

# TAPPING THE BRAKES

Surveyed chemical makers will **LIMIT BUDGET INCREASES** to 3.6% for R&D and 1.9% for capital spending, but plans vary widely

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**THE CHEMICAL INDUSTRY'S** biggest companies will again increase spending on research and capital equipment this year. But as was the case last year, many firms are concerned about the continuing weak economic recoveries in Europe and the U.S. and the less than robust economy of Asia.

Planners from individual chemical firms differ widely in their assessment of opportunities ahead and the money they are willing to commit to snagging business in the years to come. As a group, however, they are taking a cautious approach to future-oriented spending.

Ten U.S. and European companies tell C&EN they will, as a group, lift research spending 3.6% in 2013 to a combined \$7.4 billion. The increase follows a 7.8% boost to the budget in 2012, when chemical firms spent \$7.1 billion. The spending rise marks the third straight year of increases.

R&D spending for the group this year will be up a healthy 50% compared with 2003, although after adjusting for inflation the increase is only about 20% over the period. What has been consistent is that R&D spending as a percentage of company sales has hovered around 3.0% for most of the decade.

Eighteen U.S. and European firms say they collectively will bolster spending on new plants and equipment 1.9% this year to \$18.7 billion. The modest uptick follows last year's heftier 14.0% boost to \$18.3 billion in capital expenditures. An increase in 2013 will mark the fourth year of annual spending increases after investment plummeted during the Great Recession.

C&EN predicts that

the survey group's capital spending as a percentage of sales will be 6.2%, unchanged from last year. The figure is the high for the past decade. The estimate assumes average sales for the group will increase 2.0% in 2013. The 10-year low occurred in 2004 when the group spent just 4.5% of sales on equipment.

According to C&EN's survey, the overall forecast for future-oriented spending is cloudy. For the 10 chemical firms—Albemarle, Arkema, BASF, Clariant, Cytec Industries, Dow Chemical, DuPont, Eastman Chemical, W.R. Grace, and Solvay—that supplied both R&D and capital spending data, combined budgets in 2013 will increase a less than enthusiastic 3.6% to \$20.3 billion.

The modest increase in future-oriented spending shows how uncertain these firms are as a group about their prospects. In 2010, 2011, and 2012 their combined budgets rose 5.9%, 24.8%, and 8.8%, respec-

tively, after a 15.3% dip in the recession year of 2009.

The ratio of investments in new production facilities to investment in R&D for firms that supplied both numbers will be slightly lower than in 2012. Budgets for 2013 direct 63.8% of funds to capital projects, slightly below the decade high of 63.9% in 2012. The low for the decade was 55.8% in 2009, when managers tightened the purse strings.

Generally, R&D funding doesn't fluctuate as widely as capital spending does. So when the economic outlook improves, capital spending rises and a proportionately smaller share of future-oriented budgets goes to research.

This year, 36.2% of future-oriented spending is aimed at research, a tad higher than the decade low of 36.1% in 2012. The decade's high was 44.2% in 2009, when, despite the recession, surveyed companies increased R&D budgets.

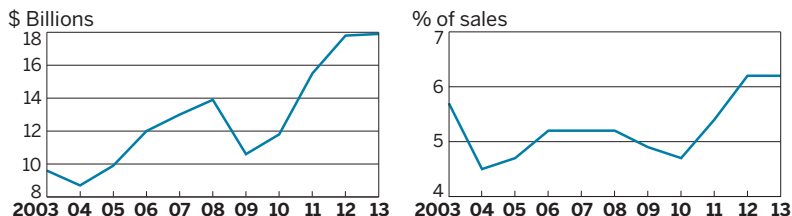
**BUDGETS CAN AND DO** change over the year. Companies surveyed in February 2012 (C&EN, Feb. 27, 2012, page 20) predicted they would increase 2012 research expenditures 3.0%, but companies in this year's group say they actually hiked spending 7.8%. Those in last year's survey predicted

they would boost capital spending budgets 14.1%. The prediction was pretty close to the 14.0% increase posted by this year's group.

Of the 10 firms that supplied R&D spending forecasts, nine plan increases in 2013 and one plans to hold spending at last year's level. This compares with seven that increased budgets last year and three that made cuts.

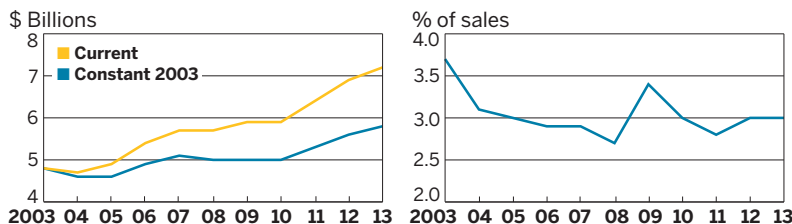
Belgium-based Solvay plans the largest R&D percentage increase, 14.9%, among the group in 2013. The increase reflects, in part, Solvay's acquisition of French chemical maker Rhodia in the fall of 2011. It also includes support for new research capabilities in India and China.

## CAPITAL IDEAS Spending on plants and equipment will rise in 2013 but will hold firm at 6.2% of sales.



**NOTE:** Values are for 17 chemical firms listed in the capital investments table on page 17. Excludes Arkema because 10 years of data are not available.  
**SOURCE:** C&EN surveys and estimates

## RESEARCH IN MOTION R&D spending continues upward momentum but will stay steady as a percent of sales.



**NOTE:** Values are for nine chemical firms listed in the research costs table on page 17. Excludes Arkema because 10 years of data are not available.  
**SOURCES:** C&EN surveys and estimates, White House Office of Management & Budget

## RESEARCH COSTS

As a group, 10 chemical firms plan a 3.6% rise in spending

\$ MILLIONS	2007	2008	2009	2010	2011	PLANNED 2012 <sup>a</sup>	ACTUAL 2012 <sup>b</sup>	PLANNED 2013 <sup>c</sup>	CHANGE		R&D SPENDING AS % OF SALES	
									2011-12 <sup>d</sup>	2012-13 <sup>e</sup>	2011	2012 <sup>f</sup>
Albemarle	\$63	\$67	\$61	\$58	\$77	na	\$79	\$81	2.6%	2.5%	2.7%	2.7%
Arkema	203	193	174	179	170	na	190	193	12.1	1.4	2.2	2.3
BASF <sup>g</sup>	1,775	1,743	1,798	1,919	2,064	na	2,245	2,357	8.8	5.0	2.2	2.2
Clariant <sup>h</sup>	198	173	140	126	165	na	164	170	-0.8	3.4	2.4	2.9
Cytec Industries	76	82	75	73	85	\$87	53	55	-37.6	3.8	2.8	3.1
Dow Chemical <sup>i</sup>	1,305	1,310	1,492	1,660	1,646	1,700	1,708	1,750	3.8	2.5	2.7	3.0
DuPont <sup>j</sup>	1,338	1,393	1,378	1,651	1,956	2,000	2,067	2,100	5.7	1.6	5.2	5.9
Eastman <sup>k</sup>	156	158	137	152	158	na	198	206	25.3	4.0	2.2	2.4
W.R. Grace	80	83	70	60	69	70	65	65	-5.8	0.0	2.1	2.1
Solvay <sup>l</sup>	715	725	713	161	200	na	336	386	67.6	14.9	1.4	2.0
<b>TOTAL</b>	<b>\$5,909</b>	<b>\$5,927</b>	<b>\$6,039</b>	<b>\$6,039</b>	<b>\$6,590</b>		<b>\$7,105</b>	<b>\$7,362</b>	<b>7.8%</b>	<b>3.6%</b>	<b>2.8%</b>	<b>3.0%</b>
<b>ANNUAL CHANGE</b>	<b>5.6%</b>	<b>0.3%</b>	<b>1.9%</b>	<b>0.0%</b>	<b>9.1%</b>		<b>7.8%</b>	<b>3.6%</b>				

**a** February 2012 estimate. **b** March 2013 estimate. **c** Budget for 2013. **d** Actual 2011 to March 2013 estimate. **e** March 2013 estimate to 2013 budget. **f** March 2013 estimate as a percentage of estimated 2012 sales. **g** Purchased Ciba in 2009 and Cognis in 2010. **h** Purchased Süd-Chemie in 2011. **i** Acquired Rohm and Haas in 2009. **j** Acquired Danisco in 2011. **k** Purchased Solutia in 2012. **l** Sold pharmaceuticals unit in 2010, bought Rhodia in 2011, and changed accounting procedures beginning in 2010. **na** = not available.  
**SOURCE:** C&EN surveys

BASF, the chemical industry's largest R&D spender, will continue a series of aggressive increases with a 5.0% rise in research spending this year. "Innovations are the basis for future profitable growth and thus lie at the core of our competitiveness," said BASF Chairman Kurt Bock at the firm's annual press conference last month.

Eastman Chemical is planning the third-largest percentage increase in R&D spending among this year's group. The 4.0% increase from the 2012 level in part reflects the acquisition of specialty chemical maker Solutia, completed in July 2012. The increase will go toward developing new product opportunities, says Gregory W. Nelson, Eastman's chief technology officer, including those to be realized from the Solutia deal.

Of the 18 firms that C&EN polled for their capital spending plans, 13 say they will increase spending and five say they will make cuts. Last year's aggregate results were the same.

Cytec Industries plans to more than double capital outlays as it ramps up capacity in its engineered-materials and process

## CAPITAL INVESTMENTS

Collectively, 18 chemical firms plan a slim 1.9% increase in spending this year

\$ MILLIONS	2007	2008	2009	2010	2011	PLANNED 2012 <sup>a</sup>	ACTUAL 2012 <sup>b</sup>	PLANNED 2013 <sup>c</sup>	CHANGE	
									2011-12 <sup>d</sup>	2012-13 <sup>e</sup>
Air Products <sup>f</sup>	\$1,055	\$1,085	\$1,179	\$1,298	\$1,352	\$1,700	\$1,870	\$1,800	38.3%	-3.7%
Albemarle	99	100	101	76	191	300	281	163	47.1	-42.0
Arkema	418	431	387	405	546	na	563	643	3.2	14.2
Ashland <sup>g</sup>	154	205	174	206	201	350	298	395	48.3	32.6
BASF <sup>h</sup>	3,296	3,242	3,224	3,277	4,385	na	5,272	5,787	20.2	9.8
Cabot <sup>i</sup>	141	199	106	108	230	225	281	275	22.2	-2.1
Celanese	306	267	167	201	349	375	361	388	3.4	7.5
Chemtura	115	121	56	138	154	na	149	168	-3.2	12.8
Clariant <sup>j</sup>	287	253	126	210	347	na	292	305	-16.0	4.5
Cytec Industries	115	196	194	116	117	225	145	300	23.9	106.9
Dow Chemical <sup>k</sup>	2,075	2,276	1,410	2,130	2,687	2,500	2,614	2,000	-2.7	-23.5
DuPont <sup>l</sup>	1,585	1,978	1,378	1,508	1,843	2,100	1,793	1,900	-2.7	6.0
Eastman Chemical <sup>m</sup>	518	634	137	243	457	na	465	500	1.8	7.5
FMC	115	175	93	142	190	250	225	350	18.4	55.6
W.R. Grace	137	132	94	113	142	150	139	190	-2.1	36.7
Huntsman Corp.	665	418	189	236	327	425	412	450	26.0	9.2
Praxair	1,376	1,611	1,352	1,388	1,797	2,300	2,180	1,900	21.3	-12.8
Solvay <sup>n</sup>	999	981	586	367	774	na	1,009	1,189	30.3	17.8
<b>TOTAL</b>	<b>\$13,456</b>	<b>\$14,304</b>	<b>\$10,953</b>	<b>\$12,163</b>	<b>\$16,090</b>		<b>\$18,349</b>	<b>\$18,703</b>	<b>14.0%</b>	<b>1.9%</b>
<b>ANNUAL CHANGE</b>	<b>8.6%</b>	<b>6.3%</b>	<b>-23.4%</b>	<b>11.0%</b>	<b>32.3%</b>		<b>14.0%</b>	<b>1.9%</b>		

**a** February 2012 estimates. **b** March 2013 estimates. **c** Budget for 2013. **d** Actual 2011 to March 2013 estimate. **e** March 2013 estimate to 2013 budget. **f** Fiscal year ends Sept. 30. **g** Bought Hercules in 2008 and ISP in 2011. **h** Purchased Ciba in 2009 and Cognis in 2010. **i** Purchased Süd-Chemie in 2011. **j** Acquired Rohm and Haas in 2009. **k** Acquired Danisco in 2011. **l** Purchased Solutia in 2012. **m** Sold pharmaceuticals unit in 2010, bought Rhodia in 2011, and changed accounting procedures beginning in 2010. **na** = not available.  
**SOURCE:** C&EN surveys

separations business. Engineered materials include carbon fibers now in heavy demand for new generations of composites used in the latest Airbus and Boeing airplanes.

FMC expects a 55.6% jump in its capital budget, much of which it plans to invest in a \$100 million microcrystalline cellulose plant, now under construction in Rayong, Thailand. The firm says the plant will help

meet growing Asian demand for the food and beverage ingredient.

In contrast, Albemarle is pulling back on capital spending 42.0% compared with 2012 to levels more consistent with its past spending. Over the past two years, a spokesman explains, the firm spent heavily on now-completed projects to double bromine capacity in Jordan, add polyolefin cat-

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Dow Chemical cited deterioration in the business environment as the reason it plans to cut capital outlays 23.5% this year. "The second half of 2012 saw significant deterioration in the markets we serve, particularly in China," noted Andrew N. Liveris, Dow's chief executive officer, when he announced 2012 results at the end of January. As a result, he told investors, Dow will cut capital spending in 2013 by approximately \$700 million compared with original plans.

The American Chemistry Council (ACC), the chemical industry's main trade association, is aggressive in its forecast of future-oriented spending, but other organizations have outlooks that are more cautious.

According to a survey conducted last fall by ACC's economics and statistics department, capital investment in the U.S. chemical industry grew 15.5% in 2012 to \$38.1 bil-

lion. Chemical firms budgeted \$43.4 billion on U.S. capital projects this year, up 14.0%, the survey found.

**LONG-TERM,** ACC's economists are bullish on U.S. capital spending as chemical makers position themselves to take advantage of the increase in low-cost domestically produced shale gas. They confidently predict that U.S. capital spending will reach \$64.5 billion by 2017 largely because of the opportunities afforded by shale gas.

The trade association's survey also found that U.S. chemical firms increased R&D budgets 3.5% in 2012 to \$58.1 billion. Looking ahead, the group's economists found that chemical makers are planning a 4.0% budget increase in 2013 to \$60.4 billion. ACC's survey includes pharmaceutical research, which the economists say will not be quite as buoyant as it has been in the past.

The nonprofit research group Battelle takes a global perspective on research

### TECHNOLOGY

## Open Innovation Still Worthwhile Despite Challenges

Intellectual property theft by employees continues to be a concern among R&D managers at U.S. chemical firms. But although many firms also expose their intellectual property to customers and research partners through open innovation arrangements, the R&D managers say these efforts are worthwhile, and they are confident in the strategies they have developed to safeguard proprietary knowledge.

Reports of companies stealing from partners are rare, but such incidents do occur. In 2008, In-vista charged Rhodia with stealing its butadiene-to-adiponitrile manufacturing process through a joint venture the two firms operate in France. More recently, a former employee of Chinese con-

tract research firm WuXi PharmaTech was convicted of stealing samples of several proprietary compounds from Merck & Co., a research partner, and offering them for sale over the Internet.

A recent White House report on the dangers of industrial espionage underscores the value of intellectual property and cites a number of instances in which employees stole proprietary information on behalf of foreign governments and corporations.

Industrial espionage "is outright stealing," says Douglas W. Muzyka, chief technology officer at DuPont. Open innovation is about sharing with customers. "You need a strategy around managing the richness of intellectual property," he says.

DuPont has had its share of problems with intellectual property theft. In one case, DuPont employee Hong Meng was convicted of stealing a process to make organic light-emitting diode displays and giving it to a Chinese university. In another case, a former employee was convicted of stealing DuPont's process to make the pigment titanium dioxide at the behest of Chinese-government-controlled companies.

The firm has shored up its information systems and policies to deal with the theft problem. "But we don't believe in closing down innovation efforts with partners," Muzyka says. To do so, "would be counterproductive in the long term." And besides, he adds, the theft was by rogue individuals and not

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spending writ large. The group's "2013 Global R&D Funding Forecast," put together with *R&D Magazine*, predicts global R&D spending will reach \$1.5 trillion this year, up 3.7% from the year before. Published in December 2012, the forecast says the largest share of the increase, about \$23 billion, will come from China.

In the U.S., 2013 R&D budgets are up 1.2% to \$424 billion, according to Battelle's forecasters. Industrial R&D funding in the U.S. is set to reach \$262 billion, up 2.3%. However, U.S. chemical and advanced-materials makers will increase global R&D a scant 0.6% to just below \$42 billion in 2013.

Another annual survey, conducted last summer, takes into account attitudes of research leaders at a variety of medium-sized to large U.S. industrial firms. According to the Industrial Research Institute's "2013 R&D Trends Forecast" (DOI: 10.5437/08956308X5601914), 89% of R&D managers predicted that R&D spending will

remain the same or increase in 2013. Only 11% said spending will be lower.

The survey found that chemical company investment in basic research, new business-related R&D projects, and lab construction and equipment will rise sharply. Chemical R&D managers, who represented 30 out of 114 surveyed, were much more positive than managers from industries such as food, industrial machinery, and consumer products.

Given the anemic economic outlook, authors of the IRI survey noted that "most respondents are preparing for a period of managed growth, in contrast to the cycles of rapid contraction and expansion that have characterized recent years."

However, C&EN's annual spending surveys suggest business cycles will continue to influence both R&D and capital spending. More cash will go to future-oriented spending in flush times, and less money will flow when profits get squeezed. ■

through the innovation framework.

"Industrial espionage is not new," says William F. Banholzer, chief technology officer of Dow Chemical. Several years ago Dow introduced digital rights management technology to track use of its documents to limit employee abuse, Banholzer says. Dow, like other firms, also has defenses against hackers, he points out.

With customers, Dow "always works under a legal framework," Banholzer notes. It would be imprudent not to protect the company with a clear agreement, he says.

Yakov Kutsovsky, Cabot's chief technology officer, says his firm also relies on agreements to keep partners honest. But he doesn't necessarily rush to the lawyers as soon as he starts collaborating with a partner. "If you put an agreement into place too early, you could

stifle innovation," he says. "You need to build trust."

Eastman Chemical's chief technology officer, Gregory W. Nelson, underscores the importance of protecting intellectual property. "We have a strong intellectual property and trade-secret protection program," he says. Most intellectual property is patented, Nelson says, because of the legal protections it affords.

Unpatented trade secrets are also a tool for protecting the firm's know-how. Eastman makes decisions on how to protect intellectual property on a case-by-case basis, Nelson says, but the firm feels patenting is often the best course of action.

"Stealing is the dark side of open innovation," says Tamara St. Claire, vice president of business development for the Xerox Innovation Group, an organization within the

document management technology company charged with fostering innovation at its global research centers. "But the return on the research investment outweighs the risk," she says.

For example, PARC, a Xerox research firm, helped energy company SolFocus develop its solar concentrator technology. Using its optical systems design capabilities, PARC helped the start-up firm create a more efficient panel to convert sunlight into electricity.

When it collaborates with a partner like SolFocus, Xerox starts by putting confidentiality agreements in place, St. Claire says. Subsequent royalty and licensing agreements help ensure that both parties share the fruits of their labors.

Intellectual property owned jointly with a partner "is a mark of success," St. Claire says.