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# C&EN

CHEMICAL & ENGINEERING NEWS

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# SUBDUED GROWTH AHEAD

Uneven economic recovery limits **HIRING OF CHEMISTS**

**AFTER SEVEN YEARS** of turmoil, the economy is stabilizing, but it's far from robust.

Consider just one measure of the economy's health—long-term unemployment, which is still twice as high as it was before the Great Recession. "Right now in the U.S., we have nearly 3 million people who've been out of work for at least 27 weeks, and they account for nearly one-third of the total number of unemployed," said Secretary of Labor Thomas E. Perez in a September speech.

Chemists and chemical engineers, like their peers in other fields, have seen thousands of jobs evaporate, many never to return. Nor are those cutbacks finished: Reductions announced

recently include specialty pharmaceuticals maker Allergan's plan to lay off 1,500 employees this year and biotech Amgen's intent to cut as many as 4,000 jobs by 2016.

The impact of these tough times ranges across demographics. "Especially hard-hit are those finishing up their bachelor's and master's degrees," notes Steven R. Meyers, assistant director of the American Chemical

Society's Career & Professional Advancement department.

Relief may be coming, however. "There are signs that new opportunities are starting to open up," says Paul Hodges, chairman of International eChem, a London-based chemical industry think tank.

In part, that's because "manufacturing in the

U.S. is coming back, growing faster than at any point in the last 15 years," according to Perez. The auto industry—a huge market for chemicals—is enjoying a major resurgence. And "our businesses are exporting more goods than ever before," he says. As a result, the unemployment rate in the U.S. has now reached a six-year low.

C&EN probes these disparate developments in this year's Employment Outlook feature package. In the first article, Assistant Managing Editor Sophie Rovner examines trends in the economy writ large and in the chemical industry and their likely impact on employment.

Next, Senior Editor Susan Ainsworth shares chemical and drug companies' measured plans for hiring chemists and other scientists into 2015.

In the third article, Senior Editor Linda Wang explores how companies are interviewing candidates for openings and how the firms decide who will be a good fit. ■

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# BETTER, BUT NOT YET GREAT

**UNEMPLOYMENT EASES** for chemists amid weaker-than-expected economic growth

SOPHIE L. ROVNER, C&EN WASHINGTON

CHEVRON PHILLIPS CHEMICAL



**BOOMING** A Chevron Phillips Chemical employee works at the company's Cedar Bayou plant, one of the sites being expanded as part of a major Gulf Coast petrochemical project.

**"MASSIVE JOB LOSS,** waves of business failures, devastating home foreclosures, decimated retirement accounts, and an economy on the brink of another Great Depression"—that's how U.S. Treasury Secretary Jacob J. (Jack) Lew describes the impact of the recession that began in the U.S. in December 2007. The ripple effects spread to many other countries, wreaking similar, and in some cases far worse, havoc.

Technically the U.S. recession ended in June 2009. The ensuing slow convalescence of the domestic economy has revived job prospects in many sectors, including the chemistry enterprise.

Yet all is not well, as evidenced by the fact that some 200 million people remain unemployed worldwide, 30 million more than when the economic crisis began, said Christine Lagarde, managing director of the International Monetary Fund (IMF), at a conference last month. "The average jobless rate in developed economies stands at 8.5%, compared with 5.8% before the crisis," she noted.

"The global recovery has been disappointing," said Stanley Fischer, vice chairman of the U.S. Federal Reserve, in a speech in August. In advanced economies, the pace of recovery has been well below the average seen after previous severe recessions, he explained. And while the recovery in emerging market economies was initially more typical, "recently the pace of growth has been disappointing in those economies as well."

Economists, who have had to make several downward revisions in their forecasts in recent years, warn that a number of factors could hinder recovery even further. Those risks include geopolitical tensions in the Middle East and Ukraine; the threat of deflation in Japan and Europe; a faster-than-expected downturn in China's real estate sector; economic shocks if U.S. interest rates rise faster than expected; corrections

in the financial markets, including stock markets; high levels of public and private debt in many countries; and even Ebola.

For now, however, IMF estimates that worldwide gross domestic product (GDP), a measure of the output of goods and services, will rise 3.3% this year and 3.8% in 2015.

In the U.S., GDP is forecast to grow 2.2% this year and 3.1% next year.

In the U.K., GDP is expected to grow 3.2% in 2014 and 2.7% in 2015. However, GDP in its neighbor, the eurozone, contracted 0.4% last year and "nearly stalled earlier this year," said Olivier Blanchard, economic counselor and director of IMF's research department, when he presented the economic forecasts at a press conference in October. He expects the region's output will expand just 0.8% in 2014 and 1.3% in 2015—hardly surprising, given that the zone's unemployment rate is still about 10%.

Japan is even worse off; it's expected to eke out growth of less than 1% both this year and next, in part because of a new sales tax.

Meanwhile, India "has recovered from its relative slump," so growth is expected to exceed 5% again, Blanchard said. China's high growth will moderate slightly, reaching 7.4% this year and 7.1% next year.

That softening concerns Paul Hodges, chairman of International eChem, a London-based chemical industry think tank. Since 2009, he says, "China has been the main support for the global chemical and petrochemical industry." But he warns that prop is weakening now that China has begun to unwind its domestic economic stimulus program.

Likewise, the Federal Reserve is tapering its support of the U.S. economy by reducing its purchases of bonds and other investments and signaling a coming hike in interest rates. U.S. government spending has also taken a hit from general fiscal austerity measures and across-the-board budget

cuts known as sequestration, which first took effect in March 2013. The cuts totaled approximately 8% in fiscal year 2013, with continuing cuts planned over the following decade. A budget deal signed in January 2014 reversed half the cuts for fiscal 2014 and a quarter for fiscal 2015. However, sequestration will return in full force next October unless Congress again relents.

The U.S. economic recovery has been further restrained by weakness in the housing sector and slowing demand growth abroad, Fischer noted.

**SLOWING POPULATION** growth in the U.S. is also damping demand, Hodges says. Furthermore, much of the increase in births is occurring in minority communities. Consumers in these communities are less affluent than the aging baby boomers, who themselves are cutting back on spending as they enter retirement and their kids leave home, he says.

All told, these trends mean that many people haven't yet benefited from the recovery. Despite improvements in the labor market, "there are still too many people

**& MORE ONLINE**

For additional data on employment by state, market sector, and job type, visit [cenm.ag/emp12014](http://cenm.ag/emp12014).

who want jobs but cannot find them, too many who are working part-time but would prefer full-time work, and too many who are not searching for a job but would be if the labor market were stronger,” Federal Reserve Chair Janet L. Yellen said at a press conference in September.

As of that month, the ranks of the unemployed numbered 9.3 million in the U.S.—down from 11.2 million a year earlier, according to the U.S. Bureau of Labor Statistics (BLS).

The U.S. unemployment rate, which peaked at 10.0% on a seasonally adjusted basis back in October 2009, has fallen to 5.9% as of this September, BLS reports. The rate was 6.1% in August 2014 and 7.2% in September 2013. The Fed expects the unemployment rate to remain at about the current level throughout this quarter and to reach approximately 5.5% in the fourth quarter of 2015.

Conversely, employment, which rose 1.0% in 2013, is forecast to grow another 1.6% this year and 1.3% next year, according to IMF. That would bring total U.S. employment to 148 million in 2015.

Within the U.S. chemical manufacturing sector in particular, employment rose 1.2% to 792,600 in 2013, according to BLS. That gain was the first since 1998, when employment in the sector stood at 992,800, points out Martha Gilchrist Moore, senior director for policy analysis and economics for the American Chemistry Council (ACC), the chemical industry’s main trade association. She anticipates that chemical manufacturing employment will rise 1.1% this year and 0.2% in 2015.

These figures include all kinds of industrial workers, whether they operate a forklift or a chemical plant, but they exclude R&D companies and contract workers as well as academics and government workers, Moore says. She estimates that roughly 26,000 chemists and 10,000 chemical engineers were working in the chemical manufacturing sector in 2013. An additional 62,000 chemists and 23,000 chemical engineers were working for other employers, she says. Moore says it’s likely that employment is rising for chemists and chemical engineers in the chemical manufacturing sector.

Her positive outlook is supported by data collected by the American Chemical Society, showing that full-time employment for chemists is growing while unemployment is dropping (C&EN, Sept. 1, page 68). The ACS survey of members

in the U.S. workforce found that as of this March, some 91.9% of chemists who responded were employed full-time—meaning they were working at least 35 hours per week. Over the past decade, that rate peaked at 92.5% in 2008 and then bottomed out at 88.1% in 2010. By last year, it had recovered to 91.1%.

Just 2.9% of member chemists reported they were unemployed but looking for a job as of this March, down from 3.5% last March, 4.2% in 2012, and a peak of 4.6% in 2011.

“The unemployment number for ACS member chemists is the lowest it’s been since 2008,” notes Steven R. Meyers, assistant director of ACS’s Career & Professional Advancement department. “While the pool of unemployed individuals is getting smaller,” he adds, “we still have a little way to go before the numbers rebound fully to the prerecession unemployment minimums, but we’re within sight.”

**THESE STATISTICS** sound wonderful, but sadly, there’s much more to the story: For instance, because of inflation, salaries continue to lose ground in terms of buying power, Meyers says. “So while the quantity of jobs appears to be increasing, the quality of the salaries attached to those positions hasn’t kept pace.”

Additionally, although job cuts announced in the chemical industry fell by one-third to 1,514 for the first three quarters of this year compared with the same period last year, they rose 11.2% in the pharmaceutical industry to 9,923, according to the outplacement consulting firm Challenger, Gray & Christmas.

And new chemists, particularly those whose terminal degree is a B.A. or B.S., have

been struggling to find work, Meyers says. ACS’s survey of students who graduated during the 2013 academic year with degrees in chemistry and related fields revealed that a shocking 14.9% were looking for work as of October 2013 (C&EN, June 2, page 28). That’s up from 12.6% in 2012 and 7.2% in 2007, right before the Great Recession began. ACS is currently surveying this year’s grads.

It’s not clear how soon these new graduates will get some relief because the signals are mixed. ACC’s Chemical Activity Barometer, an index of chemical industry activity that telegraphs coming trends in the economy, rose in each of the first seven months of this year, then slipped 0.2% in August, and remained unchanged in September. Still, that September figure was up 3.4% compared with a year earlier. In addition, ACC’s index of U.S. chemical production has risen in every month of this year except January. And as of September, it was 2.4% higher than a year earlier.

By way of comparison, growth in European chemical production in the first four months of this year was succeeded by three months of decline, reports the European Chemical Industry Council (CEFIC). Sales are flat, and prices are falling. The latest figures available from CEFIC show chemical employment in the European Union fell 5.7% last year and 18.1% the year before.

ACC’s Moore attributes the healthier state of the U.S. chemical industry in part to the overall U.S. manufacturing recovery. “Most of the chemical industry’s products end up in the manufacturing sector at some point,” she notes. So as manufacturing continues to improve and to come back to the U.S. from abroad—a trend known as reshoring—or to move from, say, Asia to Mexico—a trend dubbed nearshoring—demand for U.S. products should strengthen, she says.

“If you are making a car in Mexico, you are probably importing some resin, some polyurethane, that may be coming across the border from the U.S.,” Moore explains. “When you were making that same car in Asia, that resin, that polyurethane, might be coming from an Asian producer.”

The firming employment situation can also be attributed to enhanced U.S. competitiveness, Moore says. Greater use of hydraulic fracturing and horizontal drilling techniques to exploit previously untapped underground shale deposits in North America—along with the

### MIXED RESULTS Chemical industry employment in 2013 slipped in Europe but firmed in the U.S.



SOURCE: European Chemical Industry Council

**Arfvedson Schlenk Award 2015**

The Gesellschaft Deutscher Chemiker (GDCh) takes pleasure in announcing that the Arfvedson Schlenk Award donated by Rockwood Lithium GmbH will be awarded again in 2015.

Johann August Arfvedson was the chemist who discovered the element lithium while Wilhelm Schlenk is known as a pioneer in organolithium chemistry.

The Arfvedson Schlenk Award intends to honor outstanding scientific and technical achievements in the field of lithium chemistry.

Nominations for the award are to be addressed by **December 1, 2014**, to Barbara Köhler, Gesellschaft Deutscher Chemiker, Postbox 90 04 40, 60444 Frankfurt/Main, Germany. These should include a letter of nomination, the curriculum vitae of the nominee together with his/her list of publications.

Self-nominations are not allowed.

The award ceremony will take place at the GDCh Chemistry Forum in September 2015 in Dresden. The recipient will receive a medal, a certificate and a monetary prize of 7,500 Euro.

Prof. Dr. Carsten Strohmann,  
Chairman of the Award Selection Committee

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discovery of additional reserves—has resulted in a large volume of low-cost natural gas as well as natural gas liquids (NGLs), including ethane. These resources have proven a game changer as inexpensive feedstocks and fuel for the U.S. chemical industry, Moore says.

This new reality has unleashed a tidal wave of planned capacity expansion in the U.S. This September, ACC analyzed shale-driven projects that have been announced by the chemical industry. The trade association estimates these projects will create almost 61,000 jobs in the chemical industry

in the coming decade. Some 3,500 of those openings will be in engineering and other technical occupations—including a significant number for chemical engineers—and another 3,200 will be in scientific occupations, including a good many for chemists, Moore says.

And new announcements keep popping up. Just last month, Badlands NGL said it would build a new ethane cracker and polyethylene complex in North Dakota (C&EN, Oct. 20, page 10). That addition ups the total number of shale-related chemical industry projects ACC is tracking to 209, which together have a value of \$132 billion. Many of the new U.S. facilities will be built along the Gulf Coast, the traditional center of petrochemical manufacturing, Moore says. But she notes others will boost demand for chemical engineers and chemists in regions such as Pennsylvania, Ohio, and West Virginia to take advantage of the NGL resources from the Marcellus and Utica shale deposits; the Midwest, to make anhydrous ammonia and urea fertilizers from methane, the principal component of natural gas; and on the West Coast, where methanol projects will supply China.

**ACC DOESN'T ASSESS** whether particular projects will be built. But “a lot of these projects are going forward, lining up suppliers, doing engineering studies, ordering materials,” Moore notes. “We have not heard of cancellations. We’re not looking for overcapacity.”

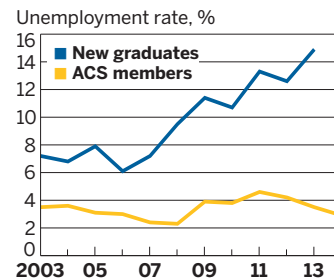
International eChem’s Hodges, in contrast, fears the sector is suffering from irrational exuberance. The U.S. is currently producing less ethylene and its derivatives—such as polyethylene, ethylene glycol, styrene, and polyvinyl chloride—than before the Great Recession, he says. “You can’t sell what you used to sell, but you’re wanting to increase the volume? This is a triumph of hope over experience.” Nor will China soak up the excess, he believes, because it is massively expanding its own capacity for petrochemicals and polymers.

With the anticipated expansions, Hodges expects U.S. manufacturers will end up having to mothball existing capacity that could have lasted another 10 or 20 years.

He sees some other changes coming down the pike for the chemical industry, including a shift to more modest goals. For the past 25 years, companies have pursued added value and the development of premium products, he says. “But that market has now run out,

**OPPOSING TRENDS**

**Unemployment continued to mount for new grads and to drop for experienced chemists and chemical engineers.**



**NOTE:** Data are for members and chemistry graduates who are unemployed but seeking employment. Data for 2014 on new graduates are not yet available. **SOURCES:** ACS Starting Salary Survey, ACS Comprehensive Salary & Employment Status Survey

due to real incomes in the West now being in more or less continuous decline for five or six years and the downturn in the emerging economy market, which means that the number of middle-class people is going to remain extremely small,” he states.

“In the world of the last 25 years, credit was easily available, people had lots of money to spend, and they confused wants with needs.” But now, “we’re in a transition to ‘the new normal,’ where affordability is becoming the key driver for demand,” meaning lower prices and smaller margins, Hodges explains.

**CHEMICAL COMPANIES** will have to respond by designing products that modern customers can afford rather than what they might dream about. “They’re not going to be interested in all these bells and whistles,” Hodges says.

An example can be found in the automobile industry, the largest single market for chemicals, Hodges notes. Renault’s Dacia line of cars, which starts at less than \$9,000 in Europe, is enjoying spectacular success, he says. Likewise, partner company Nissan’s budget Datsun brand is doing well in emerging economy markets.

The vehicles’ pared-to-the-bone pricing means that companies that want to supply polymers and other chemical products for these cars must reconfigure their business models and manufacturing processes to supply products on a “design to cost” basis, Hodges says. In turn, he says, that means chemists and chemical engineers will need to be retrained. “How you work, where you work, what you do—all of those things have to change.”

Similarly, Hodges believes that pharmaceutical companies will have to redirect resources away from lifestyle drugs for non-life-threatening conditions such as baldness so they can instead invest in treatments for deadly diseases such as Ebola.

Talented and motivated chemists and chemical engineers who can adjust to this new normal and quickly find affordable solutions will be in high demand across the pharmaceutical and chemical industries, Hodges says. “We’re talking about a complete restructuring and remodeling of most businesses,” he predicts. While he expects employment to remain subdued in the short-term, in the medium- to long-term these trends mean there will be “no shortage of work for engineers and chemists.”

ACC’s Moore says she’s already begun hearing about potential shortages of skills

required for the chemical industry, despite the fact that plenty of chemists and chemical engineers are still out of work. The location of new jobs may not match well with the supply of workers, she explains. The awful truth is that even if they want to do so, the thousands of chemists and chemical engineers who lost jobs in the Northeast in pharma aren’t likely to find a welcome

in the Gulf’s petrochemical industry.

For other chemists and chemical engineers, however, “it’s an exciting time to be coming into the profession,” Moore says. “Shale gas is offering a lot of opportunities for U.S. petrochemical manufacturers. If you’ve got the right skills and you’re in the right geographic location, it could be a good opportunity.” ■

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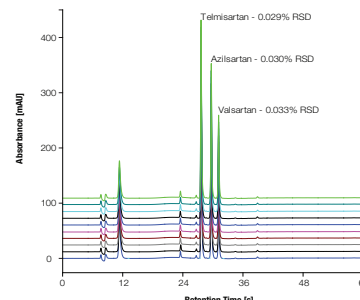
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