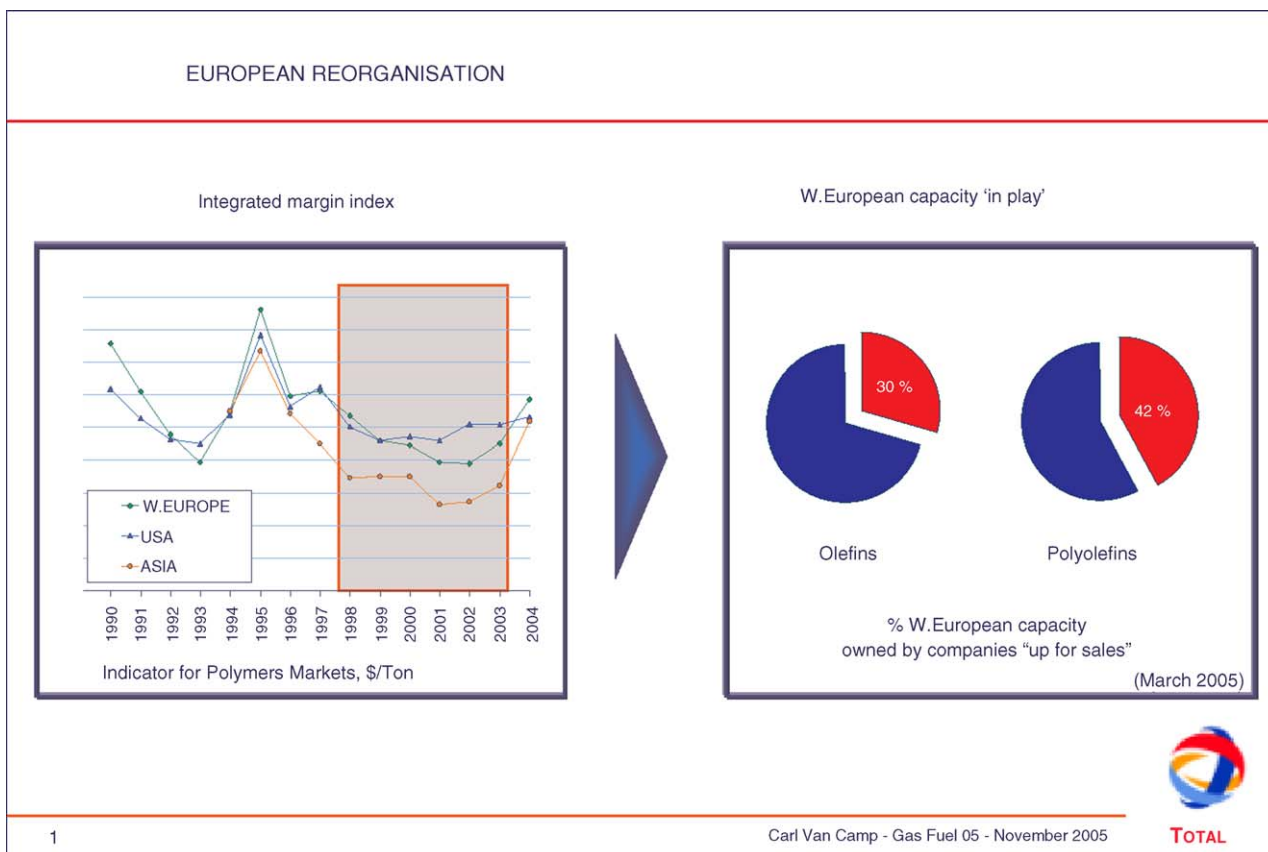


Fig. 1. European reorganisation.

Europe to the tune of 376 ktonnes. The ultimate result is that the European PE suppliers have lost these customers.

The third important driver is naturally the phenomenal growth of the local markets (Fig. 9) and particularly, the remaining potential, given the large population, the expected evolution of wealth and the resulting consumption of plastics (Fig. 10).

This globalisation phenomenon has many important consequences. The first direct consequence is an increase in the number of players. The success of the globalisation has created a number of new and strong majors (Sabic, Formosa, NPC, Reliance and Sinopec), while a whole series of other companies are starting to move into petrochemicals. As a result, the "traditional" majors will only take 10% of the

SHARE IN THE WORLD PRODUCTION

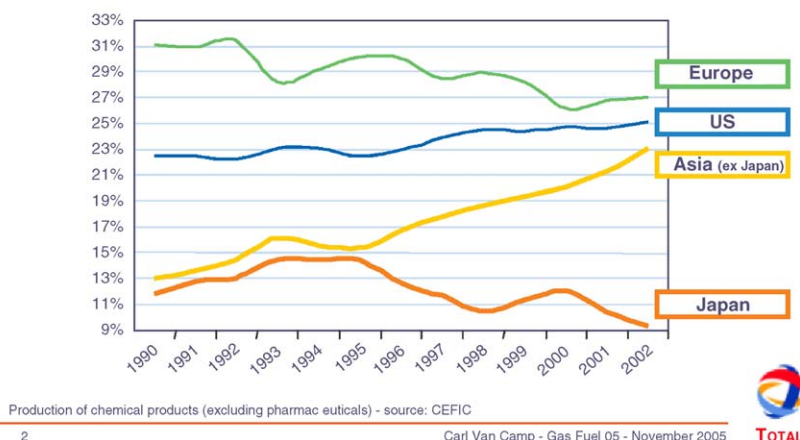


Fig. 2. European's share in world production.

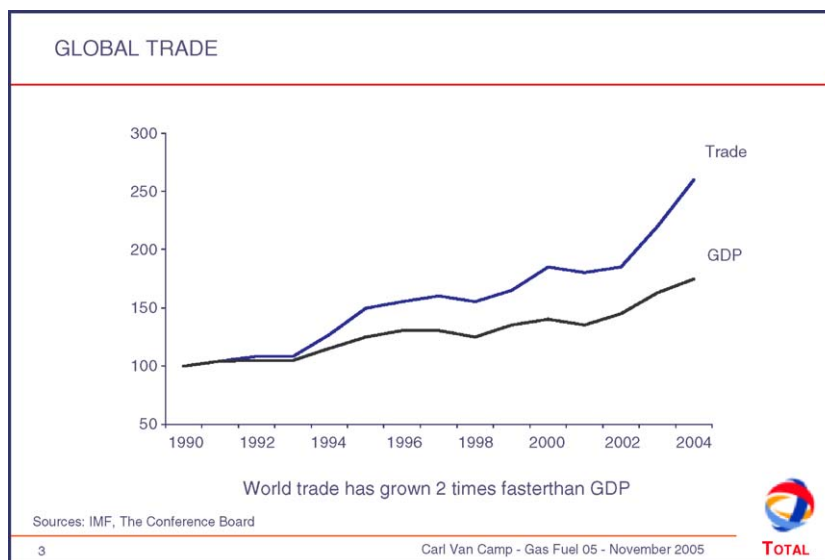


Fig. 3. Global trade.

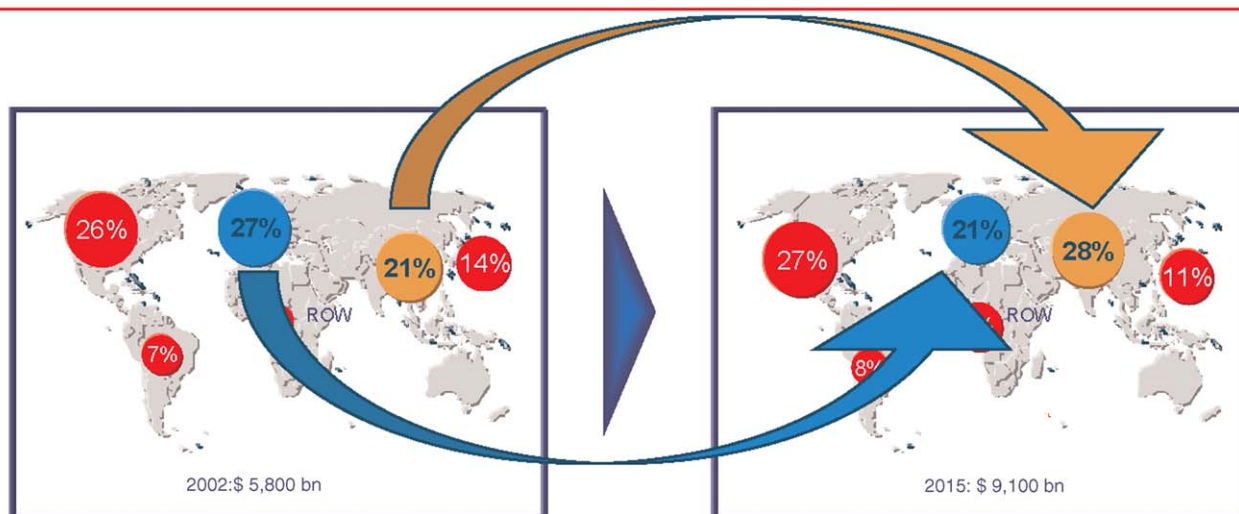
world investments in petrochemicals in the years to come (Fig. 11).

These developments have beefed up competition for both, capital and customers. The challenge facing the European industry is to keep its products competitive compared with imported products.

Fig. 12 shows the world's benzene trade flows. Europe imports, mostly through the Mediterranean, and exports, mostly through Antwerp and Rotterdam.

Ultimately, benzene from refineries and crackers is transported around the world in search of customers, particularly styrene, cumene and cyclohexane producers.

DELOCALISATION OF CUSTOMERS



Source : CEFIC, AT, Keamey, DRI-WEFA

Fig. 4. Delocalisation of customers.

ETHYLENE CASE COST CURVE - 2004 - \$/t

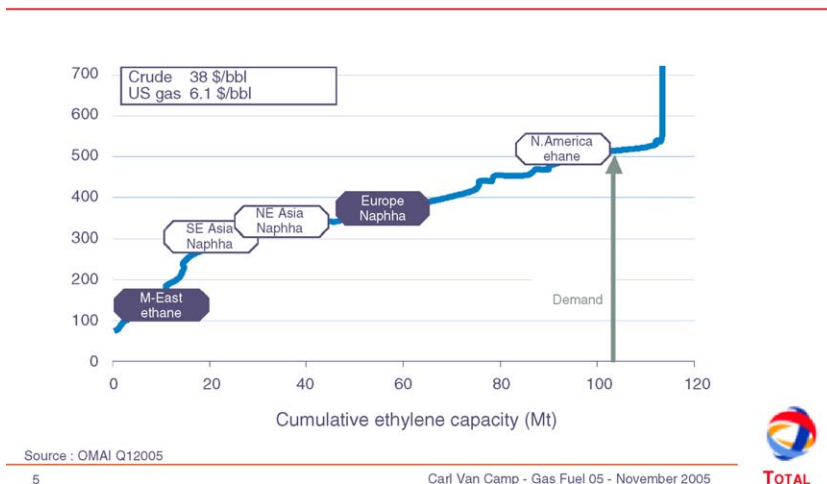


Fig. 5. Ethylene cash cost.

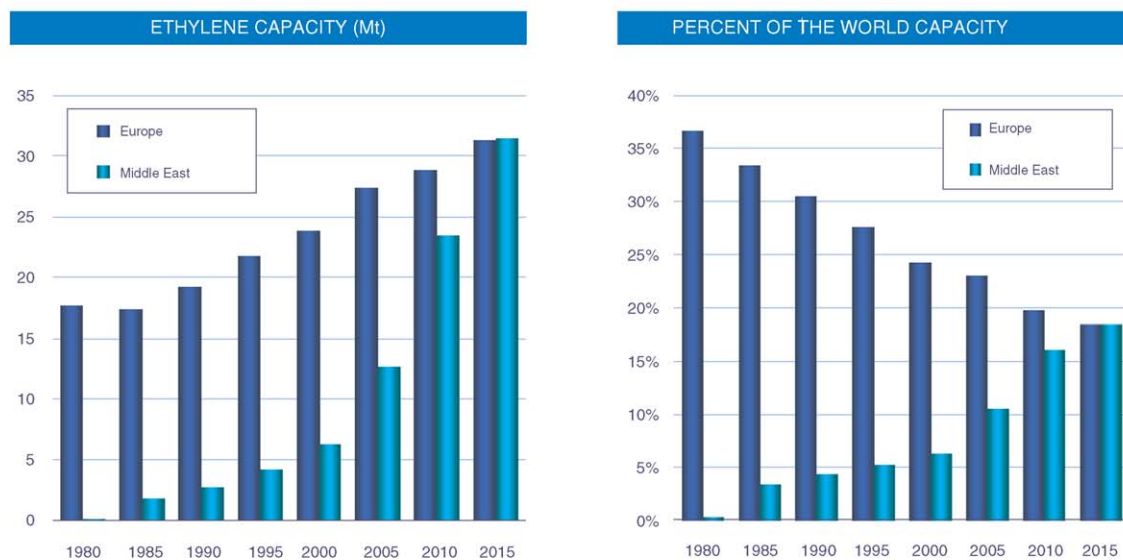
The consequence of this worldwide trade is that prices get linked to each other. Fig. 13 clearly shows that prices, in Europe too, are determined by the international markets. Regional variations are ultimately reduced to exchange rate differences, transport costs and import duties.

Clearly, in such a system, the relative competitive position of the various players has become very important.

Investment decisions are taken by companies at a global level in pursuit of the best risk–result compromise.

What does Europe offer to make up for high growth, cheap salaries and low raw materials and energy costs? With sites where expansion opportunities are limited, a market that is growing at a much slower rate, expensive energy and salaries that are several times higher, European projects are obviously at a great disadvantage and typically give returns that are several points lower. If we wish to bring projects to Europe, we have to be competitive compared with the projects in other countries.

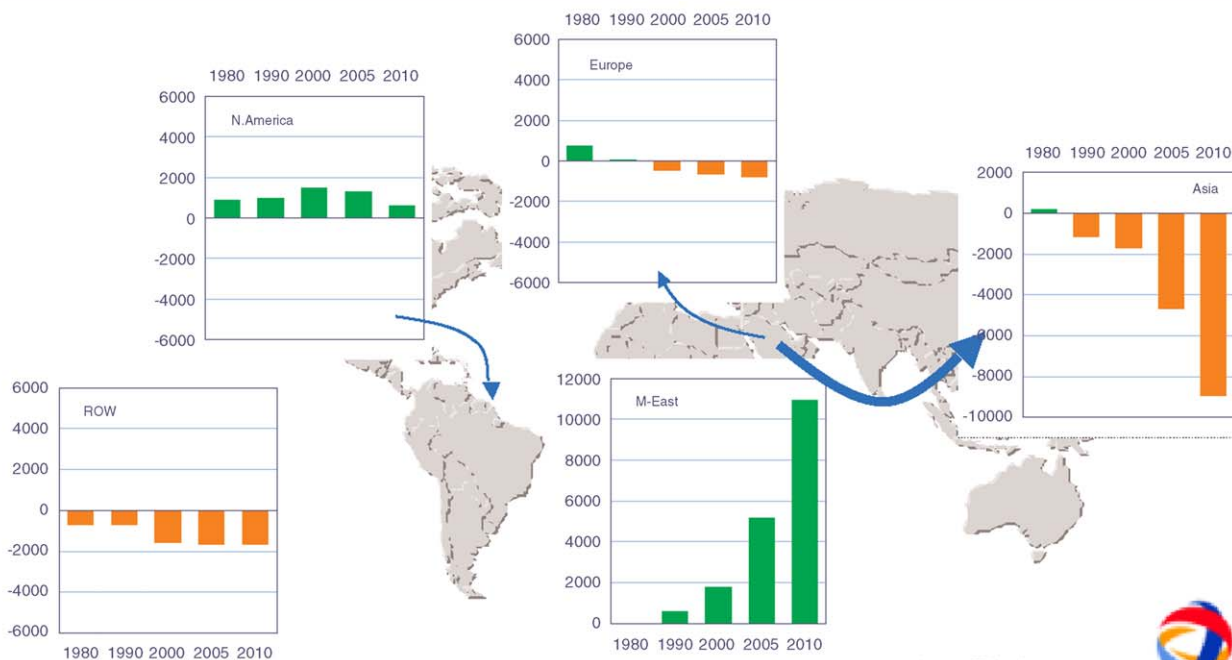
ETHYLENE CAPACITY IN THE MIDDLE EAST



Source : PTM 04Q4

Fig. 6. Ethylene capacity in the Middle East.

TRADE BALANCE POLYETHYLENE - Kt



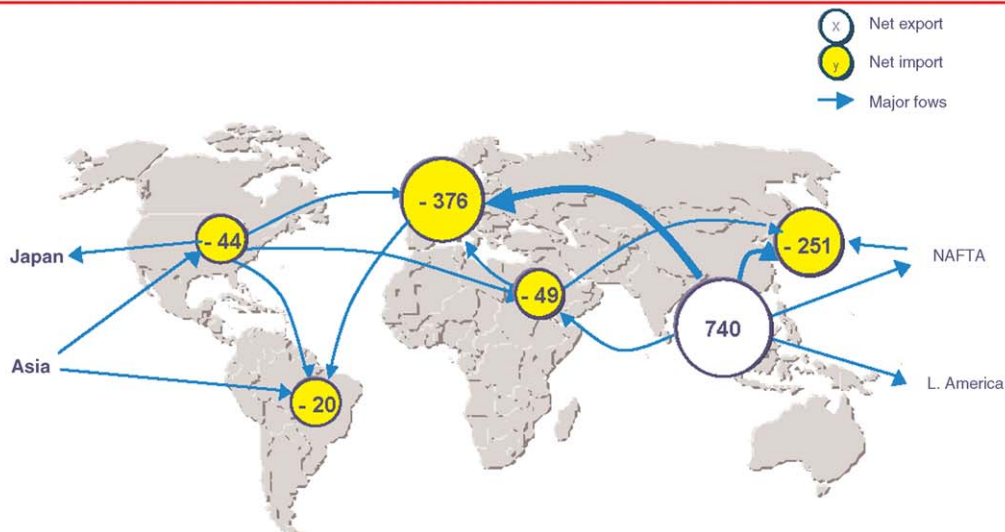
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Fig. 7. Trade balance polyethylene.

WORLD TRADE IN PE BAGS - Kt/year



World trade in PE film quadrupled in 10 years

Source: AMI conf. 2001

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Fig. 8. Trade balance in PE bags.

GROWTH OF THE ASIAN MARKET - Mt/year

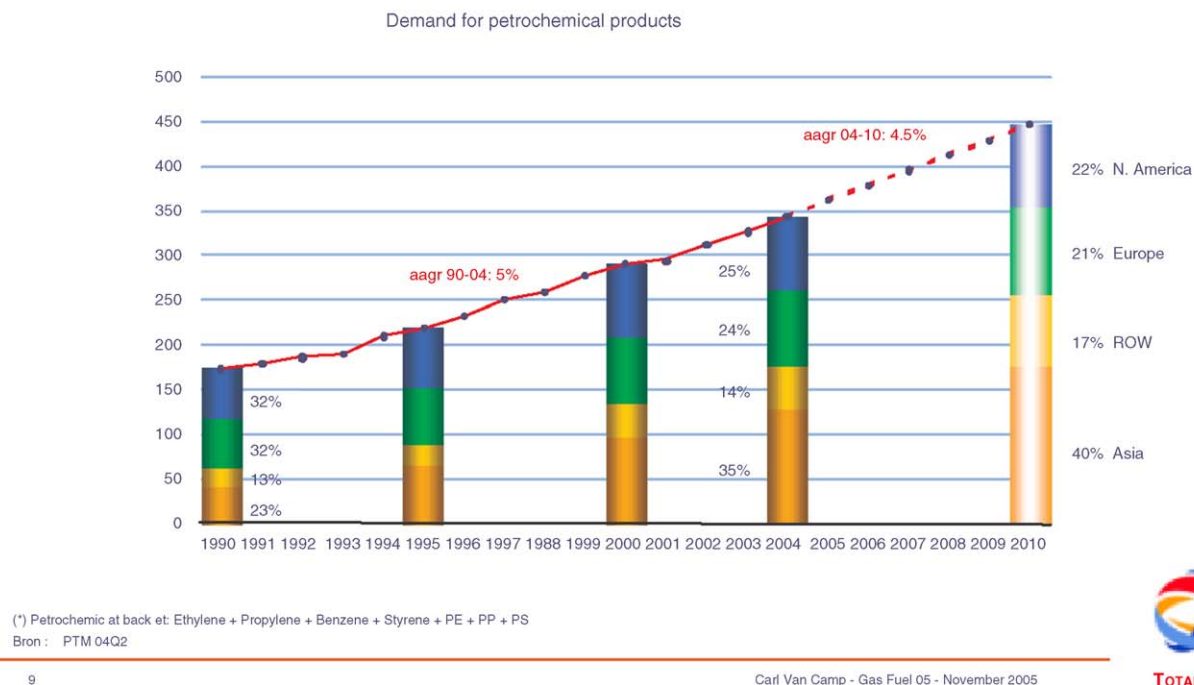


Fig. 9. Growth of the Asian market.

2. Consequences for Europe

CEFIC has studied the future of the European chemical industry. To fulfil this task, a set of scenarios has been build up by expert teams from chemical companies (Fig. 14).

The most optimistic scenario, called the “sunny” one, is based on a positive market situation and a highly favourable political environment. This is accelerated by the successful

industry efforts and an innovative climate that encourages new technologies.

The most pessimistic is the “storm” scenario, that starts from a very bad market situation, high energy prices, Middle East imports and customers that are pushed out of Europe. A discouraging macro political environment undermines the confidence of the industry. As a consequence, Europe does not attract investments and is not competitive against imports.

PLASTICS DEMAND versus GDP per CAPITA

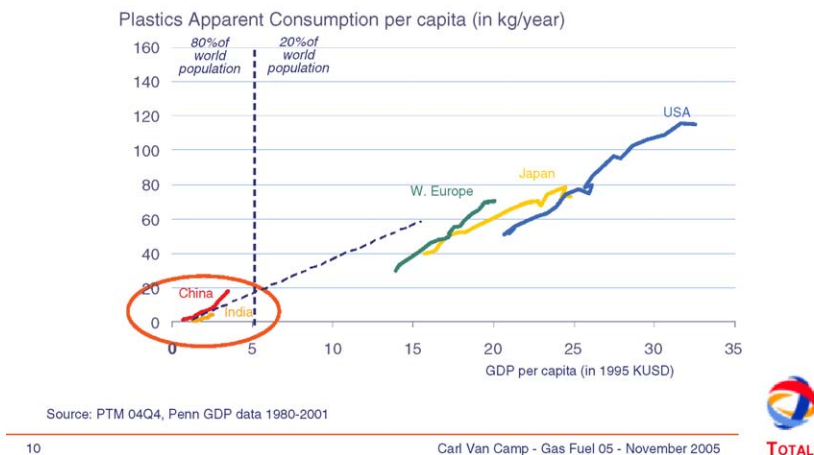


Fig. 10. Plastics demand.

BENZENE PROCE - \$/t



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Fig. 13. Benzene price.

In the different scenario's, the demand for chemical products is more or less in line with GDP. However, local production is much more vulnerable. In the worst-case scenario, we lose 1.5–2% output per year in petrochemicals, plastics, specialities and fine chemicals (Fig. 15).

As a result, the share of the European chemical industry will fall further to 23% in the most positive case to even a low 16% in the least favourable (Fig. 16).

3. Solutions for Europe

So what can Europe do? How should it respond?

Firstly, there are a number of facts that we cannot avoid and on which we have no impact: the will of countries to increase their own prosperity, the major growth of the markets outside of Europe, the availability of cheap raw

materials and the low salary costs that are the main drivers in customer relocations.

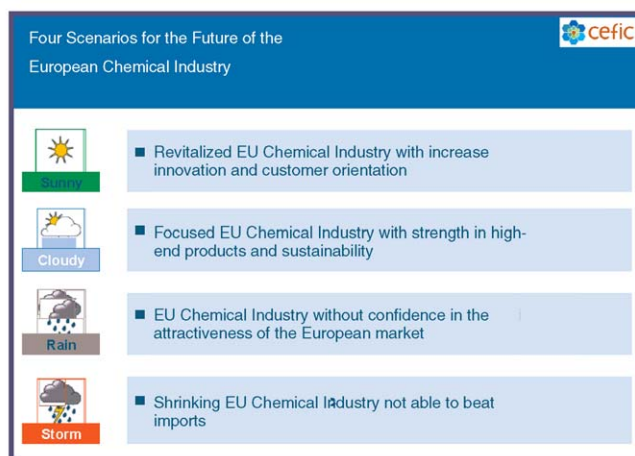
Secondly, I believe that we are deluding ourselves, if we think that Europe can limit itself to high-tech specialities and research. There are two reasons:

- (1) Speciality plants will not be built here if they do not have access to reliable and correctly priced raw materials.
- (2) R&D is not sustainable if it is not based on local production platforms.

Neither should we forget that specialities very quickly become commodities and sustained efforts are needed to improve them or develop alternatives.

To summarise, if we want to keep the high-tech specialities and the research here, we must create the conditions to retain and develop a competitive basic chemical industry.

CEFIC 2015 FOR THE EUREAN CHEMICAL INDUSTRY



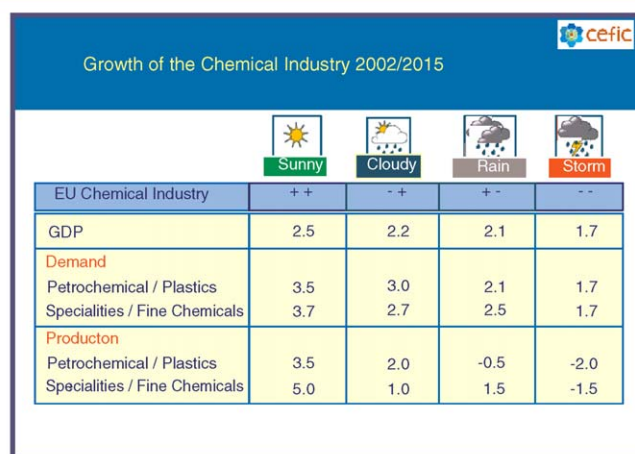
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Fig. 14. CEFIC 2015.

IMPACT ON GROWTH



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Fig. 15. Impact on growth.

Let me just enumerate the most important elements of this competitiveness.

The first crucial point is of course, the cost structure.

For crackers, salaries contribute for about 30% of the total cost. Everyone knows that Europe is disadvantaged because of its high salaries but it risks missing the boat a second time. The new crackers build around the world are about double the size of the average European cracker (Fig. 17). Both effects together have an impact of about US\$ 50/tonne of ethylene.

Next to the salary cost, two other elements are fundamental: energy and logistics. The petrochemical industry very much relies on energy. It is not only a main cost factor, energy represents about 60% of the production cost of monomers through thermal cracking, but at the same time it is also a feedstock.

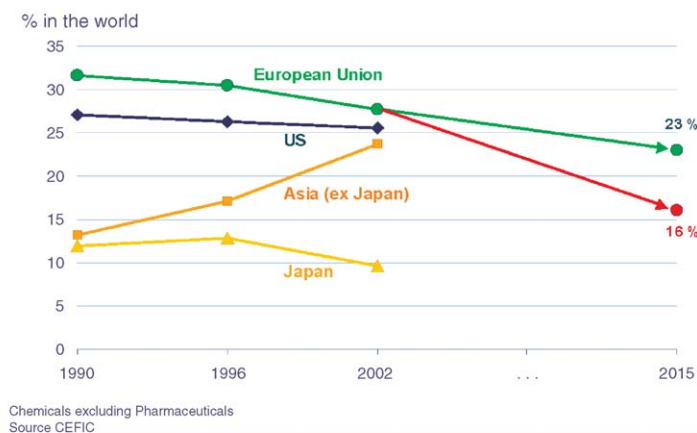
The increased energy demand in developing countries as a consequence of the growth of the local economies (Fig. 18) along with the continued growth for gasoline, mainly in the USA, have created tensions on the energy market and have drastically reduced OPEC's reserve capacity (Fig. 19).

No one can foresee the future, but it seems accepted that high oil prices will be with us for a lengthy period to come. This is not neutral for the European petrochemical industry.

Fig. 20 shows the cost of supplying a tonne of PE to a customer in Europe and the changing competitive position of a local producer depending on the oil price: at US\$ 10 a barrel, Europe was more competitive; at US\$ 17, it was a level playing field; at US\$ 25, the difference is in excess of US\$ 100 in favour of the Middle East.

Feedstock and energy prices are thus, critical determinants to the profitability of the chemical industry and higher

MARKET SHARE 2015



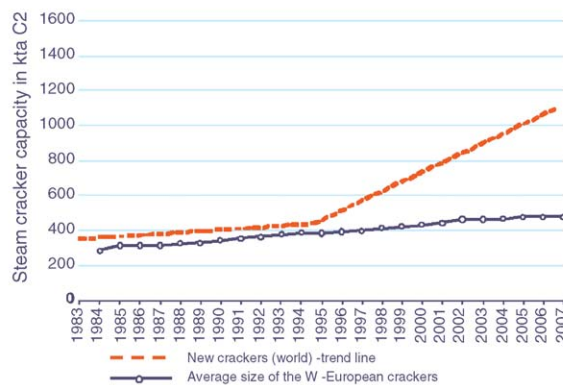
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Fig. 16. Market share 2015.

RELATIVE SIZE OF STEAM CRACKERS



Source: Jacobs Consulting, PTM

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Fig. 17. Size of steam crackers.

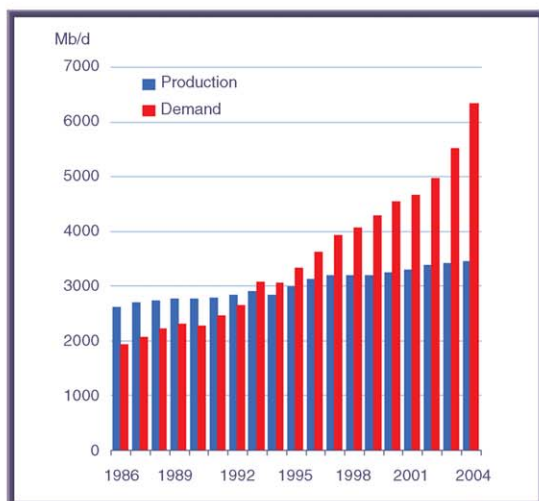
feed and energy costs can indeed not be translated in higher product prices to the customer because the globalisation of the business. Moreover, the effective liberalisation of gas and electricity markets within the EU is lagging behind. Negotiated energy prices have even doubled over the last 4 years (Fig. 21).

At the same time, environmental EU and national policies threaten to bring about further energy price increases.

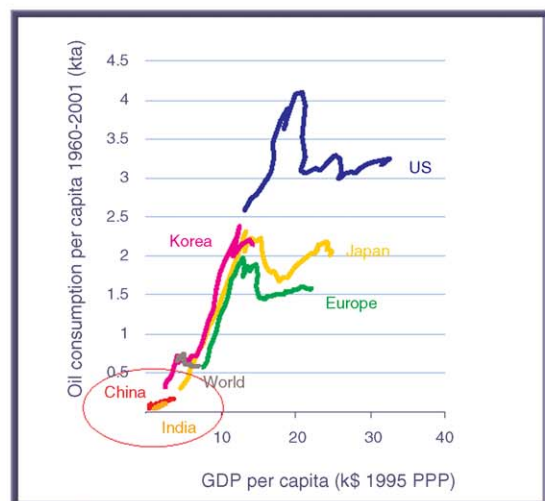
Europe has chosen to take a leadership in the reduction of global warming but it will fail if it will not be able to convince the rest of the world to participate and it will jeopardize its own economy if it decides to go alone. In addition, the European efforts will only have a marginal effect on the global warming. Fossil fuels will indeed account for more than 90% of the growth in energy demand (Fig. 22) and almost all the increase in CO₂ emissions will happen outside Europe (Fig. 23).

CRUDE IMPORTS IN CHINA: an appetite for more

Oil supply / demand in China



Oil consumption as a function of GDP



Source: IEA

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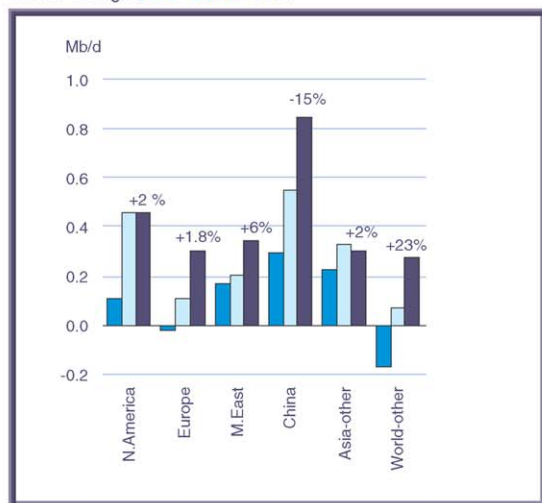
TOTAL

Fig. 18. Crude imports in China.

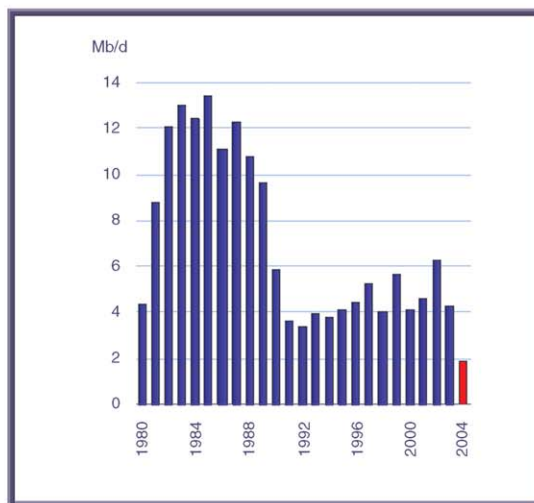
OIL DEMAND AND PRODUCTION CAPACITY

Oil demand

annual change 2002 - 2003 - 2004



Spare oil production capacity of OPEC



Demand driven by China and US is squeezing OPEC's spare capacity

Source : IEA

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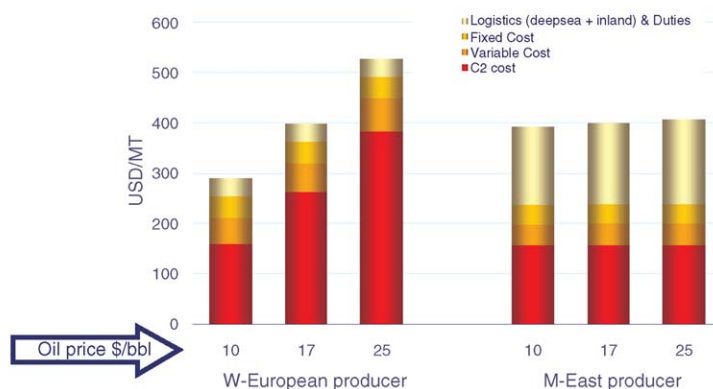
Fig. 19. Oil demand and production capacity.

The EU chemical industry has to and is committed to continue to reduce its greenhouse gas emissions by further improvements in energy efficiency, developing climate friendly product solutions and researching less energy intensive manufacturing processes. Ways have to be found to continue economical growth and at the same time reduce global greenhouse gas emissions. Intensifying research to make renewable energy sources more competitive, improved transportation and CO₂ sequestration are only three of the many possibilities. Making the results of these research

efforts available for the rest of the world, will have a far bigger effect than playing only on the European level.

This brings me to the second element in the cost structure: logistics. They count for about 10% of the global delivery cost for petrochemical products and both the industry and the government have a role to play. The industry must go further in integrating raw materials and finished products. It must reorganise into large integrated sites, with a good balance between the supply of raw materials and the production of end products close to the customer.

POLYETHYLENE SUPPLIED TO A EUROPEAN CLIENT



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Fig. 20. Polyethylene supply cost.

ELECTRICITY PRICES



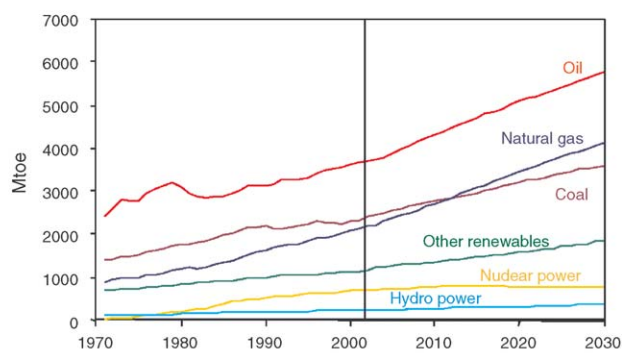
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Fig. 21. European electricity prices.

WORLD PRIMARY ENERGY DEMAND



Fossil fuels account for almost 90% of the growth in energy demand between now and 2030

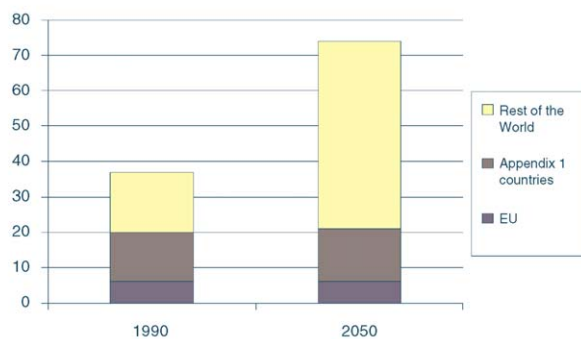
Source : IEA

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Fig. 22. World primary energy demand.

FORECASTED CO₂ EMISSIONS

Almost all the increase in emissions occurs outside Europe

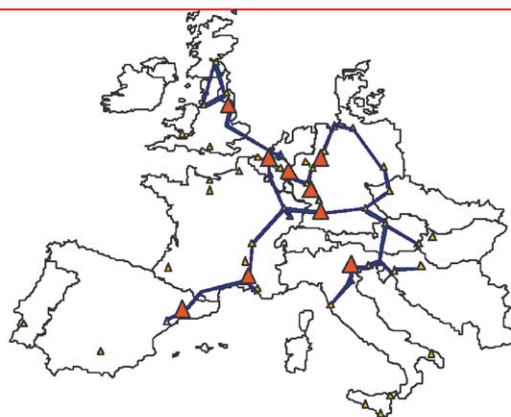
Source : Greenhouse gas reduction pathways in the UNFCCC process, CNRS/LEPII-EPE/RIVM/MBNP, ICCS-NTUA, CES-KUL(2003)

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Fig. 23. Forecasted CO₂ emissions.

INTEGRATED PRODUCTION NETWORKS



Source: EPCA Logistics Meeting W. Pratorius EU ethylene pipeline network - vision 2025

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Fig. 24. Integrated production networks.

Our industry has been promoting the development of pipeline systems for some considerable time. Safe and environmentally friendly connections that should help lighten the burden on the grid locked road network and open up access to plants further inland (Fig. 24).

The governments have already supported a great many good initiatives in this domain. But more still has to be done and a continued intensive partnership between the various players is needed. Furthermore, continued liberalisation and improved transport infrastructure will facilitate inter-modal transport and make logistics by rail and inland shipping more flexible, more efficient and so cheaper. In this way, we can reduce the 30–50% handicap, we have in Europe compared to the US.

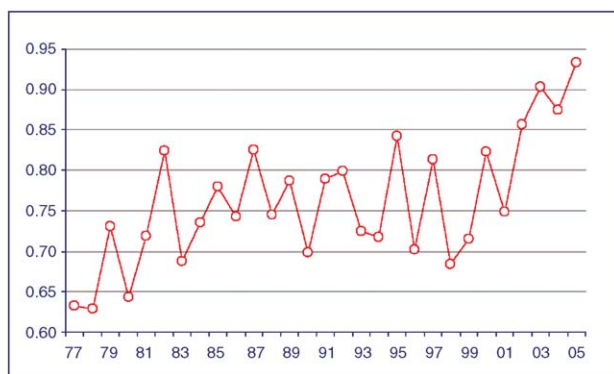
Next to the cost structure, there is another important point: innovation. The chemical industry is an engine for innovation for other industries through the development of new materials and applications.

Thanks to the globalisation and the increase of the energy prices, other technologies and alternative raw materials suddenly become interesting and offer an opportunity for research leadership. The production of plastics based on gas, the renewed interest for the gasification of coal and certainly the far-reaching synergy between refining and petrochemicals are a part of these developments.

An additional challenge is the changed propylene to ethylene balance. The increased production of ethylene from ethane and the strong growth of propylene derivatives have driven up the price of propylene compared with ethylene (Fig. 25). The consequence is once again the increased interest in refinery propylene together with the need for on-purpose technologies like metathesis or olefin cracking. It is estimated that by 2015, 10% of the propylene production or 10 million tonnes, will have to come from on-purpose technology.

Europe has always held a leading position in chemistry, thanks to high-level technical expertise and investments in

PROPYLENE TO ETHYLENE PRICE RATIO



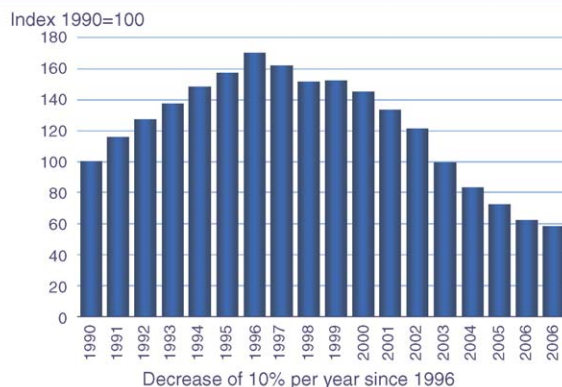
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Fig. 25. Propylene to ethylene price ratio.

CHEMICAL GRADUATES(*) IN MAJOR EU COUNTRIES



Source: CEFIC Scenarios 015 & National Chemical Federations
 *Including pharmaceuticals, industrial chemistry and engineering

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Fig. 26. Chemical graduates.

research. At its current investment level of 2% of GDP, Europe is still well short of its Lisbon objective of 3%.

In addition, we continue to have an enormous problem attracting technical and scientific talent. The number of graduates in chemistry and industrial chemistry is fallen by 10% a year since 1996 (Fig. 26).

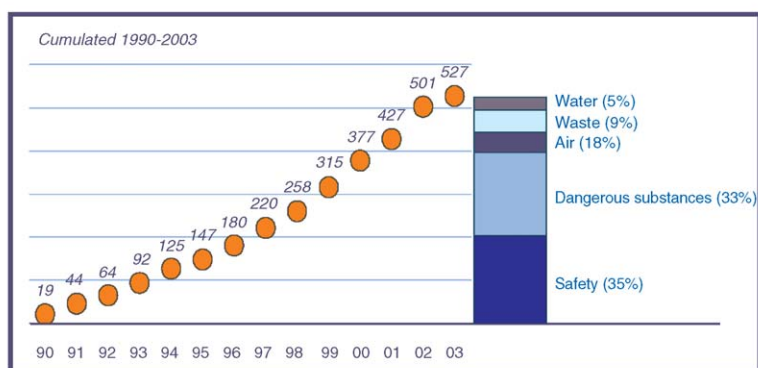
Moreover, we are slower in translating innovation into products. There are far too many regulations, and patents are an expensive and complicated matter in Europe. Compared with the United States, it takes us three times longer to bring new chemical substances to the market at 10 times the cost. It is the role of the government to simplify these systems drastically, but it is the role of the industry to generate enthusiasm for innovation, progress and new technologies. Promoting public acceptance, gaining public support and generating interest among young people will most likely require a better image. The chemical industry is one of the

least appreciated sectors of the economy. It is considered to be occult, dangerous and damaging to the environment.

The industry has already realised a very substantial improvement in its safety and environmental record. And it is decided to continue. Furthermore, greater transparency should increase confidence and reduce the need for yet tighter regulation. In reality, however, regulation continues to increase exponentially (Fig. 27). Europe appears to want to go its own way and is seemingly prepared to threaten its own economical growth.

The industry has argued many times that our laws should be benchmarked against those of the most important economical actors in the world. It advocates carefully by studying the impact of new legislation and analysing the pros and cons. The bulk of our industry is made up of small- and mid sized companies and in many cases, they will not survive ever-greater regulation.

REGULATION IN EU CHEMICAL INDUSTRY



Source: CEFIC scenario's 2015 - Unice

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Fig. 27. Regulation in European chemical industry.

CHEMICALS: THE BEGINNING OF THE VALUE CHAIN

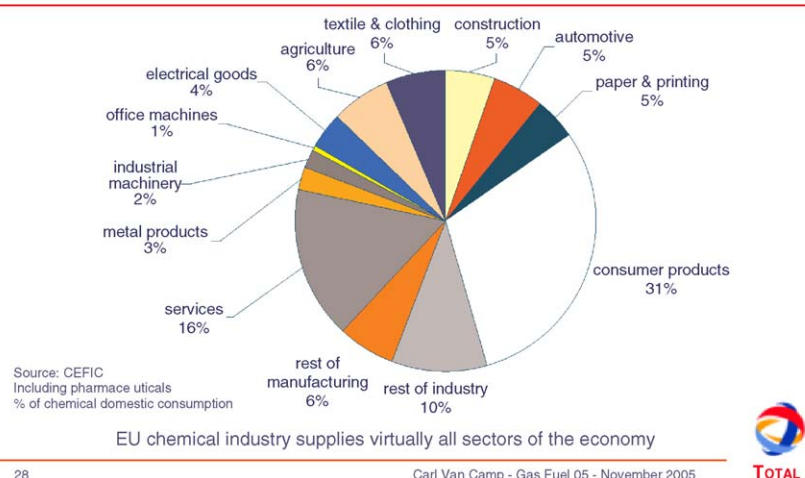


Fig. 28. Chemicals: the beginning of the value chain.

4. Conclusions

Europe needs growth as a pre-condition for generating employment and the resources to maintain our social and environmental aspirations. Europe is a world champion when it comes to social policy and environmental protection but its economical potential is shrinking.

The Lisbon objectives and the renewed attention, the Commission is giving to the EU industrial policy offers a good opportunity to address issues of concern to the chemical industry. CEFIC has proposed the creation of a European Strategy Group on Chemicals, to start a constructive dialogue at the European level on the political, economic and environmental challenges the chemical industry faces.

Indeed, the importance of the chemical industry for the European society can hardly be overestimated.

Not only it is a strong creator of wealth, thanks to its trade surplus of €40 billion, but it also provides employment for about 4 million people.

In addition, the chemical industry is at the beginning of the value chain and supplies to virtually all sectors of the economy (Fig. 28). Chemistry is synonymous with innovation and – especially in Europe – it has always played a key role in economic and social development, offering continuously new products to improve the standard of living.

Without chemical industry, there is no chemistry and without chemistry, there is no solution for the big challenges facing the world in the foreseeable future: 10 billion people with the resulting problems on energy, food and water supply.

A competitive European chemical industry has the necessary characteristics to continue to play a key role in this highly globalised industry.

This requires, however, a new style industrial policy aimed at creating the right framework conditions for business.

The industry has to realise its own part and this means also a different and more transparent way of doing business. Without a strong support and interest of the local communities, the chemical industry will indeed not survive in Europe.