



ACHEMA

Worldwide News

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THE PR CHINA — STILL A HOTSPOT FOR OUR INDUSTRY?



■ **DR. THOMAS SCHEURING**
CEO, DEHEMA
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It is true — if China makes headlines these days they are mainly bad news. Be it the volatility of the stock market, the current slowdown of its growth rate, or, quite recently, the explosion of a chemical warehouse in Tianjin: All of this is more suited to raise concerns regarding China's long-term economic and social stability than to enhance the confidence of investors in the Chinese economy.

But, then again, the decisiveness of the Chinese government to cope with these challenges commands respect as well. The combat against corruption has led to serious results and to a definite improvement of the business climate with better basic parameters for doing business in China. The devaluation of the Chinese Renminbi came as a strong signal at the right time. And the enforcement of strict environmental standards will lead to an improvement of living conditions in China on the long term with first tangible results already now.

So let's talk about economic growth. The growth rate of the Chinese GDP indeed has been in the high single-digit range or even reached double-digit values throughout the last two decades, and is now down to seven or even six percent only. To find a growth rate lower than 7% in China's more recent history you would have to go back as far as 1990, when the aftermath of the Tiananmen tragedy the year before hit China's economy quite badly.

“It would be simply very bad timing to turn your back on China now in view of some bad headlines.”

But as trivial as it may sound: The 7% today are a totally different story than they were 25 years ago. In absolute terms this means the Chinese economy is still growing, year after year, by the volume of a mid-sized European country's overall economy. In other words: The total GDP of a country like for instance Belgium is adding up to the Chinese economy every single year.

Is this really an indication of economic weakness? I guess not at all. To me it is obvious that the wealth of business opportunities which have inspired Western enterprises since Deng Xiaoping's opening policy in the early eighties is still there. Maybe you have to search harder than a couple of years ago, and maybe margins have somewhat declined, too. But then again this is normal reality with any economy which has achieved a certain level of maturity after the gold rush of the early years is over.

What does this mean for the chemical process industry? Nothing else than it would be simply very bad timing to turn your back on China now in view of some bad headlines.

The country has just recently become one of the world's leading economies, which means regular economic patterns are replacing the development scheme of China's era as an emerging country.

And, no doubt: The chemical process industry remains one of the corner stones of China's industrial landscape!

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■ **AFTER SALES SERVICES**

Cleverly designed services and B2C businesses create a win-win situation for suppliers and customers. Pumps, valves and controls are a good example. ■



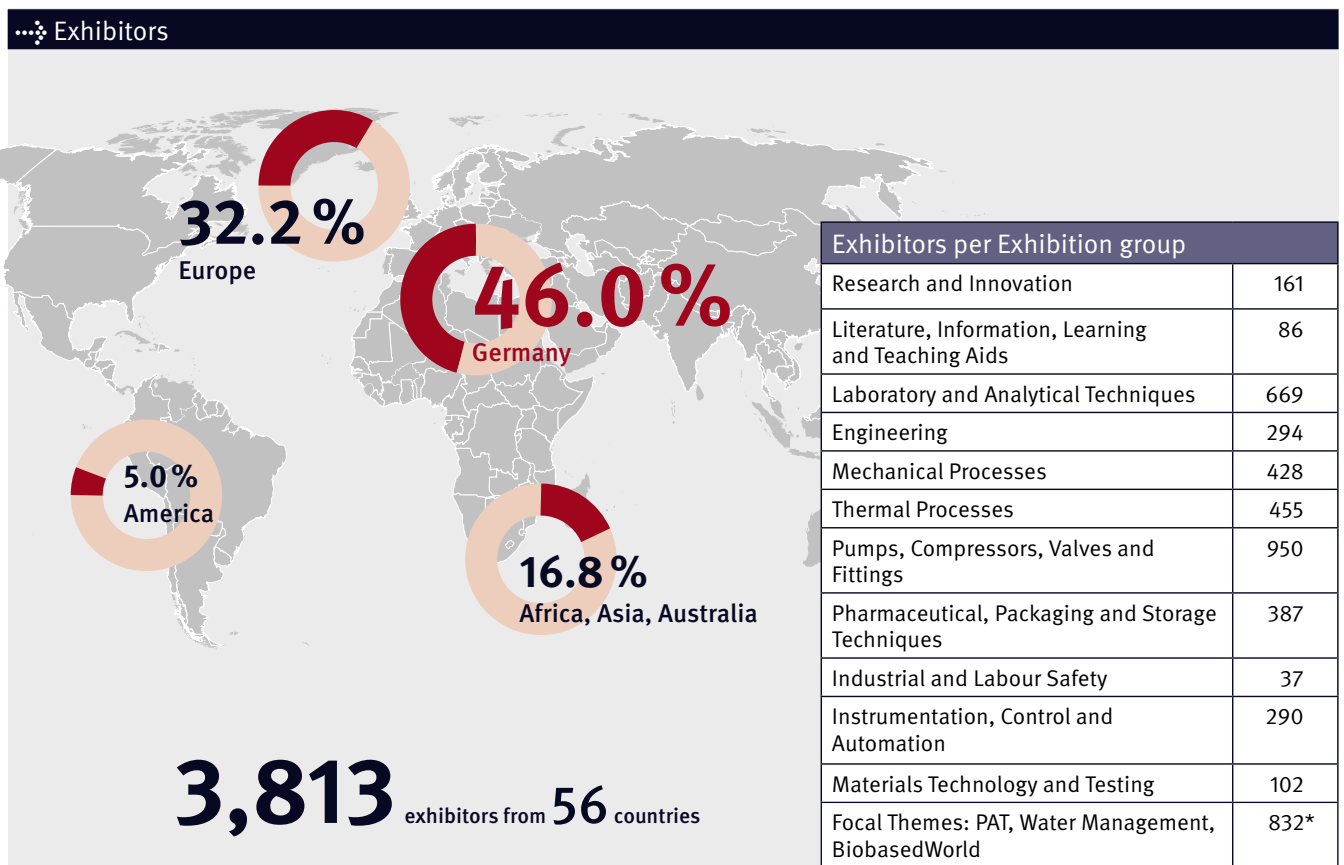
■ **ACHEMASIA 2016**

AchemAsia has become the prime communication hub for suppliers of the process industries to benefit from the chances that China continues to offer. ■

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ACHEMA 2015 IN FIGURES AND PICTURES

Positive event figures, an entire series of published business deals and a lot of work for the exhibitor's sales departments to process numerous new contacts: Those are the impressions that the organisers of ACHEMA 2015 have taken from the feedbacks.



Source: DECHEMA, Graphic: PROCESS, fotolia - © chrupka

*Profile Groups



Opening Session



Distillation equipment



Tablet coating machine

Participants

Visitors by profession

13%
Others

7.8%
Commercial Staff

18.7%
Foreman,
Technicians,
Lab Assistants

6.5%
Students, Trainees

14.3%
Chemists,
Physicists

39.7%
Engineers

166,444 participants from **110** countries

Origin of visitors

Germany	71.4%
Northern Europe	2.0%
Western Europe	12.6%
Southern Europe	1.2%
Central and Eastern Europe	3.8%
America	2.8%
Africa, Asia, Australia	6.2%

Source: DECHEMA, Graphic: PROCESS, fotolia - © keepsmiling4u



Automation pyramid



World largest
chemical plastic
pump with
mechanical
seal



Tube chain conveyor for bulk solids



Laboratory autoclave



See you in 2018

ACHEMASIA 2016 — MEET THE FUTURE OF CHINA'S PROCESS

Since its establishment more than 25 years ago, AchemAsia has become the prime communication hub for suppliers of the process industries to benefit from the chances that China continues to offer. With AchemAsia 2016 being already the 10th event in a successful row, this is the platform to stay in touch with the rapid changes China's process industry is facing today, and to seize opportunities which might be less obvious than in the early years — but are still there.

DR. THOMAS SCHEURING*



Irrespective of the recent volatility of its stock market and a slight slowdown in growth rates, there is still no other economy in the world which comes even close to China's modernization pace and economic drive. And the demand for innovative solutions in the process industries is probably higher than ever. At the same time, there is no other event in China for the chemical process industry which rivals AchemAsia in terms of nationwide visibility, standing and networking potential.

What are AchemAsia's key features?

- most international — and most visible — event for China's process industry,
- face-to-face communication with experts and decision makers,
- partnering arena 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 network.

The successful positioning of AchemAsia was not achieved over night. In fact it is the result of our commitment to the Chinese market since the mid eighties, when China's role as global economic power was barely visible on the horizon, and the approach of doing business there was anything but mainstream.

These are the top reasons why China remains a business destination no one can afford to ignore:

- the world's number one in foreign investments,
- the world's second largest consumer — and third largest producer — of chemical products,

- consistent economic growth for more than two decades,
- foreign investors welcome,
- successful reform policy,
- steady deregulation and adaptation to market economy structures,
- shift from export-driven, commodity-product economy to high-tech innovative economy,
- enormous biotech potential with approx. 5,000 biotech companies,
- large market for agrochemicals,
- global powerhouse for the production of industrial goods,
- increasing competitiveness of products "made in China",
- chemical process industry on pole position in China's economy,
- substantial progress in the protection of intellectual property rights.

Through AchemAsia the potential of this market becomes approachable even for Western SMEs which cannot afford a permanent branch office in the PR China.

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INDUSTRY



Picture: DECHEMA

AchemAsia covers the whole scope of process technology and is structured along the lines of technology defined target groups:

- Chemical Apparatus and Plant Construction
- Process Technology
- Petrochemistry
- Maintenance and Quality Assurance
- Environmental Protection
- Industrial Water Treatment
- Pharmaceutical Industry
- Biotechnology
- Food Industry
- Agrochemistry
- Laboratory and Analytical Techniques
- Packaging and Storage Techniques
- Resources Development

AchemAsia Conference

The exhibition will be accompanied by a conference where an innovative conference layout with satellite symposia on focal topics, individually organized in co-

operation with DECHEMA's partner associations, is addressing selected topics of practical relevance or special interest. This implies a close involvement of domestic partners, and it will offer attendees a wealth of inspiration together with the option to strengthen contacts with experts and decision makers from the region.

- International Forum: Applied Process Intensification (A)
- China Focus: Smog Prevention and Clean Production (B)
- International Forum: Advances in Industrial Water Technology (C)
- Euro-Asian Panel: Strategies for implementing an Industry 4.0 Approach in China (D)
- Workshop: Benefitting from Single Use Technologies (E)

Attendees at AchemAsia have the unique opportunity to:

- obtain first-hand information on recent trends in China's process industry,
- identify present technological demand,
- listen to senior speakers discussing China's investment strategy,
- meet our industry's most important Chinese companies at one venue,
- introduce products and services to potential clients,
- learn from the experience of top investors,
- discuss with potential cooperation partners.

All of this will happen in the modern China National Convention Center (CNCC) which will host the 10th AchemAsia and has set standards for exhibition facilities in China. With its convenient and central location in the immediate vicinity of Beijing's Olympic Park and its smart hall layout, combined with all the flexibility one expects from a state-of-the-art fair ground today, CNCC provides the perfect stage for AchemAsia. ■

Further Information

www.achemasia.de
www.achema.cn

UNDERAPPRECIATED COMPETITIVE FACTOR

No more “service wasteland”. In today’s world, service providers and other businesses make a big effort to keep their customers happy. However this derogatory term seems to stubbornly persist in the world of industry despite the fact that cleverly designed services and B2C businesses create a win-win situation for suppliers and customers. Pumps, valves and controls are a good example. Learn how after sales services create added value for system component manufacturers and process operators alike.



Picture: KSB

KSB service employees at a chemical plant in Shanghai, China. Services currently generate around a quarter of the company’s corporate earnings.

Every car owner probably receives mail at least once a year from the car dealership offering a summer check-up, snow tire service or a reminder for a major inspection or annual routine maintenance. The customer may see this primarily as a helpful service, but it has huge economic significance for the providers. Satisfied service customers are four times as likely to buy the same brand again as unsatisfied customers. Moreover, the service business is highly lucrative for manufacturers and dealers. Spare parts for example generate only 10 % of turnover for car makers but they rake in

50 % of profits. Automotive service centers generate 60 % of earnings with spare parts.

This consumer products model is readily transferrable to the capital goods industry. Despite the fact that an increasing number of machinery and equipment suppliers are aware of this, little effort has been made so far to exploit the existing potential. Many systems component suppliers take a rather complacent approach to after sales service. According to VDMA (German Engineering Association) estimates, German machinery manufacturers only generate 15 % of turnover with the after sales and service business. Given an estimated total worldwide turnover of €2.25 trillion (2012) in the ma-

chinery and equipment manufacturing industry and a German share of €212 billion, there is clearly huge potential out there, but small and mid-tier suppliers in particular tend to underestimate the opportunities. VDMA studies reveal that companies which operate after sales services as an independent business have an average contribution margin of 47%. On average, large suppliers with annual turnover in excess of €1 billion generate a quarter of turnover with services, but smaller suppliers lag well behind.

The consequences of substandard after sales service are even more detrimental. If the services are limited to the bothersome task of handling warranty claims and are given low priority, the product

This article is based on an AICHEM trend report. More information is available at www.achema.de.

supplier runs the risk of tarnishing its image, and the customer may place its next order with a competitor.

Enhancing Customer Loyalty, Benefiting from Field Experience

The provision of services following the sale of a product makes good business sense for a number of reasons. It gives pump, valve and controls suppliers a good sales argument for new products, and the services enhance customer loyalty. Information feedback from the service organization to the development team also helps companies improve their products.

In addition, the margins in the service business are generally much higher compared to the product business. Not only that, the after sales and service business helps companies ride out economic cycles, particularly when new product sales suffer during slowdowns.

The delivery of after sales services as a separate business is a very successful business strategy, but that approach faces a major hurdle. In a recent survey of several hundred machinery and equipment suppliers, management consultants McKinsey together with VDMA investigated the reasons behind the reluctance on the part of manufacturers to set up an independent service business. Besides the effort involved in setting up the new organization, the respondents cited customer unwillingness to pay extra for services which they expect to receive free of charge as part of the new product business. Virtually every manufacturer can point to an instance where a customer expected an old pump, valve or fitting to be repaired on a goodwill basis even if the item was ten or twenty years old.

Chemical Industry Expects 24/7 service

Then there is another challenge. Users in and around the chemical industry expect full service coverage on a 24/7 basis anywhere in the world,

something which small and mid-tier companies may find very difficult to provide.

However pump, valve and controls manufacturer KSB shows how it can be done. KSB set up its own service company and is now one of the leaders in the European rotating equipment service market. Services currently generate around a quarter of KSB's corporate earnings. The company plans to significantly expand the business over the next few years in the Asian and US markets. "We

have identified significant demand for pump spare parts in the mining industry in Asia and America," reported Bernd Garbe who is the CEO of the KSB service company.

At KSB, repair is not the first phase of the after sales service business. "Commissioning services are included in our new pump quotations," said Garbe. The KSB repair and maintenance service portfolio is no longer limited to the company's own products. Repair and retrofit of

pumps, valves and controls made by competitors are also now included. The work is carried out at repair centers or by mobile units.

Increasing the Flexibility of Fixed Maintenance Costs

These after sales services are highly welcome in the chemical industry. Chemical markets have become much more volatile in the wake of the financial and economic crisis which struck in 2008 and 2009. Companies want to have greater flexibility as they manage the fixed costs of their in-house maintenance teams. To accomplish that, they are outsourcing repair and maintenance work to an increasing extent.

The Frankfurt-based pharmaceutical company Sanofi-Aventis uses an approach which is common in the industry. It leases the pumps that are used in production from a pool provided by a system supplier which takes responsibility for repair and maintenance at a fixed price. The user can budget the costs years in advance even if it does not have its own in-house maintenance personnel. The customer and the supplier split any savings if the actual costs are less than the fixed price, so they have a common interest in minimizing the repair effort. In this way, the pharmaceutical company has been able to reduce its maintenance costs while at the same time increasing pump service life.

Samson is a Frankfurt-based manufacturer of valves and controls. At this company, after sales service begins back in the commissioning phase. Samson continues to gradually expand its worldwide network of service centers. The subsidiary in Dubai is assisting with the commissioning of 1,000 positioners and butterfly valves at the new Ruwais petrochemical complex. In addition to supporting the start-up of new plants, lines and equipment, Samson provides reconditioning support services.

Turnaround of the BASF steam cracker in Antwerp in the spring of 2013 is one example. To handle the task of overhauling or adding roughly 150 positioners and measurement points within the space of five weeks, Samson formed a 27-member internal team of valve specialists from eleven different countries at its service base in Antwerp. Besides carrying out repairs, the team also analyzed failure modes and process conditions. Based on the results, they made recommendations



Picture: Martin Joppen / Sanofi

The Frankfurt-based pharmaceutical company Sanofi-Aventis uses an approach which is common in the industry: It leases the pumps that are used in production from a pool provided by a system supplier which takes responsibility for repair and maintenance at a fixed price.

for increasing product life and extending product service intervals.

Repair Service Enters the Realm of Process Optimization

This example is representative of a current trend which is evident in the process industry. Users increasingly expect component suppliers to make process optimization recommendations. Manufacturers which are willing to engage with customers by offering this type of service have the opportunity to accumulate applications experience which can then help them position themselves as indispensable strategic partners over the long term.

The Austrian compressor supplier Hoerbiger has decided to take this approach. The worldwide reciprocating compressor service business is highly competitive. The company's strategy is to offer an expanded range of services which can, for example, significantly increase the service life of reciprocating compressors. The services include detailed reliability, efficiency and environmental soundness (REE) audits on compressors for the purpose of achieving sustained process improvement. The audit team carries out an evaluation on site to determine the cost and effort needed to optimize a compressor. It then makes specific recommendations and implements them if requested. "Process conditions are changing at a faster rate than ever before, but compressor systems are often designed to run for 20 or 30 years. We help users to continually improve the machines in order to remain competitive," explained Nikolaus Lubega, Business Development Manager and REE Au-

ditor at Hoerbiger. In a highly competitive market environment, expertise-intensive service can help companies differentiate themselves from the competition.

Avoiding the Pitfalls

The sales team sells the first machine, after sales service sells the second. The capital goods industry is no exception to this rule. However, success based on service delivery is not automatic. Manufacturers must come up with answers to the following key questions:

- How can we efficiently build and expand a sales and service network which meets the needs of our customers?
- What service portfolio is actually needed to generate real value-add for the supplier and the customer?
- What is the requirements profile for spare parts logistics and how do we fulfill those requirements?
- What qualifications do the members of our service team need?

The final point refers not only to technical qualifications but also to personal and sales skills. The service team has a major impact on the company and brand image and it holds the key to customer loyalty. A strong service team with applications experience is a valuable asset for product development and a useful resource for the sales organization.

Summary: These examples show that after sales services create added value for system component manufacturers and process operators alike. They give users greater flexibility to manage maintenance costs and they help improve system availability. On the supplier side, the services can improve the bottom line and also enhance customer loyalty. ■

BLOOMING IN THE SHALE GAS SHADOW

Over the last months, the outlook for biobased chemicals has been somewhat of a rollercoaster ride. But despite shale gas boom and low oil prices — experts agree: the trend is towards bioeconomy, it's just a question of speed. And lately there are some promising projects.

DR. KATHRIN RÜBBERDT*

After initial euphoria about the bioeconomy which seemed to promise to solve several global problems — CO₂ emissions, shortage of fossil fuels, sustainability — all at once, the shale gas boom in the United States and the low oil price threatened to crush the budding biobased industry before its first bloom. Especially for small molecules, the abundance of cheap ethane posed a hurdle that stopped a couple of projects such as an announced Green-ethylene plant by Dow, a bio-ethanol PVC plant by Solvay or a 500,000 t/a ethylene glycol plant by Indian JBF Industries.

A Silver Lining on the Horizon

In recent weeks, however, there seems to appear a silver lining on the horizon. In October, Covestro (formerly Bayer Material Science) and Reverdia announced their intent to jointly develop and promote thermoplastic polyurethanes based on renewable materials. Target industries are, among others, the footwear and consumer electronics industries. These “lifestyle industries” are currently increasing their efforts to re-invent their products, emphasizing sustainability and environmentally friendly products — and their customers are prepared to pay if they deem features such as biobased materials worth a prize premium.

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Picture: Fotolia - ©Bastos, rukawajung

Despite some recent setbacks due to the overall economic situation in its home country, Brazilian Braskem also continues its commitment to the shift from fossil to biobased resources and cooperates closely with companies like Amyris or Genomatica who develop customized microorganisms. Similar to the chemist's “dream reaction” converting CO₂ to valuable products, the biotechnologist's “dream microbe” performs the direct fermentation of sugar to whatever desired product. Routes researched at the moment include, amongst others, sugar to acrylic acid, propene, isobutene, isoprene, and butadiene. A 1,4-butanediol plant with direct fermentation is already in place; BASF operates it under license to Genomatica. First charges of THF produced from this butanediol have already been delivered to customers for testing.

In the meantime, countries rich in biomass such as Malaysia or Brazil are expanding their efforts to establish and expand their renewable chemicals industry. In 2014, the Brazilian Development Bank

published a study on the diversification of the country's chemical industry. Chemicals production from biomass features strongly in the report as it could create synergies between the agricultural and the chemical sector and contribute significantly to the Brazilian GDP. Malaysia is very active in searching cooperations in R&D and attracting investment to capitalize on the country's rich resources in palm oil and residues from palm oil production.

And there is, of course, China — not so rich in available biomass, but eager to explore technological opportunities and the potential of feedstock such as rice straw or other residues. While focusing on biofuels (both 2nd generation ethanol and algae diesel), plants such as the commercial demonstration plant for the production of cellulosic sugars in the Jilin Province (run by Edeniq and Global Biochem Group Limited) are intended to be first steps in a value chain that eventually is intended to extend from the raw material to a broad range of biochemicals and biofuels. ■

Save the Date

Biobased World, February 15–16, 2017, Cologne/Germany

... is a place to cooperate, to discuss, to find synergies.

There is a lot of space to exhibit products, technologies

and concepts and make the bioeconomy visible and tangible. There is also lot of time to exchange ideas within the congress program. www.biobasedworld.de



LOOKING BEYOND THE HORIZON: EU BIOECONOMY 2015

What can be achieved in three years? Three years after birth, a child goes to kindergarten; depending on the planetary configuration, a spaceship could travel from earth to Jupiter; and a poplar in short rotation forestry can be harvested every three years. How has the European bioeconomy developed over the past three years?

DR. KATHRIN RÜBBERDT*



Picture: Fotolia - © minzpeter

An important part of the bioeconomy: renewable resources

Is the European bioeconomy still in its infancy, has it already covered a long distance? Or is it even ripe for harvest? ACHEMA 2015 provided the chance to take a closer look and compare the status quo on the conclusions of “The Frankfurt ACHEMA-Manifesto on the PPPs within the bioeconomy” from 2012. The 2015 conference came to the clear conclusion that a lot of progress has been made: The PPPs for sustainable process industries (SPIRE) and the Biobased Industries have

been realized and are working, the overall interest in bioeconomy and the public perception have increased. The full realization, however, will need patience—we are not talking about months or years but rather decades.

The transformation to a bio-based economy is a complex undertaking. Success stories such as biolubricants, bioplastics and biosurfactants show that the transformation is possible. But they also prove that the way there is not easy and needs political and societal support. Thus, it could be said that the “low-hang-

ing fruit” has already been harvested—high-value specialties have made their way to market. For the high-volume commodities that face direct fossil competition, the road ahead is still bumpy.

To make it a road to success, the following topics need to be addressed:

1. Nomenclature as a basis for standardization, procurement and—not least—communication. Currently, for some products such as biolubricants and bio-plastics there are already definitions, while in other areas there is no common agreement or standard what “bio”

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means — biobased (and if so, what proportion of a product has to come from biomass), biodegradable or bioderived. Clear definitions are needed to set goals for public procurement, but also to inform the general public and consumers about the benefits of the respective products.

2. Logistics for fossil resources have been long established and are facilitated by the fact that most fossil sources are punctiform whereas biomass is grown on large areas. A balance will have to be found between the economically feasible size of a biorefinery and the necessary effort to ship raw material there and decentralized processing plants close to the agricultural sites.

3. The current value chains in the bioeconomy need to be intensified and more closely interlinked. Players that haven't cooperated before need to be brought together, creating new business models adapted to the specific characteristics of the bioeconomy.

4. Necessary measures include the creation of sustainability criteria for biomass use for chemicals and energy, standards and norms defining biobased products and services.

5. The availability of sustainable biomass has to be ensured. This requires adequate agricultural structures taking into account a broad range of potential biomass sources and trade agreements enabling the import from regions with abundant biomass.

6. Sustainability criteria have to be extended to topics such as soil fertility, water management and the long-term economic feasibility of the process.

7. Recently, the EU bioeconomy has been joined by a larger sibling, the circular economy. The bioeconomy is seen by many as an integral part of the circular economy, when it deals with waste, recycling, multiuse in form of cascades, and when closing value chains. Others insist on the

complementarity of both forms of an economy because of the unique features of the bioeconomy like carbon neutrality, renewability and potentials for new properties of materials, which are found in renewable biological resources — the primary resources of the bioeconomy. Both economies should therefore join forces and potentials.

Conclusion: The bioeconomy in Europe is on the verge of success, but to ensure the final breakthrough, a couple of hur-

dles need yet to be overcome. Politics, industry and science should therefore not relax in their efforts to promote the bioeconomy and create favourable conditions for the transformation. In the context of a circular economy, it is still essential to have an explicit focus on the bioeconomy. We have come a long way over the last three years; but transforming a whole economy is a marathon rather than a sprint. Let's not stop at mid-distance. ■

ELECTRIFYING IDEAS

Could “surplus” electricity be put to work in flexible chemicals production capacities that are switched on and off according to energy availability?

As the share of renewable energy grows, the volatility of the energy supply increases as well. Germany with its “Energiewende” (energy turnaround) is at the vanguard of this challenge, but other countries globally are pushing forward the installation of solar parks or wind power plants, and they will face the same issues. In the past, storage technologies have been in the focus, and they are still being developed at high pace. But recently, some other ideas have been put forward that address the demand side of the energy equation.

The chemical industry has a number of processes that can be driven either by electricity or by other means; therefore, it seems predestined to play an important role in “demand-side management”. Electrolysis ranks high among them; for example, the capacity for chlor-alkali-electrolysis in Germany alone is five million tons per year, corresponding to a connected wattage of 1,450 MW, and is already partly used to level peaks in electricity generation.

Compared to batteries or physical storage, there is an efficiency gain if the electrolysis is performed at low current den-

sity, and the chemical product has a higher energy density. But as for all large chemical plants, the primary goal is to maximize capacity utilization. If plants are made more flexible, however, they have to be dimensioned above their average sales volume, and interim storage has to be installed. Due to the current small price spread on the energy market, this is usually not economically viable if there is no additional compensation. The same is true for the flexibilization of most continuous processes.

Usually batch processes offer more flexibility as the starting point can be chosen without changing other process parameters. This applies universally and is not restricted to electrochemical processes as electricity is used for heating and cooling, compacting and pumping as well.

The generation of steam (power-to-heat) is also an option that can be relatively easily implemented and is in use at a couple of locations in Germany.

New Processes — Input of Thermal Energy

In addition to existing plants and processes, a number of other options are currently discussed, preferably for large-scale operations. The aspects to be considered include:

- The part of the plant that is run with flexible load should have the lowest investment cost (usually the reactor).
- All following steps (especially product purification) should be designed for continuous loads according to the maximum sales volume expected.
- This means that raw product needs to be stored. The investment is comparably low, but for dangerous chemicals legal permits will set limits.
- The downstream process should be located close by to avoid additional transport cost.
- The whole process chain has to be designed so that even if all raw product is transferred to storage, storage capacity is not exhausted.
- Fluctuating operation may not be dimensioned for 100 % product sales as storage capacity for the raw product cannot be adjusted freely to all situations on the electricity market.

This list shows that in order to decide on the viability of a flexible process, the whole system has to be analyzed. The selected processes have to be highly dynamic.

The Role of Electrochemistry

“Classical” water electrolysis is the basic element of many power-to-x-concepts for the production of hydrogen, methane

This article is based on the “Diskussionspapier Elektrifizierung Chemischer Prozesse” published by DECHEMA in March 2015. It is available for download at (German language only): <http://dechema.de/studien.html>



or—if chemical production is the target—methanol. A number of production concepts combine hydrogen generation with other steps to achieve a competitive production process; TU Clausthal has developed a scheme that combines water electrolysis with air rectification to provide the resources for the production of ammonia that is then oxidized to nitric acid with the oxygen from the electrolysis. The use of oxygen on site without additional transport is the key to competitive processes.

Organic electrochemistry is also experiencing a revival. The development of new electrodes has opened possibilities for many selective reactions; however, these are often not needed on the necessary scale. An interesting process could be the production of adipic acid; the current process generates N_2O that has to be catalytically decomposed.

What Is to Consider?

The following conditions have to be considered when analyzing potential processes:

- Oxidation reactions are more simply implemented than reduction reactions.
- The product has to be protected against secondary reactions; one way to do this is to design reactors where the product is removed fast from the reaction zone.
- In general, protic solvents are more suitable than aprotic solvents because they allow for a much larger electricity density, leading to higher space-time-yields.
- There is a need for new, ionic conducting membranes with higher conductivity and longer endurance.

With prices of 6 €/Mol for one electricity equivalent the electrochemical oxidation is not competitive to catalytic oxidation with oxygen from air.

Options for anorganic processes include the switch between oxygen depolarized cathodes—requiring less—and hydrogen electrodes—requiring more energy. The flexibility of aluminum production is limited by a shorter lifetime of the electrodes. But electrolytic processes for the generation of zinc or copper and galvanic processes are candidates as well as certain process steps in metal recycling.

Act Big — Think Small (and Modular)

A significant electricity surplus will materialize only when the share of renewable energy is large and back-up capacities are no longer in place.

The German government predicts 2.3 TWh of “dumped energy” in 2032; this corresponds to 500 million m^3 hydrogen or 275,000 tons per year methanol. This volume would have to be produced decentralized—according to the location of the energy generation plants—with the corresponding negative impact on economics. Therefore, new catalytic methods and plant concepts are required to develop efficient, small production plants.

In the end, there won't be just one specific process but a large variety of basically new chemistry-based concepts in order to claim the existing potential. An interdisciplinary approach and, not least, reliable political frameworks are necessary to make the most efficient use of generated energy. ■



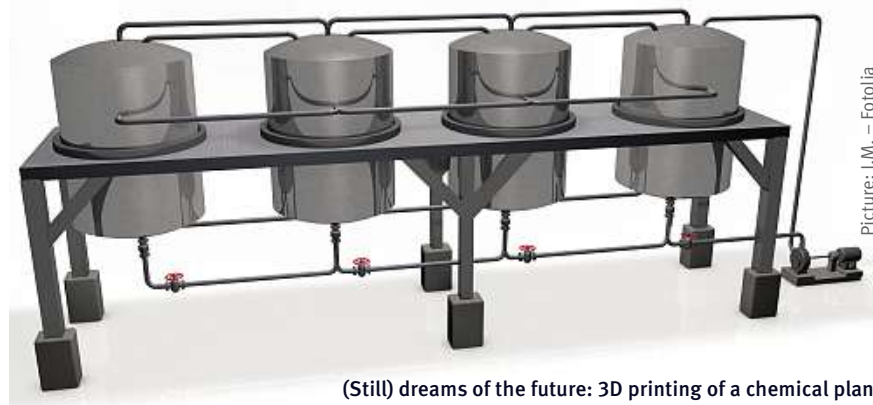
Picture: Fotolia - ©Aania, Nattis, okinawakasawa

for burner tops of gas turbines. The development of the 3D printing market is impressive: Roland Berger estimates the global market volume to reach US\$7.7 billion by 2023. In 2014, it amounted already to more than US\$3 billion.

Many players in the process industries are currently exploring the opportunities additive manufacturing offers to them. Chemical companies like BASF and Evonik develop new materials for 3D printing. Pump manufacturer KSB is testing laser melting for the production of parts. The engineers in KSB's development lab see not only the advantage for their service business. There are also additional features: With 3D printing, parts with cavities or open-pore structures are accessible, creating light-weight components while maintaining the mechanical parameters. Festo has even printed a complete bionic grapppler that weighs 80% less than its conventional metal counterpart.

Open Questions

Nonetheless, additive manufacturing will not replace conventional production technology, at least not in the foreseeable future. Even though the technology is highly innovative, for a true mass production it is too expensive and not fast enough. Economies of scale cannot be realized with 3D printing. Its strength lies in the production of highly complex custom solutions. And the degrees of freedom it offers have to be used right from the start through the concept phase to



Picture: J.M. – Fotolia

(Still) dreams of the future: 3D printing of a chemical plant

capitalize on the potential for complicated geometries.

This is also a prerequisite for an economic use of 3D printing. Even though much less material is required than for milled or cast parts, the material is 50 to 100 times more expensive than that used in conventional manufacturing. As for speed, today about 10–20 cm³ per hour can be printed — meaning that it may take several days to print a large part. The printers are becoming faster; by the beginning of the next decade, production rates of up to 80 cm³ are expected. But this is still a far way from the requirements of mass production. Furthermore, some questions regarding standards and quality management in safety-relevant components are still open. To answer them, a new generation of engineers is required: Additive design needs to be introduced in the educational curriculae.

Despite these limitations, experts are convinced that additive manufacturing will change the face of the industry in the long term. They see it as a complementary technology to today's mass production methods. Rather than waiting for a revolution by the one "killer application", they recommend an evolutionary approach, identifying examples where true value can be created for products, projects or whole industries. The inherent interdisciplinarity stimulates additional ideas: The requirements of the users lead to innovations not only in printing technology, but also in material development.

On the other hand, 3D printing allows for the processing of materials in small series, opening the way to completely new applications. In any case a playground for creative minds whose limits wait to be explored. ■

BREAKING NEWS FROM CHEMTECH FOUNDATION

As per the IMF, India will move to the 7th position from the 8th position in the year 2016 — and with the GDP growth, India will be ranked 6th globally. Bright prospects for business interactions and strategic alliances! Chemtech Foundation is India's leading industry association since 1975 creating platforms for this.

Especially Chemtech World Expo series of international exhibitions and conferences have evolved as the innovative platform for business interactions and technology exchange for the stakeholders from across the entire value chain of industry in India. What will be the next highlights?

28th Edition of Chemtech World Expo

The 28th edition of flagship event, Chemtech World Expo 2017 scheduled from February 14–17, 2017 in Mumbai will bring together the stakeholders from the refining & petrochemicals as well as specialty chemicals — along with the allied services providing sectors of EPC, industry automation and control, water management, and corrosion control to common point during the four day international exhibitions and conferences. The Ministry of Chemicals & Fertilizers, Government of India has already confirmed support for Chemtech World Expo 2017.

During Chemtech World Expo 2015, chaired by Vipul Shah, COO Petrochemicals, Reliance Industries, Chemtech organised the first “Specialty Chemicals” forum, which received a strong, positive response from the equipment and services providers as well as the end users of specialty chemicals. Dr Raman Ramachandran, Chairman & Managing Director, BASF India will be leading the next edition of specialty chemicals forum

planned to be organised in February 2017.

WaterEX World Expo 2017

In a recent development, Austria has extended support to the WaterEX World Expo 2017 as the Partner Country and will bring an industry delegation during the event. Water & waste water treatment is one of the key areas for the Indian government and the industry which is over USD 100 billion. Additionally, the municipal sewage waste treatment market is growing fast in India which will offer ample opportunities to the technology providers. India continues to set strict targets of improving CO₂ emissions and giving impetus to the alternative energy sector such as solar and wind power, environment and coal gasification technologies which will create substantial demand for energy efficient and environmentally compliant technologies. The Government is taking concrete steps in CO₂ sequestration and encouraging investments in this field.

Regional Shows in 2015 and 2016

Currently Chemtech is gearing up for two regional shows:

- Chemtech South Expo 2015, scheduled from December 10–12, 2015 in Chennai Trade Centre, Chennai, Tamil Nadu/India;
- Chemtech Gujarat Expo 2016, scheduled from February 10–12, 2016 in University Grounds, Ahmedabad, Gujarat/India.

Both shows aim to create greater engagement between the end user and services providing sectors with the regional markets in India.

❖ **More information,
you will find at:**
<http://chemtech-online.com>

International Events Organized by Dechema

- **January 19–20, 2016:** 11th Status Seminar “Chemical Biology” – Frankfurt/Germany
- **April 18–21, 2016:** 3D Cell Culture 2016: How close to “in vivo” can we get? – Freiburg/Germany
- **May 2–4, 2016:** New Frontiers for Biotech Processes (“Himmelfahrtstagung”) – Koblenz/Germany
- **May 17–20, 2016:** 12th International Workshop on Polymer Reaction Engineering – Hamburg/Germany
- **May 29– June 3, 2016:** 12th International Conference on the Fundamentals of Adsorption – Friedrichshafen/Germany
- **June 1–3, 2016:** Single Cell Technologies 2016 – Kloster Irsee/Germany
- **June 5–8, 2016:** 15th International Symposium on Loss Prevention and Safety Promotion in the Process Industries – Freiburg/Germany



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