



Markets & Companies

Cefic supports commitment to emissions reduction

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Markets & Companies

Study shows uncertainty surrounding gas and oil prices

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Newsflow

UCB has sold all its shares held in **Cytec Industries** for €248 million, realising a capital gain of more than €20 million. UCB sold its surface specialties business to Cytec at the beginning of March. Consideration for the transaction was €1,190 million in cash and 5,772,857 shares of Cytec.

BASF said it intends to reduce the size of its supervisory board to 12 members from 20 once it adopts the *Societas Europaea* (SE) legal structure, the *Financial Times Deutschland* reported, citing a copy of the invitation to the company's annual general meeting which it obtained. The report also said that Juergen Strube will remain the head of the supervisory board until 2011.

Dupont said it was considering joint ventures and alliances with other Indian firms for research and distribution, *The Economic Times* reported, citing Dupont India chief executive Balwinder Singh Kalsi. Dupont has already entered into technical collaborations with **GVK Biosciences** and **Biocon's** unit **Syngene** in the country. Last month, the company had reported it plans to invest more than US-\$22.5 million to construct its first research and development centre in India.

Reichhold has named chemicals distributor **Univar** as the company's new distribution partner for polyester resins, gel coats, bonding paste and auxiliary products in the Benelux region. Univar has an extensive network of distribution centres across Europe, the U.S. and Canada.

Nova Chemicals has signed a letter of intent with **Ineos** to expand the two companies' existing European joint venture to include North American assets. The proposed expansion agreement would include Nova's North American styrene monomer and solid polystyrene assets, as well as the company's interest in the European joint venture **Nova Innovene**. Ineos would contribute its North American styrene and polystyrene assets, as well as its interest in Nova Innovene. The transaction was expected to generate revenues of approximately US-\$3.5 billion per year.

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Azelis Is One of Europe's Fastest-growing Distributors

Since its formation in 2001, the Azelis Group's portfolio has grown to 32 companies operating in over 20 countries, making it one of the fastest growing chemical distributors in Europe. The company's strategy of growth through acquisitions reflects the ongoing trend in the industry: The number of M&A deals in 2006 totalled over €5 billion, a new record for the distribution industry, and there will be no slowing down in 2007. Azelis also switched private equity firms at the end of last year, from Cognetas to 3i, a move the company says reflects its determination for an international presence. Brandi Hertig Schuster asked Azelis CEO Udo Wenzel about his company's rapid growth, competition on the market and future plans for expansion.



Udo Wenzel
CEO of Azelis

CHEManager Europe: Mr. Wenzel, Azelis has now grown to 32 companies operating across Europe. Is there still room for expansion here? In what other regions are you looking to acquire businesses?

U. Wenzel: We have built a successful European distribution group focusing on specialty chemicals, polymers and related services since 2001. Although we now have offices and staff in most European countries, there is still a need to establish ourselves in a few countries and also to expand the market range in some of our existing countries by making "bolt on" acquisitions that fit our criteria and complement our existing businesses. Examples of regions where we are actively considering acquisitions include Switzerland, Austria and the Netherlands.

What criteria are considered when considering a company for acquisition?

Continues Page 18

A Lanxess Growth Story

Turnaround after Successful Portfolio Adjustment

The Ion Exchange Resins Business Unit (ION) is part of Lanxess' Performance Chemicals segment, accounting for roughly 10% of the overall turnover. The business unit is a key contributor to the Lanxess success story. Its international orientation makes for a strong market presence being the number 1 ion exchange resins supplier in Europe, number 2 in Asia, and number 3 in NAFTA, underlining an overall number 2 position. Brandi Hertig Schuster spoke with Dr. Michael Zobel about the custom-designed ion exchange resins and the application areas, the current situation and future perspective of the business unit, key market trends and the market environment.



Dr. Michael Zobel, Head of the business unit Ion Exchange Resins (ION) of Lanxess' Performance Chemicals segment

CHEManager Europe: Dr. Zobel, you took over as head of the Ion Exchange Resins Business Unit in 2005, and ION has successfully managed a turnaround in

recent years. How did you achieve this?

M. Zobel: The years before 2004 were difficult for the ion exchange resins business because of market conditions, competition, cost structures and missing products for certain applications. We worked hard on a lot of issues regarding our cost structures and our product portfolio. We have seen a successful product portfolio adjustment supported by our innovation capabilities and we are now in a position to push our specialty products portfolio more in which we can offer truly unique solutions to our customers. Furthermore, we extracted more value out of the business by restructuring and focussing our people on value not volume.

What did you contribute personally to this success?

M. Zobel: Apart from my doctorate degree in chemistry and an MBA, I have experience in a variety of areas such as corporate strategic planning, M & A, finance, restructuring, change management, marketing and research. This in general is my source to contribute.

In particular, besides all the strategic redirection of the BU, I launched two initiatives which mean a continuous change process and which are of very importance to our success: The first one was to understand the perceived value of our product from a customer point of view – not ours. This means listening to a customer, understanding the customer's value chain and trying to match his individual needs with what our products can do. Here is value hidden for both – the customer and us – so a true win/win situation. We are working hard on that with our sales forces and technicians, but our success proves that this is a worthwhile effort.

The second initiative is to go for value. The important thing for our sales and marketing organisation is to be truly sensitized that volume does not automatically mean adding value to a business and that a pocket price/margin is of importance and not the invoice price. For sales people this is often difficult to understand, particularly if they were punished in the past when losing volumes and if incentive systems were primarily based on volume. In that sense we are working hard on a series of topics related to that "go for value" initiative.

What are the core competences and key technologies of ION, what is your unique selling point?

M. Zobel: Regarding technology, we are one of the global leaders in the ion exchange resins business. We have the largest and most modern plant with monodisperse technology in the world located in Bitterfeld,

Germany – this is one of the key differentiating elements against our competition.

We have a unique synthesis chemistry pathway in Leverkusen, Germany, which allows us to take a unique position, especially for specialty products – none of our competitors has this kind of chemistry route. These two elements allow us to position ourselves very well in the global market.

Also, we are one of only two companies that are full-portfolio providers for ion exchange resins. Other competitors' ranges focus on certain elements of the market demand.

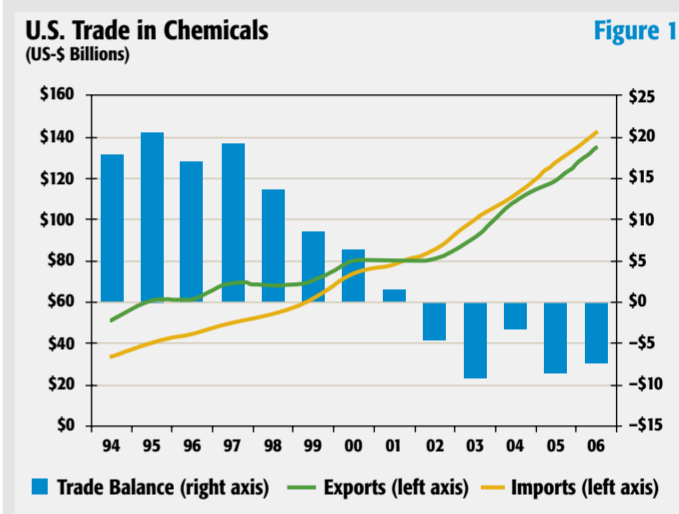
Furthermore, we are not selling a product itself – it's not enough just to put a sack of granules on the table. Our customers simply cannot work with that; technical advisory competence is also necessary. We have recently conducted an anonymous survey where we were highly rated among

Continues Page 18

MARKET REPORT

Analysis of Lost Chemistry in the U.S.

The early years of this decade were some of the most difficult for the business of chemistry in the U.S. High natural gas prices led to diminished competitiveness for domestic producers in certain segments, and combined with the downturn in the economy in general and in manufacturing in particular they challenged the U.S. chemical industry. This combined with the after effects of the Asian crisis, slow overseas economic activity, the strong U.S. dollar and the movement of end-use customer industries overseas to negatively affect the trade balance in chemicals. The trade balance in chemicals (SITC 5), a surplus of US-\$19.1



Continues Page 3

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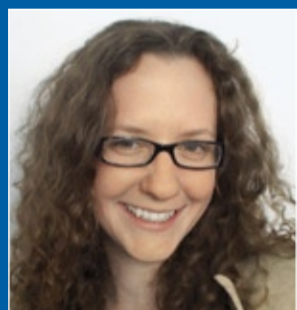


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Bayer HealthCare Announces Job Cuts

Bayer HealthCare has published concrete plans regarding the previously announced synergy goals. The integration of the activities of the former

be a reduction of 3,150 jobs in Europe. In addition, 1,000 jobs in the U.S., 750 jobs in the Asia, Pacific and Japan region as well as 1,200 jobs

"We said right from the start of the integration that job cuts would be necessary in order to achieve the synergy targets."



Werner Wenning
Bayer's board chairman

in Latin America and Canada are affected.

Schering, Germany, with Bayer HealthCare's pharma division of shall result in annual savings of €700 million from 2009. Adjustments to personnel requirements and the consolidation of processes and systems shall each contribute about half to the targeted global synergy effects. Reducing the overlap between the two companies will result in approximately 6,100 job cuts worldwide. There is to

Of the 6,100 jobs worldwide there will be a reduction of 1,400 in the global research and development functions and 1,850 in production by 2009. Approximately 2,850 positions from central administration as well as local and regional structures will be reduced. Berlin employees of the former Schering reacted with protests, and the union threatened to delay Schering's integration into the Bayer group.

"We want to create an internationally successful phar-

maceutical company with competitive cost structures," said Werner Wenning, chairman of the Bayer group management board and the supervisory board of Bayer Schering Pharma. "We said right from the start of the integration that job cuts would be necessary in order to achieve the synergy targets. These essential streamlining measures are to be fairly implemented in a socially acceptable process - balanced across the globe. This includes the reduction of the number of locations, cutting down on structural and personnel overcapacity, the concentration of research and development activities as well as the harmonization of structures and processes in marketing and administration."

Approximately 1,500 jobs will be shed in Germany. Berlin will remain the largest location and the headquarters of Bayer Schering Pharma. Key global functions and business areas will be consistently drawn together in Berlin.

www.bayerhealthcare.com

Chemcentral: Brenntag Overbids Univar

Two global chemical distributors are vying for privately owned U.S. rival Chemcentral: After Univar made a bid of US-\$600 million in cash, Brenntag followed suit days later with a competing bid of US-\$700.

"If the Chemcentral board of directors determines that a competing proposal is superior to Univar's, Chemcentral must give Univar advance notice of three business days, during

which period Univar may decide, but is not required, to negotiate with Chemcentral to make adjustments in the terms and conditions of their merger agreement," Univar said in a statement. The company also said that Brenntag's non-binding offer, which is subject to due diligence and other conditions, included a reduced termination fee payable to Univar. Chemcentral may end the merger agree-

ment with Univar in favour of a competing offer if it pays Univar a termination fee of US-\$22 million, the Dutch company said.

Privately held Chemcentral, based near Chicago, had US-\$1.4 billion in 2006 revenues and distributes specialty and commodity chemicals.

www.univarcorp.com

www.chemcentral.com

www.brenntag.com

Three Companies to Take Over Grupo Ipiranga

In one of the largest business transactions ever conducted in Brazil, Petrobras, Grupo Ultra and Braskem have come to an understanding for the acquisition of all Grupo Ipiranga's businesses, thus consolidating and expanding the businesses of the petrochemical and fuel distribution industries. The transaction is worth nearly US-\$4 billion.

Grupo Ipiranga, one of Brazil's largest and most traditional groups, operates in the industries of oil refinery, petrochemical products and fuel distribution. Last year, its net revenue amounted to R-\$30 billion, with an EBITDA of R-\$1 billion and net profit of R-\$534 million.

The first phase will be the take over, by Grupo Ultra, of

the shares of the families that control Grupo Ipiranga. In the second phase, Grupo Ultra will make a public offering of the common shares held by Grupo Ipiranga's minority shareholders.

www.braskem.com.br

www2.petrobras.com.br

www.ultra.com.br

Elsevier Acquires Beilstein Database

Elsevier announced the acquisition through its subsidiary MDL Information Systems, of the Beilstein Database, the world's largest compilation of chemical facts and the premier database in the field of organic chemistry. Elsevier has been exclusively involved in both the production and marketing of the Beilstein Database under a partnership agreement since 1998. Since then, Elsevier has added

or updated close to 5 million compounds to the database and has helped to build a strong and established customer base in both the corporate pharmaceutical and academic sectors. As a result of the agreement announced today, Elsevier will assume ownership and acquire the rights to the Beilstein Database.

The Beilstein Database covers organic chemistry

from 1771 to date. It contains over 9.8 million compounds, 10 million reactions and 320 million experimental data on chemical properties. It also contains over 900,000 original author abstracts from 1980-present, as well as pharmacological and ecotoxicological data describing the bioactivity of organic chemicals.

www.elsevier.com

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MARKET REPORT

Analysis of Lost Chemistry in the U.S.

Continued Page 1

billion in 1997, fell to a deficit in 2002 and has remained in negative territory since.

These deficits were the first that the industry has posted since at least the 1920s (the earliest for which there are consistent trade data), and possibly the first since before the Jamestown colony exported potash to England. Figure 1 shows the sharp decline in the trade balance in chemicals over the past decade.

Trade Deficit Centred in Pharma

Deteriorating trade performance abated in 2006, when a global economy growing at its fastest pace in three decades, the effects of a lower dollar and renewed competitiveness (arising from a higher oil/natural gas price relationship) in combination with tightening global supply/demand balances in many segments caused growth in exports

been cited for this deterioration of trade in goods. Currency fluctuations, the emergence of export-oriented manufacturing low-labour cost centres in East Asia and weak global demand for U.S. exports have been the leading factors. The American consumer's propensity for foreign goods is another factor.

More recently, the large U.S. deficit in trade and in the current account has resulted in a weaker dollar. This will serve to boost exports and reduce imports, thus correcting some of this imbalance. To a certain extent, this may be occurring in some areas. A portion of the deficit, however, reflects competitiveness issues and structural imbalances and, as a result, turning the deficit around will be difficult.

Quantifying Lost Chemistry

Employing standard input-output (I-O) analysis, and the total requirements table from the Bureau of Eco-

from the U.S.' net trade with China in downstream manufactured goods.

The same I-O analysis performed for US trade in goods with the world was also conducted for China. In this analysis, we include Hong Kong as part of greater China because Hong Kong serves as an entrepot for the mainland. In 2006, the chemistry content of net U.S. downstream industry trade with China was -US-\$19.4 billion, equivalent to 38% of the total US-\$50.9 billion in lost chemistry for that year. This share has been rising.

Between 1997-2006, there was a US-\$14.4 billion net change in lost chemistry for the period through deteriorating goods trade balances with China in downstream industries. The chemistry content in computers and electronics has experienced the largest change (-US-\$2.8 billion) and is followed by textile mill products (-US-\$2.3 billion), plastics and rubber products (-US-\$1.9 billion), apparel (-US-\$1.8 billion), leather and allied products (-US-\$1.3 billion), and electrical equipment and appliances (-US-\$1.0 billion).

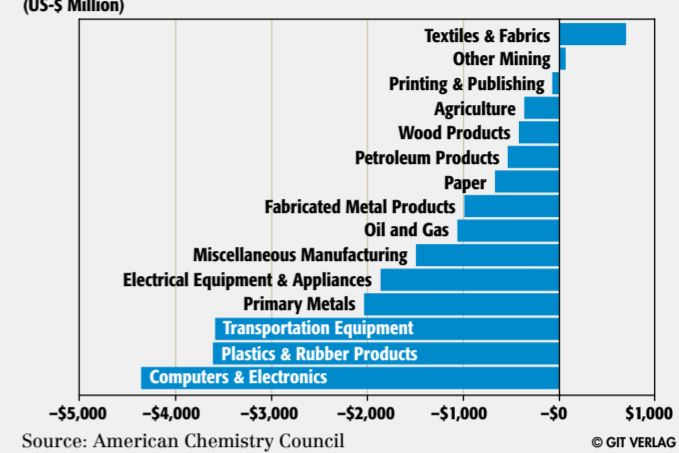
Leather and allied products largely consists of footwear and miscellaneous manufacturing includes toys and sporting goods. The imbedded chemistry in net trade in furniture

and fixtures and fabricated metal products has also contributed to higher lost chemistry. This analysis shows that China's US-\$14.4 billion net change in lost chemistry accounts for 42% of the total US-\$34.1 billion in cumulative lost chemistry since 1997.

Conclusion

The U.S. chemical industry has lost chemistry with virtually all of its major trading partners and in most downstream end-use customer industries. While cumulative lost chemistry of US-\$34.1 billion since 1997 is not trivial by any measure, this amount could be compared to industry shipments. If one were to layer this lost chemistry on top of the US-\$637.1 billion in U.S. chemical industry shipments (NAICS 325) during 2006, it would be the equivalent of 5.4% of shipments. The direct loss from the cumulative net change in the direct chemistry trade balance of \$26.5 billion since 1997 is equivalent to 4.2% of industry shipments. The cumulative lost chemistry and the net change in the chemistry trade combined amount to US-\$60.6 billion in lost business. Thus, in total, lost chemistry from deterioration of the U.S. trade in goods amounts to

Change in Lost Chemistry in Selected Industrial Categories in U.S. Trade with the World, 1997 - 2006 (US-\$ Million)



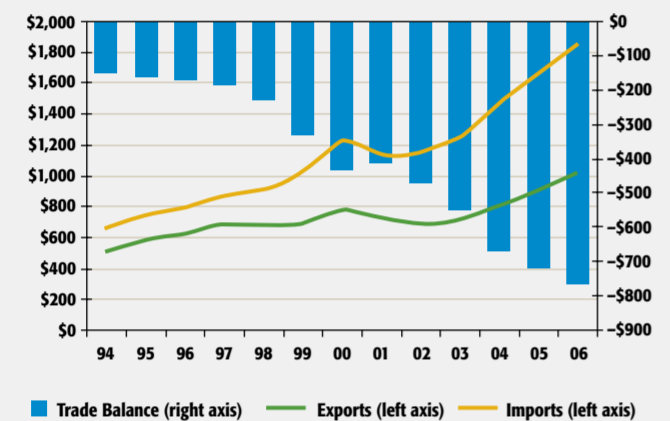
9.5% of industry shipments, both directly (in chemicals trade) and indirectly (chemistry content in the trade of downstream industries).

In other words, the 2006 shipments of the U.S. chemical industry would be US-\$698 billion if the conditions of 1997 were to prevail, with no loss of the chemical industry's trade surplus or the severe deterioration of trade balances in downstream customer industries. This examines just the cumulative change in both. If downstream end-use industries maintained a balance

in their trade with the world, and if their chemistry needs were supplied by U.S. production, then U.S. chemical industry shipments would be even higher.

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U.S. Trade in Goods (US-\$ Billions)



Source: American Chemistry Council

in chemicals to accelerate. Total chemistry exports grew 13% in 2006 reaching US-\$135.0 billion, a record. At the same time, imports grew at a slower 11.3% pace and the trade deficit shrank to US-\$7.3 billion, the third highest on record. Since 1997, the trade balance in chemistry has deteriorated a cumulative US-\$26.5 billion. That is a US-\$26.5 billion swing from surplus to deficit.

The trade deficit in chemicals is primarily centred in pharmaceuticals. Excluding pharmaceuticals, the trade balance in chemicals is positive although it weakened earlier in the decade for many of the reasons cited earlier. Other segments experiencing trade deficits include inorganic chemicals, fine chemicals, and some specialty chemical segments.

'Lost Chemistry'

Beyond the direct effects of negative trade on the potential output of the chemical industry, however, is the depressing effect on the trade performance of its downstream customer industries. The products and services of chemistry are converted into thousands of manufactured consumer and industrial products. Many of these products have also experienced declining trade balances in recent years. To the extent that there are changes in the trade of the goods downstream that contain chemistry, the entire chemical industry is affected. This is referred to as lost chemistry. Lost chemistry refers to the potential chemistry content of these goods that is lost when the production of those products occurs outside the U.S. through loss of exports or replacement of domestic production via imports.

The health of the U.S. chemical industry is dependent on the health of the rest of manufacturing, the primary customer industries for chemicals. This analysis represents one means of examining the effects of de-industrialisation in the U.S. In this analysis, our annual quantification of the lost chemistry in non-chemical agricultural, mining and manufactured goods is updated.

Trends in Goods Trade

The U.S. trade deficit in goods ballooned from US-\$180.5 billion to US-\$763.6 billion between 1997 and 2006 (fig. 2). Several factors have

economic Analysis (BEA), it is possible to estimate the amount of chemistry inputs into agricultural, mining and manufactured goods that have been impacted by the deterioration in trade. The lost chemistry content of the net trade position of customer industries totalled to US-\$50.9 billion in lost chemistry for 2006. That is, the embedded chemistry or chemistry content of the net trade in these downstream industries amounted to US-\$50.9 billion.

The deterioration in the trade balance for plastic and rubber products in particular has been pronounced. This involved a swing from a positive US-\$271 million net export of chemistry in the content of the industry's trade balance in 1997 to a large deficit or lost chemistry position of US-\$3.3 billion in 2006. This industry in particular is noteworthy as it is the largest direct purchaser of the goods and services of the chemical industry, largely plastic resins, synthetic rubber, plasticizers, flame-retardants, other plastic additives, carbon black and various rubber processing chemicals.

In addition to the direct US-\$26.5 billion impact of declining chemicals trade between 1997 and 2006, it is possible to examine and quantify the change in the net chemistry content during this period. The results of such an examination suggest that the business of chemistry has accrued an additional US-\$34.1 billion in lost chemistry since 1997 (fig. 3).

China And The U.S.

During the past several years, much has been said about China emerging as the "factory floor" to the world. Between 1997 and 2006, China's overall industrial output increased 12.9% per year on average. In contrast, industrial output in the U.S. grew only 2.5% per year during the same period. As manufacturers shift operations to China, the U.S.-based chemistry that would be used to make those goods domestically is potentially lost. The chemistry may no longer occur in the U.S.

Unlike the rest of the manufacturing sector, the U.S. chemical industry has consistently maintained a trade surplus with China that has ranged between US-\$1.3 billion and US-\$2.4 billion between 1997 and 2006. Offsetting this surplus, however, is a very large lost chemistry content

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DSM Acquires Pamako Royal DSM has acquired acquisition of Pamako in Zurich from FMS Enterprises Migun. The acquisition includes Pamako's technology for the production of UHMWPE (Ultra High Molecular Weight Polyethylene) based products. DSM will further develop and improve this technology, and incorporate it in its existing business for Dyneema fibre and Dyneema UD (UniDirectional bullet resistant sheet). No financial information was given. www.dsm.com

Degussa Considers U.S. Alkoxides Production The RAG subsidiary Degussa said is strengthening its commitment to producing alternative energy sources from renewable raw materials. The specialty chemicals company plans to construct a 60,000-mt facility at its North American Mobile, Alabama (U.S.), site for production of alkoxides, which are used as catalysts in biodiesel production. The investment volume lies in the low two-digit million euro range. Degussa is currently meeting the increasing demand for biodiesel through its site at Lülldorf, Germany. "But an additional production facility in North America is desirable in the interests of speed and customer proximity," said Dr. Thomas Haeberle, head of Degussa's Building Blocks Business Unit. www.degussa.com

Solutia to Sell Dequest Solutia announced that it will sell its water treatment phosphonates business, Dequest, to Thermphos Trading for US-\$67 million in cash. The parties will also enter into a lease and operating agreement under which Solutia will continue to operate the Dequest facility to produce Dequest products exclusively for Thermphos at Solutia's plant in Wales, U.K. The deal's closing is subject to certain government and regulatory approvals and authorisation by the bankruptcy court overseeing Solutia's reorganisation. Solutia plans to seek bankruptcy court approval of the bidding procedures and other aspects of the auction process in April. www.solutia.com
www.thermphos.com

Air Liquide Acquires Linde Gas UK Air Liquide has announced the purchase of Linde Gas UK. The transaction is based on an enterprise value of €105 million, and its completion is subject to approval by the European competition authorities. Linde Gas UK has total revenues of around €60 million derived from diversified industrial, medical and homecare customer base throughout the UK.

Air Liquide entered the UK market in 2004, following the acquisition of the local Messer operations. The company said the acquisition will help Air Liquide to almost double its size in the UK. In addition, 30% of the acquired activities are in the medical gases and the homecare services markets, a key Air Liquide growth driver and one in which the group is currently not present in the UK. www.airliquide.com
www.linde-gas.co.uk

BASF Coatings Takes Over R-M Sales Activities BASF Coatings Services is taking over major parts of Michel Deris in Sault-les-Rethel, France. BASF Coatings is acquiring Château-Arnoux Peinture in Château-Arnoux, France. Michel DERIS's and Château-Arnoux Peinture's sales activities with regard to automotive refinish paints and non-paint products will be integrated into BASF Coatings Services, France. The companies have not provided information on the purchase price. www.basf-coatings.de

Lilly Announces Acquisition of Hypnion Eli Lilly and Hypnion, have signed a definitive merger agreement whereby Lilly will acquire Hypnion, a privately held neuroscience drug discovery company focused on sleep disorders. The transaction has received the requisite approval of Hypnion stockholders and is expected to close near the end of the first quarter of 2007, contingent upon clearance under the Hart-Scott-Rodino Anti-Trust Improvements Act and other customary closing conditions. Financial terms of the deal were not disclosed. www.lilly.com
www.hypnion.com

Rhodia Sells Nylstar Stake Rhodia will sell its 50% stake in Nylstar for €1, to a third party agent acting on behalf of a consortium of Nylstar's credit banks. SNIA, Rhodia's partner in this joint venture, has also signed an agreement to sell its 50% stake. The sale of the stake in Nylstar will be effective once the necessary regulatory formalities have been completed.

This agreement forms part of the financial restructuring of Nylstar through a debt/equity swap to give the company a restructured balance sheet and a significantly reduced level of debt. Nylstar will now be in a better position to ensure its development. Rhodia will also remain a raw material supplier to Nylstar. www.rhodia.com
www.nylstar.com

Dow Polyurethanes to Acquire Hyperlast UK, Autothane Dow Polyurethanes, a business unit of the Dow Chemical Company, said it plans to acquire Hyperlast, a UK polyurethanes elastomers systems business, and Autothane, a manufacturer of advanced automotive suspension components, pending regulatory approval. Hyperlast UK and Autothane, subsidiaries of British Vita, specialise in the development of polyurethane elastomers for the marine, engineering resins, oil and gas pipeline, and automotive industries. No further details related to the transaction were disclosed. www.dow.com/polyurethane
www.britishtvita.com

Celanese Completes Sale of Oxo Products, Derivatives Businesses Celanese Corporation said it completed the sale of its oxo products and derivatives businesses, including European Oxo (EOXO), a joint venture between Celanese and Degussa, to Advent International, for the purchase price of €480 million. The transaction excludes limited business activity in Turkey, which remains subject to customary regulatory review. The sale includes oxo and derivatives businesses at Celanese's Oberhausen, Germany, and Bay City, Texas, facilities as well as portions of its Bishop, Texas, facility. The sale also includes EOXO's facilities within the Oberhausen and Marl, Germany, plants, and the 50% interest in the EOXO joint venture previously owned by Degussa. www.celanese.com
www.degussa.com

EU Energy Action Plan

Cefic Supports Commitment to Emissions Reduction

Cefic said it endorses the move towards a more coordinated, cohesive and integrated energy policy for Europe, a position that was reinforced by the spring council's adoption of the European Energy Action Plan. Cefic supports an energy policy striving for further emission reductions through energy savings, additional increases in energy efficiency, increased use of renewable energy and better international cooperation.

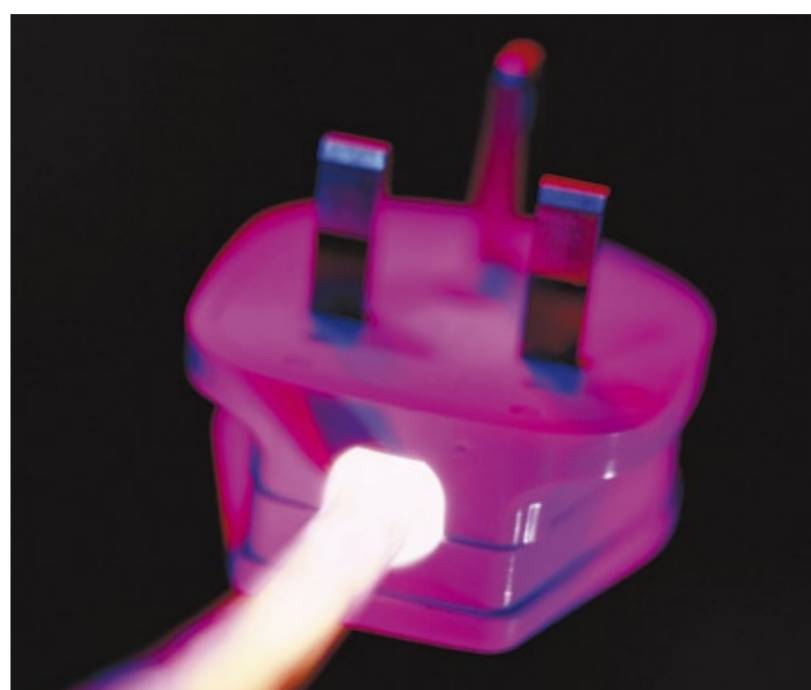
The organisation said the European chemical industry can make an important contribution in meeting this ambitious challenge. Its products and research capabilities can play a decisive role in the fight against climate change: for example, the chemical industry is essential to the manu-

"The chemical industry cannot afford to wait until 2013."

Alain Perroy, Cefic director general

facture of biofuels, lightweight high performance materials for transportation or enhanced housing insulation. And the industry has already contributed substantially to the development of low carbon technologies and increased energy efficiency in its own production processes.

The European chemical industry encourages Europe's striving for leadership on climate change and strongly supports the Commission's efforts to obtain an international commitment



to emission reductions. Europe cannot solve the global warming problem alone. Furthermore, the overall contribution of the chemical industry to society should be taken into account

when considering further greenhouse gas emission reduction measures and mandatory use of renewable energy sources. Therefore, a more differentiated and in-depth assessment of pol-

What is the aim of emissions trading?

The Emission Trading Scheme (ETS) is a cornerstone in the fight against climate change. It is the first international trading system for CO₂ emissions in the world. It covers over 11,500 energy-intensive installations across the EU, which represent close to half of Europe's emissions of CO₂. These installations include combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. The aim of the EU ETS is to help EU Member States achieve compliance with their commitments under the Kyoto Protocol. Emissions trading does not imply new environmental targets, but allows for cheaper compliance with existing targets under the Kyoto Protocol. Letting participating companies buy or sell emission allowances means that the targets can be achieved at least cost. If the Emissions Trading Scheme had not been adopted, other – more costly – measures would have had to be implemented. ec.europa.eu/environment/climat/emission.htm

Akzo Nobel Divests Business



Leif Darner

Akzo Nobel said it has divested its Akros Chemicals PVC additives business to UK-based private investment firm GIL Investments. Financial details were not disclosed. Under the terms of the deal, the company's sites in Eccles, UK, and New Brunswick in the U.S. – along with all of the approximately 160 employees at these locations – will be transferred to the new owner.

An agreement has also been reached whereby Akzo Nobel will continue to operate two smaller, related production operations in Greiz, Germany, and Itupeva in Brazil. Employees at these two locations – who will provide toll production services to the new owner – will therefore remain with Akzo Nobel.

"Transferring the bulk of the PVC additives activities to a new owner is the best way forward for the busi-

"We have just one more divestment to finalise before completing the strategic realignment of our chemicals portfolio."

www.akzonobel.com

www.gilinvestments.com

Schering-Plough Buys Organon Sciences



Fred Hassan, chairman and CEO, Schering-Plough

Schering-Plough has announced that it will purchase Organon BioSciences (OBS), a wholly owned subsidiary of Akzo Nobel, for €11 billion in cash. The price is well above the level of up to €9 billion analysts had expected Akzo to achieve in an initial public offering. The transaction is expected to be completed in the second half of the year, after consultation with social partners, and clearance from regulatory bodies. Schering-Plough said the purchase would boost earnings and lead to annual synergies of US-\$500 million within three years. It will finance the deal through a mix of cash, debt and equity.

OBS provides Schering-Plough with a steadily growing base of products and businesses with top-line sales of nearly US-\$5 billion. The pharmaceutical business, Organon, had sales of US-\$3.4 billion in 2006. In addition,

ness, which will continue to operate under its current name," explained Leif Darner, member of Akzo Nobel's board of management responsible for chemicals. "This transaction means that we have just one more divestment to finalise before completing the strategic realignment of our chemicals portfolio."

www.akzonobel.com

www.gilinvestments.com

"We expect a smooth and efficient transition."

www.akzonobel.com

www.schering-plough.com

Hexion Reports Improved Results



Craig O. Morrison, chairman and CEO Hexion Specialty Chemicals

Hexion Specialty Chemicals improved both the fourth quarter and fiscal year 2006 results. Full Year 2006 sales were US-\$5.2 billion, a 17% increase over fiscal year 2005. Of the 17% increase, acquisitions accounted for 12 percentage points when compared to 2005. Full year operating income increased by 38% to US-\$286 million, supported by lower selling, general and administrative expenses, continued realization of synergies and lower transaction costs compared to the similar year ago period. 2006 operating income was negatively impacted by increased integration costs when compared to 2005, as well as the continued rise in raw material costs and the delayed timing in contractual pass through of certain raw material cost increases to customers. In the fourth quarter of 2006 revenues were US-\$1.31 billion compared to US-\$1.14 billion during the prior year period, an increase of approx. 15%. The operating income improved 34% to US-\$59 million. Quarterly Segment EBITDA increased 11% to US-\$124 million in 2006.

CHEManager Europe: What were the key growth drivers for Hexion in 2006?

C. Morrison: The diversity of our portfolio of thermoset resins helped to improve our fourth quarter 2006 results as we experienced strong customer demand for a number of our products, including: epoxy resins and intermediates, phenolic specialty resins, oilfield services and international

forestry effects on the environment, competitiveness and society is needed.

Cefic supports the Energy Action Plan's emphasis on the central role of market mechanisms to achieve cost-effective emission reductions. In its current form, the EU Emissions Trading Scheme (ETS) leads to huge, unjustified transfer of resources from the energy consumers to the energy producers – known as windfall profits – without encouraging enough reduction in CO₂ emissions. As a member of the ETS review group set up by the European Commission to advise on a possible reform of the system for post 2012, Cefic said it will propose to carefully consider the allowance allocation according to performance. "In addition, interim solutions need to be found now," said Cefic Director General Alain Perroy. "The chemical industry cannot afford to wait until 2013."

The European chemical industry also strongly backs the aim to achieve functioning energy markets. Cefic calls for the urgent development of concrete Commission proposals based on the Spring Council's recommendations. "The high energy prices – which result to a significant extent from malfunctioning energy markets in combination with the ETS – pose an immediate threat to the global competitiveness of the European chemical industry," Perroy said. "This is why transitional measures for energy-intensive sectors are needed until energy markets function properly."

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mail@cefic.be
www.cefic.be

forest product resins and formaldehyde applications.

Which factors hampered a better result?

C. Morrison: Rapidly escalating raw material costs continued to create a negative lead-lag effect in the fourth quarter 2006. However, we continued to aggressively pursue pricing actions for both contract and non-contract customers to recapture raw material price increases. We were generally pleased with our progress to restore margins, although our efforts were hampered by the persistent rise

"Key raw materials at historically high levels."

in raw material costs that continued longer than we had previously anticipated.

How do you rate the chances for further improvements in 2007?

C. Morrison: Overall, our outlook for revenue and Segment EBITDA growth in 2007 remains positive and we are encouraged by the strength of Hexion's diverse end markets and a more favorable raw material environment. In addition, Hexion's Phase I synergy targets continued to be achieved as planned, with US-\$25 million in synergies realized this quarter. We remain confident in our ability to achieve the full balance of our US-\$125 million Phase I synergies. We have also identified US-\$50 million in Phase II synergies. www.hexion.com

Süd-Chemie: Increased Sales for 2006

Süd-Chemie said it will significantly exceed its group targets previously forecast for the 2006 financial year of €950 million in the case of sales and an operating profit (EBIT) of some €73 million. Based on the preliminary consolidated financial statements for 2006, which have not yet been certified by the auditors, the company

said sales are expected to reach just over €1 billion and the EBIT around €83 million. This rise in earnings is due to performance in the process catalyst sector in the fourth quarter of 2006, which far exceeded expectations. www.sud-chemie.com

Uncertainty Surrounding Gas, Oil Prices

Top Concern for Energy Executives in 2007

According to Grant Thornton LLP 2007 Survey of Upstream U.S. Energy Companies, the top concern among energy executives is the uncertainty of natural gas and oil prices in the near future.

More than 80 companies (40% public and 60% private) responded to the survey questionnaire distributed by Grant Thornton's Energy Practice. Reed Wood, Grant Thornton's partner-in-charge of the firm's energy practice, said, "The findings show an industry that is generally optimistic and strong, but somewhat apprehensive about projecting increases in capital spending and drilling activities when the prices of natural gas and oil remain uncertain for the most part."

According to 41% of survey respondents, the average price of natural gas for 2007 must be US-\$8.43 per Mcf in order to justify an increase in U.S. drilling activity of more than 20%. More than half indicated that natural gas production would be curtailed if prices were less than US-\$5 per Mcf in 2007. Yet, only 10% expect natural gas prices to be high enough to support an increase in drilling this year.



Survey Highlights

- 65% anticipate increases in domestic capital expenditures in 2007 (compared to 89% in 2006).
- More than half of those interviewed said they plan to focus on both natural gas and crude oil activities in 2007, not primarily natural gas as in 2006.
- As in 2006, the respondents said the Gulf of Mexico holds the greatest potential for oil and gas discoveries, followed by the Rocky Mountains and Alaska.
- 79% expect a need for more capital in the next five years (compared to 89% in 2006).
- Companies surveyed plan to add jobs in 2007, but executives surveyed expect continued challenges in finding and keeping qualified industry professionals, especially geologists and engineers, even when offering top salaries.
- espondents also anticipate a rise in merger and acquisitions and restructurings in the coming year.

About 60% believe there will be increased environmental legislation enacted in the future to further protect the environment; consequently, almost half of those interviewed say their companies will spend more on environmental remediation or studies compared to current levels.

On the topic of crude oil, 93% of respondents said that the average price per barrel of West Texas Intermediate crude must be greater than US-\$60 to justify an increase in U.S. drilling activity in 2007. Sixty percent indicated that crude oil drilling would be curtailed if prices dropped to US-\$40 or less per barrel.

Randall D. Stilley, CEO and President of Houston-based Hercules Offshore, indicated the issues for the sector this year are broad.

"For those of us in the oil and gas service industry, we face three main challenges as we enter 2007 – recruiting and retaining talented people; allocating resources in an

environment of uncertain demand and increasing geopolitical risk; and planning for the future, when faced with highly volatile commodity prices. Our success will depend largely on how well we anticipate and respond to these challenges."

Survey respondent Matt Manning, Controller of Lafayette-based Marlin Energy LLC, said, "Energy industry leaders should be concerned about replacing the rapidly aging workforce. In these times of record profits and employee compensation, jobs in the energy industry should be attractive to young professionals."

Many of the survey's respondents concluded that the growth of operations last year bodes well for local economies this year that are supported by energy and energy related companies. "We are optimistic that our market will continue to thrive, and demand will remain high," said Gene Miller, partner in Grant Thornton's Dallas office.

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Bayer: 2006 a Record Year

The Bayer Group said it achieved a record underlying operating result in 2006. Sales rose in 2006 by 17.2% to €28,956 million (2005: €24,701 million). The total for 2006 includes €3,082 million in revenues from the Schering business in the period from 23 June 2006, while the divested Diagnostics Division and the subsidiaries H.C. Starck and Wolf Walsrode, as discontinued operations, are omitted except that their net earnings are included in Group net income. Adjusted for currency and

portfolio effects, group sales rose by 5.2%. Earnings before interest, taxes, depreciation and amortization (EBITDA) and before special items rose by 21.3% to the record level of €5,584 million (2005: €4,602 million), yielding an underlying EBITDA margin of 19.3% in line with Bayer's announced target for 2006. The operating result (EBIT) before special items climbed to a record high of €3,479 million (2005: €3,047 million).

www.bayer.com

Linde Group: Improvement in 2006

In the fiscal year 2006, Linde said successfully continued its earnings-oriented growth trend and saw a double-digit increase in sales and operating profit. Sales increased by 30.8% to €12.439 billion (2005: €9.511 billion). On a comparable basis that is adjusted for first-time consolidation of the BOC Group sales rose by 10.6% to €10.516 billion.

The operating profit amounted to €3.830 billion and is therefore more than double that of the previous

year (€1.705 billion). Special items must be taken into account in this development: a book profit from the sale of KION Group as well as one-time expenses for acquisition and divestment processes. After adjustment for these special items, Linde has improved its EBITDA by 30% to €2.216 billion. Without BOC, EBITDA rose by 10% to €1.876 billion.

www.linde.com

Enel Buys Stake in Endesa

Italian energy group Enel has acquired 9.99% of Spanish electricity company Endesa's shares, making German energy company E.on's plan to take over the Spanish company more difficult. Enel paid €39 per share, totalling €4.1 billion. As soon as Enel gets the approval of the Spanish energy supervisory authority, the Italians plan to increase their holding to 24.99%, taking it to the limit

figure after which a public takeover offer would be necessary. The move came as E.on's takeover proceedings for Endesa were entering their decisive phase. E.on formally made a takeover offer to Endesa shareholders of €38.75 or a total value of €41 billion in February.

www.eon.com
www.enel.it
www.endesa.es

Rhodia Returns to Net Profit



Rhodia reported a net profit of €62 million for 2006, compared to a net loss of €616 million in 2005. Recurring earnings before interest, tax, depreciation and amortisation (EBITDA) rose to €683 million from €513 million in 2005. The company's recurring EBITDA margin had risen to 14.2% from 11.3% in 2005.

"2006 marks the successful delivery of Rhodia's recovery plan," said Chief Executive Jean-Pierre Clamadieu. "We have demonstrated the strength of our operating performance and are in a good shape to continue on our route of profitable growth."

Consolidated net debt fell to €1.657 billion at the end of 2006, including

"We have demonstrated the strength of our operating performance and are in a good shape to continue on our route of profitable growth."

the cash proceeds from the sale of its silicones business, down from €2.089 billion in 2005, which resulted in a net debt recurring EBITDA ratio of 2.4 times

www.rhodia.com



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COLLABORATION

Air Liquide Wins 15-year Contract with Shagang Air Liquide said it has won a 15-year contract to supply oxygen, nitrogen and argon to China's leading private-sector steelmaker Jiangsu Shagang Group. No financial details were provided. The group said it will invest some €90 million to set up two large air separation units, capable of producing 2,000 t of gaseous oxygen each per day. The company reported that the units will be ready by 2009 and will provide 600 t of liquid nitrogen and oxygen per day. The group also said it will supply other local industrial players, but gave no details on potential clients.

► www.airliquide.com
► www.sha-steel.com

Endura to Market Saltigo Insect Repellent Lanxess subsidiary Saltigo has signed a contract with the Italian company Endura SpA Fine Chemicals under whose terms Endura will market Saltigo's active ingredient Bayrepel with immediate effect in Central and South America, Africa, the Middle East and India. To date, the world's best known product based on Bayrepel is Autan, a registered trademark of S.C. Johnson & Son, (U.S.). In many countries across the world, dangerous diseases such as malaria, yellow fever and the West Nile virus are transmitted by mosquitoes and other insects. Bayrepel supports the fight against these diseases and is recommended by the World Health Organisation (WHO) as an active ingredient.

► www.saltigo.com
► www.endura.it

Clariant, Pantone Enter Partnership Clariant has announced a strategic partnership between its textile business and Pantone, a U.S. provider of professional colour standards for the design industries, to advance colour development for the textile industry. No financial details were given. The partnership will connect the vast number of users of the Pantone Fashion + Home colour system around the world with Clariant's global network of technical specialists and state-of-the-art colorants technology, the Swiss speciality chemicals group said. It is thereby expected to improve the colour matching and approval cycle, potentially reducing colour development times and the associated management costs by 50% or more, it said.

► www.clariant.com
► www.pantone.com

Eksigent: Distribution Agreement with Serlabo Technologies Eksigent announced a new distribution agreement with France-based Serlabo Technologies. The exclusive agreement covers sales and service of Eksigent's NanoLC HPLC product line in France. Serlabo Technologies specialises in sales, application support and maintenance of chromatography, spectroscopy and other biotech instruments. With a staff of 27, the company offers a comprehensive line of chromatography solutions.

► www.eksigent.com
► www.uvk-lab.fr

Diversa and Cargill Expand Collaboration Agreement Diversa Corporation has expanded its collaboration agreement with Cargill to discover and develop novel enzymes for the cost-effective production of a proprietary food-related product designed to help global consumers pursuing healthy lifestyles. In 2005, Cargill Health and Food Technologies and Diversa entered into an agreement to develop an innovative, multi-step enzymatic process to assist in the creation of a new Cargill product. Based on the success of the initial phase of the project, the companies have expanded the scope of their collaboration to develop additional enzymes to facilitate the next steps of production.

► www.diversa.com
► www.cargill.com

Beiersdorf to Increase Market Share



Thomas Quaas, Beiersdorf's board chairman

The Nivea manufacturer Beiersdorf said it plans to speed up its growth abroad in 2007. The aim of board chairman Thomas Quaas is to increase Beiersdorf's global market share in body care and cosmetics from its current 4.5% to 5.5% by 2010. He said that China has top priority. At present, the Hamburg-based company is negotiating with Hong Kong's C-Bons. "It's about cooperation, with a possible acquisition idea," Quaas said.

C-Bons holds a strong position on the Chinese hair care market. At present, Beiersdorf's turnover in China is around €60 million. Market researchers estimate the turnover

of the owner-managed C-Bons at around €100 million. Quaas declined to comment on the progress of the negotiations. Beiersdorf said it also

"It's about cooperation, with a possible acquisition idea."

sees growth potential in Russia, South America and India. In Eastern Europe in 2006, turnover climbed by 18.8% to €427 million.

► www.beiersdorf.com
► www.cbons.com

Sulzer: Net Income Up by 73 %

Sulzer reported it continued to perform well in 2006. The corporation achieved strong growth and substantially higher results. Sales rose by 12.1% to CHF2,801.7 million, while operating income (EBIT) was increased by 77.2% to CHF295.6 million. The net income attributable to Sulzer shareholders improved to CHF221.4 million. For the third consecutive year, the board of directors proposes an increased dividend; this year of CHF23 per share. Further

growth in sales and earnings can be expected for 2007.

The net income climbed to CHF221.4 million, up by 72.6% from CHF128.3 million in 2005. Earnings per share (EPS) equally rose by 72.8% to CHF62.27 (2005: CHF36.03). The board of directors proposes an increased dividend of CHF23 per share (previous year CHF14).

► www.sulzer.com

Aker Kvaerner Optimises Operations

Aker Kvaerner said it will optimise its operations by transforming its existing six business areas into five global business areas. The company said that by combining those specialised units which work within the same market segments better, the change results in increased capacity and a stronger offer of services and solutions to all market segments. It will also enable more effective use of the total resources.

In the new structure, the five global business areas will be:

- Field Development (FD), headed by EVP Simen Lieungh
- Subsea, headed by EVP Raymond Carlsen
- Products & Technologies (P&T), headed by EVP Mads Andersen
- Maintenance, Modifications & Operations (MMO), headed by EVP Torleif Gram

■ Process & Construction (P&C), headed by EVP Jarle Taurta

The Executive Management Team will from 1 April consist of President & CEO Martinus Brandal and EVP & CFO Bjorn Erik Naess, together with the five EVPs.

With effect for the first quarter of 2007, also Aker Kvaerner's external financial reporting will be based on the new structure, presenting the financial figures for the five business areas. Pro-forma historical numbers for the five business areas in the new structure will be published before the first quarter 2007 financial result is presented on 25 April.

► www.akerkvaerner.com

Borealis: Restructuring Initiatives



John Taylor, CEO Borealis

Borealis announces that it will reorganise its manufacturing operations in Bamble, Norway, within the framework of lean manufacturing. The company said the aim is to further increase European asset competitiveness and profitability of the plant.

In addition, Borealis considers phasing out its research and development activities in Norway, and to focus and speed up its innovation capability in Austria, Finland and Sweden, as well as at the planned Bourouge innovation centre in Abu Dhabi, in the United Arab Emirates. This supports the expansion of Borealis' business towards the Middle East and Asia.

The company also intends to move its business management currently situated in Mechelen, Belgium, to its head office in Vienna, Austria. The consolidation of management in one location will improve coordination

"We must continue to reduce complexity and improve our cost-competitiveness to achieve our full potential."

and effective implementation of the company's strategy.

"We are committed to our 'Value Creation through Innovation' strategy," said John Taylor, CEO Borealis. "At the same we develop innovative, value creating plastics solutions together with our customers, we must continue to reduce complexity and improve our cost-competitiveness to achieve our full potential."

► www.borealisgroup.com

Oil, Gas Industry to Work with EPA

The oil and gas exploration and refining industry has become the 13th industry to join U.S. Environmental Protection Agency's voluntary Sector Strategies Program that fosters collaboration among business, government, and non-government

than 500,000 producing wells and approximately 4,000 oil and natural gas platforms operating in U.S. waters. The nation's 144 refineries process more than 17 million barrels of crude oil every day. Together, oil and gas supply 65% of U.S. energy.



organizations. Through this program, EPA works with the diverse parties to improve the environmental impact of the major manufacturing and service sectors of the U.S. economy.

EPA's primary contacts in the industry will be the American Petroleum Institute (API), the Domestic Petroleum Council (DPC), and the Independent Petroleum Association of America (IPAA). Collectively, these organizations represent the full spectrum of oil and gas operations – from exploration and production to refining and distribution.

The U.S. is the world's third-largest petroleum producer, with more

Currently, more than 20 national trade associations – representing 12 major divisions of the U.S. economy – are working with the agency to improve their environmental performance with the least administrative burden. The participating sectors represent more than 780,000 facilities.

The 12 other participating sectors include: agribusiness; cement manufacturing; specialty-batch chemical manufacturing; colleges and universities; construction; forest products; iron and steel manufacturing; metal casting; metal finishing; paint and coatings; ports; and shipbuilding and ship repair.

► www.epa.gov/sectors/oilgas/index.html

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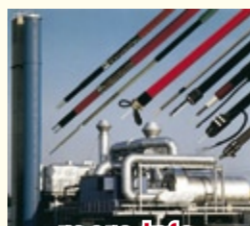
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Pharmaceuticals

Insights from an intra-industry comparison

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Managing Risk

Achieving FDA Compliance Using ISO 14971

A current popular aphorism in the FDA regulated pharmaceutical and biotech arenas are the words, "risk management." They are being used by regulated pharmaceutical and biotech manufacturers worldwide, as well as by standards developers and regulatory agencies whose primary focus is on the safety and efficacy of regulated products. Although, perhaps 'risk management' is a new term for the drug makers as opposed to the medical device makers, if you are, indeed, from the device side of the regulated business, the term stems from the ever-growing need to provide safer and more effective devices to the marketplace.

Because of a growing regulatory need for a global standard for risk management, the International Organisation for Standardisation (ISO) Technical Committee (TC) 210 Working Group 4 was formed to create a medical device risk management standard. Later, a joint working group of the International Electrotechnical Commission (IEC) in combination with ISO was formed to ensure that the new regulatory standard met the needs of other standard creators like the creators of IEC 60601. The resulting joint IEC/ISO working group expended a great deal of effort between 1996 and 2000 to establish a complete risk management standard focused on the medical device industry.

That standard is currently ISO 14971:2000. It has become widely accepted by both regulators and standards developers. ISO 14971 also received a unanimous positive vote in both the IEC and the ISO when it was circulated as a Final Draft International Standard. ISO 14971 additionally received a unanimous positive vote in both the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (CENELEC). It is well recognized in the U.S., and will soon become a Japanese Industrial Standard. Thus, ISO 14971 is widely hailed by regulators as a truly global standard for risk management.

What Drives Risk Management?

There are many good reasons for manufacturers to create and maintain a risk management system above and beyond the need for global firms to meet international agency regulations. The primary regulatory mandate, no matter who the regulatory entity may be, is to ensure that safe pharmaceutical and medical device products are used within their jurisdictions. Agencies view risk management as a way to put safe products on the market and to ensure that any unsafe products that do reach the market are promptly identified and efficiently corrected.

The regulators in the major world markets (the EU, North America, Canada and Japan) all strongly encourage the use of risk management protocols. They may not unequivocally express an explicit regulatory requirement for risk management or dictate exactly how to assess and manage risk, but the outcome of an overall comprehensive risk management protocol is encouraged by almost all regional laws and regulations for life science manufacturers.

Risk analysis should be a living document throughout the design cycle of any product and into and beyond its production. The generic steps of risk analysis are to:

- Identify the potential hazards using cross functional teams that might include engineering, R&D, clinicians, marketing, users, regulatory, product safety engineers, manufacturing, etc.
- Define the probability and risk of each hazard using either a bottom-up Failure Mode and Effect Analysis or a top-down Fault Tree Analysis.
- Determine which hazards have risk levels that require mitigation.
- Mitigate the hazards.
- Check to ensure no new hazards are generated.
- Continue to mitigate hazards until the risk level is low enough to be acceptable.

Specifically, in the U.S., the quality system regulation (QSR) states that "design validation shall include software validation and risk analysis, where appropriate." The FDA also points out that the QSR's preamble, which has the same force as the regulation, also states the following: "Manufacturers are expected to identify possible hazards associated with the design in both normal and fault conditions. The risks associated with the hazards, including those resulting from user error, should be calculated in both normal and fault conditions. If any risk is judged unacceptable, it should be reduced to acceptable levels by appropriate means".

In addition, the QSR requires manufacturers to establish a corrective and preventive action (CAPA) plan and to also analyze and follow up on complaints. Taken together, these mandates match up fairly well with the components of risk management identified in ISO 14971.

Why Medical Device Standards?

In the last few years, the development of new standards for risk analysis and risk management has mostly been for the medical device arena. EN1441 (Medical devices - Risk analysis) and EN60601-1-4 (1996) Medical electrical equipment Part1: General requirements for safety 4: Collateral Standard: Programmable electrical medical systems) have been harmonized under the Medical Device Directive (MDD) and may apply if you are selling products in the EU. ISO 14971 (Application of risk management to medical devices) is also slated to be harmonized under the MDD.

These standards may also be used for meeting requirements in other countries including the U.S., Australia, the Far East and Canada. EN1441 applies to all medical devices from tongue depressors to implanted insulin pumps and beyond. It covers risk analysis procedures, which includes identifying hazards and estimating risks, associated with the device. EN60601-1-4 applies to Medical electrical equipment (EN60601-1) and systems (EN60601-1-1). The

with inherently safe design and construction, where appropriate, take adequate protective measures, including alarms if necessary, in relation to risks that cannot be eliminated, inform users of the residual risks due to any shortcomings of the protection measures adopted. Although the above only relate to risk control, a risk analysis is always required for establishing conformity to the essential requirements. Also, according to EU law, the manufacturer is

a manufacturer might not avoid direct damages, one would hope that punitive damages might be greatly reduced or eliminated if risk management was ardently practiced.

Especially on the device side, inspectors are trained in risk management, and ISO 14971 forms an integral part of that training. Thus, it appears that practicing risk management and conforming to ISO 14971 would provide the inspector with the information he or she

would be well advised to conform to ISO 14971.

How to Apply ISO 14971

There are a few things manufacturers can do to help themselves conform to ISO 14971. It is clear that manufacturers must practice risk management and that they are driven to conform to the international standard.

If the firm is not familiar with this standard, there are several workshops and seminars available, including some taught by the developers of the standards themselves. These meetings can prove useful in acclimating staff to a device risk management approach and in applying the standard to their business. In addition, the organisation might consider hiring a risk management consultant to help guide it

in implementing risk management, particularly as part of their quality system.

Although ISO 14971 does not require that a quality management system be in place, it is much easier to practice risk management within the context of a quality management system. In fact, numerous informative references to a quality management system, and to how the various risk management documents may be included in the quality management system records, exist in ISO 14971.

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standard includes hardware, software, firmware, and interfaces. EN60601-1-4 does follow some of EN1441 concepts so you won't have to start from scratch if you have done an EN1441 risk analysis.

So why are medical device standards for risk management necessary? They simply are the first comprehensive standards for risk analysis and risk management to be written and globally accepted. They can, of course, also be applied to non-medical device products such as drugs and dietary supplements.

Additional International Risk Management Directives

Many of the current FDA guidance documents also rely heavily on risk management. FDA reviewers expect you to provide the results of risk management activities as part of your pre-market submissions to the Agency. A risk management plan is additionally aligned with the total life cycle approach currently favored by FDA senior staffers.

In Canada, Section 10 of the Canadian medical devices law states that manufacturers must: identify risks, eliminate or reduce risks, protect and provide information on remaining risks, and minimize potential failures. Canadian law also contains requirements that manufacturers must correct defects found in the field for all of the elements of a risk management system.

In the EU, although risk analysis is not a specific requirement in any of the medical device directives, the essential requirements state that manufacturers must: eliminate or reduce risks as far as possible

also required to establish procedures to review post-production information and apply protective action. The combination of these requirements, along with the requirement for balancing risks and benefits, suggests the need for a risk management system.

Lastly, in Japan, the regulators are much more direct than in North America or the European Union. ISO 14971 is currently being translated into a Japanese Industrial Standard and soon will be a standard for satisfying the country's essential requirements for medical devices established under the new Pharmaceutical Affairs Law - a mandatory requirement for manufacturers who wish to market there.

ISO 14971 is also identified in a number of other standards as either a normative ("shall") or informative ("should") reference, particularly on the international scene. With all of the various laws and standards around the world that deal with risk management, it is not surprising that harmonized global standard on risk management lead to the development of ISO 14971.

Risk Management Beyond Regulatory Requirements

A functioning risk management system may demonstrate to a court of law that the manufacturer had indeed used state-of-the-art technology in providing safe devices. A manufacturer could mount a defense demonstrating that appropriate care and diligence was taken in designing and testing the device, in further assessing post-market risks, and in promptly and effectively following up on "unavoidable" device failures. Although

needs which would ultimately benefit the manufacturer.

On the pre-market side, ISO 14971 is recognised by FDA and can be used to satisfy risk management needs in submissions to the agency. For example, in a special 510(k), the manufacturer must describe its risk analysis process and include it in the FDA submission. If a manufac-

"Many of the current FDA guidance documents rely heavily on risk management."

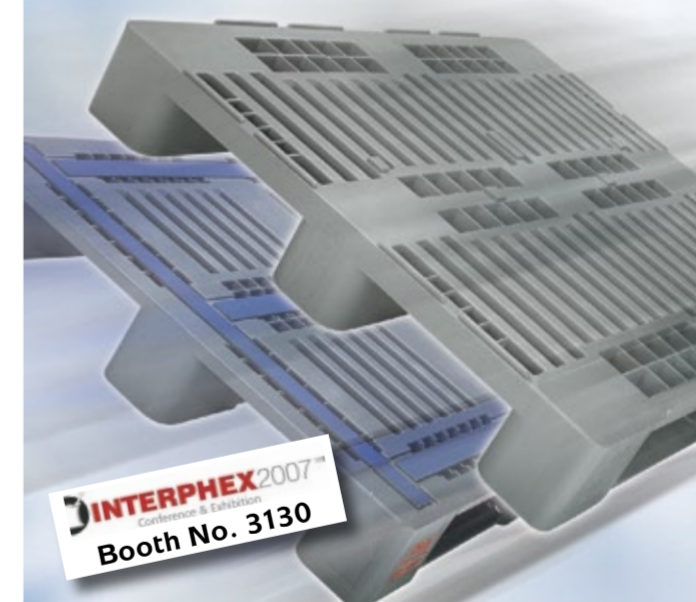
turer declares conformity to ISO 14971 for the risk analysis, the special 510(k) can be reduced to one or two pages since all that is needed is a short summary of the results.

In the EU, a firm's conformance to ISO 14971 is the evidence that a regulatory entity will look for to show that the firm meet the risk management elements contained in the directives. Although it is not necessary for any manufacturer to conform to a harmonised standard, the use of a harmonized standard is evidence that an agency must recognise.

Finally, since ISO 14971 is going to be a Japanese Industrial Standard, it means that it will become a de facto requirement for the Japanese device market. Thus, manufacturers should conclude from the regulatory requirements of the major device markets that they

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You Can Judge a Book by Its Cover

Reliability and Compliance in Product Labeling

Atremendous potential for cost saving lies in the pharmaceutical industry's packaging production. The effort needed for layout generation, for example, can be reduced by 50% through system-supported production. In addition, the use of an adequate system should allow companies to easily conform to the Good Manufacturing Practice (GMP) regulations for product labeling. Modern editing and content management systems help companies comply with legal requirements while offering a high degree of reliability in product labeling.

Packaging comes in many different forms, is expensive to produce and contains important – and often mandatory – product information. Initial information about the product's properties, area of application, and usage is found on its packaging. Coded data such as bar codes are printed on boxes, tubes, and jars. The package insert contains more detailed information about the product. All of this information needs to be current and consistent. Legal requirements and security aspects of patient information create additional requirements for packaging. For example, if new side effects of an active ingredient emerge, the German Federal Institute for Drugs and Medical Devices (BfArM) notifies the pharmaceutical industry. This new information must be included without fail for all medicines containing the active ingredient. The relevant text must be updated for all drugs with the ingredient, no matter the dos-



age, delivery format, or language. Such updates, of course, affect an enormous number of documents. The obligation of pharmaceutical companies to label their drugs and comply with regulations regarding changes, tracking, or archiving make processes for information creation and management especially complex and cost-intensive.

Automatically Generating Layouts

Packaging design is another considerable cost, especially for cosmetics and non-prescription drugs. For retail products, packaging frequently creates the first impression for a consumer. Often several different layouts and master copies exist for each

delivery form, dosage, and product type, though the information itself varies little, if at all. Modern editing and content management systems feature interfaces to layout programs such as Adobe Indesign, allowing the graphic artist or media designer to automatically import information and text into the system and generate a layout. Errors can be avoided and manual text entry omitted; instead, the graphic designer works on and corrects only the final layout.

In addition, some editing and content management systems, such as Schema ST4, offer a finely tuned status control so that users can insert late changes and newly released information right before printing. Considering that patient information

often has a print run of a million copies, this is a decisive advantage.

XML: Separating Content and Layout

The use of an XML-based editing and content management system can considerably simplify the manufacturing process for pharmaceutical packaging and thus reduce production time. Modern editing and content management systems are based on the concept of layout and content separation. Data, text, and images are created and managed in these systems as standardized information modules, which enables them to be reused for new product descriptions. This approach is especially sensible for creating pharmaceutical packag-

ing, as the same information often must be provided in different formats. For example, the most important information about the drug's area of application and patient information are found on the box as well as on the package insert. Likewise, as a rule the ingredients are printed directly onto all packaging, e.g. tubes and boxes.

Tracking Changes

For some time now, GMP has been required for manufacturing pharmaceutical and medical products. A GMP-compatible quality management system ensures product quality and complies with health authority regulations. When creating information for packaging, companies need to exercise an equal level of care. An appropriate system can generate an audit trail of the history of each information unit or document. It should also be able to reconstruct the drug description of any given date. Comparing documents and tracking content changes offers the user additional possibilities for inspection and control. Continuously documented processes make it possible to trace changes to product description and information at any time.

Central Management of Product Information and Master Copies

Creating a central data repository for all product descriptions, information, and master copies ensures a high level of security and that texts, pictures, graphics or PDF files are up to date. Data from other systems, such as those used to manage related texts (e.g. catalogues or additional product information), should also be storable.

In pharmaceutical packaging, bar codes (e.g. the Laetus Pharmacode) play a central role. The use of these codes must be carefully documented and tracked to avoid duplication. By creating a central information repository, all users work in parallel with the same data sets. External team members and vendors, such as authors, graphic artists and media agencies can be included via internet access, so that data is available regardless of the user's location. At the same time, role-based permissions ensure that information modules are not edited simultaneously and unreleased data stays protected.

Conclusion

Modern and specialised editing and content management systems allow data and information for packaging to be created and managed centrally in a single system. This makes the comprehensive representation of processes for and changes to packaging information possible. It allows companies to document the necessary tracking and release steps in a legally secure manner. All product and packaging information is stored in a central database. Apart from significant cost savings, a good editing and content management system enables pharmaceutical companies to efficiently implement GMP-requirements.

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Agile Systems And Technology

Small and Mid-tier Pharmaceutical Manufacturing

The small and mid-tier pharmaceutical manufacturing segment includes niche, specialty and generic manufacturers of prescription and over the counter products with revenues ranging from US-\$300 million to US-\$3 billion. Typically companies in this segment have developed discrete markets for their products or delivery technologies. However, global competition is forcing these companies to address complex supply chain management issues requiring increasingly complex systems.

Success demands that these companies achieve agility rather than control. Agility is defined as stability, scalability and supportability. Simply put, stability means the systems are dependable; they are available every day. Scalability means that the systems can respond to changing business conditions and work well with other systems; insuring that the scale is not just vertical but horizontal as well. Supportability means that people know how to use and leverage the system to achieve a differentiable advantage.

Case Study

Let's look at a fictitious small manufacturer we will call PhAST (for Pharmaceutical Agile Systems and Technology) PhAST Pharmaceutical is an emerging generic manufacturer of ethical drugs. They acquired the rights to a small molecule therapeutic compound called B352 and has received positive results from Phase II clinical trials. In anticipation of FDA approval, PhAST determined that it needed to modernise its existing manufacturing plant to insure that they could effectively scale up production from small scale batches for clinical trials to full scale production for commercialization. Rather than building a new plant or outsourcing production, they bought a solid dosage and packaging facility from XYZ Pharma. This facility would be the manufacturing plant for B352 and the excess

capacity would be used to continue to manufacture the products of XYZ on a contract manufacturing basis for five years. PhAST estimated that B352 would increase market share over the five year period and would grow to absorb full production capacity at the plant.

Shortly after the transaction is completed, XYZ begins to pressure PhAST to lower costs as XYZ is facing increasing price pressure from global competition. XYZ volume is decreasing and PhAST is deeply concerned that it will not generate the cash flow it expected to fund the scale up of B352.

Some of the critical production issue PHAST has identified are:

- Long production lead time: 30% of the batch documentation received by QA is incomplete or with GMP remarks that require investigation. The quality group often takes longer than thirty days to resolve a deviation. Additionally, release testing at the end of each process step is very time consuming.
- Low asset utilisation: OEE (Overall Equipment Effectiveness) is either not calculated or calculated manually. Average values of about 32% are obtained in the packaging area as compared with 65% for well run manufacturers in other industries and 85% for best in class manufacturers.
- Long change over times and low flexibility of the lines: Most of the equipment is not integrated and must be started sequentially "one-by-one." Those that can store recipes have them stored locally.
- Resolve maintenance problems: Although the equipment is mechanically sound, some equipment is so old that the OEM no longer exists;

making maintenance and access to parts very difficult. Furthermore operations is reacting to downtime rather than managing downtime.

- High waste: A lot of errors occur due to the high pressure on pro-



duction staff which often has to complete routine production during overtime.

The CEO believes that the only way to truly address the issues at the plant level and the issues at the executive level is with a comprehensive approach to manufacturing innovation. Each functional lead is promoting projects that they feel will provide the most value. The operations lead is promoting a lean Six Sigma initiative to streamline inefficient work streams. The engineering lead is focused on process design and automation to eliminate manual manufacturing activities. The

quality lead is insisting that standardising batch record documents and adding a validated document management system will deliver the greatest value because it will streamline the release process and reduce audit risk. The technology lead wants to reduce the number of stand alone applications and off-system spreadsheets used to support critical processes and focus on an effective ERP and MES solution. The finance lead is focused on pricing strategies, cost structures and overhead expenses.

The CEO gathers the functional leads together for a management meeting. The stated objective is to determine a clear direction. As each functional lead argues their perspective, it becomes clear that the recurring issue is the lack of visibility management has in the business process. The CEO is convinced that more effective planning will result in more efficient manufacturing. The CEO decides that PhAST needs to overhaul its enterprise systems to gain control of its supply chain.

Enterprise Systems

Enterprise systems have no value unless they are used to create value. This may sound a bit trite, but the subtlety is often lost on many small and mid-tier organizations. The simple truth is that systems must make jobs easier by solving business problems. Small to mid-tier companies must be focused on agility. Therefore the systems must be stable, scalable, and supportable.

PHAST adopted a four step approach to addressing its enterprise system project.

Step 1: Solve a problem, don't address a symptom. This means

that if there are bottle necks in the business process; don't solve it by "customising" a software application to mask the pain. This band aid approach adds unnecessary complexity and undermines stability, scalability and supportability. Take the time to understand the underlying problem. Identify how to solve the problem and then make the necessary changes. This sounds easier than it is and often may not require any changes to software, but changes to business process.

Step 2: Learn to use the systems already in place. Solving business problems without adding more technology is the ultimate objective. Innovation is achieved by using the tools you have more efficiently, not by having more expert tools to use. Invest in improving the expertise of the users with the tools they already have. Develop expertise in supporting and configuring the technology already in place.

Step 3: Buy – don't build. Going through steps 1 and 2 may result in a conclusion that a new system is required to solve a problem. Many small to mid-tier businesses believe they are saving money by implementing some custom developed application that addresses a discrete problem. This is a terrible mistake. These programs may be stable or supportable but typically are not scalable. The developer becomes the primary care giver and spends increasingly less effective time debugging, customizing, supporting and sometimes even using the application. This co-dependency between the business process and the application developer makes the entire solution inflexible.

Step 4: Solve one problem at a time. Creative problem solvers are – well – creative. They draw connections between problems and then design solutions that solve more than one problem at a time. Overly complex solutions often suffer from scope creep and usually exceed budget while only partially addressing any one problem. Project teams take shortcuts due to resource constraints and the result is an incomplete solution that is not stable, scalable or

supportable. Even though the technology you buy is capable of solving more than one problem, focus on one problem and solve it. This will deliver far more value in the long run. Then start over at Step 1.

Small to mid-tier companies like PhAST often get trapped by diverting financial and human resources into custom application development, costly integrations or "home grown" solutions and find that they are deeply disappointed with the outcome. The PhAST CEO worked with his management team and adopted the following key management philosophies: processes define systems; systems are the aggregation of process and technology; people use systems to make their jobs easier; and consistency yields savings.

How will this approach help PhAST address its problems?

- Long production lead time: Agility allows PhAST to build quality into the manufacturing process rather than testing for quality at the end of a process cycle.
- Low asset utilisation: Agility allows PhAST to better plan production and anticipate changes in production schedules to more effectively utilize capacity.
- Long change over times and low flexibility of the lines: Agility allows PhAST to connect shop floor equipment to production control systems to reduce errors and lead time for set up.
- Resolve Maintenance problems: Agility connects equipment maintenance to production schedules reducing unscheduled downtime.
- High waste: Agility allows PhAST to maximize resource utilization including people and equipment.

Companies like PhAST must focus on agility to compete in a changing global marketplace.

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Take A Closer Look

Insights from an Intra-industry Comparison

Lacking behind other industries with regard to Operational Excellence the role of operations for the success of pharmaceutical companies is becoming more and more important. In 2005 the University of St. Gallen conducted a benchmarking study about the status quo of Operational Excellence in galenic manufacturing which revealed vast improvement opportunities. In order to complete the picture of Operational Excellence of pharmaceutical companies the manufacturing of Active Pharmaceutical Ingredients (API) was also benchmarked.

In order to implement the modern principles of operational excellence effectively a reference model was developed by analysing current integrated production systems from the automotive industry, and these were then adapted to the needs of the pharmaceutical industry. The main objective of the Total Productive Maintenance (TPM) System is the efficient management of fixed assets while effectively using new process technologies. In contrast to that the main goal of the Total Quality Management (TQM) System is to significantly increase quality performance (e.g. reduce variability, scrap rates, complaint rates etc.). Based on that Just in Time (JIT) production focuses on the reduction of working capital by simultaneously increasing serv-

ice-levels. Besides the more or less technical parts of the model it was identified that the Management System has to support all Operational Excellence activities. Only by coordinating all these elements an API site can reach top performance.

Challenges in the API Industry

The API Industry has been a highly profitable market for several decades. Companies and its investors became used to double digit growth rates and will for sure expect this development to continue in the future. In fact, there is tremendous room for improvement in manufacturing techniques which could boost the growth rate even further. Recent observations draw a more negative picture of the situation. The API industry is facing a major and tremendous change at the moment. Increasing regulatory forces, the stronger bargaining power of the buyers and the decreasing switching costs for substitutes are more and more turning the API industry into a substitution market and as a result the rivalry among established firms is increasing drastically. In this competitive landscape Frost & Sullivan has identified five main market restraints. The most important restraint is "cost issues" closely followed by "difficult competitive situation within Europe." Both of them are said to have a high impact in the next seven years. "Delayed drug approvals and drug failures" and "reduced drug pipeline" both have the highest impact in the next two years whereas "Low-cost com-

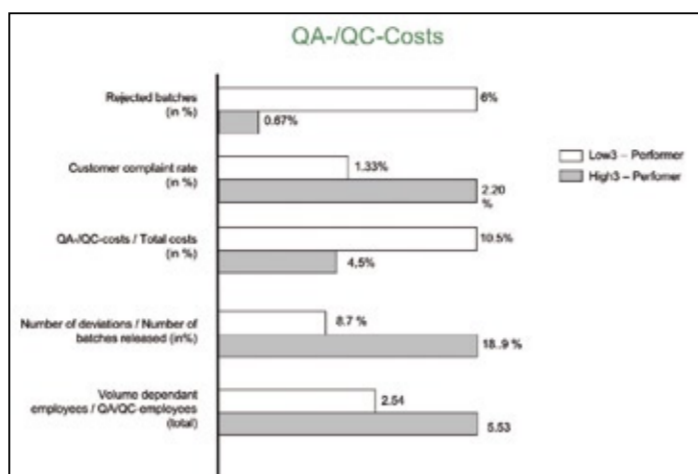


Figure 3: Saving potential in QA/QC

petition from Asia" reaches its peak in three to four years. API sites therefore feel the pressure to face changes.

As illustrated below the survey confirmed the strong need for changes not only for research driven pharmaceutical companies but also for generic and contract manufacturers.

The changes require more than just compliance with specifications. Process understanding is the key to move from corrective actions to more efficient and continuous improvements. The U.S. Food and Drug Administration has already taken the first step to reward process understanding in the revision of their Process Validation Policy.

In our worldwide study, 21 API plants have been benchmarked using this model. The average site of the sample operates with 150 employees and has costs of goods sold of €107.5 million. To get an impression of how extend performances of API sites differ, the average of the three highest and lowest performing sites of each category were compared. As a result three major saving potentials were identified.

Total Productive Maintenance

First of all API sites seem to struggle in the fields of maintenance and asset utilization. In low performing sites with smaller Overall Equipment Effectiveness (OEE) an over proportional number of unplanned maintenance occurs. As a logical consequence, the maintenance cost per volume dependant (v.d.) employees and the total number of maintenance employees rises significantly if the API site struggles in unplanned maintenance and in OEE. The discussions with benchmarking partners revealed that a strong OEE-focus can be due to high-tech equipment. Besides that the product mix (mono vs. multipurpose production) seems to be directly linked to the OEE.

The second saving potential has been discovered in the field of quality assurance and quality control. API sites are facing a trade-off between low customer complaint rates and low rates of rejected batches.

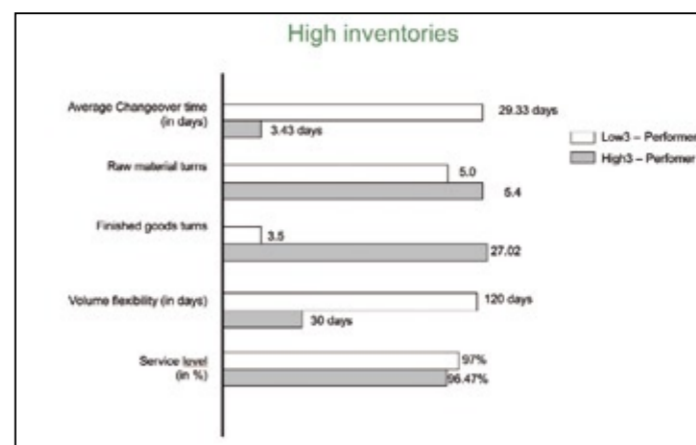


Figure 4: Saving potential in JIT

standing of operations in pharmaceuticals in several research and industry projects. Current and coming activities cover the development and implementation of customized Integrated Production Systems for pharmaceutical plants. In the past experiences from other industries as well as discussions

with site leaders have shown, that the implementation of single tools (like SixSigma, TPM) has not achieved the predicted success or sustainable impact in most cases. This reveals the high relevance of a deeper understanding of Integrated Production Systems and of the KPIs' interdependencies as a

crucial success factor. Based on in-depth analysis and the survey's key findings, each project participant is supported to develop and implement an individual Integrated Production System, which enables them to achieve the revealed potential. Operational Excellence will be a future crucial competitive advantage for western pharmaceutical companies.

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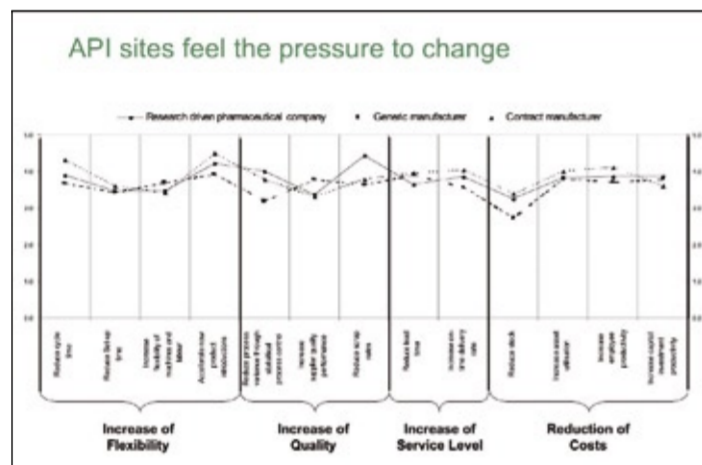


Figure 1: Prioritization of Coming Topics for Improvement

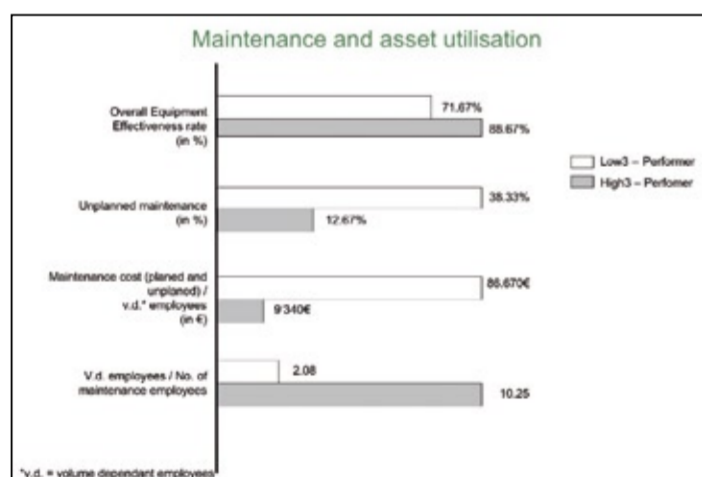


Figure 2: Saving potential in TPM

ReachCentrum, PwC Join Forces

ReachCentrum, a new service unit established as a subsidiary of the European Chemical Industry Council, Cefic and Price-waterhouseCoopers (PwC) have agreed to cooperate in a joint initiative called "Reach Readiness Review." The companies said ReachCentrum's expertise on the Reach regulation complements PwC's excellence in business risk management, perfecting compliance with laws and regulations. Both companies keep their independence and will continue to offer their own specific services. However, on a case by case basis either ReachCentrum or PwC may propose to combine services through the Reach Readiness Review.



The tool is to help prepare companies for Reach in function of their status and by defining actions for the current and upcoming Reach implementation phases. This involves a complete review of the company's product portfolio, internal

organisation and related business implications of the Reach legislation. The whole process starts with a self-assessment questionnaire and interviews resulting in a proposed review scheme.

The review itself will then be made by a multi-disciplinary team of specialists and advisors with sector knowledge, Reach expertise and performance improvement excellence.

Judith Hackitt, Marketing Director of ReachCentrum commented: "Businesses simply cannot afford to wait. They must already start preparing for Reach now, wherever they sit in the supply chain."

► www.reachcentrum.org
► www.pwc.com

Just-in-Time

The third problem is the costs of inventories. There is an alarming discrepancy between the three top and low performing sites in average changeover time. While there was a narrow performance gap among the top and low performing sites at the rate of raw material turns in the sample, the performance gap at finished good turns was significant. The study also showed that there is a lot of room for improvements in volume flexibility for low performing sites. In contrast the service level is excellent throughout the whole sample.

A further finding of the survey is that at several plants Key Performance Indicators (KPIs) are missing or not clearly defined. Only by implementing Operational Excellence initiatives and by consequently controlling them through KPIs the API sites are prepared for the coming challenges in their industry. But, if the culture and the management does not support the improvement activities, even the best initiatives will fail.

Beside the benchmarking studies for the pharmaceutical and API industry, it was possible to improve our under-

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Lonza, Bristol-Myers Squibb Extend Agreement

Lonza has extended its existing supply agreement with Bristol-Myers Squibb Company to produce in its Portsmouth, New Hampshire (U.S.) facility until the end of 2013 the active pharmaceutical ingredient for Orencia (abatacept), a biologic agent discovered and developed by Bristol-Myers Squibb for the treatment of rheumatoid arthritis. The extension will provide Bristol-Myers Squibb with additional production capacity in support of future sales of the Orencia.

Orencia, approved by the U.S. Food and Drug Administration in December 2005 and

launched in the U.S. in February 2006, is the first in a new class of biologic drugs. It is a selective modulator of a co-stimulatory signal required for full T-cell activation, for the treatment of rheumatoid arthritis.

► www.lonza.com
► www.bms.com

Avantium Doubles R&D Capacity

Avantium Technologies has announced the expansion of its R&D facilities in Amsterdam to accommodate the strong growth of its high-throughput R&D business. The expansion involves that Avantium will double its capacity with the addition of 2,500 m² of laboratory and office space. Avantium anticipates it will start using the new facilities by the first quarter of 2008.

Tom van Aken, Chief Executive Officer of Avantium said: "Avantium has made excellent progress over the past years, with our revenues increasing by over 40% per year. The expansion will provide us with sufficient capacity to accommodate the anticipated growth of our

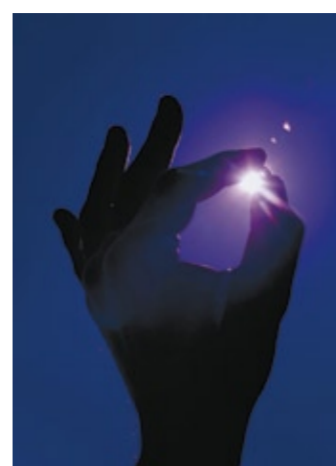


business in the coming years. Our site in Amsterdam is an attractive location because of its close proximity to Schiphol Airport, which makes it easy to reach for our global customer

base. In addition Amsterdam is a good area to attract highly educated scientists and creative people, which we need to further strengthen our team."

► www.avantium.com

Interphex: Technology Solutions and Networking



education for every aspect of drug manufacturing from process

Thousands of pharmaceutical industry professionals gather annually at the Interphex to meet one-on-one with technical experts, see the newest products and equipment, view live demonstrations, network, get expert advice to specific challenges, find resources and source new products, learn about emerging or changing trends, and to stay on top of every issue surrounding pharmaceutical manufacturing. This year's event takes place 24–26 April in New York City.

This year's event will feature technology solutions and edu-

Show hours	Conference hours
Tuesday, 24 April: 10:00am – 5:00pm	Tuesday, 24 April: 9:00am – 4:00pm
Wednesday, 25 April: 10:00am – 5:00pm	Wednesday, 25 April: 9:00am – 4:00pm
Thursday, 26 April: 10:00am – 3:00pm	Thursday, 26 April: 9:00am – 3:00pm

development through delivery to market. The show is comprised of four major segments: facilities; outsourcing and contract services; information technology; and manufacturing/processing. In addition,

key focus areas will feature new solutions and sources for: automation; packaging; RFID; contamination control; and biotech.

► www.interphex.com

Amgen, J&J Drugs to Carry Warning

The U.S. Food and Drug Administration (FDA) has requested a black box warning for the class of drugs known as erythropoiesis-stimulating agents, including Amgen's blockbusters Aranesp and Epogen. Johnson & Johnson will also have to update the safety information on its erythropoiesis-stimulating agent (ESA) drug Procrit. ESAs are approved to treat anemia in patients with chronic kidney

failure, and in cancer patients with anemia caused by chemotherapy. However, a series of recent studies have cast doubt on the safety of these medicines, prompting the FDA to demand the strongest type of warning for a prescription drug, a black box warning.

Updated information for patients in the revised label notes that "patients should be informed of the increased risks

of mortality, serious cardiovascular events, thromboembolic events, and tumor progression when used in off-label dose regimens or populations," according to the FDA. Physicians are advised in the boxed warning to use the lowest dose of ESAs that will avoid the need for red blood cell transfusions, and not to exceed 12 g/dL.

"Patient safety is unquestionably our top priority. Amgen is

committed to providing timely and appropriate communications to physicians and patients whenever we become aware of new safety information that could affect clinical practice," said Roger Perlmutter, executive vice president of R&D at Amgen.

The FDA is planning to review the safety and efficacy of ESAs at an upcoming meeting. ► www.fda.gov

Evotec, Boehringer Ingelheim Enter Collaboration

Evotec has announced a multi-year collaboration with Boehringer Ingelheim to jointly identify novel targets as potential points of intervention in the treatment of Alzheimer's disease (AD). The collaboration will also involve the Research Institute of Molecular Pathology in Vienna (IMP). Evotec scientists together with the IMP will apply their propri-

etary and well validated disease models to identify novel AD targets. Based on these models, Boehringer Ingelheim will select and further validate target candidates for its in-house drug discovery programme with the goal of developing innovative novel therapeutics. Financial details of this collaboration are not disclosed.

The contract also includes an option for Evotec to support Boehringer Ingelheim (BI) in the target validation process. If BI exercises this option, Evotec is eligible for milestone payments of up to €20 million plus royalties.

► www.evotec.com
► www.boehringer-ingelheim.com

The U.S. Food and Drug Administration (FDA) has raised concerns over the combination of Astellas Pharma's Prograf and Roche's CellCept as an adjunct therapy to prevent organ rejection in kidney, liver and heart transplant recipients in the U.S.

Prograf is currently approved for the prevention of kidney,

liver and heart transplant recipients in the U.S. The FDA sent Japanese company Astellas an approvable letter over concerns that the combination of the two drugs may lead to an increase in deaths from infection, based on the review of a clinical study.

The study, published in the American Journal of Trans-

plantation, said that the one year survival rate for kidney transplant patients on Prograf/CellCept was 95.7%, 97.6% in the cyclosporine modified and CellCept arm, and 98.6% in the extended release Prograf/CellCept arm.

However, Astellas said that peer-reviewed literature has not shown any significant differ-

ences in survival rates among patients receiving the combination of CellCept with Prograf or anti-rejection drug cyclosporine with Prograf. Astellas said that it would work with the FDA to resolve the differences in interpretation of the data and pursue approval of its supplemental new drug application. ► www.astellas.com

FDA Delays New Approval of Astellas Drug

Ranbaxy: Green Light on Zolpidem Tartrate

Ranbaxy Laboratories Limited (RL), said it has received tentative approval from the U.S. Food and Drug Administration to manufacture and market zolpidem tartrate tablets, 5mg and 10mg. The Office of Generic Drugs, FDA, has determined the Ranbaxy formulations to

be bioequivalent and to have the same therapeutic effect as that of the reference listed drug Ambien tablets 5mg and 10mg of Sanofi Aventis. The products will be manufactured at the company's Ohm Laboratories Inc. facility, based in North Brunswick, New Jersey (U.S.).

Total annual market sales for zolpidem tartrate tablets were US-\$2.12 billion. Zolpidem tartrate tablets are indicated for the short-term treatment of insomnia and related disorders.

► www.ranbaxy.com

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Industrial Locations
ECSPP wants to bring more chemical investment to Europe
Page 15



UNDER CONSTRUCTION

Shaw Contract for Huntsman Plant

The Shaw Group announced that its Shaw Constructors, Inc. business unit has been awarded a construction management and services contract by Huntsman Corporation to construct a new 100 million pound/year maleic anhydride plant at Geismar, Louisiana. Shaw's services include overall construction management, site work preparation, structural steel supply and erection, and the installation of mechanical equipment, piping systems, electrical components and instrumentation. The new plant will be constructed within an existing operating area of Huntsman's Geismar location and is expected to come on line in the fourth quarter of 2008. The value of Shaw's contract was not disclosed.

► www.shawgrp.com

Arkema Increases Capacity

Arkema said it will be launching major expansion plan at its Jarrie facility (France) in 2007. Overall investments of some €7 million will help enhance the plants' reliability and increase commercial grade hydrogen peroxide production capacity by 10% to 115,000 mt/y, therefore consolidating the site's long-term competitive position. The project is part of a global plan to consolidate the Jarrie facility's hydrogen peroxide activity by improving its competitiveness and reliability, while also reducing its energy consumption and global impact on the environment. Arkema's global hydrogen peroxide production capacity will reach 400,000 mt/y by mid-2008.

► www.arkema.com

Lanxess Invests in New Chinese Site

The Lanxess chemicals group said it is building a new plant for the manufacture of lubricant additives in Qingdao, China. The production facility, which belongs to Lanxess's subsidiary Rhein Chemie, will go on stream at the latest in the fourth quarter of 2008 and will initially employ 50 people. It is estimated that the amount in euros to be invested will be a single-digit million value. At the new facility Rhein Chemie will focus on the manufacture of customised additive formulations for lubricants.

With an annual volume of around 4.4 million mt, the market for lubricants in China is about four times as big as in Germany. Annual growth is estimated to be 8%. The industrial lubricants segment, which is of particular interest to Rhein Chemie, is likely to double by 2012 with an even higher growth rate at the current time of one million t/y.

► www.lanxess.com

► www.lanxess-goes-asia.com

Sinopec, Syntroleum Announce JT Plan

China Petroleum & Chemical Corporation (Sinopec) and Syntroleum have announced their intention to cooperate. The two parties have signed a non-binding memorandum of understanding (MOU). This establishes a joint technology development effort to advance natural gas-to-liquids (GTL) and coal-to-liquids (CTL) technologies, cooperation in verifying Syntroleum GTL technologies on an industrial scale, construction of a 700,000 t/y (17,000 barrel per day) GTL plant and a 3,000 t/y (100 barrel per day) CTL pilot plant in China using Syntroleum's technologies, and jointly marketing SSTC technology (Sinopec Syntroleum technology) in China through the most effective means. The MOU calls on Syntroleum to provide Sinopec with access to its complete set of proprietary GTL technologies including catalyst technology and Fischer-Tropsch technologies related to CTL for use in China on an exclusive basis during the period of cooperation. After signing a formal cooperation agreement, Sinopec agrees to provide Syntroleum with US-\$20 million per year over the next five years to support development of the technology.

► english.sinopec.com

► www.syntroleum.com

Ineos Nitriles to Expand Acrylonitrile Capacity

Ineos Nitriles announced plans for a major capacity expansion at its acrylonitrile complex in Green Lake, Texas (U.S.). This project includes the installation of a fourth reactor train and additional investment in associated equipment at Green Lake. According to the company, upon completion and start up in the third quarter of 2008, Green Lake will become the largest acrylonitrile production facility in the world with 544 kt of total capacity or 1.2 billion pounds.

► www.ineos.com

Innovative Measurement Technology

Cost-effective Level Measurement

Within a very short period of time, Endress+Hauser has upgraded its complete range of level measuring devices to state-of-the-art standards and adapted it to the needs of the market. The manufacturer has made improvements to almost all of the 13 different measurement methods: guided radar; free space radar; ultrasonic; microwave barrier; radiometric; vibronic; paddle switch; electromechanical/level system; capacitive; conductive; hydrostatic; differential pressure; and float switch.

For continuous level measurement in liquids and solids, customers can now avail of the enhanced Time-of-Flight power trio – made up of the Micropilot, Levelflex and Prosonic – to meet the demands of the most difficult applications even more efficiently. Time-of-Flight measuring devices (guided radar, free space radar and ultrasonic) can be used in applications with temperatures ranging from -200°C to +400°C and pressures ranging from -1 bar to 400 bar. For even more extreme conditions, radiometric measurement technology can be used. Therefore, there are virtually no application limits as far as pressure and temperature are concerned.

Guided Radar

"Guided radar level measurement with Levelflex M is characterised by its extremely reliable measurements," said Norbert Thomann, product manager for level measurement at Endress+Hauser. "This is explained by the fact that in the case of demanding applications, two redundant measurement methods run in parallel within the one device."

The product range is particularly suitable for installation in a bypass. These measuring points, which can be supplied as complete solutions, play a key role particularly in the chemical and petrochemical industries and in power plants. The new liquid devices measure up to 400°C and 400 bar. Guided radar enjoys a high level of acceptance and is also advocated by experts in large companies. In fact, the number of units in production has increased steadily in the last five years. Guid-

ed radar level measurement with Levelflex M guarantees safe measurement in bulk solids even where there is heavy buildup of dust. It even provides reliable measurements in the event of turbulence and foam. This is thanks to the use of two redundant methods of measurement (end-of-probe detection) in the one device for liquids. The sensor is precalibrated and is therefore particularly easy to commission. Automatic probe monitoring ensures a high degree of availability.

Free Space Radar

"The performance of radar technology increases from year to year. In Autumn 2006, we were again able to increase significantly the dynamics of our Micropilot free space radar measuring devices using newly developed high-frequency modules", said Carsten Schulz, product manager for level measurement at Endress+Hauser. But what does this mean in practice? In bulk solids, levels up to 70 m can be measured safely. In the case of liquids, the range of application has widened considerably, i.e. high reliability even in the event of low dk values and turbulent or lightly foaming surfaces. Since January, Endress+Hauser also has the only 26 GHz pulse radar device with a precision level of +/- 1 mm for custody transfer.

Top Performer of the Future?

In recent years, the technical advances made in the area of radar devices have been staggering. Furthermore, there has fortunately been a very positive downward price tendency. These non-contact measurement methods seem to offer attractive advantages and, without doubt, the technology is already being put to use today in some applications for which there were virtually no solutions available previously. However, is free space radar the top performer of the future? No.

According to the experts at Endress+Hauser, this method of measurement will replace one method or another in the long run. However, there are several reasons why free space

These include its cost, the absence of a self-cleaning effect as in the case of ultrasound, and restrictions regarding its installation when compared to guided radar. These are important arguments at a time when everything revolves around the catchwords process optimisation, life cycle costs, total cost of ownership and return on investment. What is important to today's users is that they only buy what they really need.

Ultrasonic

"With over 35 years of experience in ultrasonic measurement technology, the new generation of Prosonic S devices highlights Endress+Hauser's capacity for innovation," said Hans-Peter Maier, product manager for level measurement at Endress+Hauser. "Consisting



Micropilot

of a transmitter and sensor, this separately instrumented device offers key advantages, particularly in tough, impracticable and hazardous environments. These advantages become apparent even during installation and commissioning."

The user can choose between a DIN rail housing for space-saving installation in a control cabinet or a robust, weatherproof field housing for mounting on a wall outdoors. The Prosonic S/M/T ultrasonic product family is characterised



Prosonic S

radar will not become the single, universal level measurement technology of the future:

by its design, functionality and price. The devices allow for easy planning and installation, quick

Background to methods

Micropilot

■ **Application:** Free space radar level measurement is the safe solution for liquids in extreme process conditions (pressure, temperature) and for outgassing (also aggressive) media. Advancements made with regard to this measuring principle mean that it can also be used in bulk solids, regardless of dust and filling noise.

■ **Functional principle:** The Micropilot uses high-frequency radar pulses which are emitted by an antenna and reflected by the surface of the medium. The travel time (t₀) of the reflected radar pulse is directly proportional to the distance covered (d) and the velocity of light (c) according to the equation $d = c \cdot (t_0/2)$. The measurement frequencies of the frequency spectra used by the radar devices are approx. 6 and 26 GHz.

■ **Benefits:** Non-contact, non-wearing measurement, even in extreme process conditions, measurement not affected by outgassing or dusty media, safe measurement even if different products are used.

Levelflex M

■ **Application:** Level measurement using guided radar pulses is suitable for bulk solids (rope probes) and also for liquids (rod and coaxial probes). The reflected waves are guided safely which means that the surface of the medium is of secondary importance. The different angles of repose or outlet funnels, which occur in the case of bulk solids, do not affect measurement. Measurements taken in the event of turbulent liquid surfaces or where there is foam are guaranteed to be reliable.

■ **Functional principle:** The Levelflex M uses high-frequency radar pulses which are guided along a probe. When the pulses reach the surface of the medium, the characteristic impedance changes, and a portion of the pulse is reflected. The length of time between pulse transmission and reception of the reflected pulse is measured and evaluated by the device and is used to calculate the distance between the sensor and the medium surface.

■ **Benefits:** Safe measurement in bulk solids even where there is heavy buildup of dust, reliable measurement in liquids even in the event of turbulence or foam, easy commissioning thanks to a precalibrated sensor, high availability due to automatic probe monitoring.

Prosonic

■ **Application:** Ultrasound is a proven and cost-effective solution for level measurement in liquids and bulk solids. The devices in this series are available as compact devices or as separately instrumented versions. Easy planning and installation, quick and safe commissioning, a long operating life and reduced maintenance effort are the distinguishing features of this measuring principle. Typical areas of application are abrasive and aggressive media, even in tough ambient conditions.

■ **Functional principle:** The Prosonic family uses ultrasonic pulses which are reflected by the medium surface through the change in density between air and the medium. The length of time between pulse transmission and reception of the reflected pulse is measured and evaluated by the device and is used to calculate the distance between the sensor membrane and the surface of the medium.

■ **Benefits:** Product properties, such as dielectric constant, density or moisture, have no effect, quick and easy commissioning using predefined application parameters, calibration without filling or emptying.

and safe commissioning and can be optimally adapted to the requirements of the measurement task in question. Typical areas of application are abrasive and aggressive media, even in tough ambient conditions. In addition, product properties, such as dielectric constant, density or moisture, have no impact on the measurement.

Custom-made Solutions

Usually, there are two or three different measurement methods which are clearly suited to each application. Endress+Hauser helps its customers to make the right choice and provides simple aids to help with planning and decisions. Custom-made solutions are provided either by the expert field sales force or the Applicator. The Applicator is a package of easy-to-use software tools for defining, selecting and designing the right product for the measurement task in question. In the plan-

ning process, you can choose suitable products and solutions by entering specific application parameters. Different tools are available to support you in your choice of product, and each tool can be used independently. With detailed drawings, diagrams, comparisons of measuring principles and products, the Applicator provides you with a helpful overview of the chosen products or solutions.

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Going With The Times

Change of Engineering Tools from Process Industry's Perspective

The entire European process industry has been subject to radical change in the last years. This change was driven by emerging new markets and aggressive global competitors, by the necessity to buy external services in large scale, by global constraints to technical standardisation as far as possible and by penetration of IT-tools into almost all industry areas. Engineering tools used in process industry have also been heavily influenced by this change, because once they were developed and introduced under totally different circumstances.

In the 1970s and '80s, computer based CAD-drawing systems came up as the first engineering tools in process industry. These systems quickly enjoyed great popularity due to simple reuse of drawing copies and to easy drawing modification functionalities that saved time and money. At the same time, the first engineering tools with databases (DB) emerged in process simulation, in electrical and instrumentation (E&I) and piping engineering. These systems allowed the execution of complex simulation calculations and/or the processing of mass data in piping isometric programs including parts list, in programs for instrumentation wiring diagrams, etc. Certainly many company decisions to introduce such systems were also heavily driven by an "overall IT-enthusiasm" in these days.

Typical characteristics of such systems in these first years were:

- Great bandwidth of engineering content in used systems: Plant specific, project specific, company specific, department specific, engineering discipline specific, personal specific...
- Implementation of specific work standards of individual companies: Almost no pure national technical standards were implemented without noticeable modifications or enhancements; no international aspects were taken into account.
- Market offered only few commercial systems; typically systems of all kinds were in use self-developed or developed per order. In fact, only island-structured systems without interfaces existed.

- IT-platforms were expensive mainframe machines or individual workstations with high cost for development, operation and maintenance. Owner/operator companies did not scrutinize cost-benefit ratios or efficiencies, either
- No direct system accesses for genuine end-users, systems were only operated by specialists.

Real output for end-users were vast amounts of paper printouts, which were rather identical to the time before. Therefore no adaptation or change management problems existed with the end-users. But in the best case these very individual engineering tools only managed to optimise a single engineering discipline in one specific company (fig. 1).

These typical characteristics of the first IT-supported engineering tools reflected the overall business environment of producing companies in those years:

- European/German companies mainly focused on markets in Europe. Therefore their engineering tools were almost exclusively used for planning and maintenance of process plants in Europe.
- There was no noticeable competition by low-cost suppliers.
- Very limited commercial offers on the IT-market created real constraints for process companies to work with own staff.
- Most companies were totally convinced of the absolute correctness of their company's engineering discipline specific philosophies, procedures, standards, etc.

In this environment, no incentives existed for fairly uniform or even standardised engineering tools. But in the end, reality showed a striking similarity concerning the as-built plants of many different, independent companies.

At the end of the 1980s and beginning of the 1990s, demand appeared in process, piping and E&I engineering for project/plant independent, reusable master data (physical properties, pipe classes, seal data, equipment data, etc.) inside the engineering tools. Out of the past, an abundance of master data already existed on paper, but integration and maintenance of these master data in engineering tools turned out to be very expensive.

Typically, proprietary point-to-point interfaces from indi-

Figure 1
CAD-dominated, independent island-structured systems

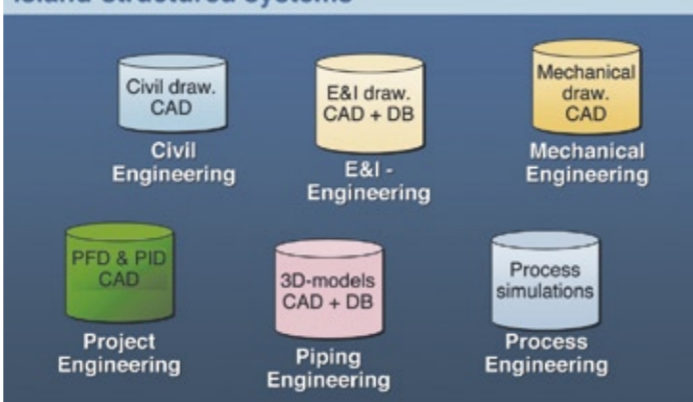


Figure 2
First productive interface chains in owner/operator companies

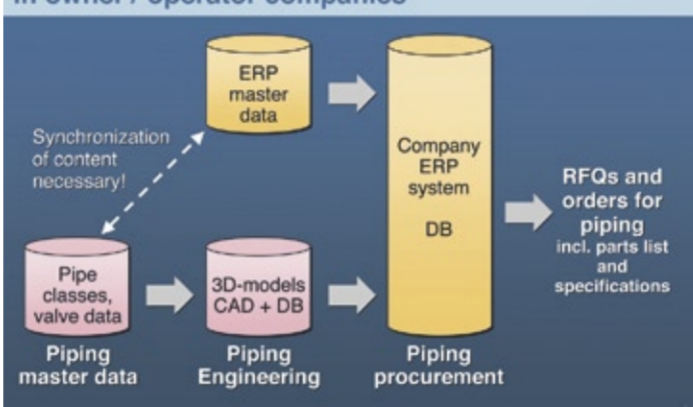
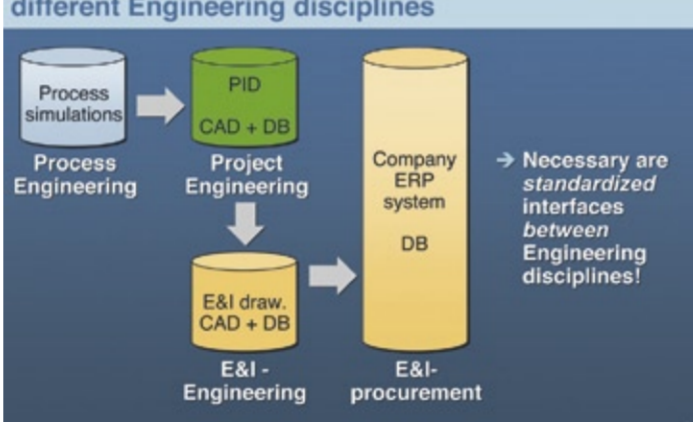


Figure 3
Example for data transfer between different Engineering disciplines



vidual master data systems to individual engineering tools were built up with acceptable bandwidths. More and more end-users worked directly with engineering tools. In owner/operator companies, modern enterprise resource planning (ERP) systems for procurement of technical goods created demand for efficient mass data transfers from far-developed engineering tools to those ERP systems. Besides the pure IT-aspects of those point-to-point interfaces, the necessary synchronisation of master data in engineering tools and in ERP systems had top priority. In most cases, a data overlap with many inconsistencies existed in those

During the 1990s, the process industry was penetrated with workstations and later on with PCs. Company-wide IT-

networks were built up with acceptable bandwidths. More and more end-users worked directly with engineering tools.

In owner/operator companies, modern enterprise resource planning (ERP) systems for procurement of technical goods created demand for efficient mass data transfers from far-developed engineering tools to those ERP systems. Besides the pure IT-aspects of those point-to-point interfaces, the necessary synchronisation of master data in engineering tools and in ERP systems had top priority. In most cases, a data overlap with many inconsistencies existed in those

separately grown-up different systems (fig. 2)

Parallel, synchronised work with engineering tools and ERP systems is a great challenge for each engineering unit in planning and maintenance. In the process industry owner/operator companies all the IT-networks, IT-standards and especially the ERP systems are tailor-made for the necessities of producing companies. Interfaces to main ERP systems are totally dominated by the needs of the producing companies, putting the wishes and requirements of engineering tool users on the back burner. Therefore a minimum basic knowledge on work procedures/sequences of ERP-systems is required from the engineering tools' end-users. In daily work very often many problems are created by this requirement (e.g. by only sporadic users, frequent changes in ERP systems).

At the turn of the millennium great structural upheavals occurred in the overall business environment of process industry. Now the market has focused on the whole world, capital investments in Europe/Germany were deeply declining. All important economic framework conditions of process industry have changed:

- Global utilisation of engineering tools combined with high functionality was required.
- Demand for international system suppliers with global support.
- Implementation of uniform, mostly company independent Engineering standards.
- User constraints to agree on corporation wide, global master data.
- Strong competition in the market by low-cost suppliers.
- Big commercial suppliers agitate in the IT-market, constraints to fix-cost reduction by minimization of work with internal staff.
- Cost pressure (by globalisation and shareholder-value) forces to general standardisation in hardware and software. These changed framework conditions have direct, radical consequences for the engineering tools and the way to work with them:
- IT-platforms are market-standard PC (typically with additional main memory, high-performance graphical cards) based on market-standard operation systems.
- Seamless integration in the predefined IT-environment of producing works / companies is required.

- Minimisation of cost for development, operation and maintenance. Cost benefit ratios and efficiencies are permanently scrutinized.
- As far as reasonable direct system accesses for all genuine end-users, systems not only operated by specialists.
- New In-/Output for end-users: Data files, in addition to paper. Large-scale usage of Internet/Intranet.

- Many end-users are directly influenced in their daily work processes and sequences, very often severe change management problems occur.
- In low-cost countries the actual situation of engineering tools is typically comparable to that in the first years in Europe. But in countries with high labour cost pressure to continuous improvements of efficiency (conservation of competitiveness) does not decrease.
- Minor or medium efficiency enhancements are still possible by continuous improvements of engineering tools and of the work processes within single engineering disciplines.
- Potential for major efficiency enhancements is in standardised data transfer between different engineering disciplines.

The IT-market now offers the first standardised interfaces between different engineering disciplines including revision management, automatic documentation, etc. These standard interfaces are more or less matured and certainly require more improvements (fig. 3).

But usage of interfaces between different engineering disciplines is primarily an organisational task. The objective is an overall optimum for the engineering unit in planning and/or maintenance. Most

important point to achieve this is a common understanding of the inter-disciplinary work processes, which must be supported on work- and on management level. The productive use (i.e. not only for pilot or other special projects) of inter-disciplinary interfaces in day-to-day business is another great challenge for each engineering unit.

During the last 30-40 years, engineering tools in process industry have thus lived through fundamental change with many aspects:

- Change from slide rules and drawing boards to high-performance simulation tools and IT-based 3D-models.
- Change from tools for specialists only to tools for all people involved in planning and maintenance.
- Change from specific tools for individual companies in Europe to standard tools for worldwide usage.
- Change from island-structured tools within companies to tools with inter-disciplinary work processes and constraints.
- Change from "showpiece luxury" tools to day-to-day tools with permanent cost pressure and constraint to efficient work.

In this field of tension, today's engineering tools must keep on proving their worth; respectively they have to be continuously improved. The ruling fundamental framework conditions offer no alternative.

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BASF Begins Two New Plants

BASF broke ground for two new plants in Pudong, near Shanghai in China, which will manufacture polyacrylate polymers and specialty chemicals for leather tanning. The plants will provide customers in the growing Chinese market with a reliable supply of high-quality chemicals. The two facilities are expected to be completed in the first quarter of 2008. Investment details were not disclosed.

The polyacrylate polymers plant will have a minimum

capacity of 30,000 mt/y, while the plant for specialty chemicals for leather tanning will have a minimum annual capacity of 12,000 mt of products in liquid or powder form. A spray dryer with a capacity of 10,000 mt/y is part of the investment. The new plants will be located next to BASF's existing facilities for polyacrylate polymers and leather chemicals in Pudong.

► www.basf.com

Alternative Solutions in the European Alkoxyates Market Needed

Scrutiny of alkylphenol ethoxylates (APEs), which are highly efficient but hazardous, has forced participants to explore new alternatives to existing solutions within the European alkoxyates market. Although alcohol ethoxylates (AEs) exist as a possible substitute, the need for improved and safer alternatives remains.

Frost & Sullivan finds that the European Alkoxyates Market earned revenues of €1,105.1 million in 2006 and estimates this to reach €1,443.5 million in 2013. The biodegradability of alkoxyates is the key factor driving growth in the European alkoxyates market, notes Frost & Sullivan Research Analyst Mahesh Kumar. The adoption of directives that mandate a specified level of biodegradability of products is encouraging the shift from existing solutions to the exploration of safer products.

Alkoxyates based on APEs, which are considered to be the most effective products, have come under heavy scrutiny with directives such as the

2003/53/EC and the Detergent Directive 648/2004, which focus on the marketing and biodegradability respectively, of product varieties. While APE-free solutions are available from most participants, there are certain areas where their effectiveness falters. Consequently, the demand for alcohol ethoxylates and other alkoxyates is witnessing a significant increase, while simultaneously new alternatives continue to be explored.

Moreover, with awareness of ingredient formulations increasing among environment-conscious consumers, the demand for biodegradable solutions is growing. Major participants have evinced inter-



APEs are important to a number of industrial processes, including pulp and paper, textiles, coatings, agricultural pesticides, lube oils and fuels, metals and plastics. Industrial applications comprise 55% of the total APE market.

est in other alkoxyate-based solutions. However, excluding a few, most of the products are in the development stage.

At present, increasing raw material and energy costs, fierce competition, the existing situation of oversupply and the enforcement of regulations are the key factors affecting the business sustainability of alkoxyate manufacturers. Rising crude oil prices are resulting in increased costs of ethoxylation, thereby leading to undue pressure on product price margins.

Large alkoxyate production capacities with limited ethoxylation capacity are impacting product prices, explained Kumar. The increase in crude oil prices has further burdened alkoxyate

manufacturers and end-user industries are unwilling to accept the price rise. Given this situation, well integrated participants are better positioned to compete in the market, even as other manufacturers are striving to sustain their business profitably.

Strong customer relationships in this low product differentiation market, coupled with vertical integration can help minimise the negative impact of various external factors. Customer-oriented product and service offerings can also be considered as a long-term strategy for active manufacturers to sustain business while consolidating their market position.

Innovative and strong customer-based services, as well as continuous product development can help to overcome market aberrations. This requires long-term vision and an investment strategy to build on infrastructure which will help to consolidate market position.

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The Digital Petrochemical Plant

What Will it Mean to You?

The advent of the digital petrochemical plant has been driven by the recent change in focus from plant optimisation to business optimisation. It is a strategy that focuses on managing the performance of a group of sites or plants. Currently, petrochemical plants are responding to the business optimisation trend by considering key challenges and managing a set of key initiatives. Many have discovered that their managers and workers spend 60–80% of their time looking backwards at historical information.

They have also discovered that real time information is overwhelming in quantity, but not actionable. As a result, much time is spent reacting to problems instead of anticipating them. This situation is a barrier to both increased business speed and productivity.

Two Key Tensions

Invensys has studied plant operations for 15 years and has identified two key tensions within organisational behaviour that must be well managed in order to achieve business optimisation.

The first of these tensions is between operators and maintenance companies. Most maintenance organisations are managed in a way that maximises plant availability for a reduced maintenance cost. However, most operator teams are managed in a way that maximises utilisation, for example throughput and yield. There is a natural tension between these two.

The second point of tension comes between the demands of plant floor operations and those of the business. The business side, for example supply chain management and marketing, does not have sufficient insight into the operations capability to make optimal decisions. At the same time, the operations side does not have sufficient insight, or time, to consider the near future.

Attempted Solutions

Many petrochemical plants have attempted to address these tensions by installing software applications that automate key operations and maintenance functions. But too often

these installations have evolved into separate architectures for operations and maintenance. As a result, they do not help to manage the tensions.

A better approach is to evolve the software architecture to coordinate the information requirements of both operations and maintenance – for assets both large and small. In this three-level approach, the Plant Business Control provides focus at the business level, while Plant Operational Control provides focus around equipment or sets or groups, and Asset Management is the focus at the field devices/equipment level. In this arrangement, each level has a better organisation of information that describes requirements and capability, and provides actionable information.

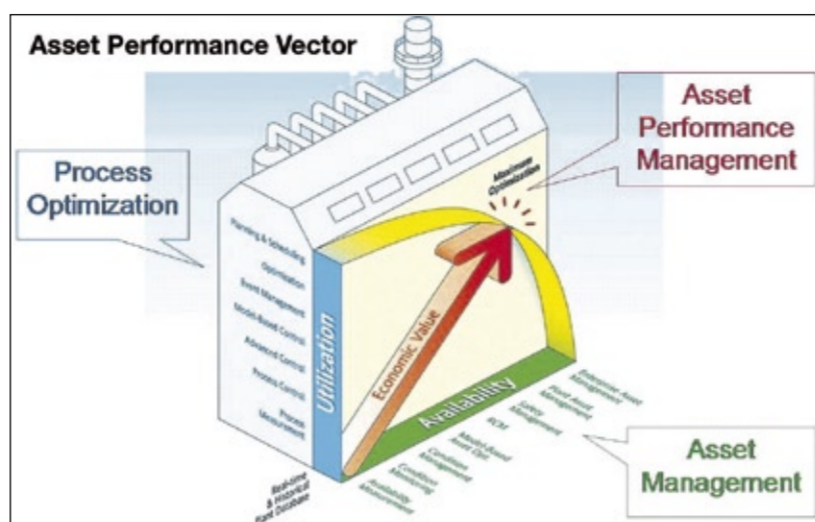
Since 1991, Invensys has developed, patented and implemented a real time financial performance calculation based on the results of interviews with over 1,400 executives and managers. This has evolved into a means of calculating an effective measure of performance that addresses the tensions described above. This calculation applies to all three levels of assets and is called the Asset Performance Vector (see diagram).

Although there are other key performance variables, availability and utilisation interact closely and are fundamental contributors to them. Each piece of equipment or asset exhibits different interactions and therefore the shape of this curve will be different for each. The important aspect of this calculation and its visibility is that the “right” combination varies with the business situation.

Maximising one of these sub-optimises the other. In most cases, maximising utilisation diminishes availability to the extent that the asset must be overhauled more often and is less reliable. However, maximising availability reduces the contribution of that asset, and as a result, its utilisation is unacceptably low. And short-term business situations often require a temporary preference of one over the other. In a petrochemical plant, teams encounter a period of time where maximum throughput is required, followed by a period of minimum throughput/maximum efficiency and variations in between.

Enabling the Digital Petrochemical Plant

So how can the digital petrochemical plant achieve this? It requires a more comprehensive and a different



approach than the common combination of office information systems and plant control and information systems.

Invensys has defined and introduced the world's first Enterprise Control System (ECS) with a set of software products called InFusion. It integrates and transforms information and its behaviour among the common control and information systems.

In this arrangement, the enhancement of data quality and the conversion into actionable information is highly automated. The asset performance vectors for all types and groups of assets are calculated by the Real-

time accounting function in the left side of the diagram.

Existing plant information systems (MES for manufacturing execution systems) are incorporated and augmented by the ECS MES, which drives the adaptive and proactive access to information, and supports decisions by supervisors and specialists. Business systems, where SAP is most popular, are integrated with an Invensys application certified by SAP and which supports the standards of ISA 95 and Open O&M.

Additional sensing and integration of mobile onsite personnel is managed by ECS Automation, which pro-

vides a uniform governance of diverse standards and connections within the intentionally separate process control and office information domains. The ECS technology exploits the latest Microsoft .NET and Office technology, which means that desktop applications can be integrated in a way that is secure, private and robust.

The Implications For You

Digital petrochemical plant introduces increased performance, but also requires increased governance. Its benefits include:

- increased productivity by engaging specialists only at the right time, wherever they are, and by engaging others with actionable information, using the next step in visual management;
- the flexibility of using other teams within the company and external contractors;
- a consistent improvement from reacting with varying success to being proactive and spending more time on continual improvement.

There are also challenges:

- operating with more visibility to stakeholders and peers, which includes exposing performance shortfalls;

- management of access and privacy;
- change management – guiding teams to trust the information, trust themselves and trust others;
- and information ethics and law – adapting the strategy to organisations and host governments who have policies that may restrict the access to information.

But the advantages of the digital petrochemical plant far outweigh the challenges. One major U.S. ethylene producer incurred 96 nuisance trips during a period of four years, mainly due to coordination challenges in responding to the increased speed of business. The company changed its response approach and over the following four years saved US-\$229 million in improved protection from process hazards and nuisance trip avoidance – with only one nuisance trip during a period of four years – a 96-fold improvement. There is no doubt that the benefits justify the challenges of change.

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DIN Standards for Water Pressure Pipes



The German standards for polypropylene (PP) pressure pipes were revised in 2006. The designations PP-H100, PP-B80 and PP-R80 were withdrawn as they did not reflect the required behaviour at elevated temperatures and were changed to PP-H, PP-B and PP-R. Also, pioneering PP-RCT has now been officially recognised as a category under the new German standards DIN8077 and DIN8078 for PP pressure pipes. The creation of a new PP-RCT class means that these solutions can now be tested according to a widely accepted quality standard.

According to EN ISO 1043 designations, PP-RCT is a PP random copolymer with special crystalline structure.

This structure gives improved pressure resistance particularly at elevated temperatures, offering more than a 50% improvement in long-term strength at 70°C over 50 years compared to standard PP-R materials. As a result, pipes based on this material can be produced with thinner walls thus with a larger internal pipe diameter, delivering a range of benefits to the plumbing industry and homeowners.

A wider internal diameter gives pipes a higher hydraulic capacity, thus benefiting systems distributing large volumes of water, such as in high-rise buildings. The capacity increase can also serve to overcome the problem of low water pressure from a supply network.

Environmental and cost-saving advantages can be generated for both extruders and installers. Thinner wall pipes allow for higher extrusion speed with reduced material usage, while a higher percentage of smaller pipes leads to smaller insulation, fittings and faster installation times.

► www.borealisgroup.com

Lubrizol to Expand Presence in China

The Lubrizol Corporation will expand its presence in China by investing approximately US-\$40 million to build a facility in Songjiang, just outside of Shanghai. The new facility will include manufacturing, commercial and technical capabilities. It will be built on approximately 31,000 m² recently acquired land adjacent to the

company's existing (thermoplastic polyurethane plant in the Songjiang industrial zone. The company expects to begin construction in the third quarter 2007, and to complete it in the fourth quarter 2008. Future plans for the site could include adding other laboratories and production lines.

► corporate.lubrizol.com

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The Great Challenge

Power Plant Business and Technology Today

The requirements for fossil-fired power plants have changed considerably over the past 20 years. Where fossil-fired power plants in the 1970s and '80s were characterised by steam power plants in base load operation with coal and oil fuels, and gas turbines were used only infrequently and then in peak load operation, the requirements have now changed, with combined-cycle power plants (gas turbines coupled with steam turbines) becoming established internationally over the past 20 years.

Scenario analyses indicate that fossil-fired power plants can be expected to still make up the larger part of our power generation in 2020 based on further development of fuel prices (fig. 1).

Based on the higher availability of natural gas, the increasing demand for combined-cycle power plants arose primarily due to demands for short licensing and construction times, low investment costs, low pollutant emissions without supplementary flue gas cleaning, as well as demands for high cost effectiveness and short amortization times. Development was further accelerated by a change in customer structure in the global market from the classical state-owned utilities to more competitively oriented private companies.

Based on the above scenario analysis, natural-gas fired power plants will by 2020 then account for a fraction of power generation ranging from a minimum of 18% to a maximum of about 50%, depending on expected gas prices.

However, steam power plants, especially those fueled by coal, retain their significance with a fraction of 22–36% in all scenarios. This is especially the case in those countries which are unable to adequately cover their electric power requirements in a cost-effective manner with natural gas despite expansion of the pipeline network and which also have sufficient coal reserves which can be exploited at low cost.

With increasing natural gas prices, power plants fired with imported coal have also again become much more competitive for some locations in Germany close to major shipping lines.

Whether this trend will continue in the form of a renaissance for coal-fired steam power plants also depends greatly on developments in fuel prices for oil and natural gas, CO₂ certificate prices and the competitiveness of innovative power plant concepts such as IGCC (combined-cycle power plants with integrated coal gasification) and high-temperature steam power plants (700 °C).

Fossil-fired Power Plant Technology

The following section describes the most important technology demanded and implemented today in Europe for

power generation. So as not to go beyond the given scope, this is restricted here to concepts which:

- Use fossil fuels,
- Cover base and intermediate loads,
- Permit large unit output levels (more than approx. 300 MW) and
- Are intended exclusively for electric power generation.

These concepts are coal-fired steam power plants, natural-gas fired combined-cycle power plants equipped with gas and steam turbines and power plants with integrated gasification (IGCC).

Steam Power Plants

A distinction must be drawn between steam power plants with sub critical and supercritical steam parameters, this depending on the steam parameters upstream of the high-pressure and intermediate-pressure turbines. The critical point for water is at a pressure of about 220 bar, beyond which there is no more difference in density between the liquid and vapor phases and these cycles can only be operated in a once-through system (e.g. Benson). Typically, power plants with steam parameters above 250 bar/580 °C are designated as.

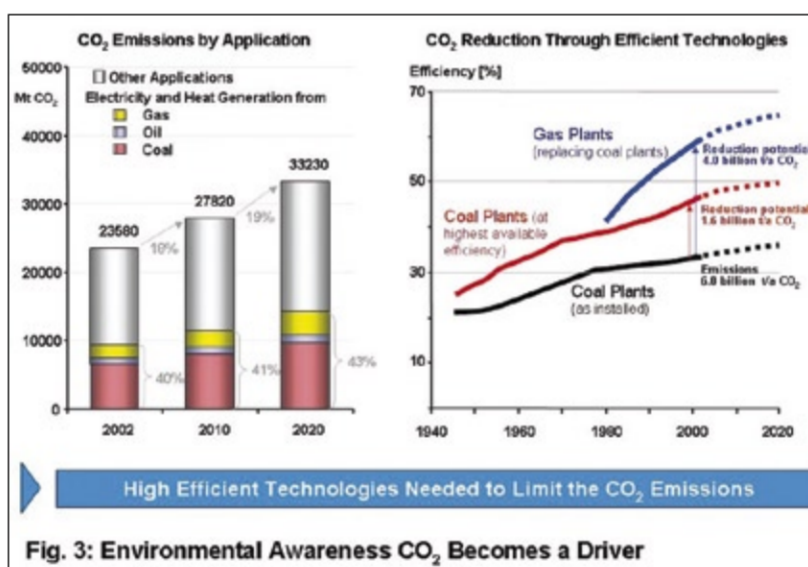
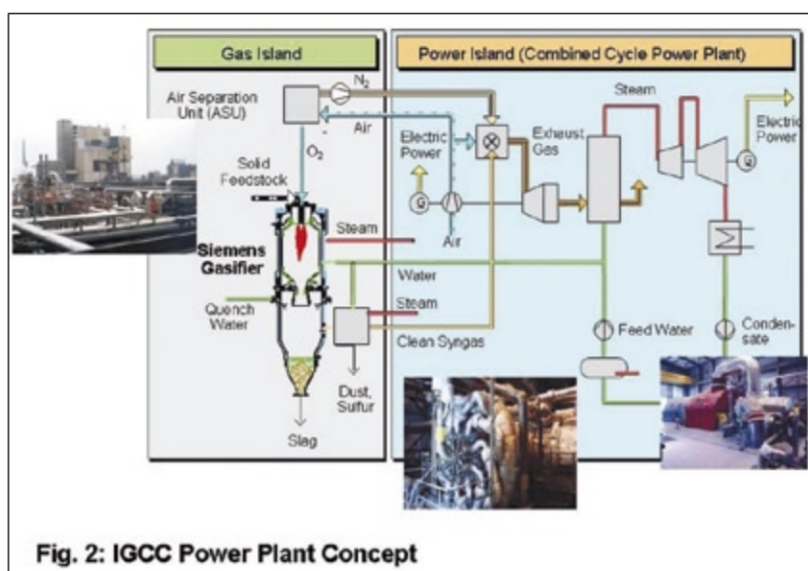
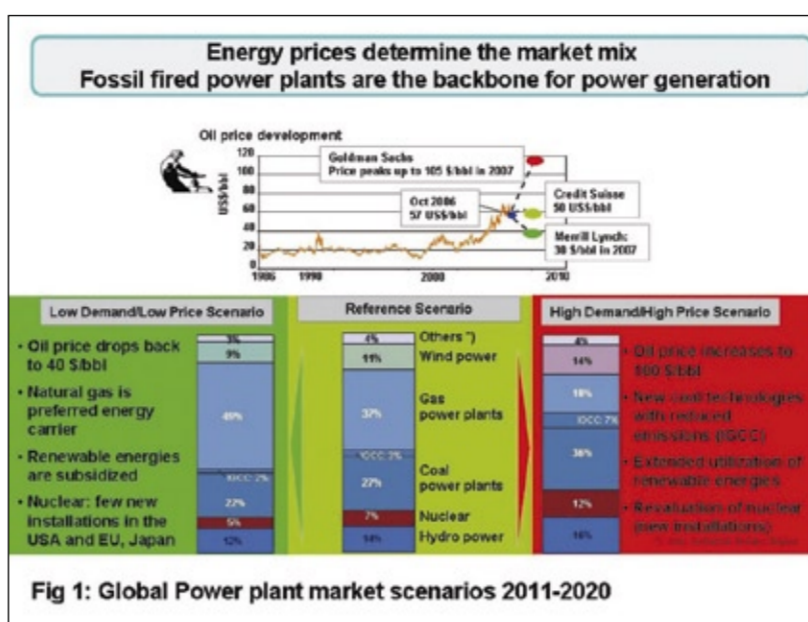
A typical value for the energy efficiency of a steam power plant based on heating value (800 MW unit, hard coal, condenser pressure 0.04 bar) with sub critical steam parameters (167 bar/540 °C/560 °C) is about 42%. Supercritical steam conditions must be selected for higher energy efficiencies. Today, efficiencies of about 46% can be achieved with supercritical, also sometimes called ultra-supercritical steam parameters of 285 bar/600 °C/620 °C under the same boundary conditions.

High-efficiency steam turbines form the basis for effective use of the energy in the fuel in all significant new power plants worldwide. Advances in turbine development (such as 3-DS blading, reduced gap losses, titanium end stages) have further contributed in recent years to significant further improvements in efficiency and reduced footprint.

Higher steam parameters (main steam pressure and temperature, reheat temperature) enable higher efficiencies for the overall system. Research projects are currently in progress in Europe with objectives of a main steam temperature of 700 °C and corresponding efficiencies of >50% and thus also a significant reduction in CO₂ emissions. However, limiting factors here are availability, creep resistance and materials costs for the high-temperature area, which have not yet been adequately investigated.

Combined-cycle Power Plants

Remarkable advances in gas turbine technology have enabled increases in net energy efficiency based on lower heating value over the last 50 years



to current levels of over 58%; efficiencies of 60% are currently being implemented. The combination of low investment costs, extremely high efficiency and moderate fuel costs in the past have made this concept a commercially successful power plant type. Whereas combined-cycle plants were previously designed for base-load operation at low natural gas prices, the current emphasis is on flexibility and the possibility of use as an intermediate load power plant.

Increased natural gas prices and requirements for low CO₂ emissions

increase the pressure to further increase efficiency. The development objective to be achieved by 2020 is for net efficiencies exceeding 62% based on the lower heating value of the fuel.

The high operating flexibility and environmental compatibility of combined-cycle power plants is a clear competitive advantage of this technology. In the deregulated markets it has crystallised that startup time from a hot or semi-hot condition (following night or weekend standstill) is a key criterion for efficient opera-

tion, as high-priced market peaks can thus be better served and total plant operation can be configured more profitably.

Innovative solutions (e.g. FACY from Siemens PG) were developed for this purpose, enabling a significant reduction in startup time from night or weekend standstill for a 400 MW combined-cycle plant.

These measures have since been implemented in Siemens cycling-plants in Europe. Results in operation confirm the preliminary estimate of a reduction in startup time to considerably less than 40 minutes, or increased service life of the steam-path components (in plants with a Benson boiler) with a corresponding commercial advantage.

All Electric E-LNG Concept

A new development derived out of CC-power plants is a concept for a power plant supplying power to a LNG compression facility which is equipped with large electric variable speed drives instead of gas turbines driving the gas compressors.

This concept, highly integrated between the power plant side and the compression side allows a much higher availability of the total compression solution and therefore a higher operational efficiency of the LNG production facility. Studies have shown that a combined cycle power plant with some adaptation to the flexibility is best suited to serve the need of such LNG production facility. Driven by the demand of natural gas in high load centers (e.g. US), there are major exploration programs under way which requires these more cost efficient power plant concept.

IGCC Power Plants

With diversification and the availability of natural gas, coal will continue to be a significant primary energy source worldwide which must also face the continuously stiffer requirements for cost-effectiveness and environmental compatibility in use as a power plant fuel. An alternative to the steam power plants introduced is the use of coal as the fuel in so-called integrated gasification combined-cycle plants (IGCC). In this configuration, a syngas generation system with corresponding cleaning stages is integrated upstream of a combined-cycle process. Such plants are capable not only of using coal as a fuel, but other fuels such as biomass, petroleum coke, Orimulsion, heavy refinery residues or waste can also be used (fig. 2).

In addition, this concept not only offers the possibility of very clean use of coal at current maximum efficiencies of 47% and in the future about 55%, but also the possibility of producing fuels and starting materials for the chemical industry from the synthesis gas (polygeneration). All of these are prerequisites for becoming more independent of highly fluctuating natural gas and oil prices and unreliable sources and to further exploit the adequate

existing global coal reserves over the long term.

Paths to the CO₂-free Power Plant

Of course, the long-term objective is also to further increase efficiency and environmental compatibility of power plants. The developments initiated today are to no small extent also driven by the consequential costs of increased CO₂ emissions and the set requirements for CO₂ reduction (fig. 3). Alternatives which are currently under investigation and which could supplement the portfolio of power generation plants over the next 10–20 years are as follows:

- Steam power plants with temperatures of 700 °C, opening the door to an efficiency exceeding 50% net.
- Combined cycle plants with increased turbine inlet temperatures, optimised gas turbine cooling and improved plant technology. The objective is efficiencies exceeding 62% net.
- IGCC plants with efficiencies of 47% net already achievable today and a further potential of eight percentage points.
- In addition to improving the environmental compatibility of power plants by increasing efficiency, the current focus is now also on methods which force improved environmental compatibility with the separation of CO₂.

Three different CO₂ separation methods are being discussed and investigated:

- Separation under pressure before combustion of the fuel in a gas turbine, such as in an IGCC plant (pre combustion capture).
- Separation after combustion, e.g. downstream of a conventional boiler in a steam power plant or downstream of a gas turbine (combined cycle plant) under atmospheric conditions (post combustion capture).
- Separation after combustion in pure oxygen (oxyfuel processes). Although this is strictly also separation after combustion, this can be implemented by "simply" condensing out the water fraction due to the lack of a nitrogen fraction in the fuel gas.

The environmental problems already recognisable today show that the implementation of these possibilities must be spurred on. This is currently supported by increased research efforts both in the EU and internationally, with the first major projects for industrial scale demonstration of these technologies in Europe and the U.S. announced for the next 10 years.

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Exxon Mobil Plans 20 Projects Through 2009

Exxon Mobil Corporation said it expects to start up more than 20 new global projects in the next three years that, at peak, are expected to add 1 million oil equivalent barrels per day to ExxonMobil's base volumes. The project inventory at year-end 2006 is expected to develop 24 billion oil-equivalent barrels net to ExxonMobil.

Chairman and CEO Rex Tillerson noted that ExxonMobil's financial strength, technological expertise, and superior resource base allow it to meet the challenges of today's increasing demand for energy while delivering industry-leading returns.

"Market and geopolitical forces continue to shape the environment in which we oper-

ate," said Tillerson. "Our view of what it takes to be successful in this industry has not changed. It requires consistency, integrity, discipline, reliability and ingenuity. ExxonMobil has these qualities in abundance."

www.exxonmobil.com

Air Products Completes Expansion

Air Products said it has embarked on a major expansion of its China Technology Centre in Shanghai to support the fast-growing businesses in Asia. The expanded centre will further complement Air Products' regional technology centres in Japan, Korea and Taiwan. The expansion, built on space adjoining the current facility, has a high bay equipped with two high-pressure polyurethane machines and accessory tools for both rigid and flexible applica-



tions that supplement the existing shoe sole capability. Two spray booths, aqueous and non-aqueous, will be used for spray coating development. The new

space also features a general-purpose lab with additional fume hoods, expanded chemicals storage areas and associated office space to provide new application and product development, technical services, process R&D and in-region analytical to support all businesses including Gases, Performance Materials and Electronics.

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Back On The Map

ECSPPP Wants to Bring More Chemical Investment to Europe

European Chemical Site Promotion Platform (ECSPPP), which was formed in September 2005, is an organisation that is active in the promotion of Europe as an attractive region for new chemical investment. Now officially a registered European association, ECSPPP is looking to increase its membership and raise awareness of what Europe has to offer as an investment location. The organisation is also strengthening its links with other well-established European institutions, including the European Chemical Regions Network (ECRN), the European Petrochemical Association (EPCA) and the European Chemical Industry Council (Cefic). Brandi Hertig Schuster spoke with Peter Anderton, President of ECSPPP and former business development manager for the Port of Rotterdam, about his organisation's plans for Europe.

CHEManager Europe: Mr. Anderton, what are ECSPPP's short- and long-term goals?

P. Anderton: For the short term, we want to raise our visibility within the chemical industry and towards our three main

target groups. The first would be potential members. However, we are also naturally targeting the investment community, because we want to see more investment coming to Europe. We are also looking at other potential strategic partners.

Our long-term goal is expressed in our slogan, "Putting Europe back on the chemical investment map." A lot of our efforts will be aimed at changing perceptions about Europe as a place for chemical investment. We believe that particularly in the chemical industry outside Europe, there are still some misconceptions about Europe as an investment location. This is an issue we want to redress by going out and explaining what Europe has to offer.

What are these misconceptions and what has happened over the years that Europe needs to be put "back on the chemical investment map"?

P. Anderton: When I was with the Port of Rotterdam, I heard things during conversations with potential investors that did not reflect the real situation in Europe. Some people still seem to have the impression that it's very bureaucratic and complex to invest here and bogged down by things like regulations, problems with trade unions and so on. These views are relics of the past. Today's Europe provides a welcoming business cli-



mate which offers the chemical investor many positive things.

We've noticed a clear shift of investment towards other areas of the world over the past few years, such as to Asia and the Middle East. We are concerned that Europe is being overlooked to some extent, and we want to make sure that investors are correctly informed about the opportunities in Europe when they look at potential locations for their next chemical plant.

What are the advantages for chemical sites in Europe?

P. Anderton: Things like co-siting, outsourcing of non-core operations and sharing site services are widely practised here in Europe, and this creates a

number of excellent opportunities for investors. Europe is also very strong in other areas such as logistics, infrastructure and operational safety. The European market is not growing at the same rate as Asia in relative terms, but in volume terms, the growth is stronger. This is something that tends to be forgotten sometimes. Markets in other parts of the world can also be accessed easily and economically from European locations.

What other areas in the world would you consider to be competition to Europe?

P. Anderton: The main investment drive is focussed on China, the rest of Asia and the Middle

East. Europe is obviously in competition with those areas for new investments.

How can Europe compete with other areas of the world in terms of cost?

P. Anderton: Europe has always been able to compete with the rest of the world in terms of overall cost. Today, the only area where Europe has a relative competitive disadvantage is in raw materials, particularly when one makes a comparison to the Middle East. However, Europe compensates for that by being able to offer competitive features in other areas such as clustering. The concept of chemical clusters or industrial parks is very widely practised here; Europe leads the world in the number of chemical clusters. By operating within a cluster, chemical producers are offered great opportunities to achieve significant savings in terms of investment and operating costs. This more than compensates for any disadvantage Europe may have on the raw material side.

How do you intend to achieve membership expansion within Europe?

P. Anderton: We are launching a pro-active recruitment drive. We have a database of organisations that we feel could be potential members of ECSPPP. In addition, we are also going to

introduce a new class of members into ECSPPP, namely associate members. These will be supply organisations and service providers who would also benefit from new investment coming to Europe, but who, unlike full members, are not primarily managers of chemical sites. This would include companies like logistical service providers, industrial gas suppliers, engineering contractors and so on.

What criteria are there for recruiting chemical sites for membership?

P. Anderton: It's very simple: To become a full member of ECSPPP, they have to be an organisation located in Europe which manages a chemical site or cluster, which has land available for expansion and which is keen to attract new investors to their locations.

ECSPPP has recently strengthened its ties to the EPCA. What will this mean for your organisation and its members?

P. Anderton: In the long run, we both have the same underlying objective, and that is to ensure that the European chemical industry flourishes. Because the organisations come from different angles, we can work together to complement each other's perspectives and knowledge. This will, in turn, strengthen both organisations.

We are currently participating in two EPCA Think-Tank projects on supply chain practices in chemical clusters. By participating in such projects, we can also ensure that our members' interests are taken into account.

What can you tell us about other partners?

P. Anderton: We have recently set up a strategic partnership with ECRN. We're cooperating in a number of areas and we're looking at topics we would like to explore together. We are sending representatives to each other's meetings to develop an understanding about where each organisation is coming from. We also feel that we can assist ECRN in its activities for the EC's 2007 High-Level Group on Chemicals project.

What projects are you currently working on with Cefic?

P. Anderton: We have started a dialogue with Cefic. They are setting up a high-level advisory group on chemicals this year, which will provide input for the EC's project. We are also discussing how we can assist them in their sectoral projects, particularly in those areas where our members have special expertise such as infrastructure, logistics, energy and feedstocks.

► www.ecspp.org

UPDA Acquisition of Oil and Gas Leases in Kansas

The Universal Property Development and Acquisition Corporation (UPDA) has executed a letter of intent to acquire oil and gas leases covering approximately one million acres in Kansas (U.S.). While these natural gas leases are not limited in depth, the acquisition will establish UPDA as one of the largest coalbed methane developers in the state of Kansas.

Approximately 113,000 of the acres to be acquired are located on the Bourbon Arch, a northern extension of the Cherokee Basin. Included are four active production batteries spanning across the Bourbon Arch and defining a 12 mile long project area. Completed intervals range from 400 to 1000 feet deep, with production gathered and handled at facilities common to each area. UPDA intends to establish an aggressive drilling program in this area, completing a minimum of 100 wells

within the year. In addition, UPDA will extend the gathering system and pipeline in order to efficiently bring the production market.

"Coalbed methane is the natural gas that lies trapped in coal seams at shallow depths. It is different from other resources because it is both generated and stored within the coalbeds themselves. It also is an attractive resource because it occurs within coal, which is the most abundant fuel in the United States," said Patrick Leahy, associate director of geology for the U.S. Geological Survey, at the congressional briefing. "Coal acts like a sponge, storing six times the volume of natural gas found in

conventional reservoirs," Leahy explained.

"Coal underlies the eastern quarter of Kansas, in both the Cherokee and Forest City basins," said Larry Brady, geologist, Kansas Geological Survey. The region is blessed with as many as 17 separate coal seams, ranging in depth from the surface to 2,000 feet. However, they do not attain the tremendous thicknesses that are common in the Rocky Mountain basins.

The typical Cherokee Basin well is drilled on 80-acre spacing. Sustained initial production rates vary from 10,000 to 150,000 ft³/d, and water production will kick off at 10 to 70 barrels per day per well. As the

wells are dewatered, gas production increases. The water is pumped into disposal wells, usually in the Arbuckle Formation. According to the Kansas Geologic Survey, the average coalbed-methane well in south eastern Kansas can produce 60 million ft³ of gas during a two-year period.

In addition to the 113,000 acres in the Cherokee basin, UPDA intends to acquire rights in the Forest City Basin, including leases totalling 766,000 acres, dozens of well bores, surface equipment, gathering and surface facilities, as well as all geological, engineering, land and accounting data and records relating to this property. These leases are generally long term in nature, allowing UPDA to schedule a secondary drilling program upon completion of the program in the Cherokee Basin.

► www.universalpropertydevelopment.com
► www.kansas.gov



Eisai: Manufacturing Subsidiary

Eisai has established its pharmaceutical manufacturing subsidiary Eisai Manufacturing Ltd. (EML) in Hatfield, UK. EML is owned by the company's European regional headquarters, Eisai Europe Limited.

EML, which is the company's first manufacturing facility in Europe, shall function as the core base of quality assurance and supply chain management for the Eisai's European operations. Establishment of a manufacturing base in Europe aims to enhance Eisai's global supply chain, ensuring the Company's commitment to a stable supply of safe and high-quality prod-

ucts across Europe. In addition, EML will be recruiting manufacturing/quality assurance experts by the targeted operation launch in fiscal year 2008.

According to the company, Eisai has been rapidly expanding its European operations with the planned construction of the European Knowledge Centre. Located in the pharmaceutical cluster to the north of London Hatfield, the Centre shall consolidate Eisai's all key value chain components in the entire region, including headquarters, discovery & clinical research, production, and marketing.

► www.eisai.com

Mitsui Chemicals Opens in India

Mitsui Chemicals opened a liaison office in New Delhi, India. This office is the first local stronghold for MCI, which will support the market development of its Elastomers business, as well as conduct market research, market development support and on-site study of In-

dia. The office belongs to Mitsui Chemicals Singapore, Ltd., a 100% MCI subsidiary based in Singapore. Mitsui Chemicals Singapore, Ltd. will be renamed as Mitsui Chemicals Asia Pacific, Ltd. in April.

► www.mitsui-chem.co.jp/e

ExxonMobil: Polymers Centre

ExxonMobil Chemical has opened its new Polymers Automotive Applications Centre in Kawasaki, Japan. The applications centre will support its polymers portfolio, including specialty elastomers such as Santoprene thermoplastic vulcanizate (TPV), polypropylene compounds, and other specialty polymers. The new applications centre is located at the site of Tonen Kagaku K.K., an affiliate of ExxonMobil Chemical.

► www.exxonmobilchemical.com

Movianto Boosts Capacity

Movianto, a Europe-wide logistics service provider for the pharmaceutical and health-care industry, has extended its warehouse capacity in Ireland and the Czech Republic by constructing two new warehouses. This has increased pallet capacity in Ireland from 5,000 to 12,000 spaces and in the Czech Republic from 3,000 to 10,500 spaces.

Construction of the new warehouses at Greenogue, close

► www.movianto.com

Albemarle: Chinese Technical Centre

Specialty chemicals maker Albemarle has opened a new Technical Centre and broke ground on a phosphorus flame retardant manufacturing plant at the company's first wholly owned site in China.

The technical centre houses polymer and flammability testing laboratories and administrative offices for Albemarle's

Asia Pacific customer technical service team, which currently assists users of Albemarle's flame retardants for polyurethane foams and thermoplastic polymers, and users of Albemarle's antioxidants for polyolefins. The site also may serve as a new product development center for polyurethane foam flame retardants.

Albemarle began construction on its 67,000 m² site at the Nanjing Chemical Industry Park in December 2005 and opened a polyolefin catalyst repackaging facility in May 2006. The flame retardant plant is scheduled for mechanical completion in the fourth quarter of 2007.

► www.albemarle.com



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Singapore – Asia's Chemicals Hub

Opportunities Abound Amidst Asia's Growing Need for Energy

It is a bit of an anomaly that Singapore has achieved international standing as a key player in the chemicals industry, despite the fact that it does not have any oil or gas resources of its own. Today, it ranks amongst the top three global centres for oil refining, and oil trading and price discovery; it is one of the world's top 10 petrochemical hubs, and top three bulk liquid ports. It is also home to eight of the top 10 flavours and fragrances companies globally.

But is growth sustainable? And what opportunities are there for chemical companies in the republic, especially those from Europe?

According to the Singapore Economic Development Board (EDB), the country's one-stop investment promotion agency, the chemicals cluster has exhibited strong growth with a compounded annual growth rate of 20% since 2000. Its manufacturing output jumped 12% from a year earlier, to exceed US-\$48 billion. Part of the manufacturing sector which drives the country's economy, the chemicals cluster is made up of the oil and gas, petrochemicals and specialties sectors. It is today one of the largest contributors to the country's manufacturing sector.

The agency points to a burgeoning Asia, an area widely expected to be the fastest growing region in the world over the next few decades, escalating need for energy and rising consumerism for the optimism. Therefore, Singapore is further fuelling its growth by moving towards a more diversified chemical industry and higher value-added downstream activities as it takes steps to strengthen its base.

A Trusted, Connected Exchange

Located in the heart of a rapidly developing Asia, the city-state makes the most sense as a base for companies which want a piece of the action.

For foreign chemical companies like those from Europe, the U.S., Japan or the Middle East, the city-state offers various key advantages – its container ports are well-connected and efficient, it has the world's top three bulk liquid ports, and its growing network of free trade agreements enhances market access to many countries and regions.

In terms of government policy, the country has received accolades affirming its pro-business environment – such as being the world's most competitive, as well as the easiest, place to do business, robust intellectual property (IP) regime and sophisticated manpower capabilities. Its holistic approach to developing the industry has spawned ecosystems within which related industry players interact in synergy with each other.

Strong Foundation Built over Decades

Lying at the south-western tip of the country, Jurong Island is the nerve centre of the chemicals cluster. It is home to over 90 companies engaged in a range of manufacturing activities in petroleum, petrochemicals, specialty chemicals and supporting industries. Adhering to a holistic approach, the island's dedicated environment spans infrastructure, integration, connectivity, capabilities, and security.

The integrated approach benefits everyone. Physical proximity means that chemical products and raw materials can be conveniently traded among companies, while shared third-party utilities and services translate to cost savings. The plug-and-play infrastructure includes a chemical logistics park, multi-layered security framework and one of Asia's biggest oil and chemical storage capacities. Work has begun on new underground rock caverns which will add as much as 23% storage space when fully developed.

The strategy of integration means the government has been placing as much emphasis on the software of manpower as it has hardware. Sited on Jurong Island is the unique

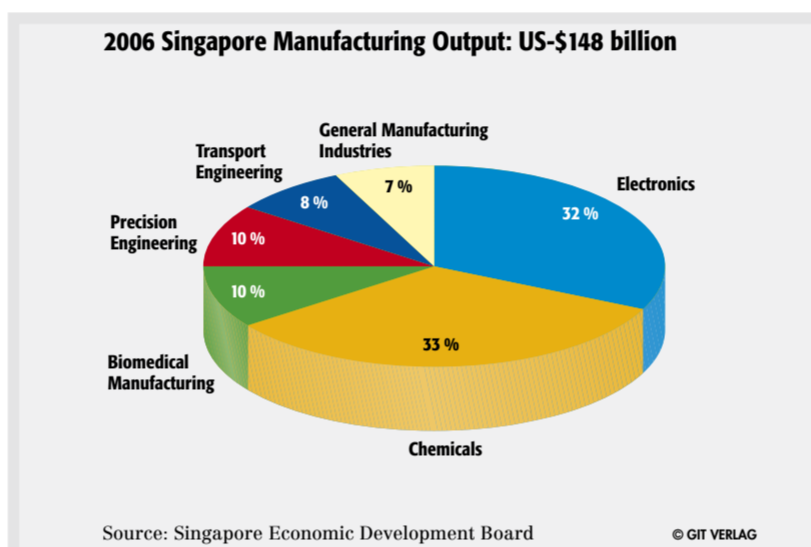


Jurong Island: the centrepiece of Singapore's chemical industry and home to more than 90 companies from all over the world.

Chemical Process Technology Centre (www.cptc.edu.sg), a fully operational "live" plant dedicated to building up manpower competencies needed by the growing chemical industry. Likewise, the similarly-located Institute of Chemical and Engineering Sciences (www.ices.a-star.edu.sg) is focused on

Taking it to the Next Level

With this foundation, companies big and small, new and existing, have been constructing more facilities and anchoring key operations here. In 2006, fixed asset investments in the chemicals cluster rang to the tune



improving the science and technology base by providing highly trained R&D manpower, and to develop technology and infrastructure to support future growth.

of US-\$1.7 billion, up 30% from the year before.

The latest addition is Shell Eastern Petroleum's investment in a world-scale ethylene cracker and mono-

ethylene glycol (MEG) plant, which will provide crucial raw materials for downstream players in Singapore. This multi-billion dollar project is the company's single largest outlay in Singapore to date.

Singapore is also hoping to hear from ExxonMobil on another world-scale steam cracker and derivative units to be integrated with its existing refinery and chemical plant in the near future. Should ExxonMobil decide positively for Singapore, it will, together with Shell's new cracker, catalyse a wave of new projects that will double Singapore's chemical output.

Seeding New Firsts

With Singapore's reputation for the respect of IP and its strengths in implementation, it is gaining ground as a partner for companies to debut their key technologies.

British firm Lucite International will be implementing in Singapore its new alpha technology for methyl methacrylate (MMA) for the first time, testifying to Singapore's ability to help bring new technology to market. Mid-way across the globe, Japan's Sumitomo Chemical is also building a similar MMA facility on Jurong Island. Together, both companies will enable Singapore to account for 10% of global MMA capacity and propel Jurong Island to become Asia's leading site for MMA production.

In Shell's plans already underway, it will also be implementing its proprietary OMEGA (Only MEG Advanced) technology in the new MEG plant. The OMEGA technology is touted to be the most efficient technology currently available in the world to convert ethylene to MEG.

If this trend continues, Singapore will be expected to play host to other first-in-the-world technologies and know-how from companies worldwide.

Creating New Knowledge

Looking beyond the horizons to meet the challenges of global markets,

Singapore has aligned its strategy to focus on developing a knowledge economy, with R&D playing a key role.

Already, technology and R&D drive the country's economy as well as its industry development. About three-quarters of private companies are engaged in some form of in-house R&D. With 105.8 researchers per 10,000 labour force, its R&D resources are comparable to those of other developed countries. And not to mention the government's move to raise R&D spending from 2–3% of GDP by year 2010.

BASF, recognising the commitment, opened its research centre for nanotechnology for Asia in Singapore last year. "This centre will help us better pick up new emerging technology trends. It allows us to strengthen our ties with innovative, technology-driven customers in Asia and open up new market opportunities," said Dr. Martin Brudermüller, member of the board of executive directors of BASF and responsible for Asia Pacific.

In the same vein, Mitsui Chemicals opened the Mitsui Chemicals Singapore Technical Centre in Singapore, its first R&D centre outside Japan, to focus on the areas of catalysis and asymmetric synthesis. Dr. Akihiro Yamaguchi, Senior Managing Director and Group Executive (R&D Centre), Mitsui Chemicals, said, "In order to conduct R&D efficiently and consistently, we need a number of things including human resources, excellent facilities, up-to-date information on science and technologies, and researchers should feel secure. And Singapore satisfies these requirements."

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The Australia Story

16 Years of Economic Growth

The Asia-Pacific region is fast becoming the engine room of world economic growth. For the next 10 years, experts forecast that Asia's economies will account for 45% of world gross domestic product (GDP), based on purchasing power parity – significantly more than the U.S. and Europe combined. Not only due to its ideal geo-strategic position, the Fifth Continent is well-placed to take advantage of economic integration as centre of gravity, while economic activity shifts to the Asia-Pacific region.

In 2006, the Australian economy was ranked the most resilient in the world for the fifth year in succession, according to IMD World Competitiveness Yearbook 2006. At the same time, the International Monetary Fund testifies in its World Economic Outlook that the nation's strong economic growth rates have exceeded those of most other major Organisation for Economic Co-operation and Development (OECD) economies including the U.S., the UK, Germany and Japan, while the GDP has grown by an average 3.6% annually since 1996.

Australia's Infrastructure

As about 1.5 billion t of freight is moved along the national road network every year, transport plays a critical role for the Australians in supporting economic growth and community needs. The Australian rail network links all five mainland state capital cities and the major intermodal ports. Maritime transport is also critical to the economy as 99% of imports and exports are carried

Sydney is the most populous city in Australia with a metropolitan area population of over 4.2 million.



by sea. However, to some degree, all exports from Australia except for bulk commodities use airfreight.

International businesses consider the quality of Australia's air transportation as effective and exemplary. "There are significant logistical advantages in building equipment for export to China in Australia," said Sean McLanahan, executive vice president and chief financial officer of the U.S.-based McLanahan Corporation. "We felt very comfortable coming to Australia. The business conditions are similar to the United States and as a whole, it was easy to establish our office in New South Wales. So far the only big difference is the Australian accent."

With regard to road and rail networks and port facilities, Prime Minister John Howard recently established a export infrastructure task force to identify priorities and reduce impediments to investment. Private sector participation has proven and tested in energy and export-related sectors but also in areas such as general transport and water supply and purification.

How the Government Invests Down Under

The socio-economic parameters speak in favour of Australia as investment destination. Nonetheless, the Australian government provided extensive financial support, got involved in the creation of major national research facilities and created a transparent legal environment in its attempt to foster an innovative culture and research and development (R&D) infrastructure.

Within the framework of its innovation program "Backing Australia's Ability," the government has announced to provide €5 billion (AUS-\$8.3 billion) until 2011 to fund innovation. Besides, the R&D tax concession allows companies incorporated in Australia to deduct up to 175% of qualifying expenditure on R&D activities. Complementing this government support for R&D, the Australians can refer to strong growth in business expenditure on research and development. In the fiscal year 2005, the volume increased for the sixth consecutive year to a record €5 billion, effectively doubling over the past five years.

What proves to be a lucrative investment destination with regard to economic growth potential also offers good condition with regard to tax matters: Australia is the eighth-lowest taxing country in the 30 member OECD. In the fiscal year 2005, Australia's total tax revenue was 31.2% of GDP, compared to an OECD average of 35.9, according to OECD Revenue Statistics.

European Multinationals Bank on Australia

A lot of international companies have found a home in Australia. Accor, American Express, IBM and Lufthansa are just a few globals that have located shared services centres catering to international markets in Australia.

Likewise, a number of European multinationals operating in Australia forms an impressive list of well-known names. With regard to the ICT sector, the country can refer to the French companies Alcatel and Webraska, as well as Ericsson from Sweden. The pharmaceutical industry is represented by Alphapharm as

a subsidiary of the Merck KGaA, while AstraZeneca and the UK-based Glaxo SmithKline round off the picture. Also with the UK-based company DST International in the Financial Services sector and the French Aerospace group Thales ATM, as well as with the German automotive companies Mahle, Schefenacker Vision Systems and Siemens VDO, European global players have made their decision for Australia.

Biotech Is Setting Standards

Asked for the reason of their biotech success, the Australians tend to explain that the country's low cost research and development, exceptional scientific talent and transparent and dependable regulatory system have helped to make Australia an attractive destination for biotech investment. In fact, there are more than 420 biotechnology companies making Australia the number one biotech location in the Asia-Pacific and sixth in the world. The estimated market capitalisation of the 157 Australian Stock Exchange listed bio-

technology, medical devices and other healthcare companies in December 2005 had increased by 56.5% compared to the previous year.

Australia may only have around 0.3% of the world's population, but it contributes 2.5% of the world's medical research. Pharmaceutical evergreens such as penicillin, the cochlear implant and the world's first cancer vaccine had their origin in Australia. However, this may not surprise very much. In the fiscal year 2004, business expenditure on biotechnology R&D was about €229 million. In 2005, Australian biotechnology companies announced 384 partnerships, of which 72% were with overseas companies or agencies. In addition, the industry has 474 therapeutic products in development and Australian inventors were granted 46 biotechnology patents in the U.S. in 2005.

Reaching Out To Investors

The government has been diligently paving the way to success over the last decades. Among its strategic decisions to facilitate doing business in Australia was the establishment of Invest Australia, the Australian Government's inward investment agency in 1997. From its 15 offices worldwide including Frankfurt, London, Paris, New York, Dubai, New Delhi, Beijing, Shanghai, Singapore and Tokyo, the agency helps global companies to establish or build their business in Australia.

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Dow Reportedly In Partnership Talks Reliance

According to the Wall Street Journal, Dow Chemical is in talks with Mumbai-based petrochemical firm Reliance Industries regarding a potential partnership that would broaden Dow Chemical's presence in the developing world. The newspaper cited sources familiar with the matter. The paper reported that the deal has been in the works for months. According to reports, both the companies are reviewing whether to have a 50-50 ownership structure, or to tilt ownership slightly to one side or the other. Dow CEO Andrew Liveris said he would "neither deny, nor confirm" the rumours. Reliance has also declined to comment.

► www.dow.com
► www.ril.com

Successful Start Of Oxea

The Oxea Group launched its business operations under the ownership of investor Advent International. In December, Advent International took over selected businesses of Celanese Chemicals and chemical company Oxo, a joint venture of Celanese and Degussa, for the purchase price of €480 million. The companies were consolidated into a new company following approval by the antitrust authorities. The product range of the transferred businesses remains fully intact, and existing contracts and orders will be taken over by Oxea. The Oxea Group has proforma annual sales of €1.2 billion and employs some 1,300 people at four production sites in Germany and the U.S. On a worldwide scale, Oxea produces and markets polyols, solvents and oxo derivatives.

► www.oxea-chemicals.com

FMC Acquires Access to Sankyo Agro Fungicide

FMC Corporation and Sankyo Agro have announced that FMC has secured exclusive access to simeconazole, a proprietary, triazole fungicide. Under an agreement with Sankyo Agro, FMC has acquired the rights to develop, register, market, and sell both stand-alone and combination products containing simeconazole globally, except for several countries in Asia and the Middle East. Subject to EPA approval and completion of the development program, first sales are expected in 2010/2011 timeframe.

Simeconazole was discovered and patented by Sankyo Agro and has been registered in several countries in Asia and the Middle East. Sankyo Agro actively markets the product in Japan and has secured registrations for use in rice, soybeans, pome & stone fruit, vegetables, strawberry, tea and turf.

► www.fmc.com
► www.sankyo.co.jp

Monopropylene Glycol from Renewable Resources

The Dow Chemical Company announced the introduction of monopropylene glycol derived from renewable resources. Propylene Glycol Renewable (PGR) is made from glycerin generated during the manufacture of biodiesel, a diesel-fuel alternative produced from vegetable oil. Dow is currently conducting PGR trials with customers and anticipates having limited commercial quantities available in mid-2007. PGR will be used in such applications as unsaturated polyester resins (UPR) for boat hulls and bathroom fixtures as well as aircraft de-icers, antifreeze for automobiles, recreational vehicles and marine and heavy-duty laundry detergents. The company has called this a "milestone in the quest for sustainable chemistries."

► www.dow.com

Cross-Licensing Agreement: Degussa and Rhodia

In recent years both Rhodia and Degussa have independently developed and protected valuable Intellectual Property (IP) related to the manufacture and use of precipitated silica. Degussa and Rhodia have, in order to enable their respective customers to effectively use their IP, entered into a cross-licensing agreement with each other in December, providing Degussa and Rhodia freedom of action to make available the said precipitated silica developments to the market and customers. Thereby the customers of both parties can to the largest extent possible benefit of the Intellectual Property of Degussa and Rhodia.

► www.degussa.com
► www.rhodia.com

BASF and Monsanto Announce Collaboration

BASF and Monsanto have announced a long-term joint research and development (R&D) and commercialisation collaboration in plant biotechnology that will focus on the development of high yielding crops and crops that are more tolerant to adverse environmental conditions such as drought. The collaboration is effective immediately.

Over the life of the collaboration, the two companies will dedicate a joint budget of potentially €1.2 billion to fund a dedicated pipeline of yield and stress tolerance traits for corn, soybeans, cotton and canola. The joint pipeline will include the companies' existing and planned yield and stress tolerance programs and be comprised of projects generated by independent plant biotechnology discovery and research from each company. The first product developed as part of this collaboration is expected to be commercialised in the first half of the next decade.

► www.basf.com
► www.monsanto.com

The picture for the year 2006 is almost complete; most indicators are available and show excellent results for the European chemical industry in 2006. Chemicals production (excluding pharmaceuticals) grew by 1.9%, which is above growth of 2005 and above the long-term average. Producer prices finally reflected the oil price and the index decreased slightly at the end of 2006, resulting in a yearly growth of chemicals producer prices (excluding pharmaceuticals) of 4.9%. Sales data is only available through November 2006, but indicates a good year, with chemicals sales growth (excluding pharmaceuticals) of 6.6%.

The good performance of the chemical industry is also reflected in a trade surplus increase of 11% comparing data from January to September of 2006 and 2005. Despite the positive results of 2006, there is some hesitation in the chemical industry whether this outcome can be achieved again in 2007. Business confidence in the chemicals sector has been decreasing, but industry a whole does not share these doubts and has an optimistic view of the coming year.

2006: Excellent Year

2006 can be seen as an excellent year for the chemical industry, with growth rates above the long-term average. After the dip in the production index of chemicals excluding pharmaceuticals in September 2006, the index continued rising until the end of the year back to the record levels of August 2006. This led to yearly production growth of 1.9% for chemicals (excluding pharmaceuticals). Pharmaceuticals remained the top performer with yearly production growth of 7.1%, the other two out-performers being specialties and consumer chemicals with 3.2% and 4.1% production growth in 2006. They improved their performance of the year 2005 by and large.

Basic inorganics production increased by 1.7%, which represents a slowdown from 2005 but is above average growth of the last 10 years. Petrochemical production increased by 1%, a slightly lower growth rate than 2005 and below average growth of the last 10 years. Polymers were the only sector with a production decrease of -0.2%.

Producer Prices Decreased

In 2006, chemicals producer prices (excluding pharmaceuticals) increased by 4.9%, rising continuously over the whole year with a slight decrease in the last month. Petrochemicals are still leading the price surge, with an increase of 8.9%

Chemicals Sub Sectors Sales Increase

Data from January to November 2006 show chemical sales (excluding pharmaceuticals) benefiting from a growth rate around 5% or more in all main sub sectors, comparing this period with the same period

EU chemicals trade balance: 2005 Jan-Sep versus 2006 Jan-Sep

Euro Million	2005 Jan-Sep	2006 Jan-Sep	Change
Pharmaceuticals	22.26	24.86	12%
Specialties	10.46	11.31	8%
Consumer Chemicals	9.13	9.70	6%
Organics	5.60	6.59	18%
Polymers	4.54	5.36	18%
Inorganics	-1.90	-2.03	7%
Chemicals excluded Pharma	27.83	30.93	11%

in 2006. Polymer prices grew by 4.7% and basic organics by 6%. Prices of consumer chemicals and specialty and fine chemicals registered a modest increase - 2% and 2.6% respectively. The more modest price increase went hand in hand with a good production performance. Pharmaceuticals is the only sector to show decreasing producer prices, -1.7%. Only at the very



end of the year did the producer price indexes - especially for petrochemicals and basic inorganics - actually reflect the easing of the oil price pressure.

At the beginning of 2007, the oil price continued to decrease to US-\$53.6 per Brent barrel, a similar price level to what was last reached in June 2005. Energy prices remained rather constant during the last three months of 2006, at clearly low-

in sales growth towards the end of the year. This trend is however counteracted by certain subgroups, such as consumer chemicals, specialties and pharmaceuticals which have rising sales figures.

EU External Trade Surplus Up 11%

In 2006, the EU trade surplus in chemicals rose by 11%, back to levels of 2003, comparing

Inorganics is the only sector with an increasing trade deficit, 7%, but it remains minor in value in comparison to the trade surplus of the other sub sectors.

The competitiveness indicator for the third quarter of 2006 does not reflect the excellent performance of the European chemical industry on external markets. However, in the last quarter of 2006 the indicator recovers towards its long-term average, indicating that the chemical trade surplus might still increase in the last quarter of 2006. The competitive position on the internal EU market is much more stable than on the external EU market and remains rather constant in 2006, indicating a positive perception of internal competitiveness.

The EU Chemical Industry: Uncertainty in 2007

Business confidence for the chemical industry decreased sharply in January, reflecting the uncertainty over future developments of the chemical industry after an excellent year 2006. However, the outlook is still optimistic. Manufacturing

confidence is declining slightly but remains well above chemicals confidence.

Looking at single manufacturing sub-sectors in January, production expectations are very encouraging for machinery and equipment; automotive; and food and beverage. Electrical machinery; rubber and plastic; and basic metals are very satisfied with production in recent months, but only slightly optimistic about the future. For the basic metal industry, this represents a sharp decline in its production expectations. A modest improvement is expected for printing and publishing; and pulp and paper. Clothing and textiles are negative about production in recent months and, moreover, do not expect an improvement - even a deterioration.

European Economic Sentiment Indicator: Record Level

After a very successful year in which the EU economy grew even faster than the U.S., the global perception of the EU economy is not surprisingly at record levels. Even consumers seem to be confident about their economic situation, as the EU confidence indicator shows in 2006. The services sector has reached a record level and seems to be looking to a bright future. A slight dip in the economic confidence indicator in December 2006 hints at some doubts whether this excellent performance can be repeated in 2007. But signs for optimism are increasing: An international survey, conducted by the service firm Grant Thomson shows that business confidence in the European Union has overtaken optimism in the U.S. for the first time in five years. Asian Business leaders were the world's most confident ones.

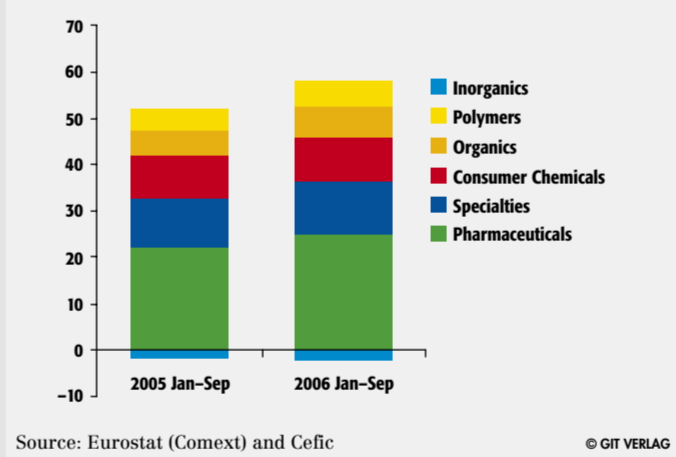
And another recent survey by NTC Economics states that chemical trade manufacturers are more optimistic that they will be able to raise output, profits and employment in 2007 than they were one year ago. But big differences exist within Europe. France is at the bottom of the survey while the Netherlands is most optimistic.

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Sectoral breakdown of EU chemicals trade balance: 2005 Jan-Sep versus 2006 Jan-Sep



Source: Eurostat (Comext) and Cefic

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er levels than in the second and third quarters of 2006, with a slight increase in December.

January to September 2006 to the same period last year. The increase in the trade surplus with Nafta (North American Free Trade Area) is most remarkable, resisting rumours of a slowdown in the American economy. The trade surplus with Asia, Latin America and Middle East shows a slight decrease, comparing January to September 2006 to the same period last year. Trade with China is rising at a fast pace, but

imports are outpacing exports and therefore the trade deficit in chemicals with China is growing.

The increase in the trade surplus is spread over almost all the chemical sub sectors. Organics and polymers show the highest increase of trade surplus with 18%, comparing January to September 2006 to the same period last year.



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'Knowledgeable, Focused And Entrepreneurial'

Azelis Is One of Europe's Fastest-growing Distributors

▶ Continued Page 1

U. Wenzel: In addition to the obvious need to fit with our core market sectors of Life Sciences (human pharma, veterinary, food and cosmetics), Coatings (paints, varnishes, inks, adhesives), Polymers & Additives (engineering plastics, rubber, composite materials and specialty additives) and Chemical Industries (performance and industrial chemicals), the com-

"For us, the key to meeting the needs of global suppliers is to be able to cover all the necessary European markets, but doing so with a clear local presence."

mon criteria for our acquisitions are that the company is already specialty focused and has a track record of profitable growth. In addition, it is important that the modus operandi of the company fits well with the established Azelis values of being knowledgeable, focused and entrepreneurial.

Azelis opened an office in Shanghai in 2005. What do European distributors have to do to get a strong foothold in the Asian market? What challenges did you encounter there?

U. Wenzel: Azelis Shanghai was the merger of our existing China sourcing activities that

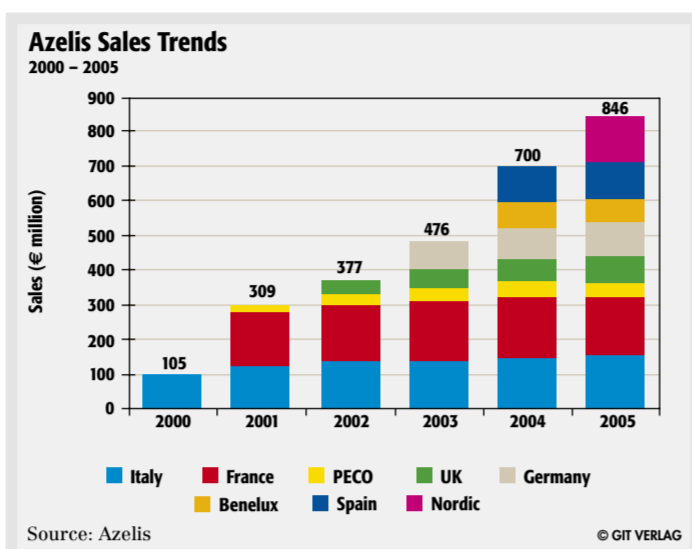
were being carried out through a number of different Azelis companies, especially Impex Quimica, Kraemer & Martin, Sibeco and Azelis Italia. This accelerated our position and overcame some of the normal problems of establishing a new office that has critical mass. After a successful integration, the next challenge will be to move into the role of distributor into China, where business traditions and habits are quite dissimilar compared with our European markets.

You have said that Azelis is planning a direct presence in India. What can you tell us about this? What other regions are you looking at internationally?

U. Wenzel: We recognise that India is a rapidly growing market for both sourcing and selling chemicals. We are well advanced in our plans to establish a direct presence in India, and this will be done via an Azelis India that will be set up to work in partnership with a selected local partner to help both source and sell specialty chemicals. These plans are expected to reach fruition this year.

What is your company doing to adapt to accommodate increasingly global suppliers?

U. Wenzel: For us, the key to meeting the needs of global suppliers is to be able to cover all the necessary European markets, but doing so with a clear local presence. Our motto of "big enough to do the job, small enough to care" summarises our approach. We can offer global suppliers a tailored package that can meet their needs of a single interface/single contract covering Europe but with the confidence that all Azelis companies have a truly excellent knowledge of the dif-



ferent requirements and cultures of the local markets. We strongly believe that a one size fits all approach does not meet the needs of suppliers – independently of whether they are global or local.

Azelis moved from the private equity firm Cognetas to 3i at the end of last year. What was the strategic thinking behind this move?

U. Wenzel: When Cognetas made its original investment in Azelis in 2003, we had a presence in Italy, France, Eastern Europe, the UK and Germany. In the three years with Cognetas, we expanded our geographical coverage to include the Iberian Peninsula, Benelux and the Nordic countries – including Denmark, Sweden, Finland, Norway, Iceland, Poland and Latvia – and Greece. This was also accompanied by a number of strategic local bolt-on acquisitions to extend market coverage. We had grown faster than anticipated and so began a process of identifying a suitable partner to support us over the next five years which could lead to a possible flotation.

We identified 3i as the ideal partner for the next phase of

international growth of Azelis. This was for three reasons: their international presence, their experience and knowledge of the chemical distribution sector and the pragmatic and hands-on way to work with their managing partners. 3i is fully supportive of our development plans; our strategic direction remains the same. We will continue with our targeted acquisition programme and further develop synergies for organic growth within the group. The existing management team remained in place and substantially increased its investment in Azelis.

What edge do you have over the big names in the business, such as Univar or Brenntag? How are you able to compete and/or stay competitive?

U. Wenzel: We believe that we operate a different business model and focus on adding value in a different way than Univar or Brenntag. An analysis of the balance sheet of these commodity-type distributors shows that they have a very high component of fixed asset investment and corresponding depreciation. The net result is that a lot of their cash generation goes

to replacing fixed assets that they then have to use to make economic sense. Our model is generally to outsource "standard" operations whilst focusing on providing services to wrap knowledge around the products that we sell.

In addition, we actively develop the entrepreneurial character of our managers and encourage them to develop different local services to meet local needs. An illustration of the basic difference is that at Azelis, more than 100 executive managers and staff hold around 35% of the equity of the company. We also operate a flat organisation with only three real levels and this, coupled with the high staff share ownership, means that there can be very rapid decisions absolutely focused on what is in the best interests of the group and its suppliers and customers.

It is expected that less than 10 distributors will cover 50% of the distribution market in Europe by 2010. While this prediction reflects Azelis' strategy of growth through acquisition, do you foresee any potential problems in the endless mergers and acquisitions in the industry?

U. Wenzel: One of the biggest problems with mergers and acquisitions is that, during this period, the management and staff can lose sight of the needs of principals and customers and focus on internal changes. One of the explicit positions of Azelis is that while we make acquisitions, we ensure that resources are constantly focused on the ongoing business and ensuring that business continues as usual. While we do go about post-acquisition integration activities that include aligning IT, accounting and management information systems, we have developed a way of doing this that minimises both the cost

and the potential disruption to business.

What do you see as challenges for the European chemical distribution market?

U. Wenzel: It is almost universally acknowledged that one of the biggest challenges facing the chemical industry – both distributors and manufacturers – is the constant flow of new regulations. Currently, the biggest one is clearly Reach. There

"At Azelis, more than 100 executive managers and staff hold around 35% of the equity of the company."

is a real risk that only those manufacturers and distributors will survive who have enough critical mass to manage the regulations. It is our belief that this is not necessarily good for the industry in general and, as such, we offer our full support to those organisations that are trying to minimise the effects by cost- and information-sharing.

How does Azelis offer support?

U. Wenzel: Azelis is a founder investor in ReFaC, the "by the industry, for the industry" Reach Facilitation Company that has been set up in the UK. The objective is to provide assistance to European distributors and SMEs all the way through the process from assessing whether products are covered by Reach to the ultimate testing and registration of products.

Azelis is active in five international business areas: food and cosmetics; pharma and veterinary; coatings, polymers & additives and chemical industries. In which area do you expect the most growth in the coming years? Why? Which area are you looking to push?

U. Wenzel: Really, we are concentrating on nine core areas across Azelis; the ones mentioned are those where we already have a consolidated European position. We expect substantial growth in all of these areas but would differentiate the Life Science areas from the others as having higher and more stable growth, whereas the other areas can be subject to a number of cyclical macro-economic factors. Our focus will be to persuade principals who currently supply Azelis in e.g. two or three countries to appoint Azelis as their pan-European partner. Therefore, we will have more organic growth in the consolidated areas, and more strategic growth in the others.

Your company's turnover has grown from €348 million in 2001 to an estimated €950 in 2006. What will the coming five years bring for Azelis?

U. Wenzel: Working with 3i, we would anticipate that the turnover of Azelis would more than double in this period to reach a level of around €2 billion. We would expect to have completed both our geographical and market coverage to ensure a consistent and substantial position in our key markets in all countries in Europe. In addition, we would expect to have further developed our sourcing from China and India and also to have established a substantial sales position in these countries.

▶ www.azelis.com

A Lanxess Growth Story

Turnaround after Successful Portfolio Adjustment

▶ Continued Page 1

competition across all regions; we are the leading company for technical advisory competence, and this is also a unique selling point for us.

Innovation is also a differentiating element. The fact that more than 20% of our product portfolio is made up of prod-



Bitterfeld is one of the world's largest production centres for ion exchange resins.

ucts younger than three years shows that the market, customer requirements and legal requirements are continuously changing and that we are able to successfully respond to these changes.

Where does innovation in your business come from?

M. Zobel: Innovation comes from listening to the market: It's very important to get feedback from the customer. Our sales force is our ears to the market. They feed this information into our business unit, which is then assessed by our technical experts. The foundation for an ever-renewing product range

that accommodates our customers' latest requirements comes from our production excellence; the unique setup of our facilities and processes are setting new industry standards. We have a series of products that are tailor made to special solutions, e.g. providing unique solutions to solve environmental problems. Our R&D group is really focused

"Innovation comes from listening to the market."

How do you see the market environment of the global ion exchange resins businesses and what role does Lanxess currently play within this market?

M. Zobel: The global ion exchange resins demand amounts to about €700 million. Lanxess is one of the leading companies here, not only from the technology side, but also from the global set-up, the marketing and technical advisory competencies.

Lanxess announced that it is planning to invest over €6 mil-

lion in the expansion of its Bitterfeld ion exchange resin production facility by the end of this year. The originally planned amount was €1.8 million. What factors led to so much more money being invested in the plant?

M. Zobel: Innovation means if we are coming up with new products, we also have to consider whether or not we can

do this in our plants or not. If we decide that it is possible, then we have to invest in that. This was the case in Bitterfeld; we are placing new products there and therefore we need to expand.

In which application sectors are you expecting above-average growth and what are the growth drivers?

M. Zobel: We classify our products into three main groups: Industrial Water Treatment; Consumer and Cartridge; and Catalysis and Chemicals Processing. Each of these segments contains sub segments, which are the true elements of the market. These sub segments include industrial water to soften or demineralise drinking or process water; ultra-pure water for chip and pharma in-

dustry; manufacturing of sugars and starches; hydroponics-fertilizer; decontamination of ground water; waste water and surface water; mining industry; and biodiesel, just to name a few. It's obvious that a company has to be highly diversified in order to be a full-portfolio provider and to satisfy the needs of the market.

We see high growth potential in all three main segments, with global demand size at about €700 million. Global water businesses account for about 60% of the total market, which illustrates the potential for growth. Also, consumers are becoming more and more aware of the problematic of water, such as purification and decontamination.

Almost 60% of all ion exchange resins go to the water sector, thus they can play a vital role in contributing to the solution of the future water problems. What are the main applications of ion exchange resins in the water sector?

M. Zobel: The main applications of the Industrial Water Treatment segment are the softening or demineralization of drinking and process water. For example, demineralisation of process water for petrochemical industry, power plants and nuclear power plants plays an important role. In nuclear power plants products are also used in the secondary or primary loop – these are sensitive areas which means the products

have to stand up to a rigorous safety test and they have to be reliable.

Further main applications are the usage of ultra pure water for the microchips and pharmaceutical industry, which are produced by IXR.



Ion exchange resins undergo practical testing in strict quality controls in the laboratory.

Ion exchange resins play also an important role as solutions provider for the decontamination of ground water, waste water and surface water.

What other mega trends will shape the future ion exchange resins market?

M. Zobel: There are several trends we are participating in and will benefit more from in the future. One of those issues is water scarcity; the world's population is expected to grow from six to eight billion by 2025. This growing population comes along with climate changes and natural disasters that push deserts into arid areas and influence the ecological

water balance in many regions. Also, new demands of agriculture and rapid industrialisation are increasing the overall demand for water. However, 40% of the world's population does not have access to clean water, and less than 1% of the water on Earth is available for human use. This all underlines the fact that we have to apply technologies to make the most efficient use of this resource.

Energy consumption is another issue. It is growing in the world, particularly when one looks at the growth in China and also other industrialised nations that are demanding

"We have the technological and marketing competence to grow above the market."

more and more energy. In the end, this will mean more and more power plants and nuclear power plants, which in turn will mean the need for the demineralisation of water.

How is Lanxess participating in these trends?

M. Zobel: Obviously environmental issues arise from this kind of growth. This is where

we can act as a solution provider for contaminated waste, ground and surface water. It is also important to consider the awareness and sensitivity of the end user. They are really asking and driving the producers to provide clean water. There is pressure coming from those who have to work with water, and this is where we come into play. These are all trends that we can really benefit from.

What about the development of new areas?

M. Zobel: We are constantly looking after market trends and market requests which is often the starting basis of new areas. Changing regulation worldwide is a further source for the development of new areas.

What are Ion's growth targets and what is your strategy to achieve them?

M. Zobel: We have the technological and marketing competence to grow above the market. We want to be and are already a growth story. We would like to push our specialties more and to be more active as a true solutions provider. In parallel we want to secure long-term growth in the industrial water treatment segment and in the consumer area. We are also looking to even improve our technical advisory competence and to gain further strength in Asia Pacific.

▶ www.lanxess.com



PEOPLE

Ashland: Mike Swartzlander to Head India Business Operations Mike Swartzlander has been named vice president and managing director, India, for Ashland. Swartzlander previously served as vice president and general manager of Ashland's Casting Solutions business. The company said that although Ashland's business interests have been represented in India for a number of years, Swartzlander will be tasked with organising, aligning and growing the businesses as one Ashland enterprise.

► www.ashland.com



Paul Krell

Abiomed Appoints GM for European Operations Abiomed has appointed Paul Krell to the position of general manager for its European operations, based in Aachen, Germany. Paul Krell joins Abiomed from ev3 Europe, where he most recently served as VP Europe, in the Neurovascular Division. He has more than 14 years of experience in the medical device industry, with a strong cardiac background built during his tenure at Guidant, where Mr. Krell held several management positions, including Country Manager in Germany for Cardiac Surgery Products and European Marketing Manager for Tachyarrhythmia Products.

► www.abiomed.com



Terrence Hahn

Honeywell: New VP, GM for Fluorine Products Honeywell has appointed Terrence Hahn as vice president and general manager for its fluorine products business. Prior to joining Honeywell, Hahn spent nearly 20 years with Air Products and Chemicals. He most recently served as senior director for the company's global electronic specialty materials business, where he was responsible for overall performance. In this position, he transformed the business and moved its headquarters to Asia while significantly increasing sales in the region. Hahn built a team that served customers worldwide and was commercially accountable for the technology, supply chain, procurement, engineering, finance and quality functions. He was based in Taipei, Taiwan.

► www.honeywell.com



Tracy Ken Tsuetaki

Laureate Pharma Elects New Chairman Laureate Pharma announced the election of Tracy Ken Tsuetaki as Laureate's new non-executive chairman of its board of directors. Currently, Tsuetaki is president of medical communications and consulting at Quintiles Transnational, where he is responsible for their global consulting and medical education groups.

► www.laureate.com

Change in Tecan's Board of Directors Timothy B. Anderson, a long term member of Tecan's board of directors, will not run for another term of office at the annual general meeting of the shareholders on 19 April. The board has proposed the Biopharma specialist Jürg Meier for the vacant seat. Meier has successfully headed the Novartis Venture Fund for more than six years. Among other things, he was the global head of research of the former Sandoz.

► www.tecan.com



Klaus Schollmeier

Santhera Proposes Klaus Schollmeier to Board Santhera Pharmaceuticals announced that its board of directors will propose the appointment of Dr. Klaus Schollmeier, the company's CEO, to the board. This appointment would be for a term of three years. Schollmeier's appointment to the board is subject to the approval at the shareholder meeting on 23 April.

► www.santhera.com

Borealis Appoints New CFO Borealis has appointed Dan Shook as chief financial officer and member of the executive board, effective 1 June. He succeeds Clive Watson, who left the company in September 2006.

Shook comes from the BOC Group. During his twelve years at BOC, he held several senior management positions, including group treasurer and divisional global business manager, before becoming finance director for Industrial & Special Products, the company's largest and most profitable division, in 2005. Dan joins the executive board of Borealis along with the newly appointed designate CEO, Mark Garrett.

► www.borealisgroup.com



Rainier van Roessel

Lanxess: Board Changes Dr. Rainier van Roessel has been appointed as the company's new labour relations director and will assume all the responsibilities held by Dr. Martin Wienkenhöver, who left Lanxess on March 31 to assume new duties elsewhere in the industry. However, he will remain associated with Lanxess in an advisory capacity.

The supervisory board of Lanxess has appointed Dr. Werner Breuers to the company's board of management effective 15 May. Breuers, who holds a doctorate in chemistry, is joining Lanxess from Dutch chemicals group Basell. With this appointment, the allocation of responsibilities within the board of management of Lanxess will be finalised effective the same date.

► www.lanxess.com

Dow: New Senior Leadership Structure The Dow Chemical Company has announced a new corporate and business leadership structure, which the company said is focused on accelerating the implementation of Dow's transformational growth strategy. The senior level realignment includes the formation of a five person Executive Leadership Committee that will concentrate on defining the company's strategic direction, prioritising its investment agenda, establishing enterprise-wide policy and setting financial plans and performance metrics. In addition to Dow Chairman and CEO Andrew Liveris, the committee comprises:

- Geoffery Merszei, executive vice president and chief financial officer
- Romeo Kreinberg, executive vice president, performance businesses
- Heinz Haller, senior vice president, strategic development and new ventures
- Mike Gambrell, executive vice president, basics businesses

Liveris has also redefined its global business portfolio, structuring it around eight distinct groups – each of which will be led by a business president. Six of these groupings are new, while two are already in place.

► www.dow.com



Lisa Hubbard

Avery Dennison Appoints Fasson Roll Technical Director Avery Dennison has promoted Lisa Hubbard to the post of technical director, Roll Materials Europe. In this new role, she leads the European product technology and innovation team, which develops adhesives, release systems, face materials, and top coatings to provide high-performance Fasson-brand product solutions for customers.

► www.averydennison.com

Linde Hydrogen Centre Awarded Germany Land of Ideas

Germany Land of Ideas



The technology group The Linde Group has been given an award for its innovative hydrogen centre in Lohhof near Munich by the federal initiative Germany: Land of Ideas. The Linde Hydrogen Centre combines the functions of a hydrogen filling station with that of a

technology test centre, a training centre and a presentation platform. The Linde Hydrogen Centre was inaugurated in October 2006 in the presence of the German Federal Minister of Transport, Wolfgang Tiefensee. At the heart of the facility is a filling station, which supplies a test fleet of hydrogen fuelled cars and buses with both liquid hydrogen and compressed gaseous hydrogen.

► www.linde.com

► www.land-of-ideas.org

Sigma-Aldrich Receives Award

Sigma-Aldrich has been named a recipient of Merck & Co. 2006 Sector Operational Award. Sigma-Aldrich was chosen for its outstanding sourcing services, helping Merck realise process efficiencies as well as significant savings. In early 2006, Sigma-Aldrich was selected to provide a comprehensive suite of organic raw materials and sourcing services through its

fine chemicals business unit (SAFC) that met Merck's needs. To date, utilisation of this service has increased by 50%. As a Merck preferred supplier, Sigma-Aldrich has also been utilised for critical pre-clinical and clinical drug deliveries as well as associated analytical testing services.

► www.sigmaldrich.com

► www.merck.com

ChemOutsourcing Conference

The annual show – 10–11 September in New Brunswick, New Jersey (U.S.) – is widely attended by large, mid-sized, small pharmaceutical/biotech company sourcing managers, R&D personnel and a large array of chemistry service providers from around the world. The con-

ference sessions cover pre-clinical and development sourcing topics, all the geo-regions, and the ever-evolving CRO-pharma relationships. ChemOutsourcing is information and networking intensive with a large exposition attracting the finest suppliers.

► www.chemoutsourcing.com

Chem Show: New Products, Ideas

The Chem Show, now in its 52nd year, is North America's largest process equipment and technology exposition. This year's show – to take place 30 October–1 November in New York City – will feature the latest equipment, technologies, trends and materials for the chemical process industries from leading manufacturers worldwide. There will also be technical, management and operations conference that includes sessions, management forums, operations workshops, tutorials and short courses focusing on industry trends, innovations and new developments in the CPI. The show hosts about 600 exhibitors from around the



world and attracts over 10,000 chemical process industry professional visitors.

► www.chemshow.com

CM Europe Welcomes Editor

Dr. Roy T. Fox, our German-American globetrotter, has been a regular fixture here at GIT Verlag for the past four years. As editor-in-chief of KunstStoff Trends, Dr. Fox is our in-house expert when it comes to plastics and the plastics processing industry. Now he will be passing along his knowledge to international readers as assistant editor of CHEManager Europe.

A Hessian by choice, Dr. Fox decided to stay in sunny Darmstadt after he completed his degree and doctorate in chemistry and chemical engineering. Whenever he's not working hard at his desk, you'll find him playing badminton, whipping



up Italian delicacies or enjoying a plate of all-you-can-eat spareribs with his beloved colleagues.

► www.chemanager-europe.com

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 Sales & Marketing Manager
 IT-Manager
 Logistics Manager
 Commercial Director
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 Head of Production
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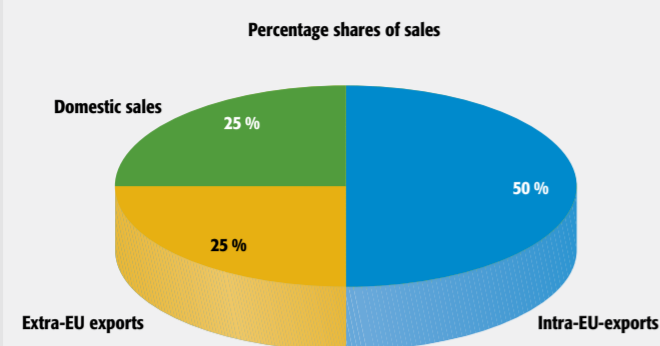
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EU Chemical Industry

Sales structure by destination

Sales 2005*: €436 billion

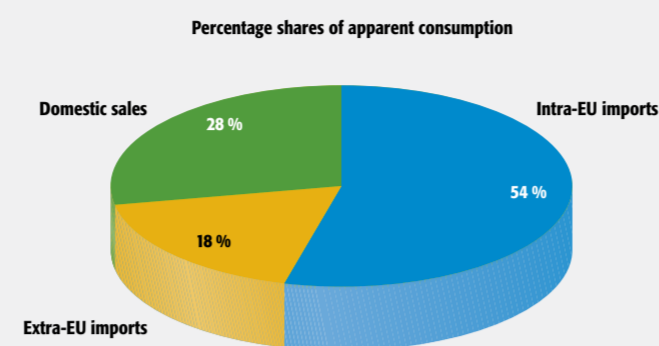


* Excluding pharmaceuticals

Source: Cefic

Demand structure by origins

Apparent consumption 2005**



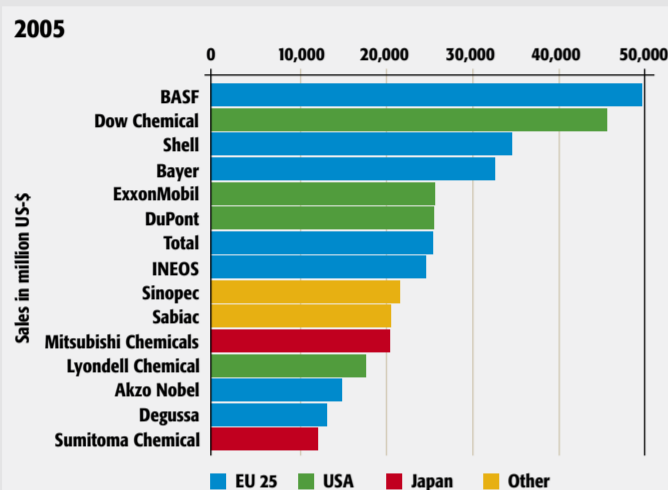
** Sales and imports-exports

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Around one quarter of chemicals sales are exported outside of the EU area. North America, other European countries (not belonging to the European Union) and Asia are the key markets. EU chemicals demand (apparent consumption) in 2005 was estimated at €398 billion (excluding pharmaceuticals), 18% of which originated from outside the region – mainly from North America, Asia and

other West, Central and Eastern European countries. More than half of the European demand for chemical products is satisfied by intra-EU imports. By 2005, almost half of sales were intra-EU (excluding domestic sales). While intra-EU sales are rising, the importance of domestic sales is decreasing. The traditional domestic preference is becoming a preference for European products.

Top Chemical Companies

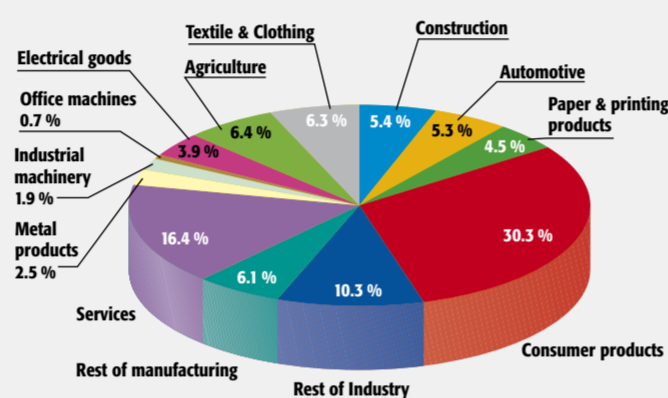


Source: Cefic

In 2005, almost half of the 30 world chemicals majors had their headquarters in the EU, representing approximately 15% of world chemical sales. These 30 companies had a combined sales turnover of €463 billion. This is a significant increase compared to the previous year and reflects not only the positive sales development in 2005, but also the ongoing consolidation in the chemicals sector.

EU* Chemical Consumption

Chemical domestic consumption in %



* EU 15

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The chemical industry underpins virtually all sectors of the economy: about 30% of consumption is absorbed by consumer products, 16.4% goes to services, 6.4% to agriculture, 5.4% to construction, 6.1% to the rest of manufacturing and 10.3% to the rest of industry. The big industrial customers of chemicals are the metals, mechanical & electrical industries, textiles & clothing, the automotive industry and paper & printing products.

Progress Toward Artificial Photosynthesis?

Plants can do it: they simply grab carbon dioxide out of the air and convert it into biomass. In this process, known as photosynthesis, the plants use light as their energy source. Chemists would also like to be able to use CO₂ as a carbon source for their synthetic reactions, but it doesn't work just like that. A team headed by Markus Antonietti at the Max Planck Institute for Colloids and Interfaces has now taken an important step toward this goal. As described in the journal *Angewandte Chemie*, they have successfully activated CO₂ for use in a chemical reaction by using a special new type of metal-free catalyst:



graphitic carbon nitride, is very heat-stable and, although it enters into many chemical interactions, it is so stable that it nearly always re-forms – an ideal catalyst. It can even be used to activate carbon dioxide. It was thus possible to oxidize benzene (an aromatic six-membered carbon ring) to phenol (which has an additional OH group). The by-product of the reaction is carbon monoxide (CO), which can be used directly for chemical syntheses.

From a purely formal point of view, this reaction cleaves the CO₂ into an oxygen diradical and CO. However, like photosynthesis, the reaction seems

to occur by way of carbamates:

In the first step, CO₂ binds to individual free amino groups present in the carbon nitride. It then oxidizes the benzene to phenol, and in the end the highly desirable CO separates from the catalyst. "This could make novel, previously unknown chemistry of CO₂ accessible," hopes Antonietti. "It may even be the first step in artificial photosynthesis."

Original publication: Markus Antonietti et al., "Metal-Free Activation of CO₂ by Mesoporous Graphitic Carbon Nitride"; *Angewandte Chemie International Edition* 2007, 46, No. 15.

worked with metal-free catalysts, turning toward plants for inspiration. Photosynthesis in modern green plants involves an important intermediate step: the bonding of CO₂ to nitrogen atoms to form carbamates. The German researchers thus also experimented with nitrogen-rich catalysts with structures that allow them to form carbamates. Their new class of catalysts is made of flat, graphite-like layers. The individual layers consist of ring systems involving carbon and nitrogen atoms. This porous material,

involved with metal-free catalysts, turning toward plants for inspiration. Photosynthesis in modern green plants involves an important intermediate step: the bonding of CO₂ to nitrogen atoms to form carbamates. The German researchers thus also experimented with nitrogen-rich catalysts with structures that allow them to form carbamates. Their new class of catalysts is made of flat, graphite-like layers. The individual layers consist of ring systems involving carbon and nitrogen atoms. This porous material,

Coming up in CHEManager 4/2007

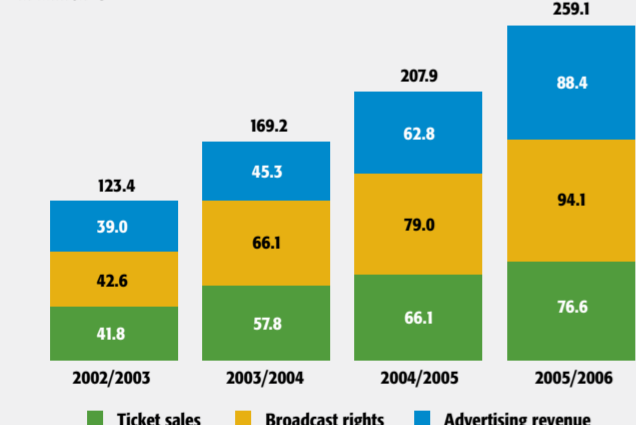
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FC Barcelona Sales

in million €

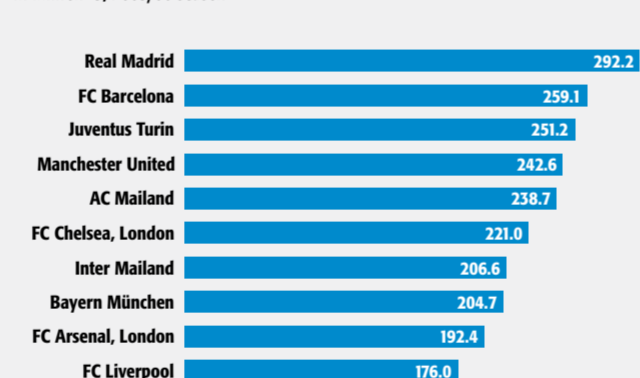


Source: Der Spiegel/Deloitte

Football in Europe has long since become a lucrative business venture, and the FC Barcelona is a prime example of a club that has best set this ideology into practice. The club has practically doubled its sales since the 2002–03 season though ticket sales, broadcasting rights and advertising revenue. The club is only second to Real Madrid in Europe in terms of sales for the 2005–06 season. This season, the club is expected to rake in over €300 million in rev-

Top-selling European Football Clubs

in million €, 2005/06 season



© GIT VERLAG

enue. However, FC Barcelona is not alone in its profitability. The total revenue of the top 20 clubs was over €3.3 billion in 2005/06. Dan Jones, partner in the Sports Business Group at Deloitte, said "Football remains a growth sport, especially at the highest level. The continued high level of public and commercial interest is reflected by another year of strong growth. The global market has become increasingly important for more European clubs."

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