

installing a carbon-capture pilot plant. In Burghausen, Germany, Linde aims to make methanol from green hydrogen and carbon dioxide in partnership with Wacker Chemie. And a joint venture between Linde and ITM Power is planning a hydrogen-producing electrolyzer, dubbed the world's largest to be based on proton-exchange membranes, by 2022. Linde is also working with BASF and Sabic to develop cracking furnaces that run on electricity furnished by alternative energy rather than fossil fuels. With Shell, the company is working on a catalytic oxidative dehydrogenation process to make ethylene.

## 10 LyondellBasell Industries

► **2020 chemical sales:** \$23.4 billion  
Most large chemical companies nowadays are plunging into plastics recycling to counter public backlash, and Lyondell-Basell Industries is at the front of the pack. CEO Bob Patel is one of the founders of the Alliance to End Plastic Waste, formed by industry to address the recycling problem. And Lyondell has its own initiatives. It and the waste management firm Suez bought the plastics recycler Tivaco and are combining it with Quality Circular Polymers, a recycling venture Lyondell and Suez started in 2018. Quality Circular has some high-profile clients. For example, Samsonite is using its resin for a line of sustainable suitcases. Meanwhile, Lyondell continues to grow its core petrochemical business, often on the cheap. In December, the firm bought, for the bargain price of \$2 billion, a 50% interest in a new ethylene cracker and two polyethylene plants that the struggling Sasol had built. Similarly, it bought into an ethylene cracker joint venture already under construction in China.

## 11 ExxonMobil Chemical

► **2020 chemical sales:** \$23.1 billion  
While oil companies such as Shell and BP were redefining themselves as alternative energy players in recent years, ExxonMobil stuck with petroleum. The firm was taking what it considered a realistic position. Oil and gas are cheap and convenient, it argued, and would be hard to dislodge from the energy market for the next few decades. But COVID-19 hit the oil and gas business hard. ExxonMobil racked up a gaping corporate loss of \$28 billion in 2020, even as its chemical unit earned an operating profit of \$2.7 billion. The company is facing shareholder pressure to change, and it is starting to respond. For example, in April, it outlined

a \$100 billion plan to store 100 million metric tons per year of carbon dioxide in the Gulf of Mexico. The new environmental consciousness trickles down into chemicals. At a complex in France, ExxonMobil Chemical plans to host a pyrolysis plant that breaks down waste plastics into

chemical raw materials. And at its Baytown, Texas, chemical facility, it is testing a plastics recycling process. Separately, in a rare move, ExxonMobil is divesting a business, selling its Santoprene thermoplastic vulcanizate operation to Celanese for \$1.15 billion.

## Spending

**Most companies pulled back on capital spending during the COVID-19 pandemic, but less so on R&D.**

	CHEMICAL CAPITAL SPENDING			CHEMICAL R&D SPENDING		
	2020 (\$ MILLIONS)	CHANGE FROM 2019	% OF CHEMICAL SALES	2020 (\$ MILLIONS)	CHANGE FROM 2019	% OF CHEMICAL SALES
Air Liquide	\$3,011	1.4%	13.0%	\$346	-4.4%	1.5%
Air Products	2,509	26.1	28.3	84	15.1	0.9
Arkema	690	-4.7	7.7	275	-3.2	3.1
Asahi Kasei	941	-3.8	10.1	308	-10.4	3.3
BASF	3,570	-18.2	5.3	2,380	-3.3	3.5
Borealis	701	63.4	9.0	172	4.0	2.2
Braskem	535	2.9	4.7	49	1.2	0.4
Corteva Agriscience	250	-14.7	3.9	n/a	n/a	n/a
Covestro	803	-22.6	6.6	299	-1.5	2.4
DIC	306	-3.9	4.7	113	-3.8	1.7
Dow	1,252	-36.2	3.2	768	0.4	2.0
DSM	523	-11.9	5.7	454	14.0	4.9
DuPont	1,194	-51.7	5.9	860	-9.9	4.2
Eastman Chemical	383	-9.9	4.5	226	-3.4	2.7
Evonik	1,091	8.6	7.8	494	1.2	3.5
ExxonMobil Chemical	1,813	-6.2	7.9	n/a	n/a	n/a
Hanwha Chemical	455	-42.5	5.3	62	39.9	0.7
Indorama	536	0.7	5.1	19	45.9	0.2
Johnson Matthey	298	-18.6	3.0	249	-2.5	2.5
Lanxess	520	-10.2	7.5	123	-5.3	1.8
LG Chem	4,689	-11.3	18.4	945	1.9	3.7
Linde	3,455	-9.7	14.2	n/a	n/a	n/a
Lotte Chemical	680	-10.1	6.6	68	-5.4	0.7
LyondellBasell Industries	1,763	-30.3	7.5	113	1.8	0.5
Mitsubishi Chemical	2,179	11.5	8.6	n/a	n/a	n/a
Mitsui Chemicals	702	4.2	6.2	317	-7.1	2.8
Mosaic	1,171	-8.0	13.5	n/a	n/a	n/a
Sabic	3,505	-34.2	12.2	n/a	n/a	n/a
Sasol	1,495	-43.3	20.5	n/a	n/a	n/a
Shell Chemicals	2,640	-35.5	22.5	109	-2.7	0.9
Shin-Etsu Chemical	2,212	-12.0	15.8	480	5.6	3.4
Sinopec	3,795	16.8	8.1	n/a	n/a	n/a
Solvay	518	-39.5	4.7	342	-7.1	3.1
Sumitomo Chemical	669	-17.4	4.2	n/a	n/a	n/a
Syngenta	n/a	n/a	n/a	577	5.7	5.1
Tosoh	474	-17.2	6.9	183	7.1	2.7
Umicore	360	-30.2	3.7	225	2.5	2.3
Wanhua Chemical	n/a	n/a	n/a	296	19.8	2.8
Westlake Chemical	525	-33.3	7.0	n/a	n/a	n/a
Yara	739	-30.7	6.4	91	1.1	0.8

Sources: Company documents, C&EN analysis. Note: Figures are for companies on the top 50 list reporting capital and/or R&D expenditures. n/a means not available.