

Markets and Companies

While the global economy slows, emerging markets gain momentum

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THE NEWSPAPER
FOR THE CHEMICAL AND
LIFE SCIENCES MARKETS

Photovoltaics

Materials lead the way in thin-film and organic photovoltaics

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Newsflow

Teva Pharmaceutical Industries allegedly is in talks to make another acquisition even before closing its takeover of **Barr Pharmaceuticals**. The company in question is German generic drug firm **Stada**. Neither Teva nor Stada were ready to comment at press time. Shares in Stada surged as much as 13% on renewed speculation that Germany's third-largest generic drugmaker, worth around €2 billion, could be taken over. Teva, the world's largest generics company, has long sought to gain a foothold in Germany, one of the largest generic drug markets in the world, and growing. With the acquisition of Barr, Teva is also expanding its European business. The acquisition of a German company, if carried out, should not come as a surprise. More surprising is the proximity to the acquisition of Barr, which will cost Teva \$9 billion, including Barr's debt.

BASF plans to sell more of its styrenics business than initially planned. The German chemicals company is now also putting the production of styrene copolymer on the auction bloc. BASF also said in a statement it will reorganize its global styrenics operations into independent subsidiaries to be set up in January 2009 while it continues its year-long search for a buyer. BASF's styrenic commodities and copolymers units generated sales of about €4 billion in 2007.

Symrise has a shortlist of 10 possible acquisition targets, Gerold Linzbach, chief executive of the German maker of scents and flavours, told Euro magazine. Two of the targets are "hot" candidates he aims to buy this year, he added. Symrise "always has about 10 companies on the radar screen" to add new technologies and to expand geographically, he said in an interview to be published in Euro's September edition. Linzbach also confirmed the company's goal for full-year sales to increase 6% to 7% and Ebita to grow 6%, both adjusted for currency swings. Sales in the first six months of 2008 were €676 million, up 6.7% (in local currencies) from last year.

No Dangerous Goods – The Chinese government has taken extra precautions to make sure the 2008 Olympic games go off without a hitch.

The Chinese authorities have placed some extreme restrictions on the import of dangerous goods for a four-month period covering the Olympics in Beijing. The restrictions, which began on June 1, ban movement of all dangerous goods in Beijing, Tianjin, Qinhuangdao, Shanghai, Shenyang and Hong Kong. Also, the discharge and loading of dangerous goods is prohibited at the ports of Beijing, Tianjin, Xingang, Qinhuangdao, Shanghai, Shenyang, Qingdao and Hong Kong. Manufacturers have been advised to adjust their production schedules so that the movement of these goods is not necessary during the period. Brandi Schuster asked Kevin Loyens, general manager of Kerry-Talke Chemical Logistics, about the effects of the ban on the chemical industry.

CHEManager Europe: How have these bans affected your business?

K. Loyens: First of all, it is important to note the restrictions that have been issued by the central and local authorities are often different from the actual implementation of those restrictions by the executive departments. The bans for the port of Shanghai for instance are only limited to certain classes of dangerous goods – classes 1, 7, 5.2 and part of 6.1. All other dangerous goods are officially not subject to any restrictions.

Nevertheless, we notice that on a day-to-day implementation level, the actual practice is a lot more complex.

Kevin Loyens
General manager of Kerry-Talke Chemical Logistics



Due to a lack of knowledge, these rules are often implemented incorrectly or too strict on a local implementation level.

For example?

K. Loyens: We've noticed that ports that are not linked with any Olympic activities are also implementing stricter rules and making it more difficult for importers and exporters than the national regulations require. We've also noticed that many of the ocean carriers reject most or even all dangerous

goods cargo both for import and export, while this is not in line with the regulations that have been issued.

What is the reason behind these arbitrary restrictions?

K. Loyens: There is often insufficient knowledge and understanding of dangerous goods classification on an operational level of port authority or customs departments. In order to avoid any risks, and due to lack of knowledge, certain goods are being refused, even if they do not belong to the restricted dangerous goods classes, etc.

Are there any goods that are particularly at risk?

K. Loyens: There is a lot of confusion mainly around the "hypertoxic" products. This is a Chinese classification, and has no significant correlation with International Maritime Dangerous Goods or UNNO classifications. It is a list of products issued in 2002 with a supplement issued later. For many

authorities and companies, it is not always clear what products are part of this list and which ones aren't.

What is your company doing to work around these extra problems?

K. Loyens: We try to be as creative as possible in our communication with port and customs authorities through referring to the policies, making sure we have the right Chinese product name to create as much clarity as possible and different classes of products can be distinguished from each other.

We have built up good contacts with the authorities and try to communicate as good as possible with our customers, to keep them updated on any developments and assist them.

Many companies that import hazardous chemicals into China are now facing a backlog on orders. How will your company cope with the increase in

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Limited Access

Chinese Port Restrictions During Olympics Create Logistical Challenges

Gearing Up

Brenntag Screens Opportunities for Further Expansion

Chemical Distribution – Brenntag finished 2007 with record results. With an increase of 9%, the company's revenues climbed to €6.7 billion, the operating Ebita increased by 14%. Eliminating currency exchange effects, sales and operating Ebita increased by 13% and 18%, respectively, revealing the strong underlying growth.

The global leader in chemical distribution operates in excess of 300 locations in 55 countries and offers an extensive distribution network for industrial and specialty chemicals. Michael Reubold spoke with Steve Holland, member of the executive board Brenntag Holding and responsible for European Operations about the strategy to further expand the business in Europe.

CHEManager Europe: Mr. Holland, in 2007 Brenntag Group recorded external sales of €6.7 billion. What part of this figure accounts for Europe?

S. Holland: In this respect you have to take into consideration that Brenntag had to face slightly restrained dynamics in some European economies, competitive market conditions and high raw material costs. In a nutshell: In 2007, Brenntag underpinned its position again as a European leading chemical distributor with external sales of €3.8 billion.

What is your strategy for growing your business in Europe?

S. Holland: Besides organic growth, we will continue to look for acquisition opportunities and we will maintain our reinvestment and upgrading strategy in Europe. Opportunities for growth can be found in geographic areas as well as product areas. Generally speaking, we



Steve Holland
Member of the executive board, Brenntag Holding

are continuing our expansion, to some extent through acquisitions, which provide a significant synergistic case. We continuously screen the acquisition landscape also to leverage our

Eastern European infrastructure.

During the year 2007 and the first five months of 2008, Brenntag completed eight acquisitions to add to both product and geographic portfolios. Which of these acquisitions have expanded your European business?

S. Holland: Our European network has most recently been expanded by the acquisitions of Natural World in Italy, Abaci in Turkey and the chemical supply activities of Yara International at the sites in Köping, Sweden and Tertre, Belgium.

In terms of products, Natural World added extensive technical expertise in the dairy and bakery industries as well as in food performance products.

Abaci expanded Brenntag's Turkish capacities into the cos-

metics, industrial and household cleaning and detergents sectors with particular product strength in the surfactants and oleo chemical lines.

The Yara transaction includes ammonia nitrate solution, aqueous ammonia and weak nitric acid supply activities conducted from the Köping production site in Sweden and the Kemira GrowHow production site in Belgium, the latter also adding concentrated nitric acid supply activities to our portfolio.

Natural World and Abaci both expand your specialties segment, which is a declared key area for Brenntag in Europe.

S. Holland: Yes indeed, specialties account for roughly more than one third of Brenntag's European business, i.e. about €1 billion in sales. You see us acquire niche operations, which further enhance our market penetration in certain specialty fields, and we will, for example,

continue to grow our food ingredients business in this regard. The underlying strategy for Brenntag as a full-line chemical distributor is a two-channel approach with one channel fully geared to specialty chemicals.

What makes the specialties segment so attractive for Brenntag?

S. Holland: The size of the market and the above-average growth rates make specialties very interesting for us. We are responding to what our principals are looking for. You need a different selling approach for specialties and deeper customer contact, and we are re-branding our offering in certain areas step by step.

Capital expenditures in 2007 for Brenntag worldwide totaled €95 million. Can you give some examples of investments you realized in Europe?

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COLLABORATION

JV: Momentive and Anabond Momentive Performance Materials and Anabond announced their joint development agreement to develop and manufacture Spur Sealants in India. Utilizing Momentive's research, development support and expertise of the Spur+ pre-polymer Anabond will manufacture this product in their Chennai/Puducherry plant for serving the local markets. Momentive will market this product in the construction segment and Anabond will market it in the automotive and electrical & electronics segment under license from Momentive. Other Areas not specified under this agreement are open to both the companies for marketing their products based on mutual understanding. Speaking on this occasion VP Nalian, Managing Director, Momentive Performance Materials said "This development is a quantum leap in silicone sealants area, in this part of the world and is in line with Momentive India's Vision of combining global technology with local application development, manufacturing and service to bring world class products and services in silicones to the Indian market. We believe Anabond is the right partner for this joint development agreement to develop Spur Sealants in India. The partnership of Momentive and Anabond will see the launch of the Spur Sealants by the fourth quarter. The project will be led by K. Adhi Narayanan, director on behalf of Anabond, and by Dr. Venkatesh Shingankuli - director technology and application development of Momentive. ■

BASF and Evonik Join Forces BASF said it agreed with Evonik Industries to jointly develop ceria-based slurries used in the production of computer chips. The two German chemical companies expect to bring the slurries to market in 2009, BASF said in a statement, without disclosing financial terms. Slurries containing nanoscale materials such as ceria are used to polish the silicon dioxide surfaces of wafers used for microchips. Evonik will provide the cerium oxides needed for the technology, while BASF will contribute its knowledge in slurry formulation chemistry, production and application. ■

Sigma-Aldrich's Antibody Collaboration Sigma-Aldrich said it has entered into a five-year collaboration with the University of California, San Francisco, to develop optimal cell lines for the production of monoclonal antibodies. The scientists will lead the research into antibodies for a variety of cancer targets, autoimmune diseases, stem cell characteristics and commonly neglected disease targets. Financial details were not disclosed. ■

Lanxess: Best Quarterly Earnings in its History

Lanxess has reported that its Q2 Ebita before special items advanced 5.7% to a better-than-expected €223 million, on higher sales in Asia and Latin America and as it passed higher feedstock prices on to customers. Analysts had expected a headline figure of €207 million on average, based on seven estimates collected by Thomson Financial News partner dpa-AFX. The chemicals maker said in a statement that net income came in at €53 million, com-

pared with a loss of €59 million a year earlier, when exceptional write-downs on its Lustran Polymers business weighed on earnings. The bottom-line figure fell short of the €57 million expected by analysts. Lanxess in October transferred the Lustran unit into a joint venture with UK chemical maker Ineos, which took control of the entity.

Lanxess plans to sell its 49% stake in the venture to Ineos in less than two years. Quarterly sales added 2.2%

to €1.765 billion from €1.727 billion a year earlier, beating the consensus, which was for €1.645 billion. Adjusted for currency swings, divestments and acquisitions, sales increased by 14%. In a separate statement, Lanxess said it plans to move its headquarters to Cologne, Germany, from Leverkusen, Germany, by 2011. Lanxess is running out of office space at its current buildings, situated at the site of the headquarters of its former parent Bayer, it said. ■

Industrial Gas Firms' Credit Quality Stays Stable

The world's leading industrial gas companies should be able to maintain or even improve their credit profiles over the coming years, despite soaring energy costs and uncertain global demand, said Standard & Poor's in the report "Why Industrial Gas Companies Can Rise Above Economic Turbulence."

Author of the report Standard & Poor's credit analyst Tobias Mock said, "Industrial gas companies' strong business models allow them to largely pass on higher energy and raw material costs to customers." They are also relatively sheltered from economic downturns because their volumes are only partially affected by lower demand. This is because they benefit partly from contractually pre-agreed volumes and the economic slowdown affects mainly their customers' selling prices rather than vol-

umes. In spite of the significant investments made over the past few years, Standard & Poor's does not expect the industrial gases segment to suffer from overcapacities because it looks set to continue growing at a pace of at least twice that of GDP over the next few years.

The five rated companies in the industrial gas sector have shown an average sales growth of 8.4% per year since 1998. The main pressure on industrial gas companies' credit profiles over recent years has been large-scale mergers and acquisitions (M&A) and generous shareholder payouts. Following a wave of M&A over the past four years, the industrial gases market is now highly consolidated. Just four major players account for about 65% of the external market: France-based L'Air Liquide (A/Stable/A-1),

Germany-based Linde (BBB+/Stable/A-2), and U.S.-based Praxair (A/Stable/A-1), and Air Products and Chemicals (A/Stable/A-1). These four globally active companies have strongly diversified sales by geography and a well-diversified customer base serving industrial clients, utilities, oil and gas companies, as well as the health care industry. A fifth major player is Airgas Inc. (BBB-/Positive/-), although it is largely focused on the distribution of packaged gas and solely active in the U.S. These dominant companies are protected by high barriers to entry due to technological, infrastructure, and capital intensity needs. All five have investment-grade ratings. Four have stable outlooks, while the outlook on Airgas is positive because further upside potential is likely over the coming years. ■



PORTFOLIO

Air Liquide's Buying Spree Air Liquide said it has bought India's Pure Helium, a supplier of liquid helium that has a presence in the Middle East. No financial details of the transaction were disclosed. The Indian company, created in 1985, is present in the UAE, Saudi Arabia and Egypt and posted \$20 million sales in 2007. Air Liquide said world demand for helium, used in electronics, offshore oil activities and certain medical treatments, is being boosted by strong growth in industrial demand. Air Liquide also said its Air Liquide Electronics U.S. (Aleus) unit has completed the acquisition of the chemical management division of Edwards Vacuum, based in Chanhassen, Minn.. It said the acquisition complements Air Liquide Electronics' position in the high purity fluid equipment and installation sector, particularly in the U.S. and Asia. "The ability to offer a more robust and cost competitive line of chemical dispensing equipment uniquely positions Air Liquide to better serve end user and OEM customers and more widely establish itself as a provider of choice to the semiconductor industry," said David LeBlanc, president of Aleus. ■

Ashland Acquires Hercules Specialty chemicals group Ashland said it agreed to acquire Hercules in a \$3.3 billion cash and stock deal. Ashland said it will acquire all outstanding shares of Hercules for \$18.60/share in cash and 0.093 of a share of Ashland common stock for each share of Hercules common stock. The deal also includes \$0.7 billion of net assumed debt. The transaction is expected to close by the end of calendar 2008, it said. ■

Pipelife Acquires Instaplant Pipelife International, a 50/50 joint venture between Belgian chemicals and pharmaceuticals group Solvay and the Austrian construction materials manufacturer Wienerberger, has acquired the Czech plastic pipe systems producer Instaplant Praha. Pipelife said Instaplant Praha generated a turnover of around €11 million and had 94 employees in 2007. The parties agreed not to disclose the financial terms of the transaction. ■

Limited Access

Chinese Port Restrictions During Olympics Create Logistical Challenges

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demand for your services after the ban is lifted?

K. Loyens: We hope that during the coming months the situation will stabilize a bit and that implementation of the regulations will normalize. What is to be expected once the

ban has been lifted is difficult to predict, and since the availability of equipment or containers in China is always an important issue for exporters, we will have to see how developments go. Nevertheless, we suggest our customers to try and arrange their planning as good as possible in advance and discuss it with us in time, so we can make the necessary arrangements.

Considering the size and importance of the Olympic Games for China, it is not surprising that very serious measures have been taken.

Some major chemical companies like BASF and Bayer have already applied for this.

How has the ban on the movement of dangerous goods affected chemical production sites in China?

K. Loyens: I think a major problem is the unclear communication and interpretation that has taken place by the authorities. Based on our resources, the coordination of the whole dangerous goods regulation was originally in hands of the Ministry of Transport,

which issued rather clear-cut guidelines at the beginning of this year. The responsibility was shifted to the Ministry of Security after a few months. Combined with certain guidelines and principles that were initially issued were suspended, reviewed and partially reissued this all created a lot of confusion on the side of the industry and other parties involved.

We were informed that there are a number of state-owned enterprises in the Beijing area seem to have decided to partly stop their production between mid July and the end of September.

As I said before, companies have the possibility to request for exemptions for the purchase, manufacturing, storage or transportation of these products, but in practice, we hear a lot of complaints from the chemical industry mainly, because there is a lot of confusion on the implementation of the regulations. This causes a lot of uncertainty and problems in their supply chain. Separate approvals are required for the manufacturing, transport, storage and movement of the restricted products.

Also, additional security and reporting measures are required for companies including daily or weekly reporting to the local police authorities, etc. We have heard comments of

chemical plants that weekly checks and audits are planned and even that security camera's need to be installed. All these elements certainly create an additional administrative and cost burden.

Are there alternative routes that can be used during the ban?

K. Loyens: Aside from importers in China applying for exemptions, we have also noticed that alternative import ports are being considered which might have more flexible implementations of the regulations. We, for instance, have noticed that the port of Ningbo or Zhangjiagang are more being considered for imports to Eastern China.

Do you think that such an extreme ban is necessary?

K. Loyens: Whether necessary or not, it is not the first time that similar regulations have been issued. Also during the People's Congress or Congress of the Chinese Communist Party, similar standards were issued in Beijing. Considering the size and importance of the Olympic Games for China, it is not surprising that very serious measures have been taken. Also the conflicts in Tibet earlier this year and

the fear of terrorist attacks feed the concern of the Chinese authorities. It is in such a case not the first time that the Chinese government decides to take – for Western concepts – very rigorous measures.

This is still an important part of the "political risk" of the business environment in China. Despite the fact that China has come a very long way, these practices show that there are still significant differences between the Chinese and Western way of dealing with these issues.

How do you see the competitiveness for foreign companies in China? A recent survey has shown that 54% of such companies believe that China is losing its advantage over other low-cost countries such as Vietnam and India. Can such a ban lead to even more companies leaving the country completely?

K. Loyens: I am not sure whether the ban necessarily will influence China's competitiveness. It is indeed true that things are changing in China. Increasing inflation and the tightening control of the central government on the rising investments all have an important impact, of course. Over the last few years, the Chinese government has also been clearly changing

its course and being more selective in what type of investment it aims for. The Chinese government is trying to refocus towards more high end, efficient and "green" industries and moving away from the older, low value, heavy polluting industries.

This has consequences, of course, and a clear shift was noticeable over the last few years of industries shifting to other countries in Southeast Asia. It is one of the major challenges of the Chinese government to monitor the modernization process its economy is going through.

Nevertheless, China still remains a very important and attractive investment base and market. It is crucial that every company individually considers what the main drivers are in their internationalization strategy. Not because China is "hot," it also means it is an interesting investment location for every company or every industry.

The political risk, of which the dangerous ban is an example, is also present in other Asian economies, maybe in other ways or forms, or maybe there are unstabilizing factors, which are not present in China. Evaluating all this elements is an exercise every company has to make individually.

▶ www.kerrytalke.com

Gearing Up

Brenntag Screens Opportunities for Expansion

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S. Holland: The majority of the investments provided expanded capabilities, greater efficiency or enhanced safety. Major 2007 capital expenditures included the modernization of our facility in Hamburg, Germany, which re-opened after a two-year construction period with state-of-the-art technology in filling, order picking and mixing and loading areas, a high quality laboratory as well as a clean room with new filling technology that meets GMP standards.

In addition, we built a full-service custom formulation and blending facility for feed additives in Kedzierzyn-Kozle in Poland with an annual capacity of 25,000 t, which serves a significant warehousing and distribution function.

Part of the investments also went into our facility in Valencia, Spain, funding extensive renovation and capacity upgrades of the solvent and inorganic tank farm, and into the relocation of the facility from Wimborne to Wareham, UK, including the upgrade of tanks, machinery and drumming facilities.

This year, we realized the relocation and upgrade of the tank farm for solvents and mixing and blending equipment in Rotterdam. The storage and distribution center was relocated to the Chemiehaven of Rotterdam Port adjacent to the Vopak terminal with whom we developed an innovative and efficient integration of facilities. Thanks to the efficient set-up and the flexibility created through the connection with the Vopak terminal this new site will support the further development of Brenntag in the Netherlands in terms of the distribution of solvents and chemicals as well as our service and quality for customers and suppliers.

Are there any new investments in acquisitions or capital expenditures planned already?

S. Holland: At this stage, we are relatively happy with the current level of investments within Brenntag Europe. We continue to upgrade our facilities in particular with regard to specialised storage of food and pharma products. Our annual investment span is broadly being maintained at 2007 levels.

The FECC Annual Congress 2008 in June had the motto "Partnerships for Success." What makes partnerships in the chemical successful?

S. Holland: Ultimately, partnerships generally work when we have shared

values in terms of both the commercial and the growth objectives for the distributor and supplier or principal. It is pretty much a shared-value approach. We find that the most successful partnerships that we have are where there is a significant correlation between the supplier and principal and ourselves in terms of our mutual objectives and targets. And when you see the seamless connection between the supplier or principal and the distributor, it is only when you have aligned objectives that you see shared success. So, it is much about learning about our values and our targets and our aspirations at an early stage what makes a successful partnership.

You participated in a panel session on topics related to the expansion of the FECC to the countries of Central and Eastern Europe. Brenntag, of course, has been operating in these markets for a while. Which business opportunities do you see in this region?

S. Holland: As far as Central and Eastern Europe is concerned, we have had a long-term investment and growth strategy. Our business has grown significantly over the past several years. Turkey and the Ukraine both are major markets for today and the future. And I think that it is fair to say that we believe that the Eastern European markets will grow in line with their demand for capital and for chemicals in the future. It is a genuine reason why we see a demand-driven growth of the Eastern European sector. So we want to be there and it is a strategic long-term view, you see us grow in specialty chemicals, in niche products and niche applications and also geographically.

Which challenges and hurdles do Western distributors have to cope with and overcome to be successful in CEE?

S. Holland: I think the key to it is to not to have a short-term view. If you want to grow successfully in CEE, you need to be prepared to be there for the long haul and to establish long-term relationships with customers and suppliers in the region. It is certainly not a transactional environment where you can go in with a cheap-priced product and expect to get loads of business. So, we are looking at mature, long-term relationships and we have to be ready to invest time and energy. For us CEE is a long-term strategic growth objective.

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SALES & PROFITS

Dow Chemical Q2 Profit Hurt by Costs Dow Chemical said that second-quarter earnings fell as its price increases had failed to offset a sharp spike in energy and raw material costs. Net income fell to \$762 million, or 81 cents a share, from \$1.04 billion, or \$1.07 a share, a year earlier. Dow has long been among the largest global makers of commodity chemicals such as those used to make plastics, but that business is typically cyclical and yields thinner margins than specialty chemicals. Shares of Dow have fallen almost 15% in the last three months, while the Standard & Poor's Chemical Index is down 3.3%. ■

Solvay Posts Q2 Decline Belgian chemicals and pharmaceuticals group Solvay posted a decline in its second quarter results, due to increased energy and raw materials costs. Net profit for the group decreased to €131 million from €195 million in the corresponding period last year, with Solvay's share of net income at €127 million from €183 million last year, under analysts' estimates of between €161 million and €166 million. Sales came in at €2.357 billion, down from €2.436 billion last year. Analysts had forecast sales of between €2.360 billion and €2.430 billion. Rebit was €249 million compared to €291 million in the same period last year, below analysts' expectations of between €260 million to €261 million. The group said its results for the full year will remain at a "sustained level" but will not reach the "record" level of 2007, taking into account the level of the U.S. dollar and continued high energy, coal, coke and ethylene prices level and it will announce price increases of 10–50% for its primary chemicals and plastics products. The group said the operating result of its pharmaceuticals division, however, should reach the 2007. ■

Symrise Q2 Net Up More than Half Symrise said second-quarter net profit jumped by more than half to €35.9 million, up from €23.4 million a year earlier, as the German flavors and scents maker cut costs and sold more in emerging markets in Asia, Eastern Europe and Latin America. The bottom line exceeded the average estimate of €29.6 million in a survey by Thomson Financial News. Quarterly Ebita edged 1.6% higher to €71.4 million, slightly below the consensus of €72 million. Symrise, whose customers include Nestle, Unilever and Procter & Gamble, said in a statement that sales rose 2.5% to €338.0 million in the second quarter. As a result of higher raw-materials, packaging and distribution costs, which Symrise said it can only pass on the customers with a time lag, the company lowered its full-year earnings guidance, while seeing higher revenues than previously. The company said it expects full-year sales to increase 6–7% and Ebita to grow 6%, both adjusted for currency swings. For the first half net profit was up 16% at €60.8 million, while sales rose 2.3% to €676.0 million. Symrise is trying to get shortlisted as a key supplier to the world's largest makers of consumer products, who are reducing the number of suppliers of scents and flavors in a bid to streamline procurement. ■

Rhodia Q2 Net Drops Rhodia has reported a 4.6% drop in second-quarter recurring underlying profit and confirmed its 2008 forecasts. Recurring Ebita, or earnings before interest, tax, depreciation and amortization, fell to €187 million from €196 million, the company said in a statement. Revenue was up 0.4% to €1.227 billion. Analysts had on average forecast recurring Ebitda of €175 million and revenue of €1.26 billion. The group repeated that 2008 recurring Ebitda should be "within 5 percent" of the 2007 level and earnings per share should increase versus 2007. Rhodia's second-quarter operating profit was unchanged at €115 million and net profit rose to €35 million from 3 million in the second quarter of 2007. Chief Executive and Chairman Jean-Pierre Clamadieu said in a conference call he expected an increase in the group's dividend in 2008. ■

Rohm & Haas Q2 Misses Estimates Rohm & Haas said second-quarter earnings from continuing operations fell to \$147 million or 75 cents a share, from \$161 million, or 75 cents a share, in the year-ago period. Excluding restructuring, asset impairments and the impact of the divestiture of the company's stake in UP Chemical adjusted earnings were 82 cents a share, missing the mean estimate of analysts polled by Thomson Reuters of 85 cents a share. Revenue for the Philadelphia-based specialty chemicals company rose 17% to \$2.57 billion from \$2.19 billion a year earlier. Analysts, on average, had estimated revenue of \$2.51 billion. Rohm & Haas attributed the increase in revenue to strong growth in its electronic materials and chemical businesses outside North America. ■

"Looking to the future, we are excited about the potential of a stronger, faster growing and more profitable company. The announcement of the definitive agreement for the Dow Chemical Company to merge with Rohm & Haas places us at the heart of change for the specialty chemicals and advanced materials industries," the company said. On July 10, Dow Chemical Co. agreed to buy Rohm & Haas for more than \$15 billion in cash. ■

Roche's Ratings on Negative Watch Fitch Ratings said it placed Swiss drug maker Roche Holding's 'AA' long-term issuer default rating (IDR) and 'F1+' short-term IDR on negative watch, based on the company's offer to acquire the 44% of shares in Genentech it does not already own, for about \$43.7 billion. Fitch said it believes that leverage will rise to a level outside of the current rating category, given a large amount of debt necessary to finance the transaction. The rating watch will be resolved as additional details of the capital structure become available, it added. ■

Halftime – At the mid-point of 2008, it's clear that the global economy is slowing, the result of high energy prices, the credit crisis and a slowing U.S. economy. Dr. Thomas Kevin Swift of the American Chemistry Council takes a closer look at the effects on the world's regions.

Growth is moderating in Western Europe and the slowdown is more pronounced in Japan. Latin America and Africa and the Middle East are still benefiting from emerging market momentum but it is the emerging markets of Asia and Europe that are experiencing the strongest growth. These markets, however, are still vulnerable as potential global transmission of the credit crisis is still in place, and could affect other economies.

Muddling Through

According to the International Monetary Fund, world gross-domestic product grew 4.9% (purchasing power parity basis) in 2007, marking the best four-year period since the early-1970s. Assuming no pronounced recession in the U.S., the global economy should muddle through in 2008, and into 2009 and 2010. Led by continued strong economic growth in emerging markets, world economic growth will average a sustained 3.8% per year in 2008 and 2009, before recovering to an above average pace in 2010. Growth in world trade appears to have peaked, but will expand at a pace 1.6 times that of output.

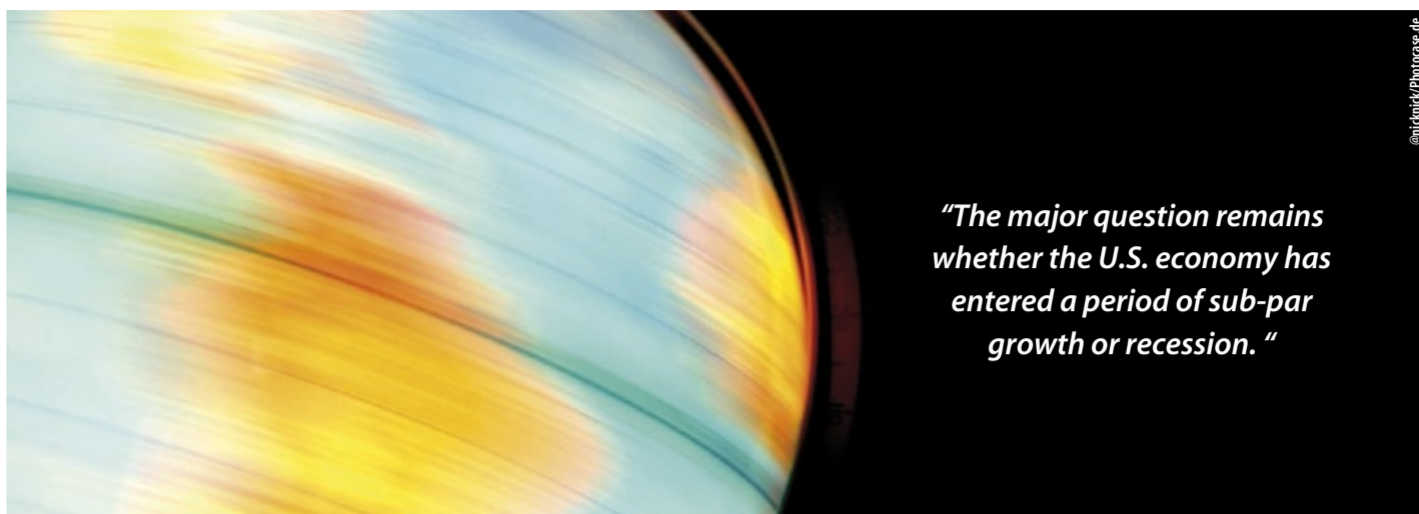
Inflation measures in many countries have intensified. High energy and food costs are fanning inflation, especially in emerging markets as the world economy encounters capacity constraints, most notably in energy. Weather and policy considerations have affected food costs as well. Global inflation will accelerate from 3.9% in 2007 to 5.3% this year. The U.S. economy has lost momentum and economic growth is well-below trend, hampered by the effects of the housing slump, the credit crisis and particularly high energy costs, which are eroding consumer income and offsetting the stimulus from the rebates. The light vehicle industry is in a downturn as are industries tied to housing (carpeting, furniture, appliances, etc.) and manufacturing in general. The major question remains whether the U.S. economy has entered a period of sub-par growth or recession.

U.S. Consumers Tightening Their Wallets

A number of positive factors (strong exports, lean inventories, solid corporate balance sheets, monetary and fiscal stimulus, etc.) should help to partially offset the adverse effects from: high energy prices; a housing sector still in a free fall; the spread of weakness to other sectors of the economy; shrinking job prospects; declining home prices; soft equity markets; falling consumer confidence; and eroding incomes from higher inflation. These factors are combining to affect already fatigued consumers, who are throttling back spending. At best, the U.S. economy will continue well below-trend for a period, with a timid recovery likely. There is, however, high risk of a more typical recession, especially as the stimulus from the rebates dissipates and as energy costs eat into incomes.

Vulnerable Times

While the Global Economy Slows, Emerging Markets Gain Momentum



"The major question remains whether the U.S. economy has entered a period of sub-par growth or recession."

Emerging Countries: Major Centers of Growth

Since early-2007, year-over-year (y-o-y) growth in global industrial production moderated, but the pace has decelerated sharply in recent months. Production in China and elsewhere in Asia-Pacific remains strong but leading indicators of global industrial production confirm a peak in the cycle and that the global industrial cycle is shedding momentum. After a 5.2% gain in 2007, growth in manufacturing activity will moderate in 2008 and 2009. Major growth centers continue to be China, other East Asia, and some Central and Eastern European nations. The risks of a sharper, more pronounced downturn (i.e., a pronounced recession) are relatively high. Rising energy costs and inflation present the largest risk and are followed by lingering effects of the U.S. housing downturn and credit crisis, which could lead to a more serious retrenchment in the broader economy. A hard landing with a post-Olympic bust in China (a major economic locomotive) is another threat as are ever present financial market risks amid global imbalances.

Finally, another major terrorist attack, or other as yet unforeseen events could dampen the global economy. Long-term world economic growth should average 4.3% per year through 2017, with global industrial production averaging 4.5% per year. Growth dynamics have shifted to the emerging nations, which account for one-half of world economic activity. World trade will continue to expand at a fast pace.

Global Chemistry Business Slowing Down

Overall activity this year in the \$3.18 trillion global business of chemistry has moderated as well. On a y-o-y basis, global production was up 2.9% in the first quarter and excluding pharmaceuticals, production was up 2.8% y-o-y. The year-earlier comparisons have moderated into the second quarter. Gains during the past year have been largest in China, elsewhere in Asia-Pacific, Africa and the Middle East, and Central and Eastern Europe. The global chemical industry still appears to be in an expansion mode, with growth shifting to emerging markets and slowing elsewhere. Leading indicators of global industrial production continue to suggest slowing activity.

Germany and Ireland to Have Strongest Growth

Global business of chemistry output will decelerate this year, increasing 3.5%, down from 4.5% in 2007 and from peak growth of 5.4% in 2004. Growth will improve slightly to 4% in 2009 and barring a global recession into 2010. The most rapid growth will occur in Asia-Pacific (excluding Japan), Africa and the Middle East, Central and Eastern Europe and Latin America. Among the

developed nations, Germany and Ireland will experience the strongest growth. Growth for the world chemical industry during the next 10 years will average 3.9% per year, with the emerging markets exhibiting the strongest prospects. With the slowdown in manufacturing, growth in American chemistry has stalled since the third quarter of 2007. A build-up of downstream customer inventories and subsequent drawdown occurred, with adverse effects on chemical industry production despite rising exports. Downstream inventory destocking, however, appears to be running its course and recent months have seen some improving activity. Leading indicators of manufacturing activity, however, point to slow activity.

American Chemistry off to a Slow Start

With a weak start to the year, American chemistry will experience a gain of less than 0.5% during 2008. Pharmaceuticals took over as the growth leader and will expand 2.1% this year. Excluding pharmaceuticals, slippage will actually occur for the year as a whole. Most basic and specialty chemical segments will face challenges this year. This will especially be the case for segments tied to housing, light vehicles, furniture and appliances. Overall American chemistry growth will improve to 2.0% in 2009 and then 2.5% in 2010 as both basic chemicals and specialties will strengthen.

Continued recovery in volumes combined with slow capacity gains pushed overall operating rates to an average of 79.2% in 2007. Cyclical softness in the industry has caused this to slip recently but improving output in combination with modest capacity additions will gradually push capacity utilization to near 80% by 2010. From

a regional perspective, the situation of American chemistry has been mixed. Most regions will face challenges during 2008, especially in the Gulf Coast and Ohio Valley regions, which are dominated by basic chemical and specialties production. Industry growth, however, will recover across all regions during 2009 and 2010. American chemistry faces some economic headwinds. A major risk at this point in the cycle is volatile natural gas costs as long-term supply-demand imbalances remain. A comprehensive U.S. energy policy ensuring adequate and diverse supply – including that from Outer Continental Shelf (OCS) – would go far in moderating volatility and supporting the competitive position of U.S. industry.

Export Prices To Increase

During 2008, high feedstock and other energy costs and improving operating rates are resulting in higher chemistry product prices and contributing to higher shipment levels. As a result, shipments of the business of chemistry in 2008 will likely rise 2.3% to \$679 billion. Continued expansion of production through the next couple years will push shipments to \$706 billion in 2009 and \$738 billion in 2010.

In 2008, U.S. exports of chemistry products will likely rise nearly 14% to \$174.9 billion and imports will increase 11.5% to \$173.7 billion. As a result, the trade deficit in chemistry will turn from a \$1.2 billion deficit to a \$1.2 billion surplus. The value of the dollar will remain relatively low through 2008 and into 2009. Chemical trade will moderate as global markets slow in 2009. As a result, the trade surplus will grow in 2009 before slipping in 2010 as the dollar strengthens and the U.S. economy accelerates, boosting imports. As a science-

and-technology, knowledge-based endeavor, the business of chemistry invested \$27.3 billion in research and development (R&D) in 2007. Spending gains will be modest, with R&D spending reaching \$28.6 billion in 2008. Continued gains are expected during 2008 and 2009. Capital spending cycles generally lag cycles of industry activity. Spending increased 8.0% to \$24.3 billion in 2007. With only nominal growth in recent years, capital spending gains will moderate, with spending increasing to \$25.9 billion in 2008, \$26.9 billion in 2009, and \$28.2 billion in 2010. Overseas capital spending gains will be stronger.

Growth for American chemistry during the next 10 years will average 2.4% per year in volume terms. Aided by a graying "baby boom" generation, pharmaceuticals will experience the strongest dynamics. In summary, the U.S. economy has slowed, with falling housing activity, squeezed consumer spending, and rising energy and food prices characterizing the near-term. Improved economic prospects are likely for 2010. This dynamic will provide an environment for the business of chemistry in which production will continue to increase, albeit at a diminished pace.

The risks, of course, are still high and another, less optimistic future for the economy is always possible. Energy and inflationary pressures could lead to a boom-bust cycle. Stronger growth and inflation lead to more aggressive tightening of monetary policies, setting the stage for weaker performance.

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Clariant: Improved Operating Margin



Jan Secher
CEO, Clariant

costs in the same period, this led to an improvement of 0.5 percentage points compared to full-year 2007 gross margin. Operating income before exceptionals amounted to CHF 310 million.

The stringent implementation of the previously announced restructuring measures has resulted in a reduction of 750 job positions in the first half of 2008, restructuring and impairment expenses amounted to CHF 53 million. Since

"We are prepared to undertake further restructuring measures that may be necessary, should the economic climate significantly deteriorate."

November 2006, Clariant has reduced about 1,800 out of the 2,200 job positions that were planned for reduction in the Clariant 2010 strategy. As part of Clariant's strategy to reduce the number of sites, the board of directors approved addressing the excess capacity situation at the textile, leather and

paper chemicals division site in Horsforth, UK. Clariant said it will enter into discussions with the employee representatives that should lead to the closure of the site, which employs roughly 270 people. If the proposals go ahead approximately 160 job positions will be made redundant.

CEO Jan Secher commented: "Against the backdrop of an increasingly difficult economic environment, we are decisively implementing the restructuring

and cost saving measures that have been initiated over the last 18 months in order to protect ourselves against the potential continuing decline in demand. We are prepared to undertake further restructuring measures that may be necessary, should the economic climate significantly deteriorate." ■

Blocking Catalysts

The Perfect Match

Reaction Routes – An important factor in developing fine chemicals, pharmaceuticals, agrochemicals, flavors and fragrances, food additives and dyes and pigments is choosing the right reaction route to the final product.

Catalytic routes have proven to be one of the most effective ways for simplifying reaction routes to these compounds by increasing product selectivity, and reducing waste and hazardous materials handling. Consequently there is an ongoing need for more active, more highly-selective and more environmentally-benign catalysts. One of the most widely used heterogeneously catalyzed chemical transformations in fine chemical applications is the deprotection reaction of protected alcohols and/or amines. The most commonly used catalysts for deprotection reactions are palladium on carbon powder (CP) supports of which Pearlman's catalyst (20% Pd(OH)₂/CP) is the most widely known.

Although these catalysts are commercially attractive for certain molecules, their disadvantages include the occasional need for high catalyst (i.e. precious metal) loadings in the reactor, and a limited choice of solvents due to low catalyst hydrogenation activity. Here, we highlight a recent BASF innovation in the field of highly active and selective heterogeneous palladium catalysts for deprotection reactions: BASF Blocking Group Removal (BGR) catalysts. This family of products was developed through combining innovative carbon supports with enhanced metal deposition technologies and was nominated in 2007 for the CPhI Innovation Award. BGR catalysts show surprisingly high catalytic activity while maintaining good selectivity, thus enabling higher process productivity and lowering overall process cost in deprotection reactions.

Research Results

Earlier work showed the deprotection reaction of 4-benzyloxy phenol (4-BP) to hydroquinone (HQ), could be used as a model reaction to evaluate the relative activity of different heterogeneous catalysts. Test conditions were optimized to guarantee that mass transport limitations were not masking intrinsic catalyst performance characteristics. Assuming zero-order kinetics, the reaction rate constants can be calculated from the slope of the hydrogen uptake curve.

Initial experiments focused on the possible effect of the metal reduction state on the overall activity of the catalyst in the 4-BP to HQ deprotection reaction. As shown in Figure 1, it was found that a significantly faster hydrogen uptake is observed for the unreduced Pd/CP catalyst compared to the reduced Pd/CP. Mechanistically this could be explained by assuming the rate-determining step to be an initial adsorption of the substrate (4-BP) to the metal surface. This adsorption process can only take place when free coordination sites are

available on the metal surface, thus the metal surface is not completely covered with hydrogen atoms, i.e. partly unreduced. This hydrogenation mechanism is not uncommon and suggests for any catalyst screening study that one should evaluate at least one catalyst in both its reduced and unreduced form. Further catalyst development work for the deprotection reaction of 4-BP focused on unreduced Pd/CP catalysts.

Optimization of the deposition technology used in the manufacturing of Pd on carbon powder catalysts resulted in further improvements of the catalytic performance in 4-BP to HQ. A summary of the results is presented in table 1. Entry 1 and 2 in this table give the performance of the two classical commercial deprotection catalysts Escat 147 and 167 (both 5% Pd/CP unreduced, waterwet) with a relative activity number of 35 and 36, respectively. Modifications in the deposition technology resulted in the preparation of 5% Pd/CP BGR-1 catalyst, which showed a significant higher activity number of 55 in the reaction 4-BP to HQ (table 1, entry 3). More in-depth studies were initiated to investigate a possible relation between catalyst performance and carbon support characteristics. It was found that carbon powder supports with certain specific total pore volume, surface area and micro pore surface area, lead to catalysts with an unprecedented high activity in the 4-BP to HQ deprotection reaction. In addition to this high activity, catalysts based on these supports may exhibit improved selectivity by minimizing side reactions, such as hydrogenation of unsaturated carbon-carbon bonds, dehalogenation reactions, etc. Several different catalysts were made based on this type of support and tested in the deprotection reaction of 4-BP to HQ. For example, combining the optimal deposition technology with special BGR carbon powders resulted in the preparation of 5% Pd/CP BGR-2 (entry 4 in table 1). This catalyst showed for a 5% Pd/CP catalyst a so far unprecedented high activity number of 83. This activity number is 50% higher than that observed for the 5% Pd/CP BGR-1 analogue (table 1, entry 3) and more than double the activity found for the classical 5% Pd/CP catalysts (table 1, entry 1 and 2). Interestingly, the novel 3% Pd/CP BGR-2 catalyst has a similar activity number of 34 (table 1, entry 6) as the classical 5% Pd/CP catalysts. The observed higher overall activity for BGR catalysts has potential technical and economical benefits to the user of BGR catalysts. Economical benefits are apparent due to the possibility of lowering the total process cost in deprotection reactions. For example, while using the same amount of BGR catalyst in a reaction as would have been used with a classic catalyst, the total conversion of the substrate can be achieved in much shorter process time. This obviously allows a higher throughput in the plant or "freeing up" the reactor sooner for other production runs. Another cost reducing alternative could be achieved by using the 3% Pd/CP BGR-2 version instead of the classical 5% Pd/

CP catalysts. This alternative would effectively lower the total amount of precious metal used in the process by 40%. With current palladium price of around \$13,500 per kg, the impact on the process cost is evident. The higher activity for BGR catalysts also leads to surprising technical benefits. The classic deprotection catalysts exhibit a catalytic hydrogenation activity which allows a limited number of different solvents to be used, like water and alcoholic solvents. Other solvents potentially lead to low hydrogenation activity for classic deprotection catalysts and thus prolonged reaction times. The limited choice of solvents also minimizes the scope of substrates for catalytic deprotection reactions, as dissolving the substrate is essential for obtaining acceptable deprotection conversions. Now, with

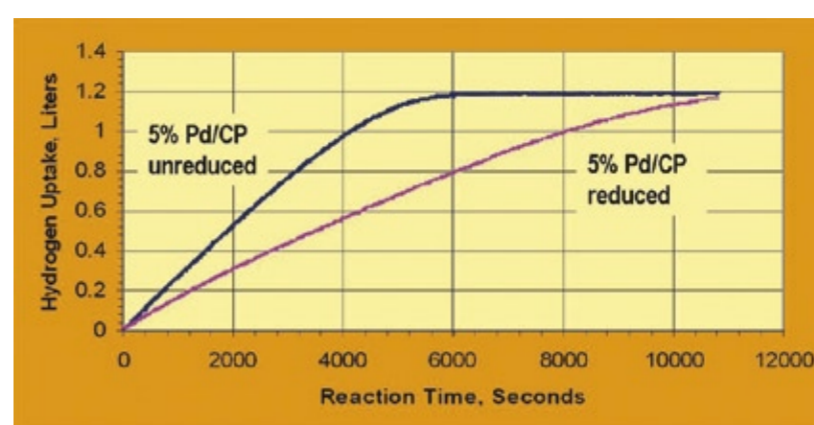


Figure 1: 4-BP to HQ deprotection reaction

the much higher intrinsic activity of BGR catalysts, other solvent systems can be taken into consideration. For example, using ethyl acetate as a solvent together with classical deprotection catalysts gives an unacceptable

activity number of 5–7 in the deprotection reaction of 4-BP to HQ. In contrast to this result, BGR catalysts give a stunningly high activity number of 116 and 135, which is even higher than the activity number for systems with MeOH as a solvent. Not only are the BGR catalysts applicable in O-deprotection reactions, they also have found effective use in N-deprotection reactions. For example, the new 3% Pd/CP BGR-2 catalyst has been evaluated in the N-debenzylation of N-phenylbenzylamine. As for the O-deprotection reaction shown before, 3% Pd/CP BGR-2 has approximately the same activity as the classical 5% Pd/CP in this N-debenzylation reaction, when compared on a similar

Table 1: Summary of catalyst results

entry	catalyst description	Solvents		
		MeOH	Ethyl Acetate	NMP
1	5% Pd/CP Escat 147	35	9	10
2	5% Pd/CP Escat 167	34	7	4
3	5% Pd/CP BGR-1	56	116	24
4	5% Pd/CP BGR-2	80	135	45
5	10% Pd/CP BGR-2	100	217	48
6	10% Pd/CP Escat 161	53	87	25

The best testimony to the innovative power of Merck, its reliability and close understanding of local and global markets is the sheer diversity of its products. The Merck portfolio currently encompasses more than 15,000 chemicals and reagents, active ingredients, test kits and analytical systems. Every day, new products join the fold, the result of purposeful research projects, specifically

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catalyst weight basis and under the same reaction conditions.

Conclusions

It can be concluded that innovations in the field of heterogeneous catalysts allow manufacturers in the fine chemicals industry to further increase the use of green catalytic technologies. The innovations leading to the new class of deprotection catalysts allow the use of non-standard solvents in deprotection reactions thus broadening the scope of deprotection substrates. In addition, this new class of heterogeneous deprotection catalysts enables higher process productivity while also minimizing overall process cost, by significantly lowering the amount of precious metals used in this reaction.

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Dow Chemical to Acquire Rohm & Haas



Andrew Liveris
Rohm & Haas

Rohm & Haas has agreed to be acquired by Dow Chemical for \$78/share. Dow Chemical said the transaction is worth roughly \$18.8 billion and that financing includes an equity investment by Berkshire Hathaway and the Kuwait Investment Authority in the form of convertible preferred securities for \$3 billion and \$1 billion respectively. Rohm & Haas said the deal provides that it will retain its headquarters in Philadelphia and continue to do business under its name. The terms also call for Dow Chemical to contribute complemen-

tary businesses to Rohm & Haas in areas such as coatings, biocides, and personal care products.

"As a result, annual revenue of Rohm & Haas will be approximately \$13 billion," Rohm & Haas said. Following the announcement, Moody's Investors Service placed the long-term debt and commercial paper ratings of Dow Chemical and Rohm & Haas under review for possible downgrade. Moody's said the transaction will be financed partly through the issuance of \$4 billion of convertible preferred securities, cash received from the formation of the PIC joint venture and up to \$5 billion of additional debt. The acquisition has been approved by the boards of both companies and will be subject to customary regulatory approvals and the approval of shareholders of Rohm & Haas. Dow currently expects to complete the transaction by early 2009. ■

Principles Of Heterogeneous Catalysis

Part II: Desired Characteristics of a Catalyst

Catalysis – Part I of this four-part series was published in CHEManager Europe 7-8/2008, www.chemanager-europe.com. This sequel focuses on the desired characteristics of a catalyst.

The following list provides several of the key attributes of a good catalyst:

- The catalyst should exhibit good selectivity for production of the desired products and minimal production of undesirable byproducts.
- The catalyst should achieve adequate rates of reaction at the desired reaction conditions of the process (remembering that achieving good selectivity is usually more important than achieving high catalytic activity).
- The catalyst should show stable performance at reaction conditions for long periods of time, or it should be possible to regenerate good catalyst performance by appropriate treatment of the deactivated catalyst after short periods.
- The catalyst should have good accessibility of reactants and products to the active sites such that high rates can be achieved per reactor volume.
- The first three key attributes of a good catalyst are influenced primarily by the interactions of the catalyst surface with the reactants, products, and intermediates of the catalytic process. In addition, other species may form on the catalyst surface (e.g., hydrogen-deficient carbonaceous deposits denoted as coke) that are not directly part of the reaction scheme (or mechanism) for the overall catalytic process.

The Principle Of Sabatier

The principle of Sabatier states that a good heterogeneous catalyst is a material that exhibits an intermediate



strength of interaction with the reactants, products, and intermediates of the catalytic process. Interactions of the catalyst surface with the vari-

ous adsorbed species of the reaction mechanism that are too weak lead to high activation energies for surface reactions and thus low catalytic activity, whereas interactions of the catalyst with adsorbed species that are too strong lead to excessive blocking of surface sites by these adsorbed species, again leading to low catalytic activity.

The principle of Sabatier is elegant in its simplicity and generality, but it is deceptively difficult to use in practice. In particular, this principle applies to a catalyst in its working state, and the nature of the catalyst surface can be expected to be dependent on the nature of the catalytic reaction conditions.

For example, one may begin the catalytic reaction with the heterogeneous catalyst in a given oxidation state (e.g., containing zero-valent metal particles following treatment of the catalyst in H_2 at elevated temperature); however, the nature of the surface can be changed dramatically upon interaction with strongly adsorbed species, such as the formation of carbonaceous deposits (coke), and formation of oxides, carbides, nitrides, or sulfides upon interaction with O, C, N, or S species, respectively. In this case, the interactions of these oxide, carbide, nitride, or sulfide surfaces with the adsorbed species enter into the reaction mechanism.

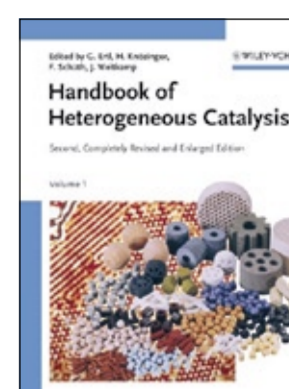
Of even greater complexity is the fact that a variety of different types of sites are typically present on a catalyst surface (e.g., sites having different coordination and/or chemical composition), and a majority of the observed catalytic activity may be caused by the contributions from a small fraction of the sites present on the catalyst surface. In this case, the adsorbed species interact with these special surface sites (e.g., steps and defect sites on a metal nanoparticle, or sites present at the metal-support interface of a supported metal catalyst).

Another factor that complicates catalyst design is that the strengths of interaction of the surface with adsorbed species typically depend on the surface coverages by adsorbed species. For example, the interaction of a transition metal surface with adsorbed CO may be very strong at low surface coverages (e.g., binding energy of nearly 200 kJ mol⁻¹), suggesting that these surfaces would be completely covered and thus poisoned by adsorbed CO at moderate pressures and temperatures; however, these surfaces may carry out catalytic reactions in the presence of gaseous CO at these pressures and temperatures because the differential heat of CO adsorption decreases significantly (e.g., to binding energies near 100 kJ mol⁻¹) as the surface

Handbook of Heterogeneous Catalysis

First published in 1997, the Handbook of Heterogeneous Catalysis, has become the standard reference on all aspects of the subject, from physicochemical foundations to large-scale industrial applications. Now in this updated and expanded edition, the Handbook of Heterogeneous Catalysis (Wiley-VCH; April 2008; 8 volumes, 4,270 pages with 2,000 figures; Hardcover; Print ISBN: 978-3-527-31241-2) provides coverage of every important topic and development related to the area of heterogeneous catalysis. This eight-volume set was edited by a world-renowned board of editors including Gerhard Ertl, recipient of the 2007 Nobel Prize in Chemistry.

► www.interscience.wiley.com/reference/hetcat



coverage by adsorbed CO increases. Accordingly, there is a relationship between activity and the interaction of the surface with adsorbed species at the surface coverage regime appropriate for the catalytic reaction conditions.

Catalyst Performance

The aforementioned complications caused by the presence of different types of sites on the surface, and the effects on the surface binding energies caused by changes in surface coverages, clearly make it difficult to interpret the performance of a heterogeneous catalyst in quantitative detail. Tools are certainly available to address these complications, such as kinetic Monte Carlo simulations combined with results from density functional theory (DFT) calculations.

Yet, from a different point of view, the presence of different types of sites and the effects of surface coverage may well contribute to the robustness of the heterogeneous catalyst for operation over a wide range of reaction conditions. In general, the presence of different types of sites and the effects of surface coverage both contribute to surface non-uniformity (different types of sites producing a prior non-uniformity, and effects of surface coverage causing induced non-uniformity). At a selected set of reaction conditions, an optimal set of surface binding energies exists that satisfy the principle of Sabatier (as discussed below).

Accordingly, the performance of a heterogeneous catalyst with a non-uniform surface will be dominated by the subset of the sites having surface binding energies closest to the optimal values. At higher temperatures, other sites having stronger binding energies with adsorbed species will become the dominant contributors to the observed catalytic activity, whereas sites having weaker binding energies with adsorbed species will control catalytic activity at lower temperatures.

Thus, while the effects of surface non-uniformity make it more difficult to predict the performance of a heterogeneous catalyst from a molecular-level understanding, these effects may serve to broaden the range of reaction conditions over which the catalyst can operate effectively. In this respect, our desire to design catalysts having very high selectivity is guided by the synthesis of uniform catalysts, where each site has the optimal properties for production of the desired reaction product. This strategy leads to the idea of highly selective, single-site catalysis as discussed by Thomas et al.

In contrast, the design of catalysts that operate over a wide range of reaction conditions is guided by the synthesis of non-uniform catalysts, such that different subsets of sites control catalyst performance at different reaction conditions. The disadvantage of using non-uniform catalysts, however, is that different sites may display different selectivities for the production of various products, and control over catalytic selectivity may thus be limited.

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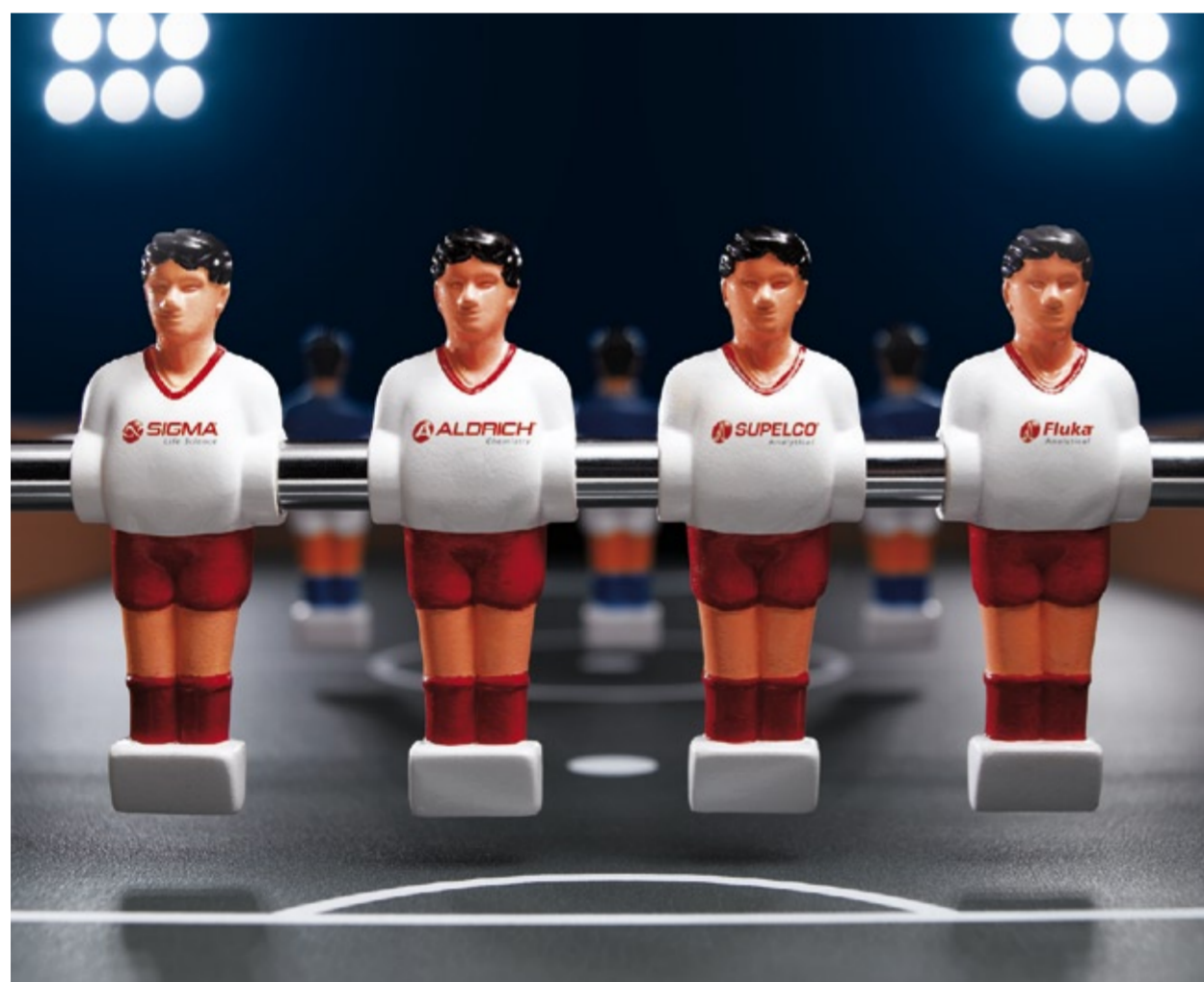
George W. Huber, University of Massachusetts, Amherst, Mass., U.S.

Michel Boudart, Stanford University, Stanford, Calif., U.S.

* References available on: www.interscience.wiley.com/reference/hetcat

Excerpt from "Handbook of Heterogeneous Catalysis"
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SIGMA-ALDRICH

Cognis Sells Its Stake in Cognis Oleochemicals to PTT Chemical

Specialty chemicals supplier Cognis has sold its 50% stake in the Cognis Oleochemicals joint venture to PTT Chemical International Private, a Singapore based wholly owned subsidiary of PTT Chemical Public Company Limited. PTT Chemical is Thailand's largest producer of olefins and associated products. Cognis said the sale was in line with its strategy of focusing on its core businesses driven by the wellness and sustainability trends. The final transaction is subject to usual closing conditions including regulatory approvals and is expected to be completed by the end of September. The sale was concluded for €104 million in cash, representing an enterprise value of €285 million for the entire joint venture.

Cognis already has established a successful relationship with PTT

Chemical: In 2005 they founded Thai Ethoxylate Ltd., a 50:50 joint venture and Thailand's first producer of fatty alcohol ethoxylate. 2006 saw the founding of Thai Fatty Alcohols Company Ltd., a 50:50 joint venture between Cognis and PTT Chemical's subsidiary Thai Oleochemicals for the production and marketing of fatty alcohols.

Cognis Oleochemicals is a major producer of natural-based oleochemical products and until now was a 50:50 joint venture between Sime Darby Plantation Sdn Bhd. and Cognis. It operates production sites in Europe, North America and Asia and achieved sales of €729 million, including €130 million deliveries to Cognis in 2007. Cognis and Sime Darby have been collaborating on the production, marketing and distribution of fatty ac-

ids, glycerin and associated products for almost 30 years. In 2006, both companies expanded the scope of their existing joint venture by transferring Cognis' global oleochemicals and plastics technology businesses into an operating company.

In an interview with CHEManager Europe, PTT Chemical said that the existing production sites will not be affected by the transaction in the short term. However, he cited the JV partners' commitment to investing in and growing Cognis Oleochemicals, which could lead to "new opportunities for the company and employee growth as the JV partners make decisions on expanding capabilities at existing production sites" in the long term.

Brandt Schuster

Brenntag Acquires Dipol Chemical International

Brenntag announced the acquisition of Dipol Chemical International. The company is focused on the distribution of chemicals in Ukraine, Russia and the Baltic States and also provides its services in Belorussia and Moldova.

Founded in 1994, Dipol is now a distributor of polymers and specialty chemicals in Ukraine, Russia and

the Baltic States. With sales in 2007 amounting to \$100 million, Dipol operates a well-established distribution network via offices and warehouses in Kiev, St. Petersburg, Moscow and Riga. The company serves a variety of industries and acts as distributor for companies such as Dow, Ineos, Ineos Nova, Dupont and DSM.

"We see huge potential in this area and want to participate in the growth of this East region. The acquisition enables Brenntag to enter the market in the Ukraine and substantially increases our presence in Russia," said Helmut Struger, managing director Brenntag Central and Eastern Europe.

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Production Expansion at SAFC Buchs Site

cGMP Compliance Significantly Improved

Expansion – Sigma-Aldrich Switzerland inaugurated its cGMP production expansion at the Buchs site mid June, aimed at improving cGMP compliance and creating additional cGMP production capacity. The construction activities were completed after 11 months

in April 2008, and the new building is fully operational.

The cGMP production expansion, an investment of CHF7.5 million will provide significant improvements on the isolation of material and personnel flow as well as on cGMP storage capabilities.

Michael Reubold asked Mike Harris, vice president sales and manufacturing Europe, SAFC, and Fabian Wahl, director production and chemistry, Sigma-Aldrich Switzerland, about the project:

CHEManager Europe: What role does the Buchs site play in the GMP production network of Sigma-Aldrich?

F. Wahl: SAFC Buchs plays a significant role within our operations network. It contributes with a significant portion to our worldwide sales within SAFC Pharma. As pipeline partner, the key role of Buchs is in process development and fast delivery of products during the clinical phases. Based on fast, flexible and reliable service we were able to build up strong relationships to key customers during the last years

How was the situation prior to the expansion of the cGMP production in Buchs? What were the drivers for the investment in the new production logistics building?

F. Wahl: Based on the fact that our main production building has very limited space and due to the significant business growth of the last years, we had reached a capacity endpoint. All modifications were handicapped through the available space. We had also to resolve various compliance issues concerning mass and personnel flow and access control.

So you realized a new GMP zone concept and separated material and personnel flow. Can you explain the key points of this concept?

F. Wahl: We have now a rigid access control to the critical areas such as cGMP production plant and could realize a directed mass flow so that only people working in specific areas enter these areas – that means there is no transmitting – which avoids the

risk of cross contamination, mix ups, etc.

How will your customers benefit from this expansion?

M. Harris: Our overall cGMP compliance has significantly improved. We have added GMP quarantine and storage capabilities for finished goods. We have three new ISO 8 classified rooms for open handling of APIs, dedicated for sampling, dispensation, etc. By separating of storage and production areas the safety level has been enhanced significantly.

What are the key technologies operated and the main products synthesized at the Buchs site at present? Are you planning additions to your technology portfolio?

F. Wahl: SAFC Buchs has a long history of producing high-quality pharmaceutical products. The plant specializes in complex, multi-step synthesis up to 1,600 l and low-temperature reactions (-60°C) up to 400 l. With the new situation of available space in the production building we plan, for example, an ongoing segregation of production equipment and closed handling, the implementation of micro reactor technology to our technology portfolio and the modernization of our drying capabilities.

Do you expect GMP production to stay in Europe rather than migrate to low-cost Asian countries?

M. Harris: Definitely yes! For projects where reliability and speed are the success factors our customers are looking for partners which can provide operations close to their own. You see also that Far East companies are building up capacity within Europe. In addition, Europe has a solid infrastructure of power supply, ecological regulations, logistics, for example which gives us competitive advantages.

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Fabian Wahl
Director production and chemistry, Sigma Aldrich Switzerland



Mike Harris
Vice president sales and manufacturing Europe, SAFC

In the past several years, sales of GMP products have increased dramatically, and with the previous production and warehousing arrangements, Sigma-Aldrich Switzerland could not attain full capacity from

the existing production operations. This was mainly due to congestion on the production floors caused by storage of raw materials and in-process intermediates that limits operations to 7/17 shift system. The expansion

project has created storage and locker room facilities with a building addition to the existing production building in order to fully use the existing production equipment and to further increase compliance with cGMP.

On level 1, a total floor space of 1,250 m² has been created in a reinforced concrete construction. The logistics part of total 900 m² will house the following functions:

- Chemical storage areas for quarantine, starting material, and blocked material
- Chemical handling for filling, sampling, and staging.

The safety concept includes explosion protected zones and automatic sprinkler systems for the storage of flammables as well as a 110 m³ retention basin for firefighting water.

The personnel part of 350 m² will house changing rooms for men and women and lounge/seminar room. In level 2 building infrastructure for supply of utilities and to maintain controlled storage conditions will be installed in a 320 m² steel construction.

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BASF Q2 Net Jumps 26.7 %



BASF said second-quarter net profit advanced 26.7% to €1.297 billion, beating the consensus, as surging oil prices bolstered the fossil fuel unit and on higher demand for food and drug supplements and pesticides. Analysts had forecast a bottom-line figure of just €1.074 billion, based on the average of seven estimates collected by Thomson Financial News. Quarterly sales at the world's largest chemical company grew 11.3% to €16.305 billion, also above analysts' expectations, which were for €15.60 billion on average.

Quarterly financial statements show that Ebit before special items, which jumped 18.6%, would have risen just 5% without the group's Wintershall oil and gas subsidiary, Germany's largest oil company. Chief executive officer Jürgen Hambrecht also confirmed his full-year outlook for sales and operating earnings to increase slightly in 2008 and his long-term guidance for BASF to grow

faster than the chemical market every year. Hambrecht, however, cautioned that he sees risks posed by "extremely high and volatile raw-material prices" and the weak U.S. dollar and a growing trend to "stagflation and the aggravation of geopolitical tensions."

Quarterly Ebit at the Wintershall oil and gas subsidiary, its largest unit, surged 44% to €1.026 billion, now accounting for 43% of the group's total. BASF said that while the company strives for an Ebitda margin of 18% every year, the margin targets lower limit is 14% when demand sinks to a "trough." The margin stood at 18.6% in the first half and at 17.6% in 2007, financial statements show. The company continues to see BASF's sales volume growth at 2% points above the expansion rate of the overall chemical market in the next five years. As before, the long-term forecasts are based on an oil price of \$100 per barrel and a euro exchange rate of \$1.40 to \$1.50, the company added. ■



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Let the Sun Shine in

Arkema is Working on Extending the Life of Solar Panels

Long Life – The life span of a solar panel is between 20 and 30 years. Its components must therefore ensure that it delivers excellent performance over the long term – a challenge which has now been taken up by Arkema thanks to a number of its polymers.

Some of these polymers have promising applications in this sector. This is the case with Evatane resins, used to encapsulate the silicon in the photovoltaic cells; Kynar Film, which forms the panel's insulating backsheet; and soon polymethyl methacrylate PMMA, which will be used to manufacture lenses to focus the sun's rays.

Dynamic R&D Policy

To develop these products, Arkema is implementing an R&D policy motivated by two objectives:

- To extend the lifetime and improve the performance of solar panels: The company aims to provide the players of the photovoltaics sector with solutions to help protect electrical circuits and active materials in photovoltaic panels.
- To reduce the time and cost involved in the manufacture of panels: Joint development programs are put in place



with photovoltaics manufacturers in order to keep on improving manufacturing processes.

"We want to offer polymers adapted to the manufacture of solar panels, as well as develop global solutions to help manufacturers produce more quickly and more cheaply," said Dominique Plee, scientific director for energy at Arkema.

Evatane: The Ideal Encapsulant

Evatane polymers are ethylene vinyl acetate (EVA) resins with a high vinyl acetate content and are used in a large number of applications: hotmelt glues, packaging film, halogen-free cable sheathing, semi-conductors, etc. In the make-up of solar panels, EVAs provide the adhesion of the various layers

(glass, silicon, backsheet) and the protection of the silicon and electrical circuits. Evatane polymers offer the ideal characteristics for the encapsulation of the panels: outstanding transparency related to the tube production process; high UV resistance; good electrical insulation; and good crosslinking ability.

Kynar Film:

Protection for Photovoltaic Cells

Kynar PVDF (polyvinylidene fluoride) is used in the manufacture of the film making up the backsheet of the panels. It ensures longevity and increases the yield of the photovoltaic cells. Its main assets include straightforward processing and UV resistance; resistance to moisture and temperature fluctuations; and stability of its

white color, which helps reflect the light toward the silicon.

"Kynar Film offers genuine qualities in terms of protection from UV rays. However, we have had to demonstrate that these qualities are in fact maintained over time. To do this we subjected samples to extreme conditions – temperature, moisture, UV rays, etc. – in 'climatic chambers,' which speed up ageing. The result: Kynar Film offers particularly effective ageing resistance, with no yellowing or embrittlement," explained Anthony Bonnet, R&D manager Fluorinated Polymers at Cerdat Research and Development Center in Serquigny, France.

PMMA: Toward a New Generation of Solar Panels?

Researchers at Altuglas International, an Arkema subsidiary, are currently working on the substitution of glass with PMMA for the top surface of the panels, to make these more cost-effective. PMMA offers inherent qualities which make it a material of the future for the photovoltaics sector: excellent transparency, very high resistance to UVs and weathering, great design flexibility, and excellent surface hardness protecting it from scratches.

Currently, the high cost of solar panels is linked to the price of silicon. Hence, researchers are looking to develop panels that produce just as much energy but with less silicon. One

of the solutions consists in using lenses that focus the light onto a given surface where narrow strips of silicon are located.

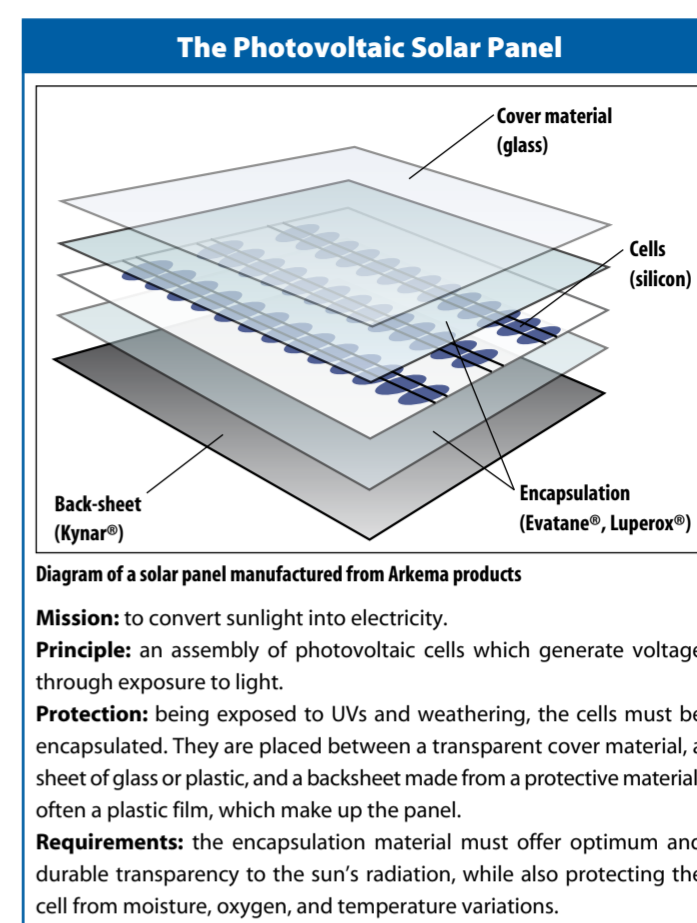
"PMMA, in this context, becomes totally relevant," said Pierre-Louis Lambert, PMMA development manager at Altuglas. Glass lenses are heavy and difficult to manufacture. With its excellent transparency, easy molding and handling, and durability, PMMA can be used to manufacture efficient lenses."

PMMA lenses are already used in the medical and automotive sectors. However, in the case of solar panels, PMMA will need to withstand high temperatures. "Here, Altuglas International stands out as it offers a product that is unique on the market: a PMMA capable of withstanding 100 °C. So we are also conducting research into PMMA with a high thermal stability," Lambert said. Altuglas International is engaged in joint research projects aiming to include PMMA lenses in the manufacture of solar panels.

"We believe that PMMA is going to play an increasing role in the photovoltaics sector," Lambert said.

Research Areas for Future Generations of Photovoltaic Panels

Arkema is engaged in an ongoing watch regarding the technologies and needs of the photovoltaics sector. New solutions are already under study. These include, for example, the use of organic mol-



ecules and polymers, and manufacturing processes based on coating. This would mean faster production but shorter life span. These techniques could be used for mobile products (lamps, batteries, refrigerators, telephones, etc.), whose use is rather more short-lived than in the case of solar panels.

Another research path consists in using photovoltaic cladding for the roof for buildings

providing waterproofness and electricity production, as well as panels installed elsewhere than on rooftops.

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The Right Mix

Materials Lead the Way in Thin-Film and Organic Photovoltaics

A Growing Market – In a recently released report, "Materials Markets for Thin-Film and Organic Photovoltaics," NanoMarkets predicts that the \$841.5-million market for thin-film photovoltaic materials (TFPV) in 2008 will grow to \$1.8 billion in 2010 before climbing to almost \$2.9 billion in 2012 and \$3.8 billion in 2015. The majority of this opportunity will come from a-Si materials, which represent 59% of the 2008 market. However, alternative-materials technologies will begin to take a larger piece of the market, representing 51% by 2015.

As a result of these trends, NanoMarkets said it believes that significant opportunities for specialty materials firms are opening up. The two general factors at play here are: The thin-film and organic PV business is immature and is still in search of novel materials and fabrication processes, a need that specialty materials firms have the know-how to address; and the underlying growth of the addressable markets is currently very high.

Special Challenges

Because of its advantages in terms of cost, flexibility and weight, markets for thin-film and organic PV are expanding even more rapidly than the already-fast-growing conventional PV market. The market is best broken out by the four main active materials classes used:

- amorphous silicon (a-Si),
- cadmium telluride (CdTe),
- copper indium selenium (CIS)
- and copper indium gallium

selenium (CIGS) organic materials and organic-inorganic hybrids.

With the possible exception of a-Si, all of these newer approaches to PV require new strategic thinking from materials suppliers. The older kind of PV, where materials were well understood called for materials suppliers to compete on little more than cost and availability. Today's emerging thin-film and organic PV are asking more than many bulk/basic materials supplier can handle. The specialty materials firms that get involved with the various thin-film/organic approaches to PV must be willing to work closely with their customers to help overcome materials and process challenges and improve conversion efficiencies. While the relationship between materials supplier and customer in the old PV was very hands off, the new PV requires something closer to a partnership. In some cases, materials suppliers may actually be required to develop materials are specifically customized for a particular solar panel manufacturer.

In this new business environment, where should specialty materials producers focus their efforts? The main challenge for TFPV is improving conversion efficiency as well as stability of the cells. These are largely materials issues and they will require innovations in several areas: substrate, manufacturing, coatings, adhesives, metallization and encapsulation.

Which Materials?

The most well known of the thin-film approaches to PV is a-Si; this is the technology used in solar calculators. PV using a-Si materials hold the largest share of the TFPV market, which translates into volume opportunities. However, the sheer "ordinariness" of the ma-



terials used in this sector limits the opportunities for materials suppliers. Garden variety silane gas is a big part of the bill of materials in this sector. This is not to say there will be no opportunity for innovation in the silicon space. Nanosilicon inks and silicon slivers are being developed and are being developed, promise better cost/performance ratios, and – from a business perspective – are value-added materials plays.

The combination of microcrystalline silicon and a-Si in tandem cell architecture has shown high conversion efficiencies and bring cell design into the product strategy as well as materials.

Other areas where NanoMarkets said it believes that there is an opportunity for a materials-based market strategy to help distinguish a-Si products in the market include substrate development, and encapsulation materials applied as a spray or roll-on laminate, both which has the potential to lower the cost of the solar module and make it more flexible.

CIS/CIGS is a material that is at the other end of the op-

portunity/risk scale from a-Si. Here is a material – actually a class of material – that seems to promise something genuinely new; performance that is close to conventional PV, with all the cost and flexibility advantages of a thin-film approach. On the other hand the formulations of CIS/CIGS films for maximum efficiency and ease of manufacture is very much an open question and helping to answer this question would be well worth the time and trouble of materials firms since NanoMarkets said it has estimated that the market opportunity for materials used in CIS/CIGS type solar cells will grow from \$193.2 million in 2008, to \$465.2 million in 2010, before climbing to \$1.11 billion in 2015.

Some of the areas where NanoMarkets said it believes that there is room for firms to distinguish themselves in the CIS/CIGS marketplace is in improved compositional control during deposition; understanding and controlling the electronic properties and grain boundary and developing wide band-gap cells for high voltage in open circuit (VOC) and use

in multi-junction cells. There is also the issue of the appropriate materials for the back contact in the CIS-based cell. Because of the CIS/CIGS cell construction, the material used for this contact must live up to unique and demanding standards. Yet another area that is seen by some as an area of opportunity in the CIS/CIGS space is the use of nanomaterials to make printable precursors that are crystallized into CIGS. Researchers are also exploring wider band-gap chalcopyrite materials with a bandgap close to 1.4eV, but efficiencies of CIGS solar cells continuously decrease with increasing bandgap when its bandgap exceeds 1.2eV, which makes it a challenging research issue. One critical thing for materials suppliers to keep an eye on is the development of new processes for manufacturing TFPV cells from specialized forms of vacuum deposition to flexo printing. These new production modes will require not so much different kinds of materials, but rather new formulations.

For CIS-based cells the need for high throughput, low-cost

processes is especially relevant; the common production methods involved in CIGS device and module fabrication suffer from relatively slow throughput, poor material utilization, and relatively high vacuum. Industry players are exploring the use of vacuum-free deposition methods based on small particles or electrodeposition; as well as deposition by high-rate co-sputtering from cylindrical magnetrons.

The Evolution of Process Development

The market opportunity for materials used in organic/hybrid type solar cells will grow from \$500,000 in 2008 to \$3.8 million in 2010, before climbing to \$223.4 million in 2015. Despite the perceived benefits of OPV devices, this technology lags behind its inorganic counterparts in efficiency. In the inorganic part of the market, there is a fairly clear distinction between materials supplier and solar panel developer. The raw inorganic materials used in TFPV often come in the form of powders, sputtering targets and involve chemicals, all of which established materials firms are familiar with. In the OPV and dye cell space, materials are highly novel and it is often the solar panel manufacturer who holds the IP on their materials in the first place.

While in the inorganic part of the market, the solar panel maker necessarily buys much of the raw materials from the established chemical industry, in the organic part of the market, the situation is more one of a firm with patents on photoactive materials making a strategic decision whether to be a materials supplier or a solar panel developer.

Output of TFPV and organic PV is like to reach a point in the next few years that this sector will be of interest to suppliers of other kinds of ma-

Weighing The Risks

"Excitement" is often another way of saying "hype"; materials firms needs to be very careful that they are not investing in a boom that is about to end. First, by 2009 or 2010, a lot of currently planned TFPV manufacturing capacity will be in place, and there will be spare capacity until the market catches up a few years later. Second, a key driver for TFPV in the past few years has been the shortage of crystalline silicon that the conventional type of PV uses. This shortage is now over. Finally – and ironically – PV materials may raise environmental issues. The toxicity of the cadmium for CdTe is an issue that is frequently raised, although the seriousness of this problem has been disputed too. Silver – used in pastes and inks for back and front contacts in PV – also have some environmental negatives.

None of these factors should hurt the growth thin-film and organic PV, according to NanoMarkets, which believes that many specialty materials firms will be likely to cash in on this growth.

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UNDER CONSTRUCTION

Capacity Expansion In Turkey The Chemicals Business Area of German-based Evonik Industries has expanded the silica capacity of its joint venture Egasil in Adapazari, near Izmir, Turkey. With the new capacity of 40,000 t/y, Evonik Industries is keeping pace with the growth in demand for tire silica in Europe. Expansion involved the addition of a new dryer, which commenced operation in the second half of 2007. The primary customers for Egasil products are the tire industry and manufacturers of industrial rubber goods and dispersion paints.

Silica are used as carriers and anti-caking agents in the animal feed and food industries. They are also used as pigments in the paints and colorants industry and as abrasives in the manufacture of toothpaste. Together with rubber silanes and rubber blacks, silica are an important component of low rolling resistance tires, which feature lower rolling resistance. Evonik Industries is the only company worldwide to offer all three of these reinforcing agents, and is also the world's leading manufacturer of these products for the rubber industry. ■

Chemtura: European Technical Service Laboratory for Growth In Polyurethanes Chemtura Corporation's Performance Specialties business has completed a substantial expansion at its European regional technical service laboratory – an investment to support further growth of its range of Adiprene/Vibrathane polyurethane prepolymers. The newly refurbished and upgraded laboratory is located at Chemtura's European manufacturing plant in Latina, Italy, where it produces Adiprene, Vibrathane & Ribbon Flow TDI and MDI prepolymers, Adiprene Low Free TDI prepolymers and Vibracure curatives.

A major part of the new capabilities is a six-component PU.MA meter mix machine, designed with Techno PU.MA to meet Chemtura's exacting requirements. The machine is one result of a recently announced cooperation agreement between Chemtura and Techno PU.MA within the Europe, Middle East and Africa markets. ■

Linde to Invest \$180 Million in South Korean Gas Units German industrial gas producer Linde said it will invest \$180 million to expand city-owned gas production facilities in South Korea, Seoul's energy ministry recently announced. Industrial gas is used in sectors such as crude refining, chemicals, steel and shipbuilding, and generates about 60 trillion won (\$58.98 billion) per year worldwide. South Korea's industrial gas market grew to 1 trillion won last year and has been expanding at a double-digit growth rate, the ministry said. Later in the day, Seoul's vice-energy minister Lee Jae-hoon will sign a memorandum of understanding (MOU) with Aldo Belloni, a member of Linde's executive board, on the development of the facilities in Yongin, south of Seoul, the ministry said. ■

Umicore to Build Automotive Catalyst Production Facility in India Specialty materials group Umicore said it is to build an automotive catalyst production facility in India. The site will have a production capacity to equip approximately 1.5 million cars a year, the group said. Construction will be completed by 2010 and production will begin soon after. The new production plant will be capable of supporting "up to a third" of the estimated Indian automotive market, it said. Umicore also said it will expand its current "commercial and technical application services" for the region. ■

BASF to Invest in Two New Polyurethane System Facilities BASF said its unit Elastogran will invest in two new facilities in Poland and Slovakia to meet rising demand for polyurethane systems in central and eastern Europe. No financial details were disclosed. The market for polyurethane systems in the Czech Republic and Slovakia is currently growing at rates exceeding 7%, driven primarily by the automotive industry, the company said in a statement. In Poland, the market is seen expanding at a rate of up to 7% over the next few years, helped by the construction, automotive and cooling appliances market. BASF will start in 2009 local production and development of polyurethane systems in the facility near Bratislava, while the one in Posnan, Poland will come online in 2010. ■

BASF: Antwerp Possible Location for Coal Gasification Plant BASF is considering Antwerp as a possible location for its planned €1.5 billion coal gasification plant, should the project be realised, Financial Times Deutschland reported, citing management board member Harald Schwager. BASF has previously also considered Ludwigshafen – where the company is headquartered – as a possible location. Currently, the project has been shelved due to uncertainty over the future costs of emission certificates, the company previously said. The German government and the European Commission are in an ongoing tussle over how to handle the allocation of emission rights from 2013. BASF was planning to use the gas from the plant to produce methanol and ammonia, which are key chemicals for plastics, fertilisers and pesticides. ■

Optimal Maintenance Strategies

Achieving High Reliability While Keeping Maintenance Costs at Bay

Getting It Right – One of the most important levers for reliability, as well as direct maintenance cost, is the right mix of maintenance strategies for components.



Cord-Philipp Winter
 Researcher, RWTH Aachen University

The right mix enables reaching high reliability with low costs. The Competence Center Maintenance Management at RWTH Aachen University's Research Institute for Operations Management in Germany launched a project making the gains of component specific maintenance strategies accessible for small and medium enterprises (SME) by reducing the effort and cost of the selection processes.

Maintenance Budget – Investments or Costs?

Maintenance organizations, both internal departments and external contractors, are exposed to a double sided pressure: While they face the challenge of reaching high uptime and reliability – due to the increasing understanding of the importance of reliability for company performance – they are nevertheless bound to a strict, often shrinking, budget – due to intensifying global competitive pressure. That results in conflicting goals for maintainers in companies: Saving costs and enabling reliable production at the same time. The top management's attention to reliability issues is often not accompanied by a resource commitment. Maintenance is mostly seen as a cost factor while the link between investments in maintenance and high uptime is neglected.

Therefore, resources – especially in SME – need to be utilized efficiently and appropriate tools and methods employed to achieve the abovementioned goals.

Maintenance strategies play a central role in this effort. They are defined as those policies that determine which maintenance tasks are performed on which components at which time. They are commonly categorized as reactive, preventive and predictive strategies and result in different cost structures, especially in respect to balancing direct maintenance costs and indirect maintenance costs (i.e. the cost of downtime). An optimized and component-specific mix of strategies results in a minimum of these combined costs.

The Cost Of Optimization

The processes to identify the optimal maintenance strategies are not yet tailored to the needs of SMEs. Looking closer to the methods used in large scale operations to identify these optimal strategy mixes, namely Reliability centered Maintenance (RCM), one finds another cost component that often constitutes the main reason why these methods are not directly applicable in SMEs: The cost of applying these methods

themselves. They are too complex, time consuming and cost-intensive, so they require too many internal resources that need to be balanced against the gains. And as these methods have their costs up-front, they must be justified in a budget by maintenance management and demonstrate their value quickly.

Every approach to making strategy selection processes like RCM applicable to SMEs needs to target that specific challenge. Balancing the costs of optimization against their gains in a quickly demonstrable way is the key to opening the door to complex maintenance optimization processes for SMEs.

The goal of the research project IH-Mix-Id (Research project Nr. 14968 N) – that is sponsored by the Federal Ministry of Economics and Technology (BMWi) through the German Federation of Industrial Research Associations (AIF) – is the development of a focused, easily applicable, resource-saving approach for an individual maintenance strategy selection, giving SMEs a powerful tool to enhance their maintenance management and improve operative performance.

A Three-Stage Approach

The approach to optimized maintenance strategy mixes developed in this project consists of three consecutive steps. A pre-selection process is the first step. It identifies the assets where the most gains can be generated and focuses the efforts explicitly on those opportunities. This streamlines the process of strategy selection, because the more complex identification of optimized strategy mixes takes place in those areas of operations yielding the largest improvement levers.

In the second stage the equipment selected for further analysis is structured, so all relevant compo-

nents are systematically documented. We use a mind mapping software for this purpose. It is easy to use and alter, and also structures the equipment visually. The structure of equipment documented in the software, builds the basis for the so called failure mode and effects analysis (FMEA). A FMEA is a method to analyze potential failure modes within a system with the objective to classify them by severity or determine the failure's effect upon the system and the associated costs. In the context of maintenance, FMEA can be used for a systematic analysis of potential malfunctions and their causes on different component groups of an asset as well as the resulting effects on the production process, the asset availability and further production related aspects while simultaneously tracking the costs of failure and downtime. We adapted the generally accepted FMEA-method to the specific SME-requirements and have developed a tool called FMEA-Analyzer which enables the user to run the FMEA very easily without external support or intensive training. As a result the FMEA-Analyzer provides a component specific prioritization of failures and their effects. This information is the input parameter for the maintenance strategy selection process.

Based on the analysis of equipment and components as well as the categorization of the technical and monetary consequences of occurring failures and effects, maintenance strategies are systematically defined on component level. These strategies are deduced by means of a

criticality matrix. The result is a detailed proposal for the right maintenance strategies.

Putting Theory into Practice: Proof of Concept

We applied this approach in one of our project partner's sites, a manufacturer of base materials for printed circuit boards. These base materials must follow the highest standards in quality and growing global demand puts a high pressure on reliability. In the plant, laminates for printed circuit boards are produced from raw materials and further processed according to customer specifications, especially regarding the size of boards. The maintenance organization of this particular site is very sophisticated in using methods like 5S – a methodology for a lossless workplace organization to improve productivity and performance – and TPM – the maintenance concept of the Toyota Production System – but is yet lacking a powerful maintenance strategy selection tool.

In the pre-selection process, we identified an integrated processing line as a first target for our further analysis. In the line circuit board laminates measuring on average one square meter are processed in several steps into smaller board sizes requested from customers, thereby being cut and grinded several times.

The line consists of a number of centrally controlled cutters, grinders, cleaning units and equipment for transport and shifting of materials, including one industrial robot. Sensors for measuring, placement and con-

trolling of material are also an integral part of the line. As the line is new to the site – transferred from another site, modified and completely renewed on the software side – there is currently only a sketchy maintenance plan at hand.

During the validation project, we systematically applied the abovementioned three-staged approach, resulting in an up-to-date maintenance strategy plan for the equipment.

Conclusion

The current results of the research project IH-Mix-Id show that it is possible to apply even complex maintenance strategy selection processes in maintenance organizations of SMEs. However, it is imperative to streamline the approach to the specific needs of SMEs and focus the efforts on the equipment that promises to show the fastest result to overcome budget pressures. Therefore a pre-selection process that limits the number of equipment for analysis is the key for the application of maintenance selection processes in SMEs. Our approach proved valid in the first field-tests and we are confident that it will continue to be successful in the forthcoming validations.

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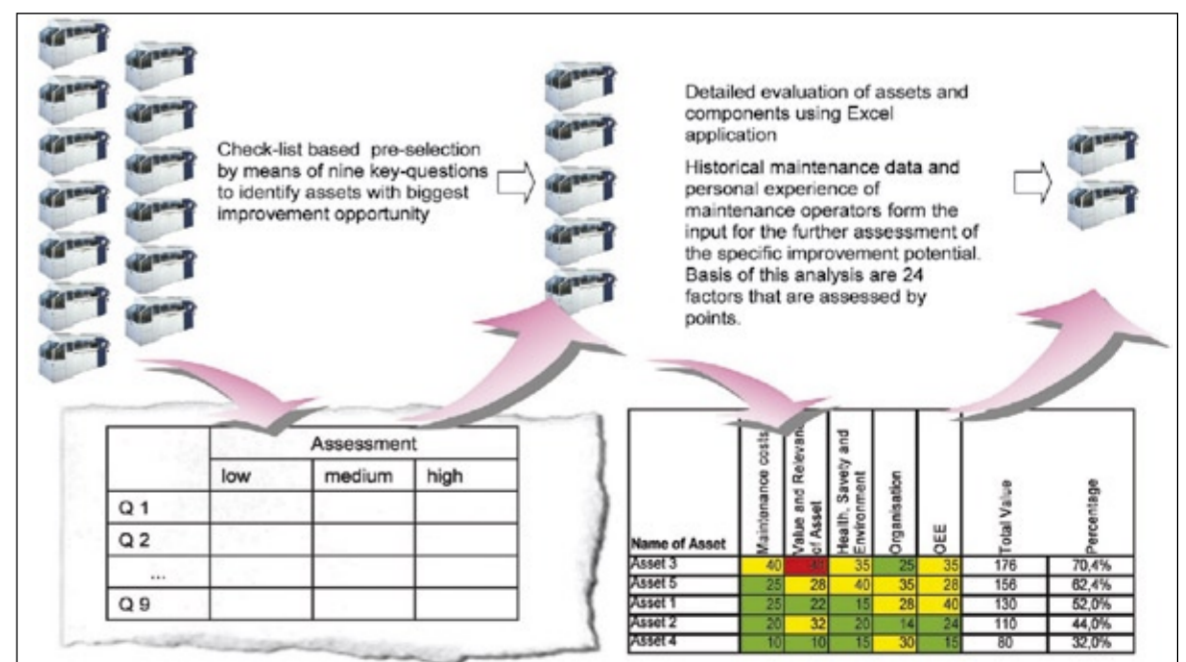


Figure 1: Three staged approach to optimize maintenance strategies

Evonik: New Process to Boost Growth of Hydrogen Peroxide Market

The Korean company SKC of Seoul has started up in Ulsan the world's first ever commercial-scale plant for production of propylene oxide by the iHPO process, according to Evonik Industries. The plant has an annual capacity of 100,000 mt. Evonik Industries and Uhde, who jointly developed the HPO process, have licensed it to SKC. Using a catalyst developed by Evonik, the process produces

propylene oxide from propylene and hydrogen peroxide (H₂O₂). The joint venture Evonik Headwaters supplies the H₂O₂ in Ulsan directly "over the fence" to the HPO plant.

The company said the commissioning brings Evonik a step closer to its strategic goal of providing hydrogen peroxide in large quantities for chemical processes such as the HPO process. Dr. Klaus Engel,

member of the executive board of Evonik responsible for the Chemicals Business Area, said he expects this first commercial-scale application of hydrogen peroxide in the chemical synthesis of propylene oxide to result in annual growth of the H₂O₂ market by 200,000 mt over the next 10 years.

Engel and Helmut Knauth, member of the executive board of Uhde, agreed that the produc-

tion facility in Korea is now a reference point for the construction of further plants using the HPO process. With an annual capacity exceeding 600,000 mt, Evonik is the world's second largest producer of hydrogen peroxide, which has so far been used mainly in paper and pulp bleaching. The annual worldwide requirement for these classical applications exceeds three million metric tons. ■

Safety In Maintenance

A Serious Problem to be Addressed

Danger – Recent AFIM (the French Maintenance Association) surveys have established that maintenance is the most dangerous industrial job in France. This situation may obviously vary in different countries; nevertheless, whatever his country, a maintenance worker often has to work in unusual positions, under unusual conditions.

The maintenance workers spend their working life in situations more prone to risks than other workers. Moreover, they often have to work under a heavy stress-load, due to pressures to work fast when an unexpected shutdown of equipment occurs.

This situation has worsened with the general trend towards increased subcontracting in maintenance. Through this process, the skilled maintenance employees of a company are often replaced by temporary low-cost young subcontracted workers, lacking experience, and not fully aware of the built-in dangers of a workshop.

Until recently, this risk was underestimated, due to the lack of statistics regarding industrial accidents and professional diseases in maintenance. Therefore, it became necessary to measure the situation to be able to correct it.

French Survey Implemented by AFIM

Before 1996, such a situation was unknown in France, as all safety statistics were "vertical" – related to industrial branches – and not "horizontal" – related to the crafts, irrespective of the branch, which is the case of maintenance jobs.

As the need of generating the lacking data became urgent, the president of AFIM decided to implement a survey on a fairly representative sample of industries, to attain some approximate figures. The most favorable conditions were



fulfilled in the Etang de Berre area, near Marseilles, with its large and diverse industrial cluster comprised of petrochemical plants, oil refineries, steel plants, cement plants etc., together with some large maintenance contractors. Managers of these companies were deeply concerned with safety in maintenance and they had already implemented the first French certification on safety assurance for their contractors (MASE certification). Local health authorities were also in favor of the survey, which helped obtain the necessary funding. The survey was carried out by a competent organization, the BIPE. The survey highlighted some very worrying trends (see info box).

Corrective Actions Implemented

The identification of problems through the findings process enabled the development of a number of corrective actions:

- More elaborated statistics, to establish priorities
- More involvement of the plant management, workers' unions and the industrial medical bodies, as well as Social Security and Institutes for Research on Safety
- Preventive actions – development of safety assurance certifications among maintenance contractors and implementation of the teaching of safety in maintenance at technical colleges and universities
- Proactive actions such as the application of the Unique Safety Document to be applied legally at every French plant, in the framework of Articles 9 & 10 of the European Directive 89/391/EEC, and safety on maintenance taken into consideration at the design stage of new equipment (e.g.



easier and safer access for maintenance specialists)

How to Improve the Situation in Other Countries?

The situation may vary from country to country, with regard to the local legal system on safety, technical training in maintenance, industrial practices, involvement of union workers and mainly the local "culture" on health and safety.

But the general trend towards an excessive cost-cutting in maintenance, as well as the harsh competition between maintenance subcontractors, leads to the development of a population of low-cost, young, unskilled and inexperienced maintenance workers who are more prone to industrial accidents. This assumes a somewhat similar trend towards a deterioration of the safety in maintenance in many countries, with not only staff safety consequences, but at times also environmental consequences. An example of this is the recent disaster at a BP oil refinery in the U.S.

Improving the health and safety of maintenance workers not only reduces the direct and indirect maintenance costs, it also reduces environmental risks by reducing potential dis-

astrous accidents. Moreover, it improves the status and state of mind of the maintenance worker, a job for which many young people are reluctant to apply.

As with any scientific approach, the first action to implement is to get the relevant data to assess the situation and to then set the right priorities in terms of corrective actions to be carried out. As the saying goes "If you can't measure it, you can't manage it."

In our opinion, it is up to any national maintenance society to start similar actions, according to the situation in their country. Maintenance not only needs brains, it also needs hands. On average the maintenance staff is comprised of 3% graduated engineers, 17% technicians or supervisors, and 80% workers (in-plant or contractor's).

The European Approach

At the beginning of the year, the Chairman of the European Federation of the National Maintenance Societies (EFNMS) requested AFIM to implement and send on his behalf a questionnaire to every European Maintenance Association.

The aim of the questionnaire – which is only a proposal – is to help the national maintenance societies in establish-

ing the necessary guidelines to implement appropriate actions to combat safety in maintenance. Answers to this questionnaire are expected at the end of 2008.

Main issues of this questionnaire are:

- To get a general overview of the existing situation regarding health and safety in the local industry (existing bodies, existing regulations, role of the Unions, teaching of safety, safety assurance certifications, usual safety procedures, etc.)
- To check existing statistics and studies regarding the safety in maintenance.
- To examine the opinion of representative panels of plant managers, maintenance managers, unions and maintenance contractors.
- To determine the policy of the local Maintenance Association to improve the situation on health and safety in its own country. In case of a lack of relevant data, it is suggested to take an approach similar to AFIM's, by implementing a suitable survey on a representative sample of industries.

The most important statistics include the frequency rate and seriousness of industrial acci-

French Survey Findings

Surveys carried out in France by AFIM and other bodies have highlighted the fact that, in this country, maintenance is the most dangerous of all industrial jobs:

- Fatality rate ranges from five to seven times the average rate for French industry (i.e. the same magnitude as civil works contractors)
- 44% of all industrial fatalities recorded in 2002, in the French industry, are related to maintenance operations
- Between 1996 and 2006, the maintenance costs have been reduced by 10%, but industrial maintenance accidents have increased by 56%
- 50% of industrial accidents strike the segment of youngest workers (20% of the maintenance staff), sometimes disabling the young workers for life
- The average frequency rate of industrial accidents for in-plant maintenance staff is 1.6 times the mean value in French industry; the frequency rate among maintenance subcontractors staff is 10 to 16 times higher than the rate among in-plant maintenance staff
- 25% of industrial maintenance accidents are caused by mishandling or falling, and 20% by process installation (e.g. poor cleaning, inadequate work permits)
- Fitters working on production equipment have the highest accident rate; other high rates occur to boilermakers, piping workers and welders. On the other hand, the frequency rate for electricians and I&C workers is lower than the mean value
- The professional diseases among maintenance workers are increasing, mainly due to asbestos (six times the French mean value), benzene (70 times) and deafness due to excess of noise (25 times)
- The average unavailability of maintenance staff due to accidents and professional diseases is 1%. This figure jumps to 9% for fitters, 4% for piping workers and 2.5% for boilermakers
- On average, 7% of maintenance workers are struck every year in an industrial accident followed by their temporary unavailability
- The average cost of accidents and professional diseases is 1% of the total direct maintenance cost of the plant. The cost range for the plant of an industrial accident involving temporary unavailability of the worker varies from €27,000 to €54,000 according to 2004 figures.

dents in maintenance compared with the average industrial rate in the country, as well as professional diseases and fatality rates.

But to enable suitable improvement policies, more detailed statistics are needed:

- Frequency rate according to the crafts (fitters, mechanics, welders etc) and the workers' status (permanent or temporary appointed)
- Relative occurrence of accidents by nature (fall, burning, electrocution, etc.)
- Localization of the wounds
- Seriousness rate according to the age of the workers
- Determination of the most frequent professional dis-

eases affecting maintenance workers.

When the relevant data is available it becomes possible to determine priorities and to propose an action plan to the relevant authorities, managers and unions.

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Structure the Approach to Manage Maintenance

A Process and Framework Reference Model

Key Words – Effectiveness, Efficiency and Assessment. These highlight the three stages required in a successful maintenance management model.

Maintenance management is multifaceted and includes the activities of the management that determine the maintenance objectives or priorities, strategies and responsibilities. These can be implemented by means such as maintenance planning, control and supervision, and can be improved through several means including economical aspects in the organization. In order to manage maintenance effectively and efficiently, we can summarize these points by clearly understanding the following: The maintenance management process – the course of action and the series of stages or steps to follow – and the maintenance management framework – the essential supporting structure and the basic system, needed to manage maintenance.

The Maintenance Management Process

The maintenance management process can be divided into different parts: maintenance effectiveness, maintenance efficiency, maintenance

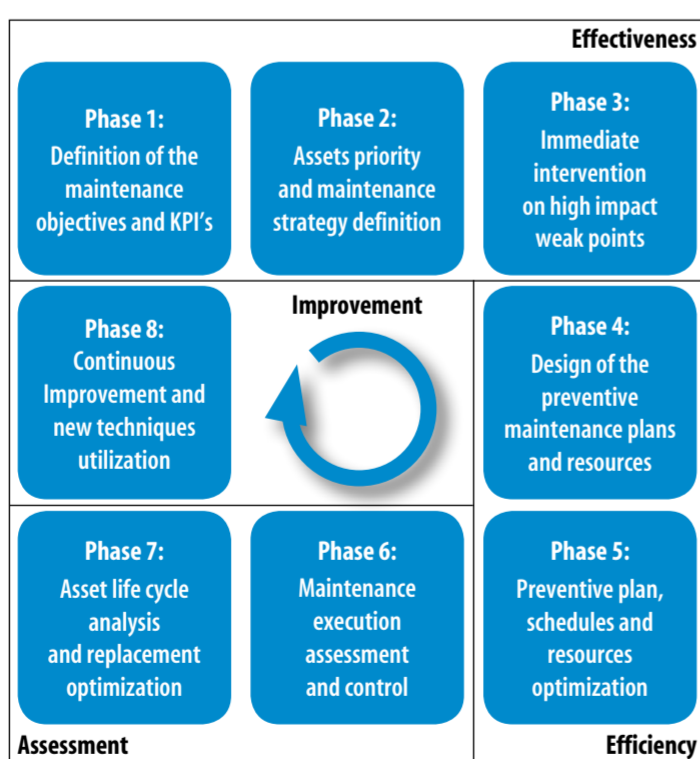


Figure 1: Maintenance management model

and life cycle cost assessment, and maintenance continuous improvement (fig. 1).

The part of the process determining the maintenance effectiveness, consist of three phases (1, 2 and 3). This initial part of the maintenance management process conditions the success of maintenance in an organization, and determines the effectiveness of the subsequent implementation of the

maintenance plans, schedules, controls and improvements. Effectiveness shows how well a department or function meets its goals or company needs, and is often discussed in terms of the quality of the service provided as viewed from the customer's perspective. This will allow us to arrive at a position where we will be able to minimize the indirect maintenance costs, those costs asso-

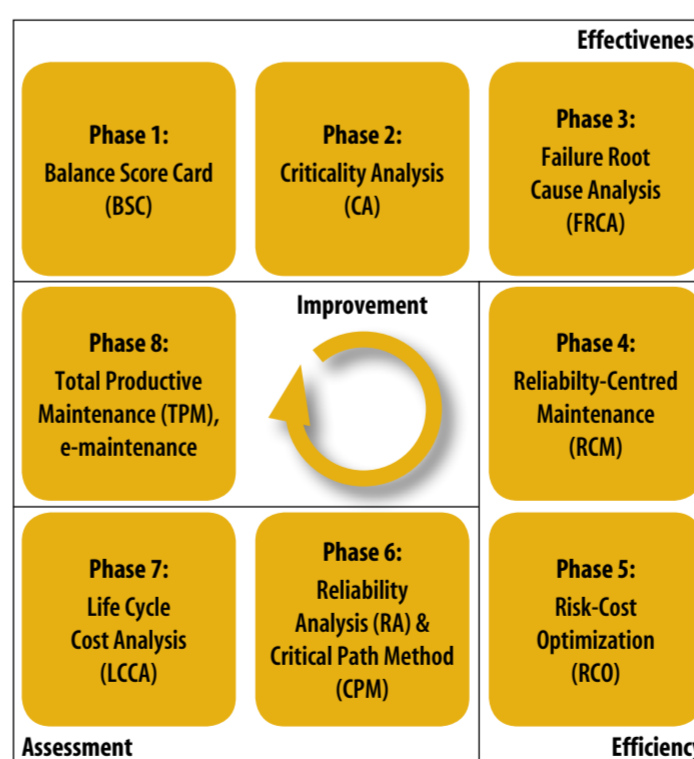


Figure 2: Sample of techniques within the maintenance management framework

ciated with production losses, and ultimately with customer dissatisfaction. In the case of maintenance, effectiveness can represent the overall company satisfaction with the capacity and condition of its assets, or the reduction of the overall company cost obtained because production capacity is available when needed. Effectiveness concentrates on the correctness of the process and whether the

process produces the required result.

The part of the process conditioning maintenance efficiency (phases 4 and 5) has a different significance level. Our ability to deal with the maintenance management implementation problem for instance, our ability to ensure proper skill levels, proper work preparation, suitable tools and schedule fulfillment will allow us to minimize

the direct maintenance cost labor and other maintenance required resources. In this part of the process we deal with the efficiency of our management, which should be less important. Efficiency is acting or producing with minimum waste, expense, or unnecessary effort. Efficiency is then understood as providing the same or better maintenance for the same cost.

The third part is devoted to maintenance and assets life cycle cost assessment (phases 6 and 7), providing information for analysis and control. Finally, the last part of the process ensures continuous maintenance management improvement, which is a must for this type of reference model.

Maintenance Management Framework

The maintenance management framework characterizes the essential supporting structure and the basic system needed to manage maintenance. A description of this framework can be made placing most well known tools and methods for maintenance management within their "best fitting" phases of the maintenance management process (fig. 2).

For instance, designing the preventive maintenance plan for a certain system (phase 4) requires identifying its func-

tions, the way these functions may fail and then establishing a set of applicable and effective preventive maintenance tasks, based on considerations of system safety and economy. A formal method to do this is the Reliability Centered Maintenance (RCM).

Conclusions

This article refers to the process – the course of action and the series of stages or steps to follow – and the framework – the essential supporting structure and the basic system – needed to manage maintenance. Models and methods to improve maintenance management decision making are numerous in literature and praxis and can be classified according to their more suitable utilization within the maintenance management process. More detailed information and case studies are presented in the book "The Maintenance Management Framework."

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Whatever Can Go Wrong Will Go Wrong

Lessons Learned from a Cluster of Incidents at Hoechst

Don't Relax – Chemical industry operates with hazardous substances under frequently hazardous conditions. Due to intensive safety measures, accident rates are well below industry average, and especially major accidents occur very seldom.

However, incidents unfortunately follow Murphy's Law: "Whatever can go wrong will go wrong, and at the worst possible time, in the worst possible way." The European regulation on major accidents (Seveso Directive), as well as similar regulations in other regions (EPAs Risk Management Program), therefore stresses the necessity to be prepared for emergencies. Although chemical companies are adhering to these obligations, not all of them have a consistent approach to crisis management.

The Case

Hoechst was one of three big German chemical corporations, operating until 1997, when it was transformed into a number of smaller companies. On Feb. 22, 1993, a major accident occurred at one of the companies' sites in Frankfurt, Germany, due to an uncontrolled reaction. Nobody was seriously injured, but a residential area was contaminated with a substance just recently identified, by Hoechst itself, as carcinogenic. On Mar. 15, 1993, in the headquarter site located nearby, an explosion occurred during maintenance work. One operator was killed and another seriously injured. On Apr. 2, 1993, again at the headquarter site, a major emission of sulfur trioxide occurred. Nobody was



Prof. Dr. Christian Jochum
Consultant

injured, but part of the site had to be evacuated.

Triggered by the first accident, the following accidents and a number of small incidents – which do happen in all major chemical sites from time to time – received unprecedented attention from the Germany authorities and media. The authorities questioned Hoechst's reliability as operator and launched a detailed investigation. Although the company was eventually exonerated, the incidents demonstrated systematic weaknesses both in prevention and crisis management, which may be found at other companies or organizations, too. Therefore the lessons learnt are still worth considering.

Lesson No. 1: Don't be Satisfied by a Good Accident History

Major chemical companies, like Hoechst, mostly only have a few reportable major accidents. Top management and safety professionals may focus on and be satisfied by low figures for occupational accidents, as until now these are the only widely used and accepted key performance indicators for safety. This may blur the view on precursors of process safety incidents as typical low probability events. Just recently, the Baker Report on the disaster at a BP facility in Texas City 2005 highlighted the need to monitor these events. A first set of indicators has recently been published by the U.S. Center for Chemical Process Safety, and chemical industry is beginning to implement them.



Lesson No. 2: Review Your Risk Assessment Process

The first major accident in the series at Hoechst (Feb. 22, 1993) was caused by a combination of operator errors. The stirrer of a chemical reactor was not switched on during pumping of

one substance to another, leading to an accumulation of a reactive mixture. When the operator noticed after several hours, he started the stirrer against the clear order of his supervisor, which led to a runaway reaction. In the safety analysis for this process, only the failure of the stirrer has been considered, not the full sequence of errors. This demonstrates the importance of a systematic and comprehensive risk assessment. It should cover all aspects (operations, neighborhood, natural hazards, supply chain, etc.) and should consider unlikely chain of events, too, especially if they may have serious consequences. Risk assessment leads to scenarios which are the basis for preventive measures, emergency response and crisis management.

Lesson No. 3: Prevent or Mitigate Risks

In the Feb. 22 incident at Hoechst, a simple and cheap interlock between stirrer and pump would have avoided any

safety, as well as quality, problems. Even if such a chain of events would have been considered as too unlikely, the installation of such a low cost device may have been justified at least as an "add-on." This demonstrates that the paramount consequence of any risk assessment should be to prevent risks or at least mitigate their impact. There is no lack of instruments and in most cases it is not a question of money. Failures are rather caused by insufficient identification or assessments of risks.

Lesson No. 4: Communicate Remaining Risks

As long as chemical industry has to use hazardous substances and has to meet economic challenges it will never be able to avoid all risks. However, many companies (i.e. Hoechst prior to 1993) do not like to talk about risks with their neighbors and other stakeholders. After an incident, this gives them little credibility in their ability to manage risks. An open and understandable communication of risks prior to any incident is also the basis for emergency preparedness, both within and outside the company.

Lesson No. 5: Prepare for Major Emergencies and Crisis Situations

Handling fires, explosions and chemical spills are the basics for chemical companies. However, it is neither technically nor economically feasible to handle all risks without external help. Based on the scenarios resulting from risk assessment, it has to be determined which additional resources (from other companies, authorities, public emergency services, etc.) may become necessary. Their availability has to be organized in advance. The whole system has to be tested regularly to improve it continuously and train the acting personnel. The bigger the company, not the affected site, the higher the public's expectations – and frustration if something goes wrong. Remarkably, in public perception, one of Hoechst most serious failures was the problem in making available internal toxicological data to the emergency responders after the Feb. 22 incident, not the incident itself.

Lesson No. 6: The Remediation of Damages is More Than an Insurance Case

The runaway reaction at the Feb. 22 incident resulted in the contamination of a rather

large residential area with a substance classified as carcinogenic. Although it became evident rather soon that there was only a very minor risk to the residents, fears remained for a long time. Any attempt to discuss them "scientifically" was counter-productive. Such fears have to be accepted. They may lead to requests for research which is scientifically not justified – but a company may be well advised to accept that.

Lesson No. 7: Consider Restoring Trust During All Actions

Trust in a company by neighbors, authorities and the media is strongly linked to its "license to operate". Major accidents and even more their handling, may therefore jeopardize the existence even of major companies. It remains to be seen to what extent the series of incidents in 1993 influence Hoechst move to becoming a life science company a few years later, splitting off the more hazardous chemical activities. It is a fact, however, that a number of companies have gone out of business after major accidents. Moreover, the basis of trust has to be laid prior to incidents. A company which behaves arrogantly to routine complaints by neighbors or questions by authorities and journalists has an especially hard time after a major accident. Even minor incidents will then serve as proof for poor reliability, as happened to Hoechst in 1993. If it has happened, top management has to demonstrate that it wants its

company to become an industry leader in safety. Among the successful examples are Hoechst, Sandoz – after its warehouse fire in Basle contaminating the river Rhine – and recently BP – after the Texas City explosion.

Crisis Can Be Managed

According to Murphy's Law, crises always "happen at the worst possible time, in the worst possible way." A comprehensive and well operating crisis management system enables companies to make best use of their own resources, activate additional resources as fast as possible and to demonstrate their competency to manage risks. This is exactly what people expect from a good "corporate citizen." A Hoechst neighbor expressed this point in a public hearing in 1993 saying: "We know that you are working with hazardous chemicals and we accept that accidents may happen. What we do not accept is if risks and even accidents are poorly managed." Therefore, the overall lesson learnt from the Hoechst incidents is to give crisis management a higher priority than frequently found. Like insurance this is an investment which may never be used, but may save lives of people and of the company.

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Maintenance Joint Venture

Some organizations take care of their maintenance process themselves, while others prefer to engage a consultant or go for outsourcing instead. The German board manufacturer, Smurfit Kappa Baden Karton carried out a strengths, weaknesses, opportunities, and threats (SWOT) analysis of each of these options.

Negative aspects such as high training costs, knowledge transfer from the consultant to company staff or intensive follow-up required by the in-house management team prompted the company to opt for a fourth possibility: a joint venture with Siemens. This resulted in a business known as SIEKap. Peter Decaigny, responsible for energy and maintenance projects at Siemens and part of the management team at SIEKap, sees only benefits.

"It was both a good short-term and long-term solution for the partners. Smurfit Kappa Baden Karton and Siemens em-



Peter Decaigny
Siemens AG

ployees worked together closely, forging a cohesive whole of reality, experience and consultancy."

Very small businesses – those with one or two maintenance staff – would not benefit from a joint venture, but that does not mean that the organization has to be enormous before it can benefit from this formula. SIEKap employs about 25 people as part of the maintenance process.

During 2001, the two companies concluded a contract which was extended again for a further five years in 2006. "Now after more than six years production capacity has increased dramatically while costs are way below the level we started at," says

Decaigny, "what is more, the number of industrial accidents dropped firmly as well."

According to Decaigny, another advantage of the joint venture is the fact that a permanently present maintenance partner ensures that the matter of maintenance receives a fixed slot on management's agenda. Agreements are reached in cooperation with management and maintenance improvements are also introduced that way. So it is not just mere lip service – there is action too. A system of annual maintenance objectives and Key Performance Indicators (KPIs) keeps everyone on their toes – a strong contributor to the joint venture's success.

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Crisis Communication

Advance Planning is the Foundation of Effective Disaster Management

Act Or React – In the event of an emergency, these are essentially the two response options a company has for both the public and the media. In context of a crisis, the conditions for effective communication are undermined by the fact that the damage has already occurred. Crisis-communication efforts that begin after an incident has already taken place always come too late.

Crisis communication and disaster management are typically not among a company's core business areas. Nevertheless, all companies – not just those subject to Germany's statutory order on hazardous incidents – should make preparations and actively implement procedures for crisis communication as part of an integrated disaster management plan. This is best done before a potential incident or disaster occurs.

If a passive, hesitant or resistant approach to the press is taken, a company runs the danger of forfeiting its opportunity to act as a source of information to the media. The media will seek out other sources of information, such as bystanders. The company then loses all influence over the emotionally tinged reporting that results. Making the statement "no comment" is a catastrophe from a public relations (PR) perspective.

A proactive communications policy provides a company with the opportunity to play a leading role in the formation of media reports. This does not guarantee that reports will automatically be of a positive nature, yet, as a general rule, fair and unbiased coverage is typically obtained. That means: The speed and precision with which information is provided in a crisis situation is directly proportional to the favorability of the reporting subsequently publicized about the company.

The PR activities undertaken by a company in the hours immediately following an incident or onset of a crisis situation are of decisive importance for all subsequent media coverage. If a professional PR response is not undertaken, or if this response is chaotic in the tumult of the incident, this will lead to additional problems beyond the immediate event itself, and is likely to generate a media climate that is irreversibly negative. Adequate



Ingrid Knöpfle
Industriepark
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preparation is thus essential for a professional crisis-communication response.

Crisis Communications as Demonstrated by Gersthofen Industrial Park

At the Gersthofen Industrial Park in southern Germany, approximately 1,650 employees work at 12 companies, four of which are globally active manufacturers of specialty chemicals. Over the years, new urban development projects have been built in ever-closer proximity to the industrial park. To the south, a housing development directly borders the park's property line. This presents a significant challenge for the company. The stakeholders are numerous and varied: neighbors, media, general public, customers, suppliers, politicians, officials, municipalities, representatives, associations, educational institutions and, last but not least, the employees and their families.

As a rule, all communication activities for the industrial park are codified and set forth in a jointly developed communications plan. Over the past few decades, it has been possible to cultivate a positive public image because of a constant willingness for open dialog and a variety of PR activities (including a visitors' day, factory tours, events, etc.). Nevertheless, the acceptance and trust of stakeholders cannot be expected as a matter of course, nor can they be acquired over the short term. To this end, strategic efforts within the scope of a long-term process are required.

Well-organized Disaster Management is an Obligation

The companies which comprise the Gersthofen Industrial Park have been granted blanket certification for disaster and environmental management in accordance with DIN ISO 9001 and 14001. At regular intervals, readiness teams conduct training exercises in cooperation with the fire department for various crisis scenarios. Training sessions in crisis communication are also offered on a regular basis. Routine participation in media training sessions is obligatory for all members of the industrial park's readiness directorate.



Fig. 1: At Gersthofen Industrial Park, approximately 1,650 employees work at 12 companies.



Fig. 2: Adequate preparation is essential for a professional crisis-communication response.

A situation room with all necessary materials and documents has been established in order to insure an optimal and coordinated response in the event of a crisis. The situation room contains, for example: walkie-talkies; a dedicated communications room; data sheets with safety information on all

products; a PC workstation with an Internet and internal-network connection; fax machines; a separate room with a citizens' hotline; informational materials such as street and topographical maps, etc.; all necessary forms for reporting to official agencies and company directors; etc.

At the core of the emergency management plan, however, is a sophisticated checklist system. This system enables incidents to be efficiently managed, even outside of normal working hours. Each participant in the situation room has clear tasks and understands the role he or she must play. The checklists ensure that even the smallest matter is not overlooked. All activities in the situation room are documented in detail so that each action can be traced and reconstructed at a later date. This is particularly important in the event of a subsequent investigation by police or legal authorities.

Precautionary Measures as a Key Element of Crisis Communication

With appropriate precautionary measures, action can be taken

for the best possible handling of an incident or crisis. Such measures include:

- A commitment by all associated companies to the emergency management plan
- The establishment of a situation room
- The establishment of defined procedures for dealing with the media and the public
- Appointing a media representative
- Prior development of stand-alone texts for press releases
- Prior joint determination of linguistic guidelines for the discussion of the crisis
- Crisis-communication/media training
- Disaster drills for all involved parties should occur at regular intervals
- Regular educational efforts informing the public about possible dangers associated with chemical plants (e.g. a disaster brochure).

Crisis communication must be an integral part of a company's overall policies. Responsibility for the handling of a disaster from a PR perspective should be assigned to a small group of highly experienced individuals in advance. Organizationally, the individual heading up PR efforts in crisis situations should occupy a prominent position within the company in order to insure the unimpeded flow of current information.

It is possible that the news-gathering departments of various media organizations don't have journalists with detailed knowledge about specific branches of industry. Consequently, it is necessary to promptly supply news teams at regular intervals with current information. A proactive engagement with the press helps to establish a bond of trust between the news organization and the company. For obvious reasons, the development of a robust relationship to a news department and/or individual journalist cannot be achieved overnight. Press contacts must be cultivated on an ongoing basis. It is also important to appoint a liaison to news departments who can answer all questions about the company. In addition, the review and optimization of all press releases regarding the needs of the media is a worthwhile undertaking.

Optimal Crisis Communication – a High Standard

Crisis communication is aimed at the preservation of a company's reputation and public image in the face of damaging or potentially adverse consequences following an undesired incident, such as a fire, explosion, gas cloud, water pollution, etc. When public relations is viewed as an integrated component of crisis management and properly deployed, negative consequences for a company's reputation following an incident can be mitigated or avoided. A company can, in fact, play a decisive role in defining how an incident is perceived and understood. With unbiased media coverage, public understanding and acceptance can be obtained. That is the best-case result in the event of a disaster.

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International Standards

ISO 14001 is the international specification for an environmental management system (EMS) against which organizations are assessed. It is part of the ISO 14000 environmental management standards family which exist to help organizations minimize their operations negative affect on the environment.

Similarly ISO 9001 is part of the ISO 9000 family of standards for quality management systems.

Requirements of ISO 9001 include:

- Procedures for all key business processes
- Monitoring processes to ensure effectiveness
- Record keeping

Arkema to Make Low-GWP Gas for Car Air Conditioning

Arkema said it will invest in European production of a new low-GWP (Global Warming Potential) fluorinated gas, R1234yf. From 2011, this gas will gradually replace the HFC134a refrigerant used in car air conditioning systems, the chemicals company said. Arkema is anticipating

more restrictive environmental standards, particularly the adoption of European Directive 2006/40/CE, and is developing next-generation fluorochemicals to help minimize greenhouse gas emissions, it said. R1234yf has a negligible GWP compared to HFC134a, Arkema said, with-

out saying how much it plans to invest in developing the new gas. The EU directive requires the substitution of HFC134a in car air-conditioning systems by 2011 for new automotive manufacturing platforms and by 2017 for every new vehicle sold in Europe, the company said. ■

Improved Adhesives

PRODUCT Momentive Performance Materials is presenting a newly developed RTV21A/22XB series, comprising a 2-component silicone RTV adhesives that can meet the demanding headlamp requirements while enabling high speed production and improved productivity, due to its fast room temperature cure technology and consistent application. The RTV210A/22XB

series is one of the fastest room temperature cure silicone adhesive systems for headlamps enabling leakage testing shortly after assembly. Silicone RTVs provide a solution to both the lamp body and the coated lens, at the same time giving a long term level of elasticity that can cope with CLTE differentials over the wide range of operating temperatures. ■

DSM to Take €25 – 30 Million Hit

Royal DSM said it expects a negative financial impact of €25–30 million from an interruption in production at its DSM Agro plant, adding that the interruption in production will take longer to end than initially anticipated.

"In view of the current positive business climate the outlook

will not be lowered due to this event," DSM said in a statement. It added that most of the costs will be booked in the third quarter and that thanks to insurances, the costs will be €25–30 million. DSM said technical problems arose at one of the DSM Agro ammonia plants at the start of June and repairs might extend

into October, longer than the initially estimated interruption of production of a few weeks. DSM said it is continuing work on possible alternative solutions. The DSM Agro plant produces industrial chemicals and is grouped under the Base Chemicals operations which have been identified for divestment. ■

Lanxess Opens Rubber Research Center in Qingdao

German specialty chemicals company Lanxess opened a new Rubber Research Center (RRC) in Qingdao, Shandong Province. Established in close cooperation with Qingdao's University of Science and Technology (QUST), the world-class research center is located within the university's vicinity. It is

jointly operated by the Lanxess business units Technical Rubber Products, Butyl Rubber and Performance Butadiene Rubbers, and marks an investment of some \$16 million.

"The RRC will cover complete functions, ranging from fundamental research involving the development of new

products and techniques, to technical customer support and preparing the commercialization of future inventions," said Juergen Gunther, head of the business line Specialties from Lanxess Technical Rubber Products business unit and project manager responsible for the RRC. ■


More Stages Of Expansion

PRODUCT Feige now offers

more stages of expansion for the drum filling machine Type 33 presented in 2004 for the filling of steel and plastic drums. An automatic de-bunging and bunging station, nitrogen purging or pre- and final filling station can be combined as per requirement. After installation and power supply has been put on, the machine is ready for use as electric and pneumatic control has been designed in such a way that it perfectly fits into one common control cabinet. Cable conduits and cable laying can be spared dur-







ing installation. The basic idea of a quick "Plug & Fill" machine has even been improved. Everything is ready mounted for production, in case of hazardous area application in zone 1 tested and designed as per ATEX regulation. ■



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External Procurement Of Pumps

Using Total Cost of Ownership as a Governing Principle

Bid Comparison – Key components in the procurement of pumps by BASF are Total Cost of Ownership (TOC) and bonus/malus evaluations.



The external procurement of pumps in the BASF Group is usually undertaken directly by the technical procurement team at the respective site with direct input from corporate engineering and the production operations on site. The main focus of this collaboration being TCO. Figure 1 provides an overview of the average pump demand of the essential pump segments in the BASF Group. In value terms, centrifugal pumps represent the key category.

but also expenditure incurred for planning, installation and startup. The operating expense typically reflects combined costs including those for power, maintenance and repair. Calculation of TCO includes tax and interest rate effects which, just like manpower costs and energy cost, depend on the particular plant site. Annual costs are discounted to current cash values.

While in the past the purchasing decision for an investment was governed by the price, a comprehensive approach is the current key consideration in procurement (fig. 2). Within BASF a bonus/malus bid comparison process is common practice in assessing both technical and commercial differences between the various bidders from a financial perspective and these are taken into account when comparing their bids.

As can be seen from figure 2, for pumps it is the subsequent

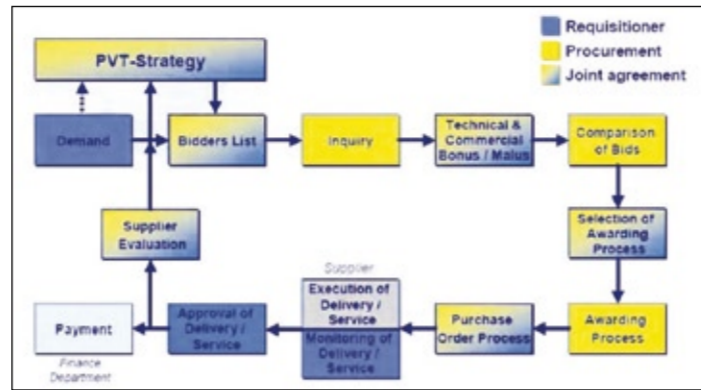


Figure 3: Procurement process

expenditure which accounts for the major proportion of the total lifecycle cost. Whilst, judging by the total up-front cost of a chemical plant, the proportion of all pumps is less than 5%, a TCO analysis turns out to be useful. This approach is further substantiated by the current energy efficiency discussion.

TCO analysis in BASF, however, is not limited to the selection of vendors in the procurement process. In fact, it is used in plant engineering during the planning and conception stage to facilitate comparison of equivalent process engineering solutions.

This is where value improving practices (VIP) are employed to scrutinize various aspects including use and cost of the contemplated pump system so as to find the best possible solution for the process engineering task definition. At this stage, a decision taken in favor of a specific design is usually not manufacturer-dependent; it is also governed by other criteria such as safety requirements.

Procurement Verbund

In 2000, BASF established a global procurement verbund (PV). This is a virtual organization which, whilst coordinating the technical goods and services needed by the BASF Group on a global scale, also defines the strategic course. The PV consists of teams, and these procurement verbund teams (PVT) deal with all relevant procurement demands and such a team exists for pumping solutions. Experts from engineering, maintenance and procurement on the various BASF sites meet to define global procurement strategies and assist in their implementation. Typical tasks are vendor recommendations, supplier evaluation, master agreements, market and price development predictions and developing standards.

Bidders' List

A combination of active supplier management and vendor recommendations are highly relevant to operative procure-

ment of pumps. With this background, the PVT draws up and updates a supplier list which forms the basis of an inquiry. Moreover, the following criteria may also be considered in the selection of vendors:

- Project-related criteria (e.g. requirements specified by process owner, pure replacement parts)
- Vendor-related aspects (e.g. process-engineering expertise, references, supplier evaluation)
- Competition-related aspects (e.g. opening up of new markets or tapping new suppliers)

Supplier Evaluation

Vendor rating by BASF is made on a global scale, taking into account price, quality, performance and services as the main criteria. Supplier performance and rating, which includes an appraisal of maintenance activities, are carried out separately by a combination of requisitioners, buyers and users. The vendor performance so registered, is assessed and considered both when establishing a bidders list and in the commercial bonus/malus evaluation.

Technical Specification Sheet

In addition to the bidders list, the technical specification sheet forms the basis of an inquiry. All the requirements to be met by the equipment to be procured are specified in the technical specification sheet. It is updated in the course of the procurement process and forms a mandatory integral part of the purchase order.

Procurement Process

Procurement of technical goods and services in the BASF Group follow the process shown in the graph (fig. 3). For defined procurement values the bidders are required to submit separate technical and commercial bids. The commercial bids are not opened until after evaluation of the technical bids, using the bonus/malus comparison has been complete. Particular

Supplier	Supplier A	Supplier B	Supplier C	Supplier D
Pump type	Canned Motor Pump	Canned Motor Pump	Centrifugal Pump with Seal	Centrifugal Pump with Seal
Price Offer	126.848,-	76.900,-	115.860,-	120.828,-
Bonus / Malus				
Piping Changes	3.900,-	3.900,-	3.900,-	
Frequency converter and transformer		53.000,-	Lowest Price	Price Purchase Order
Reconstruction of switchgear room incl. installation		10.000,-		
Cleaning connection pump	10.000,-	10.000,-		
Qmin pipe				10.000,-
Additional maintenance expenses			6.326,-	6.329,-
Energy costs	59.801,-	62.991,-	54.486,-	64.054,-
Total amount incl. Bonus / Malus	200.549,-	216.791,-	180.575,-	201.211,-

Figure 4: Concrete example

care is taken to ensure that bids are submitted in due form and time. Bids received too late or not in due form are rejected. This process, while boosting fair contract award under competitive conditions, is adapted to ensure transparency of the contract award decision and lend credence to the vendors, thus making an essential contribution to BASF's Compliance Program.

Bid Evaluation and Bonus/Malus Comparison

In the contract award decision, the technical bonus/malus takes into account the calculable elements of the TCO. It is the objective of the technical bonus/malus to render a monetary evaluation of acceptable qualitative technical differences between various vendors on the basis of relevant TCO aspects. The technical bonus/malus serves to assess the differences of costs between the various bids, which would be incurred during the period under consideration.

To enable such costs to be taken into account in the technical bonus/malus they must be predictable and calculable. Examples of such costs are:

- Expenditure incurred for quality assurance (factory test run, inspections)
- Cost of additional equipment as may be needed or structural modifications to be carried out (heat exchangers, switchgear room)

- Differences in planning or construction efforts
- Initial stocks of spare parts
- Differences in operating expense (energy, maintenance)

The technical bonus/malus ascertains the overall cost approach in the evaluation of technical bids. The commercial bonus/malus attempts to correct differing terms of delivery and services as may exist or liability agreements such that the bids submitted will be comparable. Since all bids are required to conform to the specification, BASF does not give a bonus for bids which overfill the specification or provide reserve capacities.

The TCO approach, even though not new, is still difficult to implement in practice. Often essential data is missing, in particular with respect to maintenance, and hence a more accurate calculation cannot be carried out. Also, information about the pump design to permit a manufacturer-related differentiation is not available.

Following the comparison of the technical bids and the technical bonus/malus evaluation, the bids are assumed to be technically comparable. The contract award decision will then be taken by judging commercial aspects only. There fore the next step is to open the

price bids, the results are documented in a bid-opening record and transferred to the overall bid comparison which also includes the technical and the commercial bonus/malus.

Concrete Example

As demonstrated in the following example (see fig. 4) the technical bonus/malus lends itself to identifying both the suitable pump type and the beneficial price. It can also be seen, however, that a low bid price does not necessarily result in contract award. In fact, the vendor selection is also governed by the individual requirements of the particular task.

Summary

The TCO represents the governing principle and strategy in the planning and procurement of machinery and units in BASF.

ASF adopts a global procurement strategy, focusing on preferred vendors. These vendors are scrutinized under competitive conditions and their performance measured by adopting a supplier evaluation system. The PVT being the driving force. The operative implementation of procurement takes place within the scheme of a globally valid process.

Separate submission of technical and commercial bids, as well as comparison of the bids including technical and commercial bonus/malus evaluation is a key element of BASF's procurement process. It is the objective of the Technical Bonus/Malus comparison to identify the solution that is most beneficial for BASF rather than the cheapest solution.

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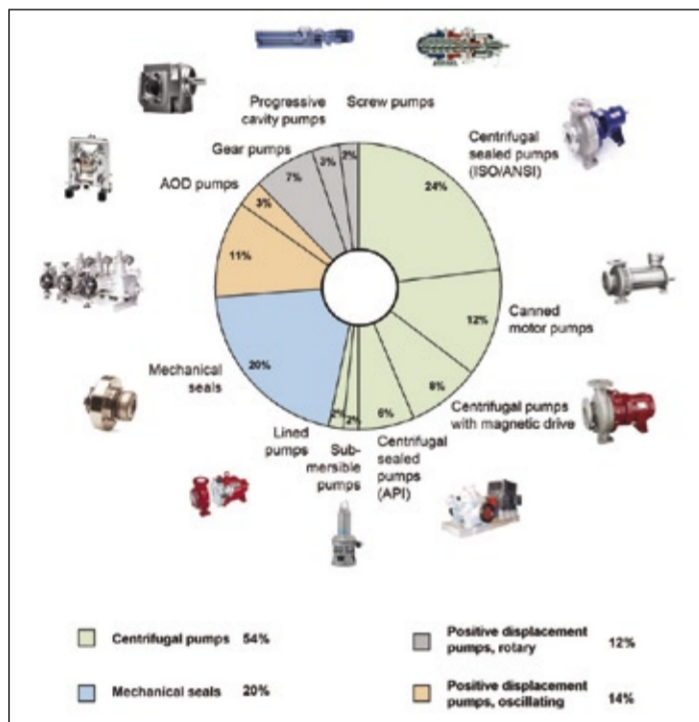


Figure 1: Average pump demand at BASF

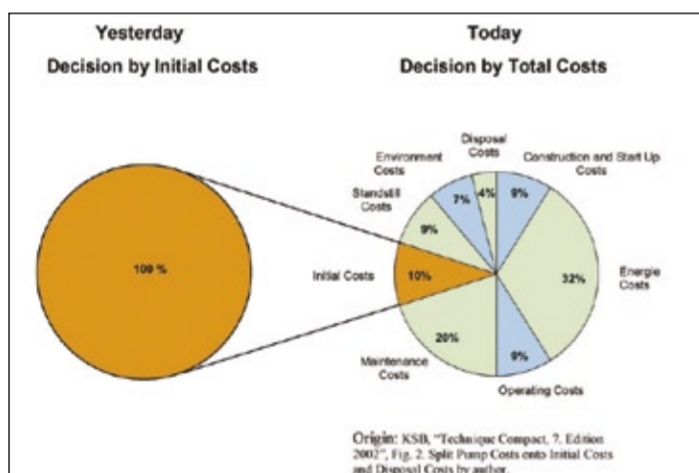
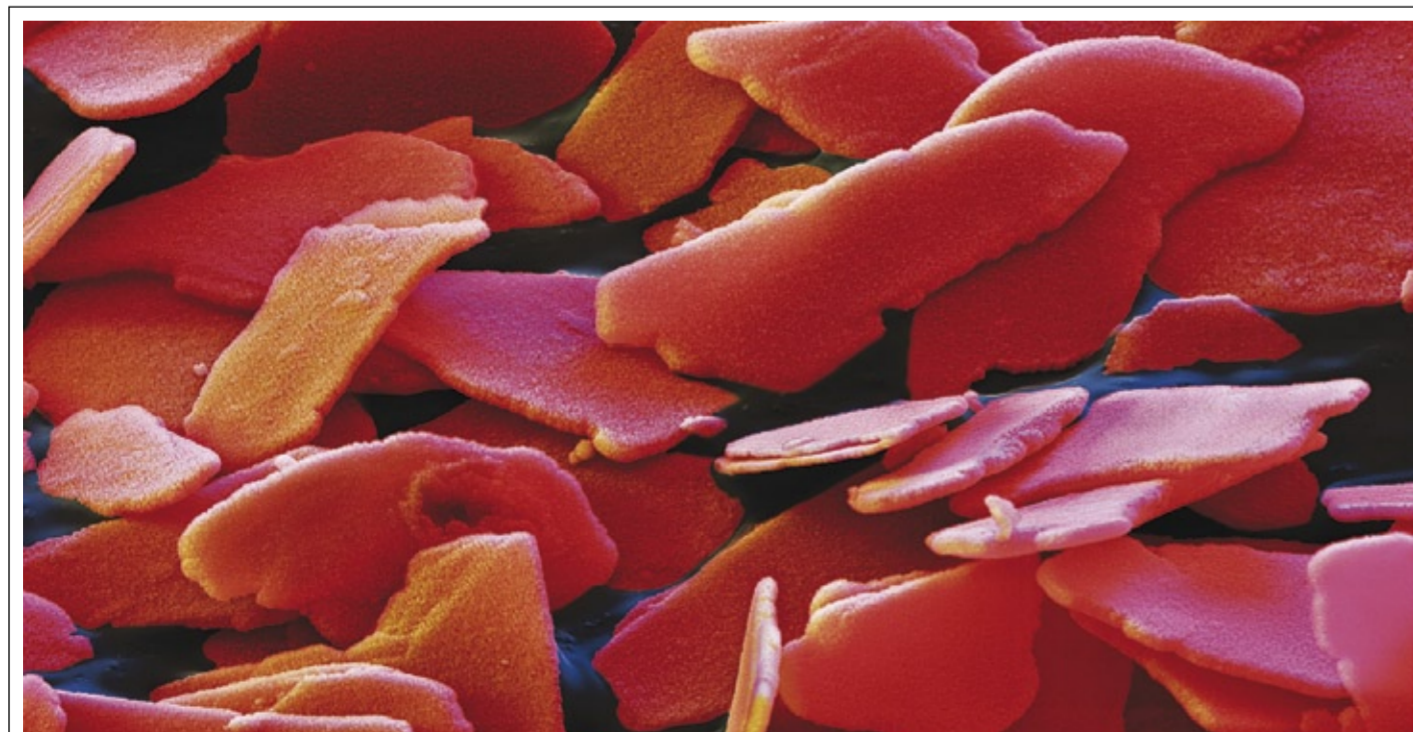


Figure 2: Total point of view during procurement



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Save Energy Using Condition Monitoring

How to Optimize Overhaul of Centrifugal Pumps

Maintenance – Centrifugal pumps are common, yet relatively little information is available on applying condition monitoring to them. When the effect of deterioration is only to increase power consumption, condition monitoring can be used to find the time to overhaul for minimum cost and greenhouse impact. Here is how to use condition monitoring methods to estimate the increased power consumption caused by pump wear and help optimize maintenance.

Ideally, major pumps should be overhauled when really necessary, rather than on a fixed time or breakdown basis. Field or original equipment manufacturer (OEM) experience should be considered too. Monitoring methods should be chosen to detect the degradation modes expected. For critical machines, more than one method may be justified:

- Vibration monitoring and analysis, to detect unbalance, misalignment, looseness, soft foot and resonance
- Sampling and analysis of lubricants for deterioration and wear debris – relevant for bearings/lubrication system
- Electrical plant tests for motor condition



Ray Beebe
Senior lecturer at
Monash University

- Visual inspection and Non-Destructive Testing – particularly relevant for casing wear
- Performance monitoring and analysis: the most relevant for pump internal wear, and the subject of this article.

Figure 1 shows the trend in degradation of a 230 kW pump to be closely linear. Wear amplitude is expressed as the percentage reduction in Total Head at a selected datum Flow compared with the new condition.

The Head-Flow Test

Of several condition monitoring methods, head-flow measurement at duty point detects changes in system resistance as well as detecting pump deterioration, provided settings are unchanged. Testing over the full flow range is not needed: points near the normal operating duty point are sufficient to reveal the effects of wear, usually shown by the head-flow curve moving towards the zero flow axis by an amount equal to the internal leakage flow.

A series of test readings at steady conditions at about 15 second intervals is sufficient,

taking the average values to plot. Variable speed pumps need Speed measured, and the head-flow data corrected to a standard speed using affinity laws. Field tests are less accurate than at the manufacturer's works, but for monitoring it is relative changes we seek rather than absolute accuracy.

Unless a plant's permanent instrumentation is verified as being in calibration, test instrumentation will be needed. Test-grade bourdon tube pressure gauges or electronic types are satisfactory. Non-intrusive ultrasonic flowmeters are usually applicable, provided the pipe bore diameter is known. A permanent flowmeter installed can be used, provided its long-term condition is considered to be constant, or it can be inspected regularly.

How to Calculate the Optimum Time for Overhaul

The most economic time to restore lost performance by overhaul will vary with the circumstances. If the deterioration is constant over time, then a cash flow analysis can be done to ensure that the investment in overhaul will give the required rate of return: The same process used in deciding on any investment in plant improvement. If the deterioration rate is increasing with time, then the optimum time for overhaul can be estimated, by methods now described for some of the situations which occur.

Scenario One

If pump deterioration results in a reduction in plant production, the cost of overhaul is insignificant relative to the cost of lost production. Prompt overhaul is usually simply justified at a convenient window of opportunity.

Scenario Two

If the pump runs intermittently to meet a demand, and the system flow is relatively constant over a period, deterioration in the pump will result in it taking more time to do its duty. Therefore, the extra service time required, results in increased power consumption which can be related to the cost of overhaul.

Scenario Three

With constant speed and throttle valve controlled pumps, pump deterioration does not, at least initially, affect plant production. Here, the control valve opens to ensure that pump output is maintained at the required rate, so internal wear does not initially cause any loss in production from the plant. Figure 2 shows the Head-Power-Flow site test characteristics of such a pump. Duty flow is 800 m³/h, and the duty point in the new condition is A. The power absorbed is read off the Power-Flow curve as 2150 kW. B. The power-flow curve should ideally be found on site, but the

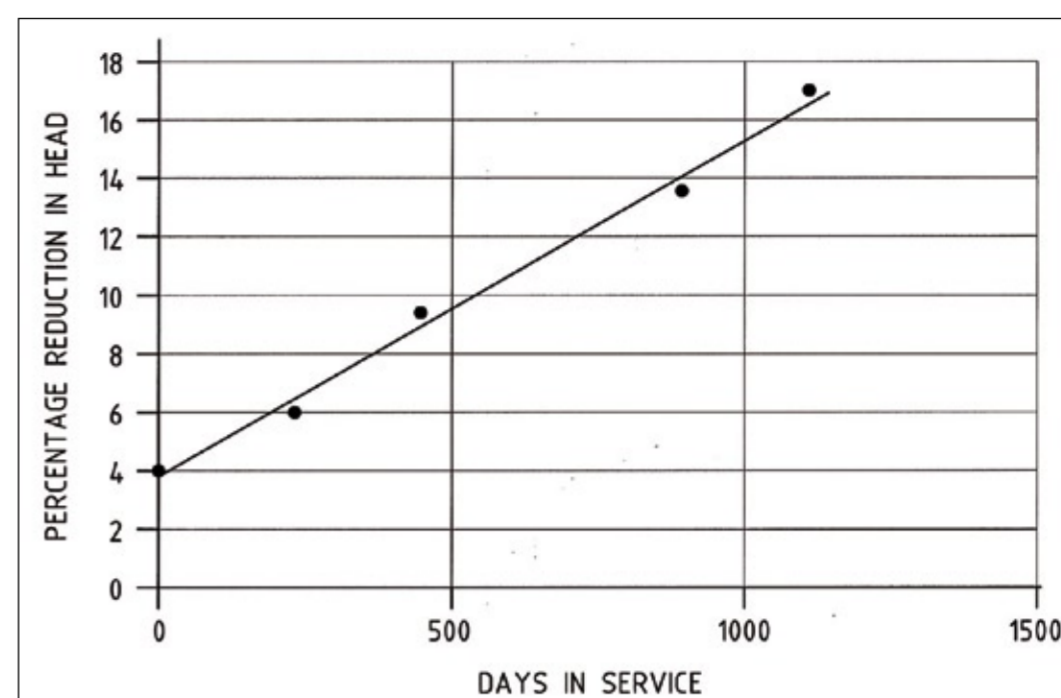


Figure 1: Degradation of a 230 kW pump shown by Head-Flow testing

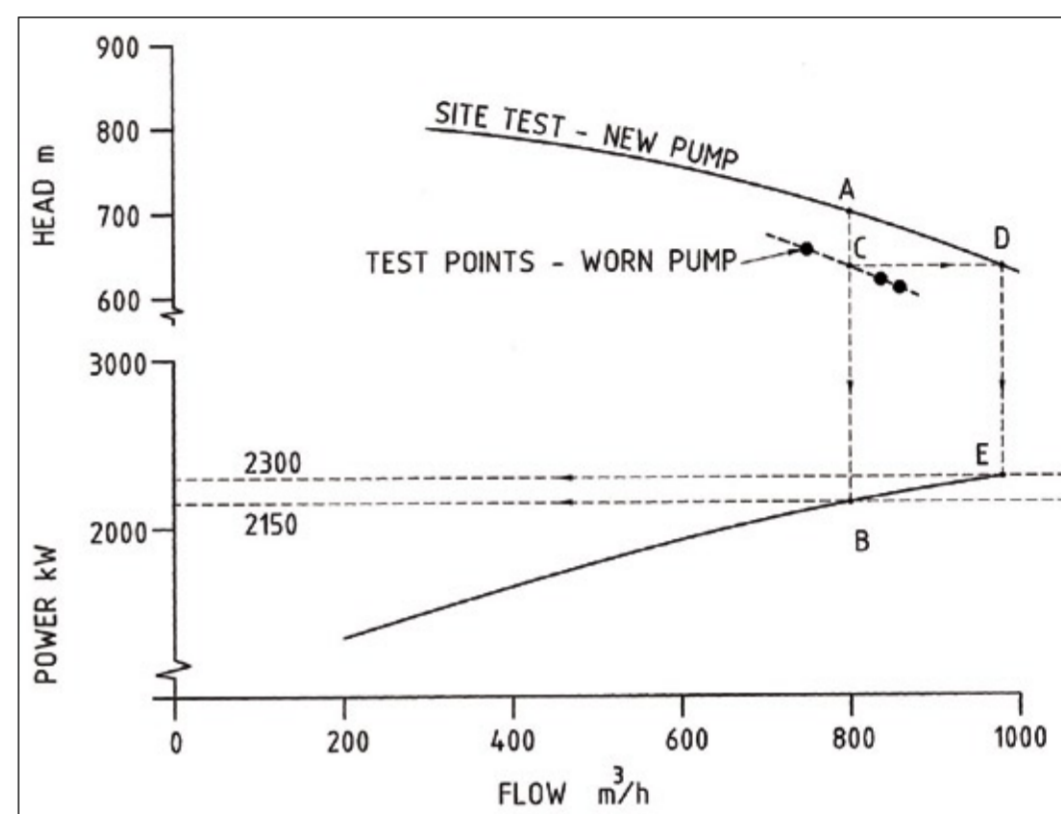


Figure 2: Head-flow-power characteristics of new pump, and head-flow points from worn pump

work tests information may have to suffice.

After some service, the "Test points – worn pump" plotted indicate internal wear. Duty point is now at C, as the systems resistance lowers when the throttle valve is opened.

The increased power required in the worn condition can be estimated by extending from the head-flow curve at constant head from the operating point to D, and then intersecting the Power-Flow curve for new condition at constant flow: E. Follow the arrowed line in figure 2. The basic assumption here is that the original curve still represents the flow through the impellers (of which less is leaving the pump to the system due to internal wear). The flow difference C – D represents the internal leakage.

If the pump is motor-driven, the actual power could of course be measured on test at extra expense. In our example, the power required for this duty in the worn condition is shown in figure 2 by the projection from the duty flow of 800 m³/h to the test curve at 640 m head, then across to the "Site test – new pump" curve, to find 2300 kW. The extra electricity consumption is therefore 2,300 – 2,150 = 150 kW ÷ motor efficiency (here 90%), to obtain 167 kW.

Using this method, a number of pumps of varying wear conditions could be prioritized for maintenance, based on their increased power consumption and their relative costs of overhaul, i.e. the cost/benefits. However, a further calculation assists the decision as to which pump or pumps justify the expense of overhaul.

Finding the Optimum Time for Overhaul

In this example, the test points were obtained following 24

months of service since the pump was in new condition; an overhaul would cost \$50,000, electricity costs 10 c/kWh and the pump is in service for 27% of the time on average.

Our test shows that the rate of increasing cost/month has reached 167 × 0.10 × 0.27 × 720 = \$3,240/month (taking an average month as 720 h). As the time now is 24 months, \$3,240 ÷ 24 gives the average cost rate of deterioration as \$135/month/month. This is assumed to be linear with time, based on experience as reported in figure 1.

The optimum time for overhaul can be calculated:

$$T = \sqrt{\frac{2 \times O}{C}}$$

where: O = cost of overhaul, and C = cost rate of deterioration giving here T = 27.2 months.

It is better to calculate and plot the average total cost/month values for a range of times. Seen clearly will be the cost impact of doing the repairs at some other time, such as at a scheduled plant shutdown.

How to Calculate the Total Average Cost per Month

Example for 22 months:

The average cost of overhaul is now: \$50,000 ÷ 22 = \$2,273/month.

The average cost of extra energy is now: \$135 × 1/2 × 22 = \$1,485/month.

The total average cost/month is now: the sum of these two figures = \$3,578/month.

Repeating this calculation for several months will give curves that show the cost per month of overhaul dropping with time, with the cost of lost energy increasing with time.

This calculation is only correct if the wear progresses at a uniformly increasing rate with time, but as figure 1 shows,

this is not unusual. Information may not be available to make any other assumption, and decision makers have to start somewhere. If the pump does not operate at constant flow, then the calculation must be amended.

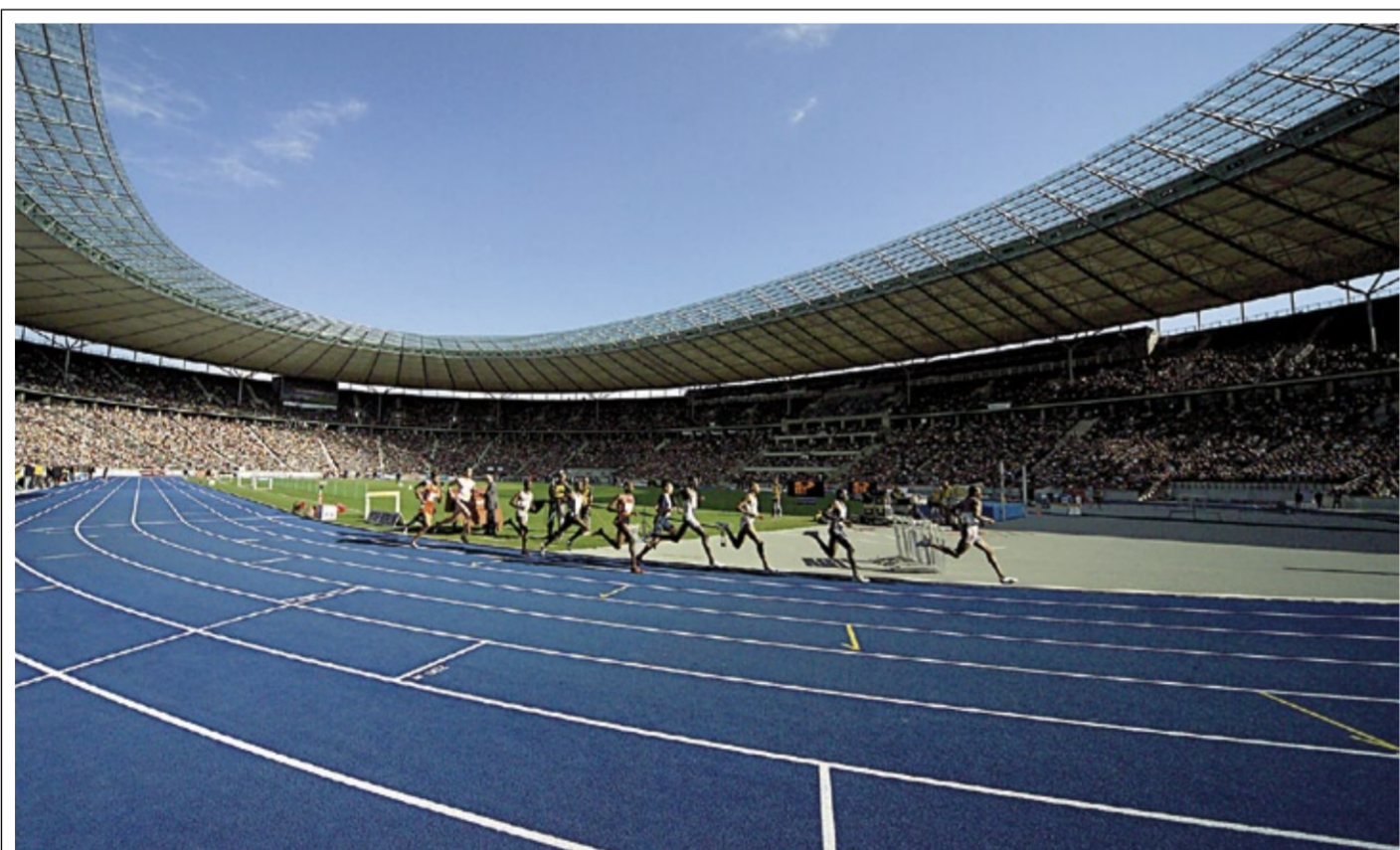
Some relatively small pumps may never justify overhaul on savings in energy use alone. The method does not apply to pumps of high specific speed that show little change, or even a reduction, in power with increased flow.

Last But Not Least – Scenario Four

Also with variable speed controlled pumps, the pump deterioration does not initially affect production. For a pump where the speed is varied to meet its desired duty, the effect of wear on power required is much more dramatic than for the case of a constant speed throttle controlled pump. This is because the power increases in proportion to the speed ratio cubed.

Unless the pump output is limited by the pump reaching its maximum speed, or by its driver reaching its highest allowable power output, then no production will be lost. However, power consumed will increase more dramatically for a given wear state than for a constant speed pump. The method shown can be used.

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Together with the exhibition, there will be a four-day interesting calendar of lecturers and conferences presided by a "Scientific Committee" composed of important representatives and experts from universities, associations, companies, and media.

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A World Of Technologies – World CIA 2008 is an international exhibition dedicated to chemistry, industrial application products and technologies for the environment which combines the development and consolidation of business relationships with the exchange of knowledge and experience between researchers and economic players from all over the world.

The event will take place Nov. 20–23 in the Montecarlo Grimaldi Forum in Monaco. It will focus on the best worldwide technologies and offers the perfect context to share and develop new ideas and opportunities, new researches, materials and manufacturing techniques. The show strives to support chemistry on an international and global level, by creating a worldwide platform of the main players of the chemical productive world. Exhibiting companies and relevant en-

gineering firms will have the occasion to meet and consider new products and techniques to help their business grow. The most important brands of the world of chemistry will exchange information and experiences, exploring new solutions and obtaining useful elements to better focus on the market needs and demands.

The entire world of chemistry will be represented through the following sectors: fine chemistry and specialties; basic chemical products; physical chemistry of materials; industrial biochemistry; electrochemistry; gas; chemical fibers; plastic materials; rubbers; petrochemicals; raw materials and auxiliaries for ceramics industry; fertilizers; planning and plants constructions; tanks and trucks; technical press; trade associations and research laboratories; testing and certification standards institutes; and systems and technologies for the environment.

Together with the exhibition, there will be a four-day congress with an interesting calendar of lecturers and conferences by well-known speak-

ers coming from universities, associations, companies, and media. The congress activities are presided by a scientific committee composed of important representatives and experts from the academic and industrial international world.

The strength of the event is in fact to offer a high quality exhibition and congress program, where exhibitors and researchers will find the occasion to learn about the latest developments of the market and the most innovative technologies and projects in the whole sector. In this way, an innovative mix between business and professional updating has been created, in order to allow exhibitors to present their own solutions and academics and researchers to dialogue with the big industry, thus contributing together to the future of chemistry.

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Program for the 55th Sepawa Congress Released

Sepawa (Soap, Perfume and Detergent Experts Association) said visitors to its 55th congress in Würzburg, Germany, Oct. 15–17 can expect a versatile program on a wide range of current issues in the cosmetic and detergent sectors.

One of the highlights will include a keynote address by the German

entrepreneur, Wolfgang Grupp, highlighting economic incentives. Several keynote lectures will address the issues of tomorrow, such as: multifunctional detergents, penetration routes of agents through the skin as well as alternative washing methods. The additional exhibition "Meet your Business" offers the opportunity to

contact customers directly. Over 100 exhibitors from research institutes, various SMBs and large-scale industry will be on hand.

► www.sepawa.de

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Chemical Customer Connectivity Index (C3X)

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Future Feedstocks for Fuels and Chemicals: Posters Requested

This international conference, to take place Sept. 29–Oct. 1 in Berlin will provide a forum for chemists and engineers from refinery, petrochemistry and the chemical industry as well as from academia to discuss scientific and technical issues related to possible future feedstocks and their conversion to classical (or even new)

fuels and chemicals. The topic will be covered by eight invited lectures, 15 oral and 19 poster presentations. Moreover, additional last minute posters are welcome. Authors who wish to present a last minute poster can contact the scientific chairs at or before the conference. This international conference is organized by the

DGMK German Society for Petroleum and Coal Science and Technology in association with the Società Chimica Italiana (SCI) and the Austrian ÖGEW Österreichische Gesellschaft für Erdölwissenschaften.

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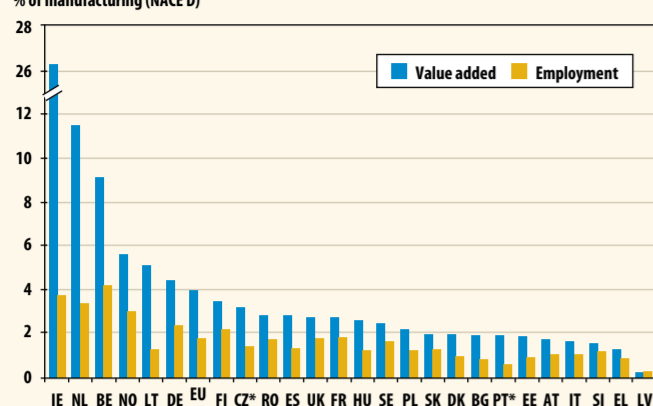
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Manufacture Of Basic Chemicals

Individual countries' basic chemical sectors



*2004; EU27 - excluding: CY, LU and MT

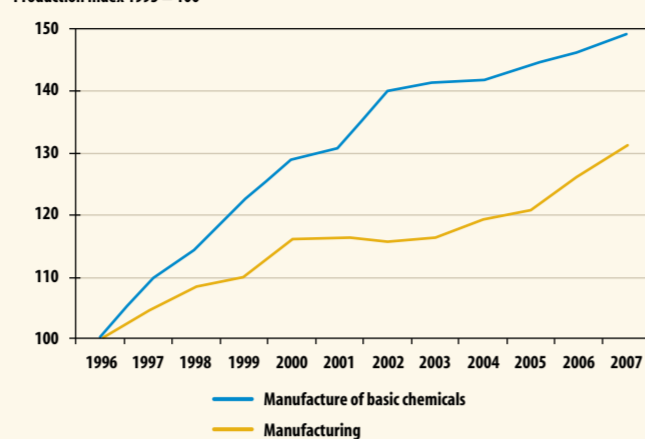
Source: Eurostat, SBS

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In 2005, manufacturing basic chemicals produced a value added of €64.2 billion in the EU27. Ireland showed the greatest value added (26.2%) and Belgium the highest employment (4.2%). In all countries except Latvia, the share of the basic chemicals sector's value added in manufacturing was higher than that of employment, reflecting the industry's high labour productivity.

Recent trends

Production index 1995 = 100



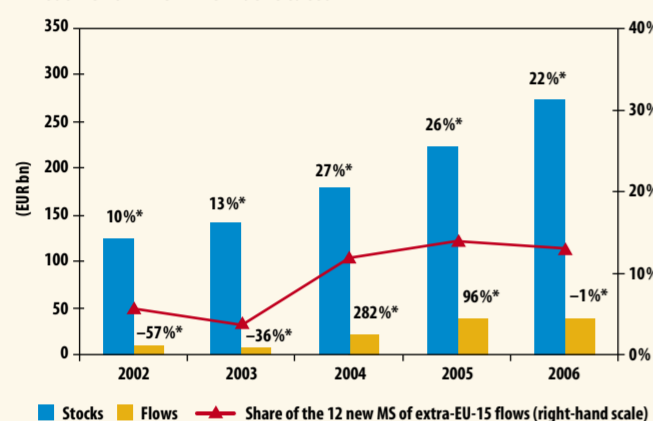
Source: Eurostat, STS

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Between 1996 and 2007, the manufacture of basic chemicals outperformed the EU-27 manufacturing sector. Production of the former grew by 49% while manufacturing rose by 31%. Between 2000 and 2003 the production of basic chemicals continued its progression while manufacturing production stagnated. A reduction in growth of basic chemicals production was seen between 2002 and 2004, which is assumed to be linked to weaker export demand.

Foreign Direct Investment

Investment in New Member States



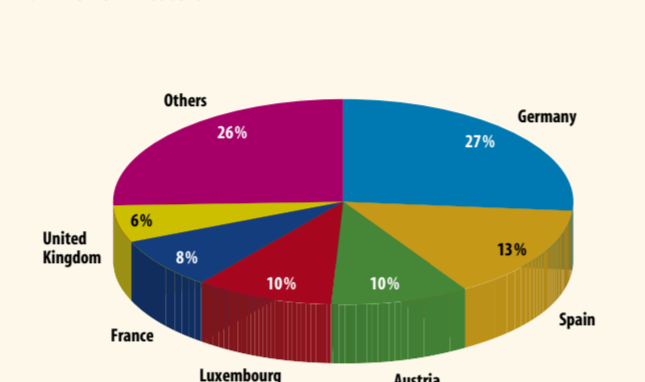
* Annual growth rate

Source: Eurostat

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In 2004-2005, EU-15 outflows to the new MSs grew at a faster rate than total extra-EU-15 flows: in 2005, the growth in total extra-EU-15 flows compared with the previous year was 67%, while investment in the new MSs increased by 96%. However, 2006 registered a slowdown in the growth of all extra-EU-15 investment to only +7%, and for the new MSs a slight decrease was even recorded (-1%). The share of the 12 new MSs in EU-15 outward FDI flows jumped to 12% in 2004 and has remained at that level since.

Main EU-15 Investors



Source: UNCTAD "World Investment Report 2007"

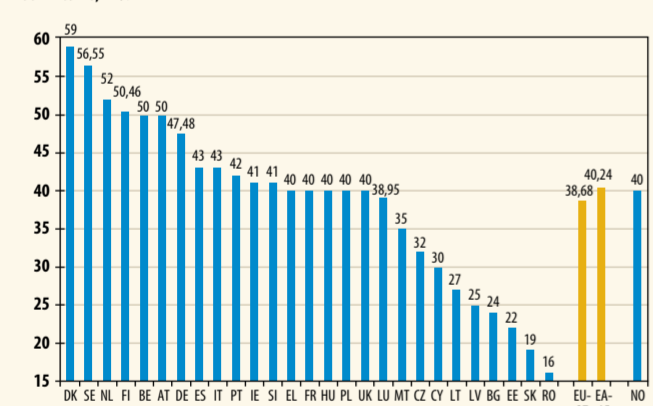
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Between 2004 and 2006, Germany was the main investor in the new MSs, with a three-year average of €8.5 billion. Germany's investment in Poland almost doubled between 2005 and 2006, from €1.2 billion to €2.1 billion. The second largest investor among the EU-15 was Spain, with outflows to the new MSs averaging €4.1 billion. Hungary was Spain's main partner, with 42% of total Spanish outflows. The Austrian investment flows average to the new MSs was €3.3 billion during this period, with Romania receiving the bulk investment (73%).

European Tax Rates

Personal income tax rate

2007 income, in %



Note: Please refer to endnote 2 for details on the calculation of the rates.

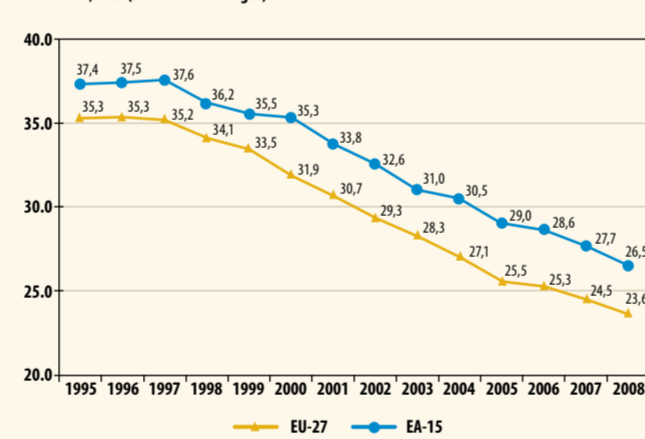
Source: Eurostat

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At present, the top personal income tax rate amounts to 38.7% on average in the EU-27, unchanged from 2006. The actual rate varies substantially within the Union, ranging from a minimum of 16% in Romania to a maximum of 59% in Denmark. As a rule, the new member states display lower top rates. The highest rates are typical of member states with highest overall tax ratios, such as the Nordic countries.

Corporate income tax rate

1995-2008, in % (arithmetic averages)



Source: Eurostat

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Since the mid-1990s, corporate income tax (CIT) rates in Europe have been strongly cut. This trend has continued in 2008, as shown by a 0.9% drop in the EU-27 average. The even stronger cut (-1.2%) was seen in the euro area, whose rates nevertheless remain somewhat higher (at 26.5%, the EA-15 average is almost 3% above the EU-27 average). In 2008, seven member state countries cut the corporate tax rate, most notably Germany (-8.9 points to 29.8%) and Italy (-5.9 points to 31.4%).



Kick-Off In Chicago More than 250 people gathered at Chicago's Navy Pier for the unveiling of exiderdome, a traveling technology expo and learning laboratory from Siemens. Built on a barge for the first part of its nine-city tour, exiderdome has been stationed at Navy Pier before it headed to Detroit. Siemens expects more than 9,000 customers to visit the multimedia event during its nine-city, 10-month tour of major U.S. manufacturing centers between July 2008 and May 2009. "The U.S. is the company's largest market and Siemens' roots run deep in the Chicago area where we have been operating for nearly 120 years," said Heinrich Hiesinger, CEO of Siemens Industry Sector. www.exiderdome.com/us

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