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1|2013

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Vogel Business Media

THE CENTER OF THE WORLD

Where is the center of the world? This question may have been simple to answer in the 15th century (and the answer would have strongly depended on where you were living). Today, it is considerably more complicated; it depends on what you are looking for, and there will hardly ever be one answer: In terms of raw materials, we have moved from a clear layout to a quite complicated one.

When the oil age started, the US was the unquestioned center of the world. Later, the Gulf region moved into the focus. With the development of natural gas to a sought-after resource, Russia and later Qatar appeared on the scene. And today with biomass Brazil and South-East Asia might become important regions with respect to resources.

■ **PROF. DR. RAINER DIERCKS**
President of Petrochemicals Division, BASF; Chairman of DECHEMA e.V. ■

But this development is currently overshadowed by the shale gas discussion which is strongest in the US but also audible in China, Argentina and some European regions. There are some hopes in the US that due to shale gas, the development will take a full turn, and the US will be once more the unquestioned champion of energy resources; but in today's complex resource landscape, the full impact is still not foreseeable.

And the focus has widened even more: Whereas in the 80s, fossil fuels dominated everything else, today additional materials such as rare earth metals have gained enormously in importance. This created new centers of geostrategic importance and potential wealth.

Similar considerations apply to research and innovation. China is gaining ground on the US, Western Europe and Japan not only with regard to numbers of patents but also in terms of quality. Multinational companies supplement their R&D activities in Europe and the US by R&D centers in China in order to be closer to the markets and to benefit from a new generation of highly-skilled graduates in science and engineering.

"In terms of raw materials, we have moved from a clear layout to a quite complicated one."

But industrialized countries are motivated by the challenge; countries like Japan, or Germany and again the US, whose wealth relies strongly on the ability to innovate are set to defend their reputation as world leaders in technology.

The structure of global markets is also evolving: Europe is facing a demographic change and stagnant population figures. Also the Chinese market is affected by a demographic change. These developments have implications for industries such as pharmaceuticals, medical devices, but also consumer products that are adapted to an ageing population. In combination with the overall growth, this offers tremendous potential.

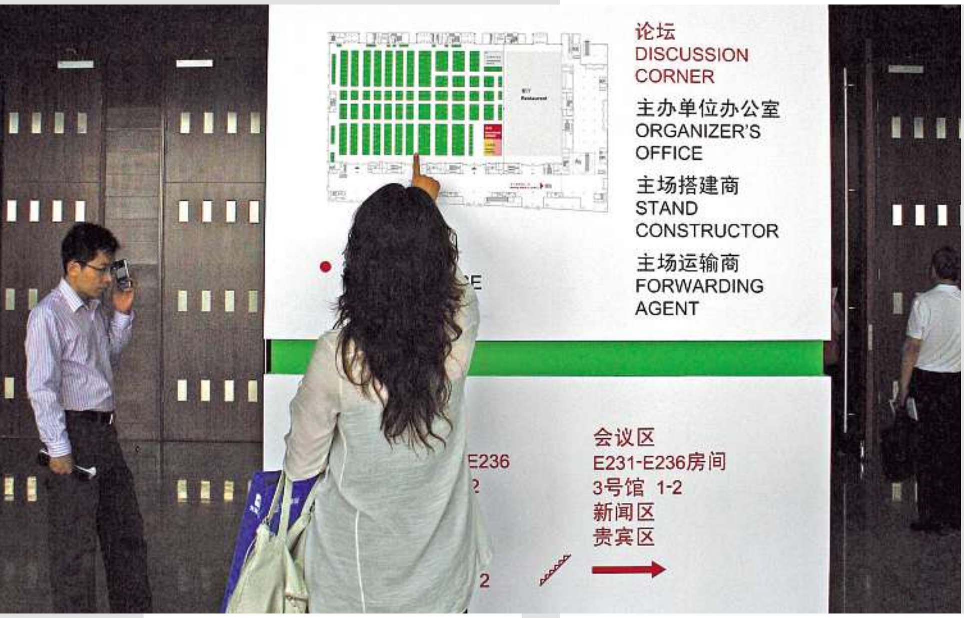
Furthermore, some analysts point out that the next group of emerging countries is already stepping on the world stage: With the acronym "MIST" they label Mexico, Indonesia, South Korea and Turkey as future players worth watching.

The multi-centered world today leads to new geostrategic considerations. It is complicated and very dynamic, but at the same time it offers a wealth of opportunities. And it is not only consumption that is a market driver — there are also other issues such as environmental concerns that evolve with the development of economies.

If you ask the initial question more specifically there may even be some simple answers. One example: In May, Beijing will for one week be the center of the world — at least as far as the process industries are concerned. AchemAsia will unite more than 400 exhibitors and more than 12,000 visitors from China and all over the world. It will be a hub of innovation and of international cooperation. The congress and the exhibition will cover topics that are important to any economy: Efficient production, preservation of resources and sustainability. Complicated questions will be solved together, and ideas will spread from this center of progress.

Isn't it nice that some questions are easy to answer?

CONTENTS



■ **ACHEMASIA 2013**
Getting an overview of the program: New conference layout — Satellite Symposia on focal topics, individually organized in cooperation with DECHEMA's partner associations, are addressing subjects of practical relevance or special interest. ■

■ **INTERVIEW**
ACHEMA worldwide News spoke with Prof. Yang Yuanyi, the new executive vice president and secretary general of CIESC. ■

■ **BIOMINING**
Geobiotechnology plays a significant role in mining. ■

ACHEMASIA 2013 阿赫玛亚洲展
Beijing PR China
13-16 May 2013

GET READY FOR ACHEMASIA 2013!

Two more months and a few days to go... then it's show time for AchemAsia 2013.

AchemAsia 2013 – Satellite Symposia						
Monday, May 13 Afternoon		Resources for the Substitution of Petroleum: Biomass, Coal, Natural Gas		New Technology Used in Water Treatment and Zero Emission in Petrochemical Industry	Vogel Pharmaceutical Engineering International Forum	New Products and Services
Tuesday, May 14	DVS Industrial Forum: Joining in Chemical Apparatus and Plant Construction	Environmental Protection: Upgrading of Transportation Fuels, Reduction of Air Pollution, Loss Prevention	Chemical CO_2 Utilization			
Wednesday, May 15	Process Analytics and Control Technology: Control is key	Break through to World Challenges		Advanced Separation Technology and Equipment Conference		
Thursday, May 16 Morning						

Time schedule of satellite symposia subject to change

Getting an overview of the program: New Conference Layout — Satellite Symposia on focal topics, individually organized in cooperation with DECHEMA's partner associations, are addressing subjects of practical relevance or special interest

Pictures: DECHEMA

DR. THOMAS SCHEURING

With new exhibitor registrations reaching our offices each day, we are getting close to the finish line now, and the event is rapidly taking shape. Especially encouraging for this ninth edition of China's leading show for the chemical process industry: We are right on track to surpass the figures of the last event. In any case, the upcoming AchemAsia 2013 will be this year's most visible platform and meeting point for China's process industry, and a magnet for everybody affiliated with the country's chemical sector. No other event enjoys a similar standing in China's chemical engineering community.

What are AchemAsia's success factors?

- Most international — and most visible — event for China's process industry
- Face-to-face communication with experts and decision makers
- Partnering platform among China's heavyweights and trendsetters
- Stepping stone to investment decisions
- Showcase for innovations
- Integrated technical solutions for all sectors of the process industries
- Opportunity to recruit new personnel
- Synergies through DECHEMA's global and local network

Or, at this point, let the facts do the talking — and let us share with our readers the current exhibitor list (see next double page) and conference layout (bottom left). Both give valuable suggestions of what to expect, whom to meet, and which conference part to attend.

Looking forward to seeing you in Beijing this May! ■

T. Scheuring is CEO of DECHEMA Ausstellungs-GmbH.

The Essentials in Brief

AchemAsia 2013 — 9th International Exhibition and Conference on Chemical Engineering and Biotechnology

Date:	May 13–16, 2013
Venue:	CNCC — China National Convention Center No 7. Tianchen East Road Chaoyang District 100105 Beijing, PR China
Opening hours:	Monday, May 13 – Wednesday, May 15: 9.00am–5.00pm Thursday, May 16: 9.00am–1.00pm
Exhibition Profile:	• Chemical Apparatus and Plant Construction • Process Technology • Petrochemistry • Maintenance and Quality Assurance • Environmental Protection • Water Treatment • Pharmaceutical Industry • Biotechnology • Food Industry • Agrochemistry • Laboratory and Analytical Techniques • Packaging and Storage Techniques • Resources Development

For more information e-mail rentalinquiries@dechema.de, go to www.achemasia.de or www.achema.cn; or simply call +49-69-7564-700.

PRELIMINARY EXHIBITOR LIST ACHEMASIA 2013

3V Tech, Shanghai

A-Sung Plastic Valve, Seoul
Airmotec Chromatotec, Saint Antoine
All Flo, Mentor
ALLGAIER PROCESS TECHN., Uhingen
Allied Supreme, Jiaxing
Anbao, Qinhuangdao City
Andritz, Foshan
Anping County Ansheng Wire, Hengshui
Anping County Dongri Chitong, Anping
API Heat Transfer, Suzhou
ARCA Regler, Tönisvorst
Argal Chemical Pumps, Dalian
Armaturenwerk Hötensleben
Armstrong Chemtec, Singapore
ART Photonics, Berlin
Asahi Organic Chemicals, Shanghai
ATEA Group, Shanghai
atech innovations, Gladbeck
Auma Actuators, Tianjin
AZ Armaturen, Taicang

Badger Meter, Neuffen
Bälz, Heilbronn
BASF, Ludwigshafen
Baum Fluorplastic, Shanghai
Beijing Aerospace Petrochemical, Beijing
Beijing Huake Bomex, Beijing
Beijing Kenod Liquid Equipm., Beijing
Beijing Plastics Research Inst., Beijing
Beijing sailor seal, Beijing
Beijing Zhongxing Shiqiang, Beijing
Beot Inorganic Membrane Separation Equipment
BEPEX, Minneapolis
Bertrams Chemical Plants, Beijing
BHS, Sonthofen
Biar, Sembrancher
BMWi, Bonn
BOKELA, Karlsruhe
Bristol Metals, Bristol
Bronkhorst, Shanghai
BSI PM Engineering, Bobigny
Busch Vacuum, Shanghai

Casals Cardona, Manresa
CFV, Shanghai
Chair Man Hi-Tech, Kaohsiung
Chematur Ecoplanning, Pori
Chematur Engineering, Karlskoga
Chemical Engineering, Frankfurt
Chemieanlagenbau, Chemnitz
China Filtration Inform. Techn.,Zhengzhou
Chromalox, Shanghai
COG Gehrckens, Pinneberg
Comi Condor, Settimo Milanese
Compass Bulk, Beijing
Control Valve/Pump Engineer, Shanghai
Corning China, Shanghai
Corrosion Materials, Shanghai
CPM SKET, Magdeburg
CreaPhys, Dresden

Dalian Eurofilm, Dalian
Dalian Hermetic Pump, Dalian
Dalian Hualong Filter Cloth, Dalian
Dalian Leader Fluid Control, Dalian
De Dietrich, Wuxi
DeChem Tech., Hamburg
DECHEMA Ausstellungs-GmbH, Frankfurt
descote, Feyzin
DKD Filter System, Jingjiang
Dockweiler, Neustadt-Glewe
Dongfang Liya Int. Advertising, Beijing
Dongtai Shengshi Int. Advertis., Beijing
DongXin Seals, Shanghai
Dongying Yicheng Precision, Dongying
Doright, Qingdao
DrM, Shanghai
Dürr Paintshop Systems, Shanghai

EagleBurgmann, Shanghai
Eclipse Combustion Equipment, Suzhou
EIC, Shanghai
ELAFLEX Gummi Ehlers, Hamburg
Elesa+Ganter, Shanghai
ElringKlinger, Qingdao
eltherm, Burbach
EM Technik, New Taipei City
Emborio, Shanghai
ESK Ceramics, Kempten
Evonik Degussa, Shanghai
EXA, Offanengo
EYELA, Beijing

Federal Screen, Beijing
FELUWA Pumpen, Mürlenbach
Fenix Process Technologies, Pune
FGT, Wuhan
FineTek, New Taipei
Fink Chem+Tec, Bad Dürrheim
Firstman, Beijing
FLUX GERÄTE, Maulbronn
FRANKEN FILTERTECHNIK, Hürth
Frenzelit, Bad Berneck
FRISTAM Pumpen, Hamburg
Funke Heat Exchanger, Changzhou
FWG IHW techn. Federn, Grevenbroich

Gardner Denver, Margate
Gardner Denver Nash Machinery, Shandong
Garlock, Shanghai
GEA Group, Düsseldorf
GEFA, Dortmund
Gemeinschaftsstand Verlage, Frankfurt
General Machinery Magazine, Beijing
Georg Fischer Piping Systems, Shanghai
GERB Vibration Control, Qingdao
Gericke, Shanghai
German Fluid Systems, Shatin
GFTZ IWAKI Engineering Trading,Guangdong
GLEANTA, Beijing
Goetze Armaturen, Ludwigsburg
Golden Fluid Pumps, Tianjin
Gore Filtration Products, Shenzhen
Graco, Shanghai
Grande Tek Flow Control, Cangzhou
GSKET, Ticengo
Guangzhou Longhuilong Filter, Guangzhou
GVS, Suzhou

Haiyan New Century, Haiyan
Hakohav Valves, Kiryat Gat
Halifax Fan, Shenzhen
Hammelmann Maschinenfabrik, Oelde
Hangzhou Xingyuan Filter Techn.,Hangzhou
Hebei Guanyu Stainless, Shijiazhuang
Hebei Seko Fluid, Zhuzhou
Hebei Sinter Filter Technic, Anping
Hefei Xinhu, Hefei
Heinz Meßwiderstände, Elgersburg
Hemera, Meylan
Hempel Special Metals, Kowloon
Hengshui Haijiang Filter Press, Hengshui
Heta Verfahrenstechnik, Lich
Himile, Gaomi City
HTT energy, Herford

i safe MOBILE, Lauda-Königshofen
IMM Inst. Mikrotechnik, Mainz
Inevo, Caluire et Cuire
IPL Industrial Hoses, Shanghai
ITALVACUUM, Borgaro

Jianda Dry Equipment, Changzhou
Jiangsu Huaqing Fluid, Zhangjiagang
Jiangsu Industry Enamel, Jiangsu
Jiangsu Jiuwu Hitech, Nanjing
Jiangsu Saideli, Jingjiang
Jizerska Porcelanka, Desna
JPB Industry, Olonne sur Mer
JUMO, Fulda

K Tron, Niederlenz
K VAC Vacuum Technology, Shenzhen
KAISER Steel Belt Systems, Krefeld
Kantec, Osaka
KEM Küppers Elektromechanik, Karlsfeld
KEYVALVE, Shenzhen
Kind, Gummersbach
Klaus Union, Bochum
Klinkau, Marktoberdorf
Klöpper Therm, Dortmund
KNF Neuberger, Shanghai
Körting, Hannover
KPA Kyffhäuser Pumpen Artern, Ringleben
KSB Shanghai Pumps, Shanghai
Kunshan Kinglai, Jiangsu
Kunshan RVT Process Equipment

LABBE, Tournan en Brie
Lanfeng Int. Advertisement, Beijing
Lechler, Metzingen
LEWA Pumps, Dalian
Liaoning Bolian Filter, Tielingshi
Liaoning Yutong Petrochemical, Shenyang

Liaoyang Youxin Pharmaceut., Liaoyang
Lödige Maschinenbau, Paderborn
LÖMI, Aschaffenburg
Longshen Seal manufacture, Wuhan
LORD STEEL INDUSTRY, Suzhou

Maag Pump Systems, Grossostheim
Manifattura Tubi Gomma, Grisignano
Mankenberg, Lübeck
Matsui, Osaka
Maximator, Shanghai
MECA INOX, Cergy
Membrane, Shanghai
Mersen Xianda, Shanghai
Mettler Toledo Instrument, Shanghai
Mettler Toledo International, Shanghai
Mixel, Beijing
Modentic Valve, Nanjing
Montz, Julius, Hilden
MSG Dichtungswerk, Mücke
Muegge, Reichelsheim
Munktell&Filtrak, Bärenstein
Munters, Beijing
M+W, Shanghai

Nanjing Duble Metal Equipm., Nanjing
NERAK Fördertechnik, Hambühren
Netzsch Gerätebau, Selb
Neumo Vargus, Shanghai
Newson Gale, Nottingham
Ningbo Durrex, Ningbo
Ningbo EDSV Trading, Ningbo
Ningbo IDT Sinyuan Sealing Technology
Ningbo Lehui Food Machinery, Zhejiang
Ningbo Tiangong Mechanical Seals, Ningbo
Ningbo Yinzhou, Ningbo
Novus Sealing Technology, Shanghai
Nuclear Industry Yantai Tongxing, Qixia

Omeax, Chalon sur Saone
ONUEE Electronics, Shenzhen
Orientec Industrial Developm., Beijing
Oschatz, Essen

Palintest, Beijing
Pallmann Maschinenfabrik, Zweibrücken
Paul, Steinau
Peiyang Chemical Equipment, Tianjin
Penghan Machinery, Suzhou
Pentair, Beijing
Pharmaceut.&Engineering Design, Beijing
Pharmaceutical Industry Review, Kiev
Piller Industrieventilatoren, Moringen
Plinke, Bad Homburg
PMP Precision Ind., Zengcheng
Power Idea Technology, Shenzhen
Process Combustion, Pittsburgh
Process Systems, London
ProMinent Fluid Controls, Dalian
proRheo, Althengstett
Püschner, Schwanewede

Rasaii Flow Lines, Chennai
RathGibson, Shanghai
Regeltechnik Kornwestheim
Rembe, Brilon
Rettenmaier, Rosenberg
Richter Chemie-Technik, Kempen
Ringier Trade Media, Beijing
Rolled Alloys, Suzhou
Roten, Milano

SAACKE, Bremen
Samoa, Gijon
Sandmeyer Steel, Guangzhou
Satake, Saitama
SBS Steel Belt Systems, Elgin
SBS Steel Belt Systems, Milano
Scenic Precise Element, Kaohsiung City
Schrader Verfahrenstechnik, Ennigerloh
SepTech, Beijing
Shandong Huge Heat Exchange Techn, Jinan
Shandong JingJin Environm. Prot., Dezhou
Shanghai Bluepard, Shanghai
Shanghai Everspring Filtration Techn, Shanghai
Shanghai KRD M&E Equipment, Shanghai
Shanghai Morimatsu Pressure Vessel
Shanghai Victory Fluid, Shanghai
Shanghai Wald, Shanghai
Shanghai Weser Industry, Shanghai
Shanghai Weser Machinery, Shanghai
Shanghai Yonshi M&E Equipm., Shanghai
Shenzhen Kelida, Shenzhen
Shenzhen Yihuaxin Electronics, Shenzhen
Silica Verfahrenstechnik, Berlin
Silkroad24, Shanghai
Sistag AG Absperrtechnik, Shanghai
Smith Flow, Beijing
Sodimate, Sartrouville
Solex Thermal Science, Calgary
Someflu, Bagnolet
Spectron Gas Control, Frankfurt
SPX Flow Technology, Shanghai
St. Michael, Hangzhou
Stahlhandel Gröditz, Gröditz
Staubli Mechatronic, Hangzhou
Steamloc, Beerse
Steelco, Riese
Stellar Tube&Pipe, Wenzhou
Steuler Bobby, Shanghai
Strassburger Filter, Westhofen
Sulzer, Shanghai
Sunrising Optronic, Beijing
Supercritical Fluid Technol., Newark
Suzhou Baohua Mechanical Techn., Taicang
Suzhou Donit Sealing Materials, Suzhou
Suzhou Kung Hai Trade, Suzhou
Swissfluid, Shanghai
Sympatec, Clausthal-Zellerfeld

TAMI, Nyons
Tantec, Hanau
Technosklo, Drzkov
Tefulong, Wenzhou
TEMA Siebtechnik, Tianjin
TEMAC, Zverinek
Tethys Instruments, Meylan
The Spencer Turbine Company, Beijing
ThyssenKrupp Uhde, Dortmund
Tianjin Shengkai Industrial, Tianjin
Tiantai SouthWest Filter Cloth, Taizhou
Tonson Air Motors, Shanghai
Tool Peaks, Zhangjiagang
Torresin Titanio, Limena
Tranter Heat Exchangers, Beijing
Trelleborg Sealing Solutions, Shanghai
TÜV SÜD, Shanghai
Tycon Alloy, Hong Kong

UBIFRANCE, Paris
UIC, Alzenau
Universal Filtration, Shanghai

Vahterus, Kalanti
Veltek, Malvern
VIBRA MASCHINEN SCHULTHEIS, Offenbach
Vogel Media Group, Beijing
Vögtlin Instruments, Aesch
Volz, Deilingen

WAGO Electronic, Tianjin
Wanner Pumps, Kowloon
Wealth Int. Advertising, Beijing
WEICON, Münster
Weidouli Valves, Wenzhou
WEKA, Bäretswil
Wenzhou Huahai Sealing, Wenzhou
Whiting Equipment, Welland
WITT Gastechnik, Witten
Witte Pumps&Technology, Uetersen
Wuhan Greatall Machinery, Wuhan

Xiamen Hyperwave Instrument, Xiamen
Xidao Media, Int.Control Valve, Shanghai
Xuanda Industrial Zhejiang Doxi, Wenzhou

YL Instrument, Anyang

Zhangjiagang Chemical Mach.,Zhangjiagang
Zhejiang Cathay Packing&Sealing,Hangzhou
Zhejiang Filter Technology, Pujiang
Zhejiang Great Wall Reducer, Wenzhou
Zhejiang Jiari, Jiashan
Zhejiang JIULI, Huzhou
Zhen O, Shanghai
Zhongda Bright Filter Press, Shandong
Zhuzhou Hongda, Zhuzhou

QUANTITY ON SCHEDULE, QUALITY CATCHING UP

Research in China: By 2020 China wants to be a world player in its capacity to turn science into wealth.

Picture: BASF

For BASF the access to qualified employees is a key factor, and so its decision to locate one-quarter of R&D staff in Asia by 2020 "is not a cost-containing exercise".

Among individual nations, China is now second only to the USA in R&D spending, having overtaken Japan by 2011. In 2012 China's estimated gross expenditure on R&D (GERD) was US$ 199 billion, compared to US$ 436 billion in the USA and US$ 338 billion for the whole of Europe (all figures in terms of purchasing power parity (PPP)). Annual growth in R&D spending may currently be below the 20 % figure that is often quoted, but it is certainly well ahead of China's fast-rising GDP.

In its volume of scientific publications China already leads both Japan and Europe, and may overtake the USA this year. The number of overseas patent applications by Chinese institutions, though still low, is rocketing.

The driving force behind this growth is China's centralised leadership, which until recently has been dominated by scientists and engineers — "the world's largest technocracy". An ambitious growth plan published in 2006 draws on China's formidable ability to mobilise resources in pursuit of national goals, from cancer cures to manned space flight.

Yet Chinese R&D still has a long way to go. GERD is still less than half that for the USA, which has only a quarter as many people as China. GERD as a proportion of GDP remains low (1.6 % compared to 2.8 % for the USA). The great majority of companies don't own the key intellectual property on which their business depends. Most R&D spending is on improving existing products, not basic research.

Some Chinese attitudes may work against effective research and especially innovation. Central control and "picking winners" may not be the best ways to foster innovation. There is an emphasis on quantity over quality, while traditional ways of thinking deter originality and perhaps over-value the ability to copy. The situation is changing, but the transformation will probably take longer than the raw R&D spending figures suggest.

A 15-year Plan for R&D Leadership

Long ago, Chinese inventions — paper, printing, the compass, gunpowder — were key to the development of the modern world. But subsequent centuries of isolation left China technologically backward by the time the country re-opened to Western influence in the mid-19th century. Following the Communist revolution in 1949, two decades of Soviet-style technological progress were largely undone by Mao Zedong's Cultural Revolution.

Not until 1976 did science, technology and innovation reappear on the political agenda under the leadership of Deng Xiaoping. Jiang Zemin and Hu Jintao, both engineers by training, followed Deng's example in pinning China's future to progress in science and technology. Xi Jinping's leadership has continued the trend.

2006 saw the pace of change quicken with the launch of a hugely ambitious 15-year Medium to Long Term Science and Technology Development Programme. Three years in the making, this ambitious plan recognised that the existing drivers of the Chinese boom — cheap manufacturing, technology imports and foreign investment — would not carry the country through its next phase of growth in the

This article is based on the AchemAsia trend report "Research in China".

face of challenges such as shortage of energy and resources, pollution, and poor capacity for innovation.

The plan says that China should aim to be among the top five countries worldwide in terms of patents and scientific citations, with advances in science and technology eventually accounting for 60% of economic growth. “By the end of 2020… China will achieve more science and technological breakthroughs of great world influence, qualifying it to join the ranks of the world’s most innovative countries,” said President Hu Jintao in 2006.

The Medium to Long-Term Programme charts China’s technological future through a wide-ranging set of application areas, goals, special research projects and large-scale research programmes. Topics include microchips, nuclear reactors, transgenic crops, nanotechnology, quantum research, and projects of national prestige, notably space exploration.

To fund all this, China will increase spending on R&D from 1.4 % of GDP in 2006 to 2.5 % in 2020 — a target which should be achievable if the current rate of growth is maintained. Other supporting measures include improvements in the coordination of research, including military applications across public institutions; a new benchmarking system for research institutes and researchers; new banking policies and fiscal incentives to support innovative start-ups and promote R&D investment by established companies; and a new national strategy on intellectual property rights.

Besides the governing State Council, China has six ministry-level organisations dealing with science and innovation.

Research Organisations in China

- The Ministry of Science and Technology (MOST) has the main responsibility for science and technology policy and strategy. It finances a large amount of research, primarily through special programmes, administers technological development zones and oversees international collaboration.
- The Ministry of Industry and Information Technology (MIIT) oversees broadcasting and the Internet, the national knowledge economy, and the manufacture of electronic equipment and software. MIIT includes the State Administration for Science, Technology and Industry for National Defence (SASTIND), which controls aerospace and the nuclear industry.
- The Ministry of Education (MOE) is responsible for education policy and management of higher education. It oversees key laboratories and research institutes in universities, and has established initiatives to commercialise research.
- The National Natural Science Foundation of China (NSFC) is a key funder of research, with a rapidly-growing budget which by 2010 had reached USD 1.6 billion.
- The Chinese Academy of Sciences (CAS), founded in 1949, is China’s most prestigious science organisation. The CAS runs more than 100 research institutes which in turn have spun out several hundred companies, including Lenovo, the world’s largest PC supplier. It also runs research programmes and graduate training schemes, as well as advises the government on science policy.
- The Chinese Academy of Engineering (CAE) is involved in policy advice and development, but does not run its own research institutes.

People, Skills, Ethics and Results

There is no doubt that under the right circumstances Chinese researchers are capable of true scientific breakthroughs. Examples in medicine include Gendicine, the world’s first licensed gene therapy, which has been successfully treating cancer since 2003, and stem cell research. In both cases, China’s less-cautious approach in moving from lab to licensing has helped to create rapid progress. China is also a global force in nanotechnology, and by 2009 was publishing nearly a quarter of all papers in this field.

China produced 1.5 million science and engineering graduates in 2006. Though the country’s top universities are world-class, graduates of the other 1700-odd universities and colleges are still very variable in quality. There is often an emphasis on graduate numbers over quality, and terms like “engineer” are defined loosely by Western standards.

Starved of opportunity at home, Chinese scientists and engineers have traditionally travelled abroad — notably to the USA — for education and work. As in the past, most remain outside China, but rising salaries are now tempting them home in increasing numbers. Traditional Chinese education favours rote learning; there is evidence that training abroad makes Chinese people more independent in thought, and hence more quickly able to innovate.

With China’s new research jobs comes relentless pressure to publish. A 2011 study by the UK’s Royal Society suggested that by 2013 China could be producing more scientific papers than any other country. According to data from science publisher Elsevier, in 1996 the USA — the current leader — published more than ten times as many papers as China. By 2008, the USA was publishing 316,317 scientific papers a year, while China had surged to 184,080. China still ranks low in terms of citations, which measure the quality and also the accessibility of publications, but the quality is rising.

Pressure to produce results has sometimes pushed researchers into scientific fraud. One prestigious Chinese journal reported in 2010 that nearly a third of articles submitted for publication showed evidence of plagiarism — a trend that is by no means confined to China, however.

Security of intellectual property is also a worry. In a high-profile case in 2012, for instance, Chinese wind turbine manufacturer Sinovel was found to have stolen crucial control software developed by US company American Superconductor Corp. (AMSC). In November 2011, US intelligence agencies said that China and Russia use Internet hacking to steal US intellectual property as a matter of national policy. Where it is possible to resort to legal protection, however, Chinese intellectual property law has teeth and is often more cost-effective to apply than its foreign counterparts.

In 2009 China moved into the top ten foreign countries applying for patents at the US Patent Office, though the 1,655 Chinese applications were dwarfed by 35,501 from Japan, 9,000 from Germany and 82,382 from the USA. In 2010 China filed 12,337 international patents, a year-on-year increase of 56 %.

Statistics from the journals confirm that collaboration between Chinese academics and researchers abroad is increasing. This corresponds with the trend towards increased international collaboration across the whole of science, with the benefits it brings to all parties.

Further Reading

- Battelle 2012 Global R&D Funding Forecast, R&D Magazine, 2011.
- Knowledge, networks and nations: Global scientific collaboration in the 21st century, Royal Society, 2011.
- UNESCO Science Report 2010, pp 379–397, Mu Rongping, 2010.
- China: The next science superpower? James Wilsdon and James Keeley, Demos, ISBN 1 84180 173 9, 2007.

The rise in international co-operation also acts as a check to the nationalism that is a significant driver in centrally planned ambitions for Chinese research. One goal of nationalistic science must surely be a Nobel prize for research carried out in the People's Republic. Since 1957, eight Chinese scientists have won Nobel prizes in science, but none of these has been for work carried out in mainland China.

R&D in Chinese and Foreign Companies

Compared to the top universities and state-funded research institutes, Chinese manufacturers — both private and state-owned — in general have a poor R&D record. Technology transfer between industry and academia is poor, and the huge majority of firms have no stake in the intellectual property that underpins their business.

Many large companies that are becoming well-known outside China are taking R&D very seriously, however. Examples include PetroChina and CNOOC in the oil and gas industry, Huawei and Lenovo in information technology, Haier in white goods, Bank of China, Air China and China Mobile. As policies and attitudes change, it will also be no surprise to see SMEs leading the R&D stakes.

For two decades now, multinational companies have also been opening research centres in China. The trickle that began with Motorola, Nokia and Microsoft has latterly turned into a flood, with an estimated 1,600 R&D centres now operating or being built. Of this number, perhaps a quarter are genuinely innovating rather than customising existing products for the Chinese market or fulfilling a mainly political role.

Originally, the main attraction of research in China was the low cost of hiring qualified staff. As salaries have risen and even production has started to return to the home countries, R&D costs have taken second place to the ability to service fast-growing Chinese markets — and in some cases to create global products through Chinese research.

Analyst McKinsey says that multinational drug companies have invested more than US$ 2 billion in R&D in China in the past five years, with Chinese R&D sites opening or growing almost as quickly as European and US sites are closing or shrinking.

In Shanghai, PepsiCo recently opened its largest R&D centre outside the USA, a US$ 40 million project that will enable the company to get new products to market in as little as two weeks. BASF has rationalised its Chinese R&D in a € 55 million pan-Asian innovation centre in Shanghai. BASF agrees that access to qualified employees is key factor, and that its decision to locate one-quarter of R&D staff in Asia by 2020 "is not a cost-containing exercise". ■

MORE THAN ENVIRON

The Chinese industrial water treatment market is quite attractive for technology suppliers.

Water is used in industries for multiple purposes: cleaning, heating/cooling, steam, transport, as raw material, solvent, or part of product. According to UNESCO, industry accounts for about 5 to 20 % of the worldwide freshwater withdrawals. In China, the share of industrial water use was 23 % in 2007 and is expected to reach 33 % by 2030; this is equivalent to 265 billion m³. In the meantime the demand will outstrip the supply by 201 billion m³.

Due to increasing quantitative and qualitative water shortage, process industry has started to install wastewater reuse and desalination plants. Closed loop technology will be increasingly employed in China in the near future. The goal: By 2015, 20 % of waste water will be reused; according to Innovation Center Denmark, this corresponds to 3.7 billion m³/year.

The Chinese water treatment market is quite attractive for technology suppliers. In 2011 alone, the PR imported plants and equipment that are mainly used in the water sector worth US$ 11 billion — an increase by 23 % in just one year.

For the treatment of the wide variety of process and wastewater flows, various physical, chemical and biological technologies and their combinations are applied. But almost every project is singular in terms of content, temperature, pH etc. The different methods or combinations thereof have to be customized to the specific requirements and depend on the desired outcome: Is cleaning the only issue, or is recovery of valuables also a goal? Which content has to be recovered and what are qualitative requirements?

Membrane Processes

Membrane processes are often the first step. However, they generate between 50 and 30 % of the treated effluents as concentrate which contains the organic contaminants, metals and salts. Usually those concentrates are discharged into the municipal wastewater treatment plant or have to be disposed. They are causing extreme financial burdens and secondary pollution if disposed (CO_2-emissions, air pollution in the case of evaporation/incineration). If discharged into municipal wastewater treatment plants, they cause tremendous operational problems including environmental impact as recalcitrants and salts are not eliminated before release into water bodies.

Precipitation and flocculation offer the possibility to eliminate impurities for following processes like membrane separation, processing of resulting concentrates or the recovery of valuables e.g. phosphate. Besides the target compounds (e.g. metals), other substances can be removed, which has positive effects on water matrices as well as on the precipitates. But, the risks of detracting the quality of precipitates have to be considered as well and must be predictable for the evaluation of further processing. If

This article is based on the AchemAsia trend report "Industrial Water Treatment".

MENTAL PROTECTION

Picture: BASF

Late last year BASF has begun production of chemicals for water treatment and paper manufacturing at the Nanjing Chemical Industry Park in Nanjing, China.

precipitation and flocculation is running well-directed under optimized process conditions, they can be coupled easily to others processes and produce high-quality precipitates in combination.

Selective sorption und membrane processes have multiple options to recover valuables (e.g. metals, catalysts, antioxidants etc.), to remove problematic ingredients for biological treatment (e.g. As, Cu, Hg, phenols, dyers, biocides etc.), to separate silicates and phosphates for protecting membranes or to reduce the environmental load. Depending on the composition of the concentrates, ion exchangers with different specific functional groups are investigated, since they are capable of adsorbing metals even from water with high salinity. Another focus is the application of MIPs (molecularly imprinted polymers) which excel by high selectivity and stability, robustness towards extreme pH-conditions, high pressures and temperatures as well as organic solvents. The MIPs have synthetic receptors complementary molded in their chemical structure for the template-molecules.

Biological Water Treatment

Biological water treatment processes are very important due to their cost-efficiency and adaptability. Depending on the type of microorganism, aerobic or anaerobic process management, stimulation of growth or sustained metabolism etc. they can be customized to a large variety of water treatment tasks.

But modern process engineers think beyond end-of-pipe water treatment. To establish a powerful water treatment process, water management has to be planned when the production process is established. Waste water flows are separated into recyclable and non-recyclable streams. Streams may also be combined to obtain synergies or control parameters such as salinity or pH. When planning an integrated water management, the impacts on production, energy demand and economics have to be considered. Integrated water reuse concepts are set near or directly at the source of the water where complexity of ingredients is limited.

In the future, engineers might think still further: Creating integrated concepts of industrial and municipal water use is already discussed. And the concept of microbial fuel cells — currently explored at the lab stage — might one day even turn water treatment plants into power generation plants. ■

Event Tip

Find out more at AchemAsia 2013: International Seminar on New Technology Used in Water Treatment and Zero Emission in Petrochemical Industry, May 13–14, 2013

"WE CAN HAVE A GREAT IMPACT ON CREATING AN INNOVATIVE COUNTRY"

Together with DECHEMA, CIESC — Chemical Industry and Engineering Society of China is the organizer of AchemAsia 2013. ACHEMA worldwide News spoke with Prof. Yang Yuanyi, the new executive vice president and secretary general of CIESC.

Biography

Picture: CIESC

Prof. Yang Yuanyi

Prof. Yang Yuanyi was born in Zhejiang Province in 1949. He graduated from the Refining Dept. of Daqing Petroleum Institute in 1976, and obtained an Engineering Master Degree of Basic Organic Chemicals in 1981. He advanced his studies and collaborative research twice at the German Karlsruhe University. He worked as a researcher for 12 years at Beijing Research Institute of Chemical Industry (BRICI), Chemical Industry Ministry (CIM); since 1993, he was successively appointed as Deputy Director and Director of Technology Dept. of CIM, and Director of Development Planning Dept. of the National Petroleum & Chemical Industry Bureau. He transferred to Sinopec Group in 1999 and was successively appointed as President of BRICI, Deputy Chief Engineer of Sinopec Group and concurrently Director of the R&D Dept., as well as Consultant of Sinopec Group. Since April 2012, he is Executive Vice President and Secretary General of the Chemical Industry and Engineering Society of China (CIESC).
Professional Field: Technology Development and Management of Petroleum Energy Sources, Petrochemical Materials and Petrochemicals.

• Professor Yang, congratulations on becoming the new executive vice president and secretary general of CIESC. You have held office nearly nine months since then, which implementations did you initiate?

YANG: We initiated, as a new event format, the comprehensive Annual Meeting of CIESC to be held in Nanjing in September this year. Topic will be "Green Chemical and Ecological Civilization". 15 professional committees have applied to organize different sessions, making it our most important activity this year. Besides our regular academic exchange programmes we also organized a "National Student Competition on Chemical Engineering Design". In order to improve communications with our members our "CIESC Newsletter" is being published on a monthly basis now. And, last but not least, our "Chemical Industry Journal" and "China Chemical Engineering (English)" were named most influential international journals in 2012.

• You have an excellent personal reputation in the chemical industry with a strong focus on application oriented research. CIESC is a society with an academic background. How do you balance the academic and the practical aspect?

YANG: CIESC was an academic-oriented society, but now we try to combine academic discussions and industrial technological progress. Companies can increase their impact on academic activities and the academic labor market, and scientists can improve their research work within companies. Both of which are complementary. There is great consensus in our community on this aspect, so we will organize more conferences of this kind.

• CIESC has a history of nearly 90 years, how do you evaluate their future? As a society, membership development and services for members are your basic tasks, what kind of initiatives have to be fathered?

YANG: CIESC was indeed established 90 years ago, we surely had twists and turns in the past, but today the situation is very conducive to the development of civil society. China is further developing towards a socialist market economy. This implies that, as a technological society, we need to be even more active to increase our number of members and our services towards these members. We can have a great impact on creating an innovative country.

• International exchange is one of the important tasks of your society, how do you conduct exchanges and cooperations with overseas partners?

YANG: CIESC has a very good basis in terms of international exchange. In 2013 we have two major international academic exchange activities. One is organizing a delegation to participate at the World Chemical Engineering Conference in Seoul, the other one is our involvement with AchemAsia 2013, together with DECHEMA. Also our journal "Chemical Engineering (English)" will be distributed in other countries in order to strengthen mutual understanding and communication. ■

The interview was compiled by Ms Sinian Huang who is coordinating DECHEMA's China-based networking activities.

Collage: © malajscy / © Sebastian Kaulitzki - Fotolia.com

Biomining or bioleaching is a microbial process where insoluble metal compounds are converted into water soluble forms.

MICROBES AS MINERS

Learn how geobiotechnology opens up new resources.

DR. KATHRIN RÜBBERDT

Geobiotechnology is a discipline that carries interdisciplinarity in its name. Its main topics are exploitation of primary resources and remediation of water and soil by biotechnical methods as well as the development of supporting analytical and sensor technologies.

Whereas geobiotechnological remediation methods are widely established, the concept of biomining or bioleaching is less well-known. To many process engineers, it may seem a rather exotic approach. But geobiotechnology, in fact, plays a significant role in mining even today. At least 8 % of the global primary copper production in 2010 was obtained by bioleaching of copper minerals, according to estimates by the German Federal Institute for Geosciences and Natural Resources (BGR). Bioleaching of other metals such as cobalt, nickel or zinc is currently less relevant; about 1.3 % of global cobalt production is gathered in a stirred-tank bioleaching process in Kasese, Uganda. The capacity of bioleaching projects for uranium accounts for about one third of global production.

As accessible primary ores are becoming increasingly rare, the importance of bioleaching might significantly increase. For low-grade primary ores or the exploitation of secondary sources such as mine dumps or for recycling, bioleaching offers an effective and economically competitive alternative to conventional technologies.

How Biomining Works

Biomining or bioleaching is a microbial process where insoluble metal compounds are converted into water soluble forms. The most widely known bioleaching process results in acid mine drainage — a usually unplanned and unwanted phenomenon during mining activities.

When sulfidic minerals are exposed to air, they are oxidized and sulfuric acid is set free. The chemical reactions are rather slow and almost irrelevant at low pH. But acidophilic microbes such as Acidithiobacillus ferrooxidans or Leptospirillium ferrooxidans promote the process until quantitative conversion of the sulfidic ores is reached. This natural process is the basis for commercial bioleaching technologies.

Heap or Dump Bioleaching

A common method is heap or dump bioleaching where low grade sulfidic ores are piled up and sprinkled with acid drainage water. The microbes that occur naturally in this environment proliferate

K. Rübberdt, Head of Biotechnology, DECHEMA e.V.

and bioleaching starts. An alternative is stirred-tank bioleaching where the ores are stirred with acid water and seeded with microbes in large tanks. Byproducts of the oxidation process include sulfur and sulfuric acid.

In situ bioleaching takes place directly at the deposit without prior mining. Industrial in situ bioleaching projects have been conducted in Canada and in Germany for uranium and in Bulgaria. The challenge is to prevent leakage from the site and to stop the process once the site is closed.

For the refraction of gold, the approach is similar, although the mechanism is different: Bioleaching is used to break down the matrix and set free the enclosed gold. The gold itself is neither oxidized nor reduced.

Bioleaching of Silicates, Carbonates or Oxides

Bioleaching of sulfides is quite well understood. The technology for bioleaching of silicates, carbonates or oxides is less advanced. The potential is remarkable: aluminum, lithium, cobalt, and nickel from laterites or marine manganese lumps would be accessible.

Laboratory experiments have shown that in principle heterotrophic bacteria and fungi are able to break down these ores. But they require organic carbon which has to be supplied externally (e.g. from agricultural residues or algae biomass). Therefore, the method is more complex and costly, and unwanted microbes may disturb the process as it cannot be kept sterile.

Much hope is set on the new ferredox process that has currently been developed: Acidithiobacillus ferrooxidans is employed in an anaerobic environment. It oxidizes added sulfur and reduces iron(III), at the same time breaking up laterite ore. The process has been demonstrated for concrete case studies, but is intended as a generic concept for a wide range of applications.

Processing of Industrial Dumps

Experts assign the greatest potential for bioleaching to the processing of industrial residues and dumps. Especially at historical mining sites, processing technologies at the time of mining were not very advanced, and metals such as gallium, germanium, indium or niobium were of no economic interest. Thus, the inventory of these mining dumps is remarkable. Moreover, they are relatively easily accessible. The same holds true for industrial residues such as slurry from electroplating or aluminum production or from water treatment.

Ashes from municipal waste incineration could also be interesting raw material sources. Ashes from lignite power plants occur in large quantities; based on their metal inventory, 1 t of lignite ash is worth € 520 at current metal prices.

Depending on the matrix, several mechanisms are possible:

- In acidolysis, microbes generate inorganic acids that lead to the dissolution of the matrix. Organic acids often act also as complexing agents; the process is then called complexolysis.
- So-called siderophores are able to build complexes with insoluble metal oxides, making them accessible for further reactions.
- Redox reactions lead to destabilization of the mineral matrix. Methlyation and ethylation are discussed for a number of applications, but practical knowledge is very limited.

There is an urgent need for R&D in this field; the development of applications would open up a tremendous reservoir of resources and might even lead to progress in recycling of "modern" waste such as catalysts, solar cells or electronic waste.

Opening New Opportunities

Geobiotechnological methods are not restricted to metal production. In the exploitation of fossil resources, they open up new opportunities as well. The buzzword is MEOR, microbial enhanced oil recovery. It includes a range of methods that enable a more efficient exploitation of deposits: Microbes could transform oil or coal that are difficult to access to methane that can be more easily recovered. The microbial generation of acids or biotensides in situ may influence the flow property and direction of oil or water.

Progress in geobiotechnological research is thus essential for a more efficient use of different kinds of resources. The processes are complex, and a wide range of very different aspects has to be taken into account. But once this is achieved, based on the astounding toolbox nature offers in the form of microbes, the possibilities are almost endless. ■

DEVELOPING DOWNSTREAM: ECONOMY IN MIDDLE-EAST

Shale gas boom in the US, biorefinery research in Europe — it seems that Middle East has dropped from the geopolitical resource landscape. But despite the recent developments elsewhere, the region is very much worth looking at.

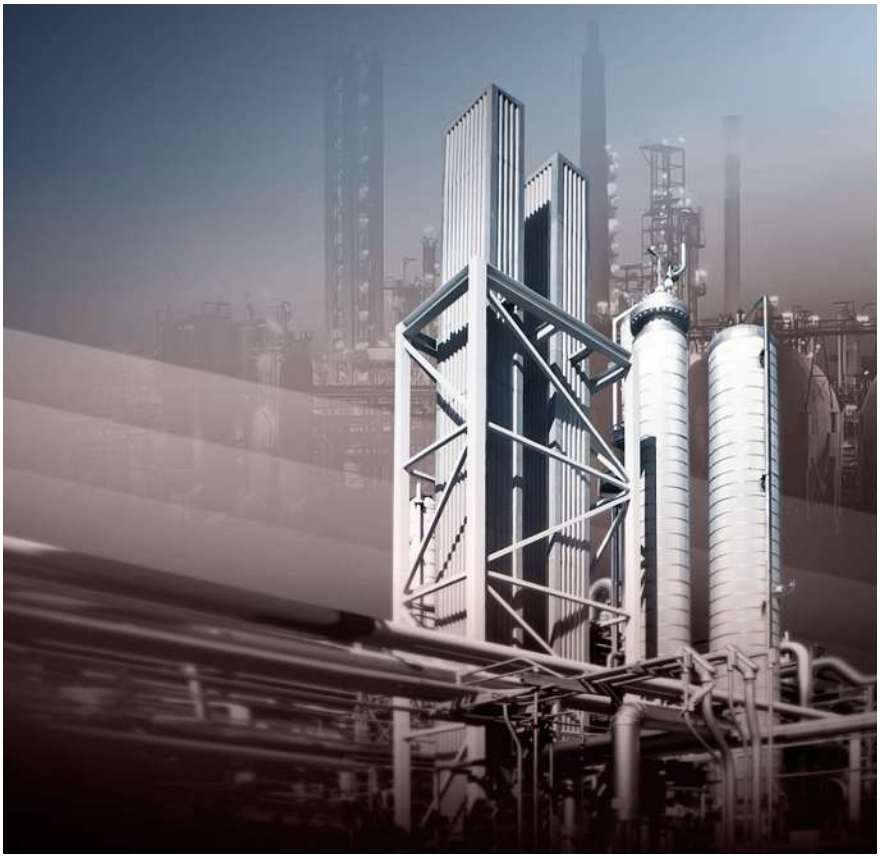


Bild: Siemens

Over the past years, the Middle East region has faced a number of changes and challenges. The political revolutions in Northern African countries and civil unrest in countries such as Bahrain have created both uncertainty and, at least in some parts, at the same time an upbeat feeling. The US' new-found resource independence due to the shale gas boom has hit the economies and is expected to lead to a stagnation in oil production.

But stable or even declining oil prices might actually stimulate a development that is already under way: Sensitive to the fact that their economies rely heavily on one single industry, the Middle Eastern states have for some time been trying to develop additional economic pillars.

While Dubai has become a tourist centre and international hub for trade and conferences, Saudi Arabia's efforts at diversification have so far not really have a significant impact on the composition of the GDP. The country has initiated a number of "giant projects", some of which Germany Trade and Investment dubs as having a "doubtable future". This, however, may not apply to a number of downstream processing projects that have been started. The focus of these projects is in the Yanbu and Jubail regions and is expected to lead to an increase of refinery capacities by more than 50 % until 2016. Some of the investments are supported by international partners such as Dow, Total, Saudi Aramco, and Sinopec. Specialty and fine chemicals are gaining in importance; Saudi Arabia has announced to start production of 120 new chemicals over the next five years.

The United Arab Emirates are also aiming for more downstream processing facilities. The most important project is located in Abu Dhabi and will be finished in 2014, creating a production capacity of 4.5 million t/a for polyolefines. In the Khalifa Port and Industrial Zone, the Abu Dhabi National Chemicals Company is planning twelve downstream processing plants, a total investment of 20 billion US$. China Petrochemicals is also investing in this area.

Climate Favourable for Photovoltaic or Solar Thermal Power Plants

Meanwhile, Kuwait's modernization ambitions seem to have come to a standstill. A US$ 112 billion modernization plan developed in 2010 lays in shambles. The political blockade is also hindering some already planned downstream processing projects. Bahrain is suffering from political instability with a strong impact on the economy.

Overall, the region offers very attractive opportunities for suppliers of plants, equipment and engineering services. In addition to traditional challenges such as water supply, new topics enter the scene: Sustainability issues are increasingly discussed, although projects like skiing halls in the desert do not really suggest this. But there is an awareness that the remaining oil could be put to better use and might still serve as the economic foundation for the near future. And the climatic conditions certainly are favourable for photovoltaic or solar thermal power plants. ■

Chosen Engineering-Projects in the Middle East

Location	Principal / Operator	Project / Completion	Capacity
Sitrah / Bahrain	Bapco	Oil Refinery / 2017	26.7 million m³/a
Mina al-Ahmadi / Kuwait	KNPC	Oil Refinery / 2018	46.42 million m³/a
Ras Al Khaimah	RAK Maritime City, Zuari Agro Chemicals	Diammonium Phosphate / 2016	1 million t/a
Ruwais / Abu Dhabi	Borouge	Polyolefins / 2013	4.5 million t/a
		Cracker / 2014	1.5 million t/a
	GASCO	Natural Gas / 2013	2147.48 million m³/a
	Takreer	Oil Refinery / 2014	18.15 million m³/a
		Oil Refinery / 2014	47.45 million m³/a
	Takreer	Carbon Black / 2016	40,000 t/a
Shah gas field / Abu Dhabi	ADNOC	Natural Gas / 2014	102.2 million m³/a
Taweelah / Abu Dhabi	GASCO	Gas Pipeline / 2015	297 kilometer
Fujairah	IPIC	Oil Refinery / 2016	11.61 million m³/a
	ENOC	Lubricants / 2014	250,000 t/a
Madinat Zayed / Abu Dhabi	Abengoa Solar, Masdar, Total	Concentrating Solar Power Plant / 2012	100 megawatt
Abu Dhabi	Al Dahra Agricultural Company, W.R. Grace	Additives / 2015	n/a
	Chemaweyaat	Petrochemical Complex / 2015	7 million t/a
Umm Wual / Tarif / Saudi Arabia	Maa'den	Phosphoric Acid / 2016	1.5 million t/a
Jizan Economic City / Saudi Arabia	Saudi Aramco	Oil Refinery / 2016	23.21 million m³/a
Ha'il / Saudi Arabia	Sipchem	Ethyl Acetate / 2013	4000 t/a
Rabigh / Saudi Arabia	Saudi Aramco, Sumitomo	Phenol / 2015	275,000 t/a
		Petrochemical Complex / 2016	2.4 million t/a
Ras Tanura / Asch-Scharqiyya / Saudi Arabia	Saudi Aramco	Oil Refinery / 2016	31.92 million m³/a
Yanbu / Medina / Saudi Arabia	Yasref	Oil Refinery / 2014	23.21 million m³/a
	Luberef	Lubricants / 2015	710,000 t/a
Al-Jubail / Saudi Arabia	Exxon Mobil, Sabic	Elastomers / 2015	400,000 t/a
	Arabian Petrochemical, Sabic	Acrylonitrile Butadiene Styrene / 2014	140,000 t/a
	Sipchem	Ethyl Acetate / 2013	100,000 t/a
	Saudi Aramco,Total	Oil Refinery / 2013	23.36 million m³/a
	Dow, Saudi Aramco	Propylene Oxide / 2015	400,000 t/a
	Sadara	Petrochemical Complex / 2015	3 million t/a
		Aromatic Compounds / 2015	490,000 t/a
		Chlorine / 2015	100,000 t/a
	Dammam 7 Petrochemical	Acrylic Acid / 2014	600,000 t/a
	KEMYA	Butyl Rubber / 2013	110,000 t/a

Source: GROAB, the project database for international plant construction (www.groab.net)

VBU FOR THE FIRST TIME AT ACHEMASIA

The German biotechnology landscape is vibrant, as is the Chinese one. Sino-German cooperation in this field goes back to a treaty signed in 1978. VBU (Association of German Biotechnology Companies) is a federation of companies and institutions active in the fields of biotechnology and related sectors. Fostering international contacts is one of the key goals of VBU. Thus, VBU has for the first time organized a joint participation at AchemAsia, offering its members — especially SMEs — the chance to present information on their products and services to the visitors of AchemAsia.

For further information, a comprehensive broshure and information material can be found at booth R 40. www.v-b-u.org

OVERCOME THE BARRIERS TO BIOTECH INNOVATION

Launched in September 2012, BIO-TIC — the Industrial Biotech Research and Innovation Platforms Centre — aims to establish an overview of the barriers to biotech innovation and design a clear action plan to overcome them.

The three-year project is “a solutions approach” centered on an extensive roadmap development process comprehensively examining these innovation hurdles in IB across Europe that will involve a broad stakeholder base from industry, knowledge organisations, governments and civil society. A series of stakeholder workshops will take place at national and European level to reach a comprehensive view on solutions BIO-TIC can offer to accelerate market uptake of industrial biotechnology. In addition, the project will develop and market test a methodology to measure the growth of biomass use and industrial biotechnology in the market as metric to evaluate the impact of the project.

The final aim of the project will be to draw up a blueprint document with a comprehensive set of policy recommendations for overcoming the identified innovation hurdles within a selection of European business and societal opportunities.

For further information, please visit www.industrial biotech-europe.eu

EFFICIENT WATER MANAGEMENT

An economical and environmentally friendly, efficient water management is seen as one of the key strategies for environmental protection in many European countries. The project E4Water — “Economically and Ecologically Efficient Water Management in the European Chemical Industry” which started in 2012 aims at optimizing water consumption in the chemical industry in Europe. The project aims to develop new integrated techniques for greater efficiency and sustainability in industrial water treatment and water management. For four years, 19 international partners jointly create new techniques to lower water consumption and effluent volumes and power consumption.

For further information, visit e4water.eu/

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