

carbon dioxide generated during hydrogen production. ExxonMobil will use this low-carbon, blue hydrogen for its chemical operations and to make ammonia. South Korea's SK has already agreed to buy ammonia from the complex. In January, ExxonMobil awarded the engineering contract to Technip Energies. The oil and gas company is also eager to provide CO₂ transport and storage to third parties. Over the past year it has signed contracts with the fertilizer maker CF Industries, the industrial gas supplier Linde, and the steelmaker Nucor covering 5 million t of CO₂ per year. ExxonMobil is also planning a hub in the UK that would capture and store 3 million t per year of the greenhouse gas.

6 Ineos

2022 chemical sales: \$41.2 billion

Long a major European and US player in petrochemicals and plastics, Ineos is now making a push into Asia. Last year, it signed a series of deals with Chinese oil and chemical producer Sinopec that could together generate about \$10 billion in annual sales. Ineos purchased a 50% interest in Shanghai Secco Petrochemical, which had once been a joint venture with BP. Ineos and Sinopec also agreed to join on future projects in acrylonitrile-butadiene-styrene polymer and high-density polyethylene. Ineos bought Mitsui Chemicals' phenol complex on Jurong Island, Singapore, for \$330 million in April. In Europe, Ineos is buying out TotalEnergies' interest in an ethylene cracker joint venture in Lavéra, France. Ineos may soon be diversifying in dramatic fashion. The firm is reportedly in the running to buy Manchester United. Ineos founder Jim Ratcliffe has always been a supporter of the soccer club.

7 Formosa Plastics

2022 chemical sales: \$40.2 billion

Some chemical projects remain in a holding pattern forever. They aren't canceled formally; they are just quietly shelved. One of these might be Formosa Plastics' \$9.4 billion petrochemical project in Louisiana, originally announced in 2015. The plan has always faced stiff opposition from the local community and activists, who have scored major victories. In 2021, the US Army Corps of Engineers ordered a full environmental review, and last year a local judge pulled the air permits. Formosa's project website hasn't been updated since 2021, and the firm still hasn't reached a final investment decision. The company is, however, pressing on with a more modest project in its home country: an expansion

of its styrenic block copolymer joint venture with Kraton in Mailiao, Taiwan.

8 LG Chem

2022 chemical sales: \$40.2 billion

LG Chem is stepping up investment in battery materials. In November, the South Korean firm revealed plans to build

the largest cathode material facility in the US. The \$3 billion plant, in Clarksville, Tennessee, will have the capacity for 120,000 metric tons per year of nickel, cobalt, manganese, and aluminum cathode materials. A few months earlier it signed an agreement to supply cathode materials to General Motors. This April, LG Chem and Huayou Cobalt announced a joint venture

Spending

Both chemical capital expenditures and chemical R&D investment increased substantially for many firms in 2022.

| | CHEMICAL CAPITAL SPENDING | | | CHEMICAL R&D SPENDING | | |
|----------------------------|---------------------------|---------------------|---------------------------|-----------------------|---------------------|---------------------------|
| | 2022 (\$ MILLIONS) | CHANGE FROM 2021 | % OF CHEMICAL SALES | 2022 (\$ MILLIONS) | CHANGE FROM 2021 | % OF CHEMICAL SALES |
| Air Liquide | \$3,351 | 10.8% | 10.8% | \$324 | 1.3% | 1.0% |
| Air Products and Chemicals | 2,927 | 18.8 | 23.0 | 103 | 10.1 | 0.8 |
| Alpek | 152 | -30.6 | 1.4 | 3 | 1.5 | 0.0 |
| Arkema | 745 | -7.3 | 6.1 | 284 | 11.1 | 2.3 |
| Asahi Kasei | 810 | -11.8 | 8.1 | 318 | 23.7 | 3.2 |
| BASF | 4,609 | 23.9 | 5.0 | 2,421 | 3.7 | 2.6 |
| Borealis | 702 | 1.0 | 7.1 | 10 | -47.8 | 0.1 |
| Braskem | 940 | 41.7 | 5.0 | 73 | 26.3 | 0.4 |
| CF Industries Holdings | 453 | -11.9 | 4.0 | n/a | n/a | n/a |
| Covestro | 876 | 8.9 | 4.6 | 380 | 5.9 | 2.0 |
| Dow | 1,823 | 21.5 | 3.2 | 851 | -0.7 | 1.5 |
| DuPont | 743 | -16.6 | 5.7 | 536 | -13.3 | 4.1 |
| Eastman Chemical | 611 | 10.1 | 5.8 | 264 | 3.9 | 2.5 |
| Evonik Industries | 911 | 0.0 | 4.7 | 485 | -0.9 | 2.5 |
| ExxonMobil | 2,955 | 109.0 | 6.2 | n/a | n/a | n/a |
| Hengli Petrochemical | n/a | n/a | n/a | 176 | 16.2 | 0.6 |
| ICL Group | 747 | 22.3 | 7.5 | 68 | 6.3 | 0.7 |
| Indorama Ventures | 731 | 28.4 | 3.9 | 42 | 116.0 | 0.2 |
| Ineos | 2,008 | 22.2 | 4.9 | 79 | -4.1 | 0.2 |
| LG Chem | 6,508 | 45.6 | 16.2 | 1,366 | 30.0 | 3.4 |
| Linde | 3,255 | 3.4 | 10.6 | n/a | n/a | n/a |
| Lotte Chemical | 2,007 | 235.3 | 11.6 | 79 | 10.8 | 0.5 |
| LyondellBasell Industries | 1,830 | -1.4 | 4.6 | 124 | 0.0 | 0.3 |
| Mitsubishi Chemical Group | 1,856 | 19.2 | 6.3 | n/a | n/a | n/a |
| Mitsui Chemicals | 1,007 | 23.6 | 7.0 | 327 | 12.9 | 2.3 |
| Mosaic | 1,247 | -3.2 | 6.5 | n/a | n/a | n/a |
| OCI | 394 | 58.3 | 4.1 | n/a | n/a | n/a |
| Resonac Holdings | 668 | 29.7 | 6.3 | 198 | -8.9 | 1.9 |
| Sabco | 2,569 | -7.4 | 5.3 | n/a | n/a | n/a |
| Shin-Etsu Chemical | 2,248 | 50.9 | 10.5 | 511 | 7.7 | 2.4 |
| Sinopec | 8,710 | 13.5 | 13.0 | n/a | n/a | n/a |
| Solvay | 859 | 45.3 | 5.1 | 376 | 9.8 | 2.2 |
| SQM | 905 | 94.8 | 8.5 | n/a | n/a | n/a |
| Sumitomo Chemical | 866 | 33.2 | 5.1 | n/a | n/a | n/a |
| Umicore | 382 | 25.8 | 2.9 | 259 | 19.7 | 2.0 |
| Wanhua Chemical | n/a | n/a | n/a | 508 | 8.0 | 2.1 |
| Westlake | 913 | 61.0 | 8.3 | n/a | n/a | n/a |
| Yara | 926 | 14.5 | 3.9 | 95 | 1.1 | 0.4 |

Sources: Company documents, C&EN analysis. Note: Figures are for companies on the top 50 list reporting capital or R&D expenditures or both. n/a means not available. Some figures were converted at 2022 average exchange rates listed on page 23. Comparisons with prior years are based on revised numbers that reflect restated prior-year results and changes in exchange rates.