STEPPING UP

Annual Report 2021

Bayport Complex, TX

lyondellbasell

Advancing Possible

"While the external environment was volatile and hard to predict, we remained true to our core values and advanced our ambitions to create a more sustainable future for our industry."

Kenneth (Ken) Lane

Interim CEO and Executive Vice President, Global Olefins & Polyolefins

MESSAGE FROM THE INTERIM CEO

Dear LyondellBasell Shareholders,

I am honored to serve as LyondellBasell's Interim CEO and report to you on our record-setting results from the past year. Through the diligent work of our talented team, our company established new benchmarks for cash flow and profitability.

In 2021, LyondellBasell benefited from a rebounding economy that provided strong demand and tight market conditions. We continued to execute our strategy which remains grounded in the safe and reliable operation of our assets, deliberate cost management and disciplined growth investments. As a result, our company generated substantial cash flows enabling us to deleverage the balance sheet, increase dividends paid to shareholders, repurchase LyondellBasell shares and reinvest in our businesses.

Lockdowns, travel restrictions and changes in lifestyle stemming from the pandemic created pent-up consumer demand. Demand for packaging and products used to combat the virus remained strong, re-emphasizing the value of our products in serving the needs of modern society. Pandemic-driven disruptions to global supply chains intensified during 2021 and made it challenging for many producers to keep up with high consumer demand.

While the external environment was volatile and hard to predict, we remained true to our core values and advanced our ambitions to create a more sustainable future for our industry. The pursuit of GoalZERO safety performance remains our top priority. Continuous learning and a self-improving culture are key focus areas as we continue to work towards zero injuries and zero process safety, product safety and environmental incidents. We also took action to become a leader in circular plastics and accelerated our emissions reduction targets. These ambitions reflect our commitment to help address the world's most pressing challenges.

At LyondellBasell, we are stepping up for the future.

Stepping up our earnings

In 2021, our record-setting results were the product of our disciplined approach to running our businesses and the increased earnings power from our value-driven investments. The investments we made over the past few years have increased our earnings power. Our 2021 EBITDA exceeded our prior record by 15%.

Since 2018, we have:

- **Acquired A. Schulman** and formed our Advanced Polymer Solutions segment to expand our compounding business;
- **Constructed and commissioned a polyethylene plant in Texas** with a capacity to produce 500,000 tons per year, using our next-generation *Hyperzone* HDPE technology;
- **Established new joint ventures** for integrated cracker complexes in Louisiana and Northeastern China; and,
- **Invested in two new propylene oxide manufacturing sites globally.** Our new manufacturing site in Texas is expected to be commissioned in 2022, and our joint venture in China successfully started up earlier this year.

These projects have grown our asset base and position us well for the future.

Stepping up our value

In 2021, our diligent cash management set us apart. We delivered on our promises to shareholders by prioritizing deleveraging, increasing dividends and repurchasing shares.

- **We strengthened our balance sheet**, reducing $4 billion in long-term debt.
- **We continued our focus on a strong and progressive dividend**, a fundamental component of our capital allocation strategy, returning $4.44 per share to our shareholders.
- **We repurchased shares**, reducing our outstanding share count by approximately 5 million shares.

Stepping up in circularity

We are leveraging our strengths in polyolefins and catalyst technologies to capture value from the rapidly growing markets for recycled and renewable-based polymers. To help eliminate plastic waste in the environment and support our customers' goals of increasing the recycled content of their products, we launched our *Circulen* portfolio of polymers.

- ***Circulen*Recover** polymers, manufactured using the mechanical recycling process, are already in use, producing consumer products such as the Samsonite Magnum Eco suitcase line.

- ***Circulen*****Renew** polymers are manufactured from renewable-based feedstocks, and we are working towards increasing volumes globally.
- ***Circulen*****Revive** polymers are manufactured from feedstock produced using the advanced recycling process, and we have recently collaborated with Berry Global and Wendy's® restaurants to use our *Circulen*Revive polymers in the production of more recyclable Wendy's drink cups, using a mass balance approach. In addition, our proprietary catalyzed pyrolysis technology at our *MoReTec* molecular recycling pilot facility in Italy converts plastic waste into feedstock. As we continue to advance this technology, our goal is to bring *Circulen*Revive polymers to commercial scale.

The *Circulen* portfolio of products advances our ambitious goal to produce and market two million tons of recycled and renewable-based polymers annually by 2030.

Stepping up our climate commitments

Addressing climate change is a key part of our sustainability strategy, and I am proud of the actions our company is taking to align with the Paris Agreement and make a positive impact for future generations.

In September 2021, we announced accelerated targets and a goal to achieve net zero scope 1 and scope 2 greenhouse gas emissions from global operations by 2050. In support of our ambitions, we set an interim goal to reduce absolute emissions from global operations by 30 percent by 2030 relative to a 2020 baseline. In the early part of this decade, we will turn our ambition into action by purchasing renewable energy and maximizing the use of existing and accessible technologies to reduce emissions from our facilities and operations.

As we look beyond 2030, we are evaluating technology options, such as cracker electrification, use of hydrogen, carbon capture and storage, and carbon utilization. Cross value chain collaboration is essential to our success, so we are actively working to identify opportunities across multiple sectors to accelerate the scale up and deployment of these breakthrough technologies.

Stepping up Diversity, Equity and Inclusion in our workplace

I am encouraged by the enthusiasm from our employees to cultivate a more inclusive work environment and enhance diversity. Driven by our commitment to support our global workforce and the communities we serve, we progressed diversity, equity and inclusion (DEI) through key initiatives:

- **We progressed new talent programs** to improve mentorship and succession planning for diverse talent, embed diversity into our hiring processes and increase job posting transparency.
- **We implemented an annual equity audit** of pay and performance practices to minimize any unintended bias in our rewards programs and performance evaluations and promote a sense of fairness for all employees.
- **We launched employee networks** to help cultivate a community where all employees feel valued and respected. These networks allow colleagues with similar interests, identities and goals to foster professional and personal growth.
- **We prioritized and implemented DEI training** to accelerate measurable change in our workforce at all levels. This mandatory training helps us drive toward a culture of inclusion and belonging, and I am proud to say that 9,500 employees engaged in DEI training during 2021.

Stepping up for the future

Looking forward, we will continue to build on our strong foundation as we deploy our business model across a larger asset base, increasing cash flow and further strengthening our business portfolio. LyondellBasell is building innovative business models that aim to increase our utilization of plastic waste as a circular feedstock and capture more value from the growing and attractive market for circular plastics.

As Interim CEO, I am grateful for the opportunity to lead our global team of extremely talented employees. Together, we will continue building momentum as we prepare for our new CEO, Peter Vanacker, to join us in a few months. Our company is strong and our strategy has proven to be resilient. We will continue stepping up for our shareholders, our employees, our communities and the environment. I am very optimistic about our company's future.

Best wishes,

Kenneth Lane
Interim CEO
Executive Vice President,
Global Olefins & Polyolefins

2021 LyondellBasell HIGHLIGHTS

Delivered $5.6 B of net income

Generated $9.3 B of EBITDA ex. LCM and impairment*

Launched *Circulen* portfolio of polymers

Announced Net Zero ambition

* See other information concerning our non-GAAP financial measures for a discussion of the Company's use of EBITDA and EBITDA excluding LCM and Impairment.

STEPPING UP FOR THE FUTURE

LyondellBasell's earnings and cash flows are stepping up from levels seen over the last decade. We are well poised to continue delivering on our track record of substantial cash generation and strong returns for shareholders.

Highlights of Consolidated Financial Statements

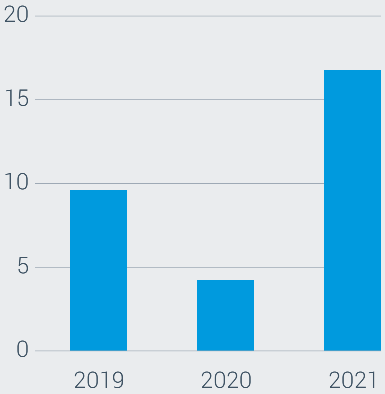
In 2021, LyondellBasell achieved record profitability and generated record cash from operating activities. During the year, we paid $4.44 per share in dividends, our eleventh consecutive year of annual dividend growth, and repurchased 5.2 million shares totaling $0.5 billion; thereby returning approximately $2 billion to shareholders.

($ IN BILLIONS)	2019	2020	2021
Sales and other operating revenues	$34.7	$27.8	$46.2
Operating income	$4.1	$1.6	$6.8
Net income	$3.4	$1.4	$5.6
Diluted weighted average share count (millions)	353	334	334
Diluted EPS ($/share)	$9.58	$4.24	$16.75
Diluted EPS excluding LCM and impairment ($/share)	$9.65	$5.61	$18.19
EBITDA excluding LCM and impairment	$5.7	$3.9	$9.3
Cash from operating activities	$5.0	$3.4	$7.7
Capital expenditures	$2.7	$1.9	$2.0

Trends in Profitability and Financial Resiliency

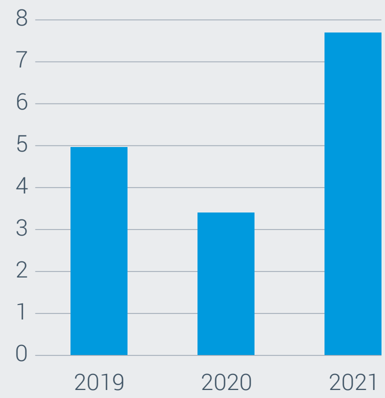
Diluted EPS

($/SHARE)



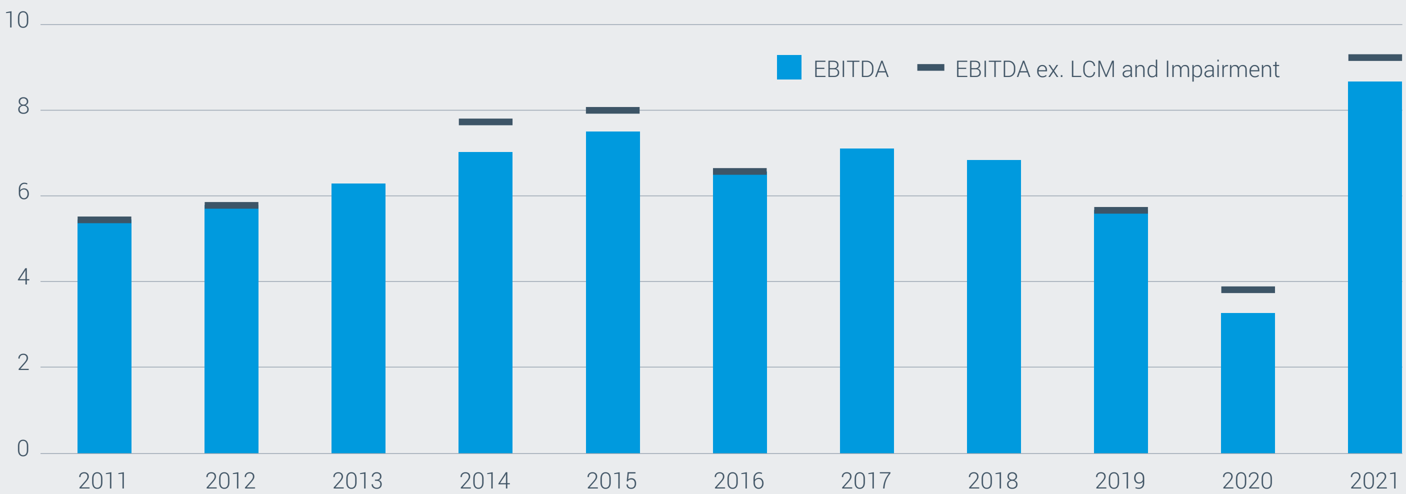
Cash from Operating Activites

($ IN BILLIONS)



Annual EBITDA

($ IN BILLIONS)



Reconciliations and other information concerning our non-GAAP financial measures can be found beginning on page 143.

STEPPING UP IN SUSTAINABILITY

ENDING PLASTIC WASTE

In April, we launched our ***Circulen*** **portfolio** of polymers to enable our customers and brand owners to improve the sustainability of their products. With the introduction of our *Circulen* product line, we are making further progress towards LyondellBasell's goal of producing and marketing

two million tons of recycled and renewable-based polymers annually by 2030.

ADDRESSING CLIMATE CHANGE

In September, we announced even more ambitious goals to help address the global challenges of climate change. In line with the Paris Agreement, we announced our ambition to achieve net zero greenhouse gas emissions from our global operations by 2050.

By 2030, our goal is to reduce absolute emissions* from global operations by 30 percent

relative to a 2020 baseline.

* Scope 1 and Scope 2

SUPPORTING A THRIVING SOCIETY

We are committed to advancing diversity, equity and inclusion to ensure a positive experience for all employees.

In 2021 **9,500 employees engaged in DEI training with their colleagues**

to develop skills to ignite inclusion in our workplace.

Matagorda, TX (MTO)

BOARD OF DIRECTORS

Jacques Aigrain

Chair of the Board of Directors
Nominating and Governance Committee, Finance Committee

Lincoln Benet

Nominating and Governance Committee, Finance Committee

Jagjeet S. Bindra

Audit Committee, Health, Safety, Environmental & Sustainability Committee

Robin W. T. Buchanan

Nominating and Governance Committee, Compensation and Talent Development Committee

Anthony R. Chase

Audit Committee, Compensation and Talent Development Committee

Stephen F. Cooper

Health, Safety, Environmental & Sustainability Committee

Nance K. Dicciani

Compensation and Talent Development Committee, Finance Committee

Robert W. Dudley

Health, Safety, Environmental & Sustainability Committee, Finance Committee

Claire S. Farley

Nominating and Governance Committee, Compensation and Talent Development Committee

Michael S. Hanley

Audit Committee, Health, Safety, Environmental & Sustainability Committee

Albert J. Manifold

Audit Committee, Health, Safety, Environmental & Sustainability Committee

Note: Committee assignments in orange denote chairperson; Board and Committee Chairs are also members of the Executive Committee

LEADERSHIP TEAM

Kenneth Lane

Interim CEO / Executive Vice President, Global Olefins & Polyolefins

James Guilfoyle

Executive Vice President, Advanced Polymer Solutions & Global Supply Chain

Jeffrey Kaplan

Executive Vice President, Legal & Public Affairs

Michael McMurray

Executive Vice President and Chief Financial Officer

Torkel Rhenman

Executive Vice President, Intermediates & Derivatives, and Refining

Kimberly Foley

Senior Vice President, HSE, Global Engineering and Turnarounds

Dale Friedrichs

Senior Vice President, Human Resources and Global Projects

Jean Gadbois

Senior Vice President, Europe, Asia & International Manufacturing

Richard Roudeix

Senior Vice President, Olefins & Polyolefins, Europe, Middle East, Africa and India

James Seward

Senior Vice President, Research & Development, Technology & Sustainability

Anup Sharma

Senior Vice President, Global Business Services

Michael VanDerSnick

Senior Vice President, Americas Manufacturing

SHAREHOLDER INFORMATION

STOCK EXCHANGE

LyondellBasell's common stock is listed on the New York Stock Exchange under the symbol LYB.

WEBSITE

Shareholders and other interested parties can learn about LyondellBasell by visiting www.lyondellbasell.com.

INVESTOR RELATIONS CONTACT

David Kinney +1 713 309 7141

CORPORATE GOVERNANCE

LyondellBasell's Corporate Governance Guidelines and related materials are available by selecting "Investors" and then "Corporate Governance" on our website at www.lyondellbasell.com.

ONLINE ANNUAL REPORT

LyondellBasell's Annual Report is available by selecting "Investors" and then "Company Reports" on our website at www.lyondellbasell.com.

REGISTRAR AND TRANSFER AGENT

Computershare Shareholder Services, Inc.
250 Royall Street
Canton, MA 02021
+1 877 456 7920 (U.S. Toll-Free)
+1 781 575 4337 (U.S. Toll/International)
www.computershare.com

CAUTIONARY STATEMENT

Certain disclosures in this annual report may be considered "forward-looking statements." These are made pursuant to "safe harbor" provisions of the Private Securities Litigation Reform Act of 1995. The "Cautionary Statement" on page 2 of LyondellBasell's Form 10-K for the fiscal year ended December 31, 2021, should be read in conjunction with such statements.

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

(Mark One)

☑ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2021

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission file number: 001-34726

LyondellBasell Industries N.V.

(Exact name of registrant as specified in its charter)

Netherlands **(State or other jurisdiction of incorporation or organization)**	**98-0646235** **(I.R.S. Employer Identification No.)**

1221 McKinney St., **Suite 300** **Houston, Texas** **USA 77010**	**4th Floor, One Vine Street** **London** **W1J0AH** **United Kingdom**	**Delftseplein 27E** **3013AA Rotterdam** **Netherlands**

(Address of principal executive offices) (Zip Code)

(713) 309-7200	**+44 (0) 207 220 2600**	**+31 (0) 10 2755 500**

(Registrant's telephone numbers, including area codes)

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Trading Symbol	Name of Each Exchange On Which Registered
Ordinary Shares, €0.04 Par Value	**LYB**	**New York Stock Exchange**

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. ☑ Yes ☐ No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. ☐ Yes ☑ No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. ☑ Yes ☐ No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). ☑ Yes ☐ No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ☑ Accelerated filer ☐ Non-accelerated filer ☐ Smaller reporting company ☐ Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☑

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). ☐ Yes ☑ No

The aggregate market value of common stock held by non-affiliates of the registrant on June 30, 2021, the last business day of the registrant's most recently completed second fiscal quarter, based on the closing price on that date of $102.87, was $27.0 billion. For purposes of this disclosure, in addition to the registrant's executive officers and members of its Board of Directors, the registrant has included Access Industries, LLC and its affiliates as "affiliates."

The registrant had 328,009,583 shares outstanding at February 22, 2022 (excluding 12,202,411 treasury shares).

Documents incorporated by reference:

Portions of the 2022 Proxy Statement, in connection with the Company's 2022 Annual Meeting of Shareholders (in Part III), as indicated herein.

		Page
Cautionary statement for the purposes of the "safe harbor" provisions of the Private Securities Litigation Reform Act of 1995		2
	PART I	
Items 1. and 2.	Business and Properties	4
Item 1A.	Risk Factors	20
Item 1B.	Unresolved Staff Comments	32
Item 3.	Legal Proceedings	33
Item 4.	Mine Safety Disclosures	33
	PART II	
Item 5.	Market for Registrant's Common Equity, Related Shareholder Matters and Issuer Purchases of Equity Securities	34
Item 6.	Reserved	35
Item 7.	Management's Discussion and Analysis of Financial Condition and Results of Operations	36
Item 7A.	Quantitative and Qualitative Disclosures About Market Risk	55
Item 8.	Financial Statements and Supplementary Data	57
Item 9.	Changes in and Disagreements With Accountants on Accounting and Financial Disclosure	133
Item 9A.	Controls and Procedures	133
Item 9B.	Other Information	133
Item 9C.	Disclosure Regarding Foreign Jurisdictions that Prevent Inspections	133
	PART III	
Item 10.	Directors, Executive Officers and Corporate Governance	134
Item 11.	Executive Compensation	134
Item 12.	Security Ownership of Certain Beneficial Owners and Management and Related Shareholder Matters	134
Item 13.	Certain Relationships and Related Transactions, and Director Independence	134
Item 14.	Principal Accounting Fees and Services	134
	PART IV	
Item 15.	Exhibits, Financial Statement Schedules	135
Item 16.	Form 10-K Summary	140
Signatures		141

CAUTIONARY STATEMENT FOR THE PURPOSES OF THE "SAFE HARBOR" PROVISIONS OF THE PRIVATE SECURITIES LITIGATION REFORM ACT OF 1995

This report includes "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933 (the "Securities Act") and Section 21E of the Securities Exchange Act of 1934 (the "Exchange Act"). You can identify our forward-looking statements by the words "anticipate," "estimate," "believe," "continue," "could," "intend," "may," "plan," "potential," "predict," "should," "will," "expect," "objective," "projection," "forecast," "goal," "guidance," "outlook," "effort," "target" and similar expressions.

We based forward-looking statements on our current expectations, estimates and projections of our business and the industries in which we operate. We caution you that these statements are not guarantees of future performance. They involve assumptions about future events that, while made in good faith, may prove to be incorrect and involve risks and uncertainties we cannot predict. Our actual outcomes and results may differ materially from what we have expressed or forecast in the forward-looking statements. Any differences could result from a variety of factors, including the following:

- the cost of raw materials represents a substantial portion of our operating expenses and energy costs generally follow price trends of crude oil, natural gas liquids and/or natural gas; price volatility can significantly affect our results of operations and we may be unable to pass raw material and energy cost increases on to our customers due to the significant competition that we face, the commodity nature of our products and the time required to implement pricing changes;
- our operations in the United States ("U.S.") have benefited from low-cost natural gas and natural gas liquids; decreased availability of these materials (for example, from their export or regulations impacting hydraulic fracturing in the U.S.) could reduce the current benefits we receive;
- if crude oil prices are low relative to U.S. natural gas prices, we would see less benefit from low-cost natural gas and natural gas liquids and it could have a negative effect on our results of operations;
- industry production capacities and operating rates may lead to periods of oversupply and low profitability;
- we may face unplanned operating interruptions (including leaks, explosions, fires, weather-related incidents, mechanical failures, unscheduled downtime, supplier disruptions, labor shortages, strikes, work stoppages or other labor difficulties, transportation interruptions, spills and releases and other environmental incidents) at any of our facilities, which would negatively impact our operating results;
- changes in general economic, business, political and regulatory conditions in the countries or regions in which we operate could increase our costs, restrict our operations and reduce our operating results;
- our ability to execute our organic growth plans may be negatively affected by our ability to complete projects on time and on budget;
- our ability to acquire new businesses and assets and integrate those operations into our existing operations and make cost-saving changes in operations;
- uncertainties associated with worldwide economies could create reductions in demand and pricing, as well as increased counterparty risks, which could reduce liquidity or cause financial losses resulting from counterparty default;
- uncertainties related to the extent and duration of the pandemic-related decline in demand, or other impacts due to the pandemic in geographic regions or markets served by us, or where our operations are located, including the risk of prolonged recession;
- the negative outcome of any legal, tax and environmental proceedings or changes in laws or regulations regarding legal, tax and environmental matters may increase our costs, reduce demand for our products, or otherwise limit our ability to achieve savings under current regulations;
- any loss or non-renewal of favorable tax treatment under tax agreements or tax treaties, or changes in tax laws, regulations or treaties, may substantially increase our tax liabilities;

- we may be required to reduce production or idle certain facilities because of the cyclical and volatile nature of the supply-demand balance in the chemical and refining industries, which would negatively affect our operating results;
- we rely on continuing technological innovation, and an inability to protect our technology, or others' technological developments, could negatively impact our competitive position;
- we have significant international operations, and fluctuations in exchange rates, valuations of currencies and our possible inability to access cash from operations in certain jurisdictions on a tax-efficient basis, if at all, could negatively affect our liquidity and our results of operations;
- we are subject to the risks of doing business at a global level, including wars, terrorist activities, political and economic instability and disruptions and changes in governmental policies, which could cause increased expenses, decreased demand or prices for our products and/or disruptions in operations, all of which could reduce our operating results;
- if we are unable to achieve our emissions or other sustainability targets, it could result in reputational harm, changing investor sentiment regarding investment in our stock or a negative impact on our access to and cost of capital;
- if we are unable to comply with the terms of our credit facilities, indebtedness and other financing arrangements, those obligations could be accelerated, which we may not be able to repay; and
- we may be unable to incur additional indebtedness or obtain financing on terms that we deem acceptable, including for refinancing of our current obligations; higher interest rates and costs of financing would increase our expenses.

Any of these factors, or a combination of these factors, could materially affect our future results of operations and the ultimate accuracy of the forward-looking statements. Our management cautions against putting undue reliance on forward-looking statements or projecting any future results based on such statements or present or prior earnings levels.

All subsequent written and oral forward-looking statements attributable to us or any person acting on our behalf are expressly qualified in their entirety by the cautionary statements contained or referred to in this section and any other cautionary statements that may accompany such forward-looking statements. Except as otherwise required by applicable law, we disclaim any duty to update any forward-looking statements. Additional factors that could cause results to differ materially from those described in the forward-looking statements can be found in the "Risk Factors" section of this report.

PART I

Items 1 and 2. Business and Properties.

OVERVIEW

LyondellBasell Industries N.V. is a global, independent chemical company and was incorporated, as a *Naamloze Vennootschap,* under Dutch law on October 15, 2009. Unless otherwise indicated, the “Company,” “we,” “our,” “us” and “LyondellBasell” are used in this report to refer to the businesses of LyondellBasell Industries N.V. and its consolidated subsidiaries. We are one of the world’s top independent chemical companies based on revenues.

We participate globally across the petrochemical value chain and are an industry leader in many of our product lines. Our chemicals businesses consist primarily of large processing plants that convert large volumes of liquid and gaseous hydrocarbon feedstocks into plastic resins and other chemicals. Our chemical products tend to be basic building blocks for other chemicals and plastics. Our plastic products are used in large volumes as well as smaller specialty applications. Our customers use our plastics and chemicals to manufacture a wide range of products that people use in their everyday lives including food packaging, home furnishings, automotive components, paints and coatings. Our refining business consists of our Houston refinery, which processes crude oil into refined products such as gasoline and distillates. We also develop and license chemical and polyolefin process technologies and manufacture and sell polyolefin catalysts.

Our financial performance is influenced by the supply and demand for our products, the cost and availability of feedstocks and commodity products, global and regional production capacity, our operational efficiency and our ability to control costs. We have a strong operational focus and, as a producer of large volume commodities, continuously strive to differentiate ourselves through safe, reliable and low-cost operations in all our businesses. We purchase large quantities of natural gas, electricity and steam which we use as energy to fuel our facilities and purchase large quantities of natural gas liquids and crude oil derivatives which we use as feedstocks. The relatively low cost of natural gas-derived raw materials in the U.S. versus the global cost of crude oil-derived raw materials has had a significant positive influence on the profitability of our North American operations.

SEGMENTS

We manage our operations through six operating segments. Our reportable segments are:

- *Olefins and Polyolefins—Americas* (“O&P—Americas”). Our O&P—Americas segment produces and markets olefins and co-products, polyethylene and polypropylene.
- *Olefins and Polyolefins—Europe, Asia, International* (“O&P—EAI”). Our O&P—EAI segment produces and markets olefins and co-products, polyethylene and polypropylene.
- *Intermediates and Derivatives* (“I&D”). Our I&D segment produces and markets propylene oxide and its derivatives; oxyfuels and related products; and intermediate chemicals, such as styrene monomer, acetyls, ethylene oxide and ethylene glycol.
- *Advanced Polymer Solutions* (“APS”). Our APS segment produces and markets compounding and solutions, such as polypropylene compounds, engineered plastics, masterbatches, engineered composites, colors and powders, and advanced polymers, which includes *Catalloy* and polybutene-1.
- *Refining*. Our Refining segment refines heavy, high-sulfur crude oil and other crude oils of varied types and sources available on the U.S. Gulf Coast into refined products, including gasoline and distillates.
- *Technology*. Our Technology segment develops and licenses chemical and polyolefin process technologies and manufactures and sells polyolefin catalysts.

Financial information about our business segments and geographical areas can be found in Note 20 to the Consolidated Financial Statements. Information about the locations where we produce our primary products can be found under “Description of Properties.” No single customer accounted for 10% or more of our total revenues in 2021, 2020 or 2019.

Olefins and Polyolefins Segments Generally

We are one of the leading worldwide producers of olefins and polyethylene (“PE”) and we are the world’s second largest producer of polypropylene (“PP”). We manage our olefin and polyolefin business in two reportable segments, O&P—Americas and O&P—EAI.

Olefins & Co-products—Ethylene is the most significant petrochemical in terms of worldwide production volume and is the key building block for PE and many other chemicals and plastics. Ethylene is produced by steam cracking hydrocarbons such as ethane, propane, butane and naphtha. This production results in co-products such as aromatics and other olefins, including propylene and butadiene. Ethylene and its co-products are fundamental to many parts of the economy, including the production of consumer products, packaging, housing and automotive components and other durable and nondurable goods. Olefins & co-products sales accounted for approximately 11% of our consolidated revenues in 2021 and 9% of our consolidated revenues in each of 2020 and 2019.

Polyolefins—Polyolefins such as PE and PP are polymers derived from olefins including ethylene and propylene. Polyolefins are the most widely used thermoplastics in the world and are found in applications and products that enhance the everyday quality of life. Our products are used in consumer, automotive and industrial applications ranging from food and beverage packaging to housewares and construction materials.

Polyethylene—We produce high density polyethylene (“HDPE”), low density polyethylene (“LDPE”) and linear low density polyethylene (“LLDPE”). PE sales accounted for approximately 22%, 21% and 17% of our consolidated revenues in 2021, 2020 and 2019, respectively.

Polypropylene—We produce PP homopolymers and copolymers. PP sales accounted for approximately 17%, 16% and 14% of our consolidated revenues in 2021, 2020 and 2019, respectively.

Olefins and Polyolefins—Americas Segment

Overview—Our O&P—Americas segment produces and markets olefins and co-products, polyethylene and polypropylene.

Sales & Marketing / Customers—Most of the ethylene we produce is consumed internally as a raw material in the production of PE and other derivatives, with the balance sold to third party customers, primarily under multi-year contracts.

We use all the propylene we produce in the production of PP, propylene oxide and other derivatives of those products. We also purchase propylene from third parties. In addition to purchases of propylene, we purchase ethylene for resale, when necessary, to satisfy customer demand above our own production levels. Volumes of any of these products purchased for resale can vary significantly from period to period and are typically most significant during extended outages of our own production, such as during planned maintenance. However, purchased volumes have not historically had a significant impact on profits, except to the extent that they replace our lower-cost production. We also consume PP in our PP compounding business, which is included in our APS segment.

Most of the ethylene and propylene production from our Channelview, Corpus Christi and La Porte, Texas facilities is shipped via a pipeline system, which has connections to numerous U.S. Gulf Coast consumers. This pipeline system extends from Corpus Christi to Mont Belvieu, Texas. In addition, exchange agreements with other ethylene and co-products producers allow access to customers who are not directly connected to this pipeline system. Some ethylene is shipped by railcar from our Clinton, Iowa facility to our Morris, Illinois facility and some is shipped directly to customers. Propylene from Clinton and Morris is generally shipped by marine vessel, barge, railcar or truck.

Our PP and PE production is typically sold through our sales organization to an extensive base of established customers and distributors servicing both the domestic and export markets either under annual contracts or on a spot basis. We have sales offices in various locations in North America and our polyolefins are primarily transported in North America by railcar or truck. Export sales are primarily to customers in Latin America, with sales to Asia expected to increase in the coming years as global supply and demand balances shift.

Joint Venture Relationships—In December 2020, we purchased a 50% interest in Louisiana Integrated PolyEthylene JV LLC ("Louisiana Joint Venture") which provides us with capacity of approximately 770 thousand tons of ethylene and 445 thousand tons of low density and linear-low density PE production per year. We operate the joint venture assets and market the polyethylene off-take for all partners through our global sales team. We also participate in a joint venture in Mexico, which provides us with capacity of approximately 290 thousand tons of PP production per year. We do not hold a majority interest in or have operational control of this joint venture.

The capacities are based on our percentage ownership of the joint venture's total capacity.

Raw Materials—Raw material cost is the largest component of the total cost to produce ethylene and its co-products. The primary raw materials used in our Americas olefin facilities are natural gas liquids ("NGLs") and heavy liquids. Heavy liquids include crude oil-based naphtha and other refined products, as well as condensate, a very light crude oil resulting from natural gas production. NGLs include ethane, propane and butane. The use of heavy liquid raw materials results in the production of significant volumes of co-products such as propylene, butadiene and benzene, as well as gasoline blending components, while the use of NGLs results in the production of a smaller volume of co-products.

Our ability to pass on raw material price increases to our customers is dependent on market-driven demand for olefins and polyolefins. Sales prices for products sold in the spot market are determined by market forces. Our contract prices are influenced by product supply and demand conditions, spot prices, indices published in industry publications and, in some instances, cost recovery formulas.

We can manufacture olefins by utilizing a variety of feedstocks, including heavy liquids and NGLs. Technological advances for extracting shale-based oil and gas have led to an increased supply of NGLs, providing a cost advantage over heavy liquids, particularly in the U.S. A plant's flexibility to consume a wide range of raw materials generally provides an advantage over plants that are restricted in their processing capabilities. Our Americas facilities can process significant quantities of either heavy liquids or NGLs. We estimate that in the U.S. we can produce up to approximately 90% of our total ethylene output using NGLs. Changes in the raw material feedstock mix utilized in the production process will result in variances in production capacities among products. We believe our raw material flexibility in the U.S. is a key advantage in our production of ethylene and its co-products.

Industry Dynamics / Competition—With respect to olefins and polyolefins, competition is based on price and, to a lesser extent, on product quality, product delivery, reliability of supply, product performance and customer service. Profitability is affected not only by supply and demand for olefins and polyolefins, but also by raw material costs and price competition among producers, which may intensify due to, among other things, the addition of new capacity. In general, demand is a function of economic growth, including the regional dynamics that underlie global growth trends.

We compete in North America with other large marketers and producers, including global chemical companies, chemical divisions of large oil companies and regional marketers and producers.

Based on published capacity data and including our proportionate share of joint ventures, we believe as of December 31, 2021, we were:

- the second largest producer of ethylene in North America, with ethylene capacity of 6.2 million tons per year, including our share of our Louisiana Joint Venture capacity;
- the third largest producer of PE in North America with capacity of 4.1 million tons per year including our share of our Louisiana Joint Venture capacity; and
- the second largest producer of PP in North America, with capacity of 1.9 million tons per year, including our share of our Mexican joint venture capacity and approximately 280 thousand tons of *Catalloy* capacity reported within our Advanced Polymer Solutions segment.

Olefins and Polyolefins—Europe, Asia, International Segment

Overview—Our O&P—EAI segment produces and markets olefins and co-products, polyethylene and polypropylene.

Sales & Marketing / Customers—Our ethylene production is primarily consumed internally as a raw material in the production of polyolefins, and we purchase additional ethylene as needed to meet our production needs. Our propylene production is used as a raw material in the production of PP and propylene oxide and derivatives of those products, and we regularly purchase propylene from third parties because our internal needs exceed our internal production.

With respect to PP and PE, our production is typically sold through our sales organization to an extensive base of established customers under annual contracts or on a spot basis and is also sold through distributors. Our polyolefins are primarily transported in Europe by railcar or truck.

Our regional sales offices are in various locations, including The Netherlands, Hong Kong, China, India, Australia and the United Arab Emirates. We also operate through a worldwide network of local sales and representative offices in Europe and Asia. Our joint ventures described below typically manage their domestic sales and marketing efforts independently, and we typically operate as their agent for all or a portion of their exports.

Joint Venture Relationships—We participate in several manufacturing joint ventures in Saudi Arabia, China, Poland, South Korea, Thailand and The Netherlands. We do not hold majority interests in any of these joint ventures, nor do we have operational control. These joint ventures provide us with additional annual production capacity of approximately 1.6 million tons of PP, approximately 1.2 million tons of olefins and approximately 820 thousand tons of PE. These capacities are based on our percentage ownership interest in the joint ventures' total capacities.

Our 50% joint venture in Quality Circular Polymers ("QCP"), located in The Netherlands, uses mechanical recycling to transform post-consumer plastic waste into high-quality polymers that can be used to make new products. The QCP plants, located in The Netherlands and Belgium, are capable of converting consumer waste into 55 thousand tons of recycled polypropylene and recycled high-density polyethylene annually.

We generally license our polyolefin process technologies and supply catalysts to our joint ventures through our Technology segment. Some of our joint ventures are able to source cost advantaged raw materials from their local shareholders.

Raw Materials—Raw material cost is the largest component of the total cost for the production of olefins and co-products. The primary raw material used in our European olefin facilities is naphtha; however, we also have the capability to displace up to half of our European assets naphtha needs with other feedstocks, such as liquified petroleum gases. We have flexibility to vary the raw material mix and process conditions in our plants in order to maximize profitability as market prices for both feedstocks and products change.

The principal raw materials used in the production of polyolefins are propylene and ethylene. In Europe, we have the capacity to produce approximately 50% of the propylene requirements for our European PP production and all of the ethylene requirements for our European PE production. Propylene and ethylene requirements that are not produced internally are generally acquired pursuant to long-term contracts with third party suppliers or via spot purchases.

Our ability to pass through the increased cost of raw materials to customers is dependent on global market demand for olefins and polyolefins. In general, the pricing for purchases and sales of most products is determined by global market forces, including the impacts of foreign exchange rates relative to the pricing of the underlying raw materials, most of which are priced in U.S. dollars. There can be a lag between raw material price changes and contract product price changes that will cause volatility in our product margins.

Industry Dynamics / Competition—With respect to olefins and polyolefins, competition is based on price, product quality, product delivery, reliability of supply, product performance and customer service. We compete with regional and multinational chemical companies and divisions of large oil companies. The petrochemical market has been affected by the price volatility of naphtha, the primary feedstock for olefins in the region.

Based on published capacity data and including our proportionate share of our joint ventures, we believe as of December 31, 2021, we were:

- the fifth largest producer of ethylene in Europe with an ethylene capacity of 1.9 million tons per year;
- the largest producer of PE in Europe with 2.2 million tons per year of capacity, including our share of our joint ventures in Poland and The Netherlands; and
- the largest producer of PP in Europe with 2.7 million tons per year of capacity, including our share of our joint ventures in Poland and The Netherlands, and approximately 280 thousand tons of *Catalloy* capacity reported within our Advanced Polymer Solutions segment.

Intermediates and Derivatives Segment

Overview—Our I&D segment produces and markets propylene oxide ("PO") and its derivatives, oxyfuels and related products, and intermediate chemicals such as styrene monomer ("SM"), acetyls, and ethylene oxides and derivatives.

PO and Derivatives—We produce PO through two distinct technologies, one of which yields tertiary butyl alcohol ("TBA") as the co-product and the other of which yields SM as the co-product. The two technologies are mutually exclusive with dedicated assets for manufacturing either PO/TBA or PO/SM. PO is an intermediate commodity chemical and is a precursor of polyols, propylene glycol, propylene glycol ethers and butanediol. PO and derivatives are used in a variety of durable and consumable items with key applications such as polyurethanes used for insulation, automotive/furniture cushioning, coatings, surfactants, synthetic resins and several other household usages. We are currently constructing a world-scale PO/TBA plant in Houston, Texas. Once completed the plant will have the capacity to produce 470 thousand tons of PO and 1.0 million tons of tertiary butyl alcohol per year. The project is expected to start-up at the end of 2022 and expected to result in total capital expenditures of approximately $3.4 billion.

Oxyfuels and Related Products—We produce two distinct ether-based oxyfuels, methyl tertiary butyl ether ("MTBE") and ethyl tertiary butyl ether ("ETBE"). These oxyfuels are produced by converting the TBA co-product of PO into isobutylene and reacting with methanol or ethanol to produce either MTBE or ETBE. Both are used as high-octane gasoline components that help gasoline burn cleaner and reduce automobile emissions. Other TBA derivatives, which we refer to as "C4 chemicals," are largely used to make synthetic rubber and other gasoline additives.

Intermediate Chemicals—We produce other commodity chemicals that utilize ethylene as a key component feedstock, including SM, acetyls and ethylene oxide derivatives. SM is utilized in various applications such as plastics, expandable polystyrene for packaging, foam cups and containers, insulation products and durables and engineering resins. Our acetyls products comprise methanol, glacial acetic acid ("GAA") and vinyl acetate monomer ("VAM"). Natural gas (methane) is the feedstock for methanol, some of which is converted to GAA, and a portion of the GAA is reacted with ethylene to create VAM. VAM is an intermediate chemical used in fabric or wood treatments, pigments, coatings, films and adhesives. Ethylene oxide is an intermediate chemical that is used to produce ethylene glycol, glycol ethers and other derivatives. Ethylene oxide and its derivatives are used in the production of polyester, antifreeze fluids, solvents and other chemical products.

Sales & Marketing / Customers—We sell our PO and derivatives through multi-year sales and processing agreements as well as spot sales. Some of our contract sales agreements have cost plus pricing terms. PO and derivatives are transported by barge, marine vessel, pipeline, railcar and tank truck.

We sell our oxyfuels and related products under market and cost-based sales agreements and in the spot market. Oxyfuels are transported by barge, marine vessel and tank truck and are used as octane blending components worldwide outside of the U.S. due to their blending characteristics and emission benefits. C4 chemicals, such as high-purity isobutylene, are sold to producers of synthetic rubber and other chemical products primarily in the U.S. and Europe, and are transported by railcar, tank truck, pipeline and marine shipments.

Intermediate chemicals are shipped by barge, marine vessel, pipeline, railcar and tank truck. SM is sold globally into regions such as North America, Europe, Asia and South America export markets through spot sales and commercial contracts. Within acetyls, methanol is consumed internally to make GAA, used as a feedstock for oxyfuels and related products and also sold directly into the merchant commercial market. GAA is converted with ethylene to produce VAM which is sold worldwide under multi-year commercial contracts and on a spot basis.

Sales of our PO and derivatives, oxyfuels and related products, and intermediate chemicals are made by our marketing and sales personnel, and also through distributors and independent agents in the Americas, Europe, the Middle East, Africa and the Asia-Pacific region.

Joint Venture Relationships—We have two PO joint ventures with Covestro AG, one in the U.S. and one in Europe. We operate all production facilities for the PO joint ventures. Covestro's interest in the U.S. PO joint ventures represents ownership of an in-kind portion of the PO production of 680 thousand tons per year. We take, in-kind, the remaining PO production and all co-product production. Covestro also has the right to 50% of the PO and SM production of our European PO joint venture. Our proportional production capacity provided through this venture is approximately 160 thousand tons of PO and approximately 340 thousand tons of SM. We do not share marketing or product sales with Covestro under either of these PO joint ventures.

We also have two joint venture manufacturing relationships in China with China Petroleum & Chemical Corporation ("Sinopec"). The first joint venture provides us with additional production capacity of approximately 50 thousand tons of PO per year. The second joint venture, which began production in January 2022, will provide us with additional annual production capacity of approximately 140 thousand tons of PO and 300 thousand tons of SM. These capacities are based on our operational share of the joint ventures' total capacities. We market our share of the joint ventures production in the Chinese market.

Raw Materials—The cost of raw materials is the largest component of total production cost for PO, its co-products and its derivatives. Propylene, isobutane or mixed butane, ethylene and benzene are the primary raw materials used in the production of PO and its co-products. The market prices of these raw materials historically have been related to the price of crude oil, NGLs and natural gas, as well as supply and demand for the raw materials.

In the U.S., we obtain a large portion of our propylene, benzene and ethylene raw materials needed for the production of PO and its co-products from our O&P—Americas segment and to a lesser extent from third parties. Raw materials for the non-U.S. production of PO and its co-products are obtained from our O&P—EAI segment and from third parties. We consume a significant portion of our internally-produced PO in the production of PO derivatives.

The raw material requirements not sourced internally are purchased at market-based prices from numerous suppliers in the U.S. and Europe with which we have established contractual relationships, as well as in the spot market.

For the production of oxyfuels, we purchase our ethanol feedstock requirements from third parties, and obtain our methanol from both internal production and external sources. Carbon monoxide and methanol are the primary raw materials required for the production of GAA. We source carbon monoxide from internal production, which can be complemented by purchases from external sources as needed. The methanol required for our downstream production of acetyls is internally sourced from our methanol plants in La Porte, Texas, and Channelview, Texas. Natural gas is the primary raw material required for the production of methanol.

In addition to ethylene, acetic acid is a primary raw material for the production of VAM. We obtain all our requirements for acetic acid and ethylene from our internal production. Historically, we have used a large percentage of our acetic acid production to produce VAM.

Industry Dynamics / Competition—With respect to product competition, the market is influenced and based on a variety of factors, including product quality, price, reliability of supply, technical support, customer service and potential substitute materials. Profitability is affected by the worldwide level of demand along with price competition, which may intensify due to, among other things, new industry capacity and industry outages. Demand growth could be impacted by further development of alternative bio-based methodologies. Our major worldwide competitors include other multinational chemical and refining companies as well as some regional marketers and producers.

Based on published capacity data and including our proportionate share of our joint ventures, we believe as of December 31, 2021, we were:

- the second largest producer of PO worldwide; and
- the second largest producer of oxyfuels worldwide.

Advanced Polymer Solutions Segment

Overview—Our APS segment produces and markets compounding and solutions, such as polypropylene compounds, engineered plastics, masterbatches, colors and powders, engineered composites and advanced polymers, which include *Catalloy* and polybutene-1 polyolefin resins.

Compounding and Solutions—Our polypropylene compounds are produced from blends of polyolefins and additives and are largely focused on automotive applications. Engineered plastics and engineered composites add value for more specialized high-performance applications used across a variety of industries. Masterbatches are compounds that provide differentiated properties when combined with commodity plastics used in packaging, agriculture and durable goods applications. Specialty powders are largely used to mold toys, industrial tanks and sporting goods such as kayaks. Performance colors provide powdered, pelletized and liquid color concentrates for the plastics industry.

Advanced Polymers—*Catalloy* and polybutene-1 are unique polymers that can be used within the segment for downstream compounding or can be sold as raw materials to third parties. *Catalloy* is a line of differentiated propylene-based polymers that add value in packaging applications and construction materials such as the white membranes used in the commercial roofing market. Polybutene-1 is used in both specialty piping and packaging applications.

Sales & Marketing / Customers—Our products are sold through our global sales organization to a broad base of established customers and distributors under contract or on a spot basis. These products are transported to our customers primarily by either truck or bulk rail. The sales of compounding and solutions products accounted for approximately 9% of our consolidated revenues in 2021, and 12% of consolidated revenues in each of 2020 and 2019.

Joint Venture Relationships—We participate in several manufacturing joint ventures in Saudi Arabia, Indonesia and Thailand. We hold majority interests and have operational control of the joint ventures in Indonesia. We do not hold majority interests in any of the remaining joint ventures, nor do we have operational control. These ventures provide us with additional production capacity of approximately 75 thousand tons of compounding and solutions. These capacities are based on our percentage ownership interest in the joint ventures' total capacities.

Raw Materials—The principal materials used in the production of our compounding and solutions products are polypropylene, polyethylene, polystyrene, nylon and titanium dioxide. Raw materials required for the production of our compounding and solutions products are obtained from our wholly owned or joint venture facilities and from a number of major plastic resin producers or other suppliers at market-based prices.

The principal raw materials used in the production of advanced polymers are ethylene, propylene and butene-1. Ethylene and propylene requirements that are not produced internally and externally-supplied butene-1 are acquired through long-term contracts with third party suppliers or via spot purchases.

Our ability to pass through the increased cost of raw materials to customers is dependent on global market demand. In general, the pricing for purchases and sales of most products is determined by global market forces.

Industry Dynamics / Competition—With respect to product competition, the market is influenced and based on a variety of factors, including price, product quality, product delivery, reliability of supply, product performance and customer service. We compete with regional and multinational marketers and producers of plastic resins and compounds.

Based on published capacity data and including our proportionate share of our joint ventures, we believe as of December 31, 2021, we were the largest global producer of polypropylene compounds.

Refining Segment

Overview—The primary products of our Refining segment are refined products made from heavy, high-sulfur crude oil and other crude oils of varied types and sources available on the U.S. Gulf Coast. These refined products include gasoline and distillates.

Sales & Marketing / Customers—The Houston refinery's products are primarily sold in bulk to other refiners, marketers, distributors and wholesalers at market-related prices. Most of the Houston refinery's products are sold under contracts with a term of one year or less or are sold in the spot market. The Houston refinery's products generally are transported to customers via pipelines and terminals owned and operated by other parties. The sales of refined products accounted for approximately 16% of our consolidated revenues in each of 2021 and 2020, and 22% of consolidated revenues in 2019.

Raw Materials—Our Houston refinery, which is located on the Houston Ship Channel in Houston, Texas, has a heavy, high-sulfur crude oil processing capacity of approximately 268 thousand barrels per day on a calendar day basis (normal operating basis), or approximately 292 thousand barrels per day on a stream day basis (maximum achievable over a 24-hour period). The Houston refinery is a full conversion refinery designed to refine heavy, high-sulfur crude oil. This crude oil is more viscous and denser than traditional crude oil and contains higher concentrations of sulfur and heavy metals, making it more difficult to refine into gasoline and other high-value fuel products. While heavy, high-sulfur crude oil has historically been less costly to purchase than light, low-sulfur crude oil, in recent years the price difference has narrowed. U.S. production is predominantly light sweet crude and much of the heavy crude has generally been imported from Canada, Mexico and other global producers, which has at times been subject to supply disruptions.

We purchase the crude oil used as a raw material for the Houston refinery on the open market on a spot basis and under a number of supply agreements with regional producers, generally with terms varying from one to two years.

Industry Dynamics / Competition—Our refining competitors are major integrated oil companies, refineries owned or controlled by foreign governments and independent domestic refiners. Based on published data, as of January 2021, there were 129 operable crude oil refineries in the U.S., and total U.S. refinery capacity was approximately 18 million barrels per day. During 2021, the Houston refinery processed an average of approximately 231 thousand barrels per day of heavy crude oil.

Our refining operations compete for the purchases of crude oil based on price and quality. Supply disruptions could impact the availability and pricing. We compete in gasoline and distillate markets as a bulk supplier of fungible products satisfying industry and government specifications. Competition is based on price and location.

The markets for fuel products tend to be volatile as well as cyclical due to supply and demand fundamentals and changing crude oil and refined product prices. Crude oil prices are impacted by worldwide political events, the economics of exploration and production and refined products demand. Prices and demand for fuel products are influenced by seasonal and short-term factors such as weather and driving patterns, as well as by longer term issues such as the economy, environmental concerns, energy conservation and alternative fuels. Industry fuel products supply is dependent on short-term industry operating capabilities and on long-term refining capacity.

A crack spread is a benchmark indication of refining margins based on the processing of a specific type of crude oil into an assumed selection of major refined products. The Houston refinery generally tracks the Maya 2-1-1 crack spread, which represents the difference between the current month U.S. Gulf Coast price of two barrels of Maya crude oil as set by Petróleos Mexicanos and one barrel each of U.S. Gulf Coast Reformulated Gasoline Blendstock for Oxygen Blending Gasoline and of U.S. Gulf Coast Ultra Low Sulfur Diesel. While these benchmark refining spreads are generally indicative of the level of profitability at the Houston refinery and similarly configured refineries, there are many other factors specific to each refinery and the industry in general, such as the value of refinery by-products, which influence operating results. Refinery by-products are products other than gasoline and distillates that represent about one-third of the total product volume, and include coke, sulfur, and lighter materials such as NGLs and crude olefins streams. The cost of Renewable Identification Numbers (“RINs”), which are renewable fuel credits mandated by the U.S. Environmental Protection Agency (the “EPA”), can also affect profitability.

Technology Segment

Overview—Our Technology segment develops and licenses chemical and polyolefin process technologies and manufactures and sells polyolefin catalysts. We market our process technologies and our polyolefin catalysts to external customers and also use them in our own manufacturing operations. Over the past three years, approximately 20% to 25% of our catalyst sales were sold internally to other segments.

Our polyolefin process licenses are structured to provide a standard core technology, with individual customer needs met by adding customized modules that provide the required capabilities to produce the defined production grade slate and plant capacity. In addition to the basic license agreement, a range of services can also be provided, including project assistance, training, assistance in starting up the plant and ongoing technical support after start-up. We may also offer marketing and sales services. In addition, licensees may continue to purchase polyolefin catalysts that are consumed in the production process, generally under long-term catalyst supply agreements with us.

Research and Development—Our research and development ("R&D") activities are designed to improve our existing products and processes, and discover and commercialize new materials, catalysts and processes. These activities focus on product and application development, process development, catalyst development and fundamental polyolefin-focused research.

In 2021, 2020 and 2019, our R&D expenditures were $124 million, $113 million and $111 million, respectively. A portion of these expenses are related to technical support and customer service and are allocated to the other business segments. In 2021, 2020 and 2019, approximately 45%, 45% and 50%, respectively, of all R&D costs were allocated to business segments other than Technology.

GENERAL

Intellectual Property

We maintain an extensive patent portfolio and continue to file new patent applications in the U.S. and other countries. As of December 31, 2021, we owned approximately 6,000 patents and patent applications worldwide. Our patents and trade secrets cover our processes, products and catalysts and are significant to our competitive position, particularly with regard to PO, intermediate chemicals, petrochemicals, polymers and our process technologies. While we believe that our intellectual property provides competitive advantages, we do not regard our businesses as being materially dependent upon any single patent, trade secret or trademark. Some of our production capacity operates under licenses from third parties.

Environmental

Most of our operations are affected by national, state, regional and local environmental laws. Matters pertaining to the environment are discussed in Part I, Item 1A. *Risk Factors*; Part I, Item 3. *Legal Proceedings*; Part II, Item 7. *Management's Discussion and Analysis of Financial Condition and Results of Operation*s; and Notes 2 and 17 to the Consolidated Financial Statements.

We have made, and intend to continue to make, the expenditures necessary for compliance with applicable laws and regulations relating to environmental, health and safety matters. We incurred capital expenditures of $198 million in 2021 for health, safety and environmental compliance purposes and improvement programs, and estimate such expenditures to be approximately $285 million in 2022 and $390 million in 2023.

While capital expenditures or operating costs for environmental compliance, including compliance with potential legislation and potential regulation related to climate change, cannot be predicted with certainty, we do not believe they will have a material effect on our competitive position in the near term.

While there can be no assurance that physical impacts to our facilities and supply chain due to climate change will not occur in the future, we do not believe these impacts are material in the near term.

Sustainability

LyondellBasell is taking action to help tackle the global challenges of eliminating plastic waste, addressing climate change, and supporting a thriving society. Our sustainability strategy identifies five pillars that frame our response to these challenges: end plastic waste in the environment; advance the circular economy; address climate change; grow sustainable solutions; and enhance our workplace, operations and communities.

In 2020, we announced our ambition to produce and market two million metric tons of recycled and renewable-based polymers annually by 2030. We are pursuing this goal by focusing on mechanical recycling, advanced (or molecular) recycling, and increased use of renewable feedstocks. In furtherance of this goal, in April 2021, the Company launched a new suite of products under the name *Circulen*, primarily enabling brand owners to improve the sustainability of consumer products. The LyondellBasell *Circulen* product family supports the reduction of plastic waste through the use of recycled content, and a lower carbon footprint through the use of renewable-based content as compared to feedstock from fossil-based sources, and includes: *Circulen*Recover (polymers made from plastic waste through a mechanical recycling process), *Circulen*Revive (polymers made using an advanced or molecular recycling process to convert plastic waste into feedstock to produce new polymers) and *Circulen*Renew (polymers made from renewable-based feedstock derived from bio-based wastes and residual oils, such as used cooking oils).

In September 2021 we announced our ambition of, and approach to, achieving net zero scope 1 and 2 emissions from global operations by 2050. As an interim step toward 2050, we also announced a strategy to achieve an absolute reduction of 30 percent in scope 1 and scope 2 emissions by 2030. These targets are consistent with efforts to support the Paris Agreement's goal of limiting climate change by achieving net zero for global greenhouse gas emissions by mid-century. Our approach to achieve our 2030 goals include reducing flare emissions, optimizing the use of energy in our operations, increasing our use of lower carbon intensive fuels and a minimum of 50 percent of electricity procured from renewable sources. Our ambition to achieve net zero by 2050 will also need to be enabled by the development and deployment of new technology, including those related to cracker electrification, the use of hydrogen, carbon capture and storage and carbon utilization, across the company's manufacturing footprint.

To achieve our targets, we expect capital spending in the future will include investments to support lowering emissions in our operations. We also anticipate incurring costs for environmental compliance, including compliance with potential legislation and potential regulation related to climate change. These projects are currently at various stages of evaluation or progress. We do not expect capital spending to support these ambitions over the next two years will represent a significant amount of total capital expenditures.

Human Capital

Our success as a company is tied to the passion, knowledge and talent of our global team. We focus on creating a work environment that is safe, respectful, inclusive and inspires employees to strive for excellence. We recognize that individuals cannot succeed alone; we believe in the power of many, placing emphasis on teamwork.

We reward performance based on personal, team and company results. We engage in open and ongoing dialogue with employees and their representatives to ensure a proper balance between the best interests of the Company and its employees. We provide all workers with fair wages and uphold all applicable fair wage laws, wherever we work. We never use child, forced, bonded or involuntary labor, and we do not knowingly work with subcontractors or suppliers who use child or forced labor or engage in human trafficking practices. In several of our locations, we partner with employee representatives on initiatives such as health and safety.

Our Code of Conduct sets out our expectations on topics such as respecting fellow employees, anti-corruption, conflicts of interest, trade compliance, anti-trust and competition law, insider trading, sanctions, misconduct and political donations. It is available in eighteen languages on our company website. New employees are trained on the Code and all employees receive annual refresher training. Our Supplier Code of Conduct expresses our expectations to our suppliers that they also comply with similar standards for conducting business ethically, providing for the safety of employees, and operating in an environmentally responsible manner. We also have a human rights policy that establishes our standards for workforce health and safety; prevention of discrimination, harassment and retaliation; diversity and inclusion; workplace security; working conditions and fair wages; freedom of association; freely chosen employment; and child labor protections.

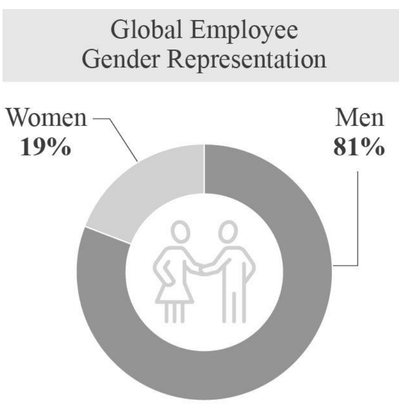
Safety, Employee Health and Well-Being—We are committed to providing a safe workplace, free from recognized hazards, and we comply with all applicable health and safety laws and recognized standards. GoalZERO is our commitment to operating safely and with a goal of zero incidents, zero injuries and zero accidents. We cultivate a GoalZERO mindset with clear standards, regular communication, training, and targeted campaigns and events, including our annual Global Safety Day.

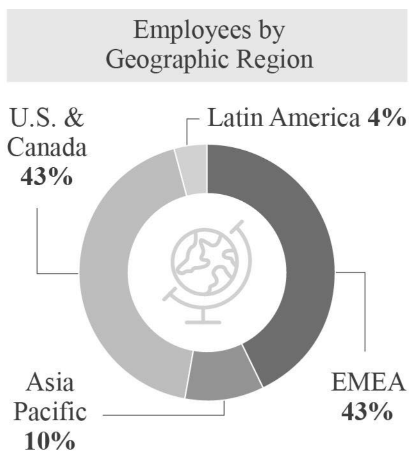
As the COVID-19 pandemic persisted for a second year, we continued to operate with three key objectives: protecting the health and safety of our people; ensuring the safety and security of our work locations; and maintaining business continuity with our customers and suppliers. In 2021, we supported employees in several ways. We expanded our global Employee Assistance Program, introduced US caregiver support services and provided a cash award for over 10,000 manufacturing employees globally recognizing their efforts on the front lines to keep our plants running safely and reliably throughout the challenges of the pandemic. We also launched an Advancing Immunity Campaign and incentives to maximize voluntary employee vaccinations. Further, we implemented new global flexible work policies.

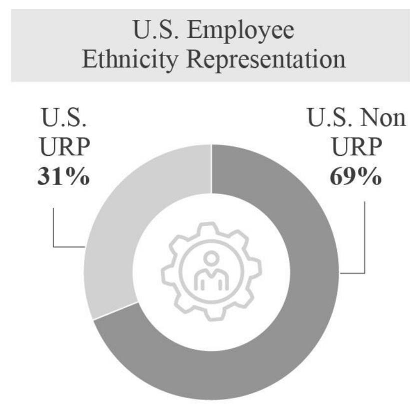
Talent Development and Engagement—Employee growth and development are key elements supporting our vision of superior performance. We provide development opportunities for our employees through on-the-job experiences, learning from others, and in-class and online learning. In 2021, completion of e-learning training by employees increased by 33%. We continued our investment in developing future leaders through regular talent reviews, robust succession planning, and leadership development programs; including accelerated development academies and career planning targeted at our high potential leaders. We encourage high performance and alignment with business goals through our performance management program which includes annual goal setting, performance conversations throughout the year, and a year-end process to measure performance against goals. Employees are measured not only on results delivered, but how they are delivered based on established enterprise-wide competencies.

We regularly collect employee feedback to improve the employee experience and strengthen our culture. In 2021, both enterprise-wide and leader action plans were implemented with focus on improving diversity and flexible work practices. A pulse survey was completed to monitor progress.

Demographics—As of December 31, 2021 we had 19,100 employees. Our employee demographics, excluding temporary employees, consisted of the following:







U.S. Underrepresented includes employees who self-identify as Hispanic or Latino, Black or African American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, or two or more races. Employees who self-identify as White or Caucasian are considered U.S. Non-Underrepresented.

Diversity, Equity, Inclusion ("DEI")—DEI is a key driver to achieving our business and sustainability ambitions. We are committed to increasing diversity and fostering an inclusive work environment that supports our global workforce and the communities we serve. Our strategic DEI efforts are personally overseen by the executive leadership team and directed by the Chief Talent & DEI Officer and a Leadership Council comprised of seventeen senior leaders representing businesses, functions and regions across the globe.

In 2021, we advanced our DEI efforts significantly by launching several new talent programs. To attract and advance diverse talent, we focused on mentoring and talent moves, sourced more diverse candidates externally, increased internal job posting transparency and expanded diverse interview panel practices.

We implemented an annual equity audit of pay and performance practices to minimize any unintended bias in our rewards programs and performance evaluations and promote a sense of fairness for all employees.

As part of our work on building an inclusive culture, 9,500 employees completed required diversity training. This year, we also launched four new employee networks representative of the Company's diverse workforce. These networks are organized around diverse groups including women, black employees, LGBTQ+ employees, and early career professionals. Senior leaders serve as executive sponsors for each network. In 2021, our global employee participation rate in the employee networks was seventeen percent.

INFORMATION ABOUT OUR EXECUTIVE OFFICERS

Our executive officers as of February 24, 2022 were as follows:

Name and Age	Significant Experience
Kenneth ("Ken") Lane, 53	Interim Chief Executive Officer since January 2022. Executive Vice President, Global Olefins and Polyolefins since July 2019. President, Monomers Division at BASF, a German chemical company, from January 2019 to July 2019. President, Global Catalysts at BASF from June 2013 to December 2018.
Michael C. McMurray, 57	Executive Vice President and Chief Financial Officer since November 2019. Senior Vice President and Chief Financial Officer at Owens Corning, a global manufacturer of insulation, roofing and fiberglass composites, from August 2012 to November 2019.
James Guilfoyle, 51	Executive Vice President, Advanced Polymer Solutions & Global Supply Chain since July 2018. Senior Vice President, Global Intermediates & Derivatives and Global Supply Chain from February 2017 to July 2018. Senior Vice President, Global Intermediates & Derivatives from June 2015 to February 2017. Vice President of Global Propylene Oxide and Co-Products from March 2015 to May 2015. Director of Polymer Sales Americas from January 2012 to February 2015.
Jeffrey Kaplan, 53	Executive Vice President, Legal & Public Affairs and Chief Legal Officer since March 2015. Deputy General Counsel from December 2009 to March 2015.
Torkel Rhenman, 58	Executive Vice President, Intermediates & Derivatives, and Refining since August 2020. Executive Vice President, Intermediates & Derivatives from July 2019 to July 2020. Chief Executive Officer and Director of Lhoist Group, a privately held minerals and mining company, from 2012 to 2017.

Name and Age	Significant Experience
Kim Foley, 55	Senior Vice President, HSE, Global Engineering and Turnarounds since August 2020.
	Vice President, Health, Safety and Environment from October 2019 to July 2020.
	Site Manager at Channelview from May 2017 to October 2019.
	Senior Director, Global Supply Chain from January 2016 to May 2017.
	Director, Supply Chain, Americas from August 2010 to January 2016.
Dale Friedrichs, 58	Senior Vice President, Human Resources and Global Projects since August 2020.
	Vice President, Human Resources from October 2019 to July 2020.
	Vice President, Health, Safety, Environment and Security from February 2017 to October 2019.
	Site Manager of various facilities from January 1995 to February 2017.
James Seward, 54	Senior Vice President, Research & Development, Technology and Sustainability since August 2020.
	Senior Vice President, Technology Business, Sustainability, and Olefins & Polyolefins, Europe, Asia and International Joint Venture Management from September 2018 to July 2020.
	Vice President, Joint Ventures and International Marketing from May 2014 to August 2018.
Anup Sharma, 47	Senior Vice President, Global Business Services since February 2019.
	Vice President and GE corporate officer at GE Digital, a software company for industrial businesses, from May 2016 to February 2019.
	Global Chief Information Officer at GE Oil & Gas, a division of General Electric that owned investments in the petroleum industry, from 2011 to 2016.

Description of Properties

Our principal manufacturing facilities as of December 31, 2021 are set forth below and are identified by the principal segment or segments using the facility. All of the facilities are wholly owned, except as otherwise noted.

Location	Segment
Americas	
Bayport (Pasadena), Texas	I&D
Bayport (Pasadena), Texas(1)	I&D
Bayport (Pasadena), Texas	O&P–Americas
Channelview, Texas	O&P–Americas
Channelview, Texas(1)(2)	I&D
Chocolate Bayou, Texas	O&P–Americas
Clinton, Iowa	O&P–Americas
Corpus Christi, Texas	O&P–Americas
Edison, New Jersey	O&P–Americas
Houston, Texas	Refining
La Porte, Texas(3)	O&P–Americas
La Porte, Texas(3)	I&D
Lake Charles, Louisiana	O&P–Americas
Lake Charles, Louisiana(4)†	O&P–Americas
Matagorda, Texas	O&P–Americas
Morris, Illinois	O&P–Americas
Victoria, Texas†	O&P–Americas
Europe	
Berre l'Etang, France	O&P–EAI
Botlek, Rotterdam, The Netherlands†	I&D
Brindisi, Italy	O&P–EAI
Carrington, UK†	O&P–EAI
Ferrara, Italy	O&P–EAI Technology
Fos-sur-Mer, France†	I&D
Frankfurt, Germany†	O&P–EAI Technology
Knapsack, Germany†	O&P–EAI APS
Kerpen, Germany	APS
Ludwigshafen, Germany†	Technology
Maasvlakte, The Netherlands(5)†	I&D
Moerdijk, The Netherlands†	APS
Münchsmünster, Germany	O&P–EAI
Tarragona, Spain(6)†	O&P–EAI APS
Wesseling, Germany	O&P–EAI

Location	Segment
Asia-Pacific	
Geelong, Australia†	O&P–EAI
Panjin, China[7]†	O&P–EAI

† The facility is located on leased land.

(1) The Bayport PO/TBA plants and the Channelview PO/SM I plant are held by the U.S. PO joint venture between Covestro and Lyondell Chemical Company. These plants are located on land leased by the U.S. PO joint venture.

(2) Equistar Chemicals, LP operates a polybutadiene unit, which is owned by an unrelated party and is located within the Channelview facility on property leased from Equistar Chemicals, LP.

(3) The La Porte facilities are on contiguous property.

(4) The Lake Charles site is owned by the Louisiana joint venture and is located on land leased by the Louisiana joint venture.

(5) The Maasvlakte plant is owned by the European PO joint venture and is located on land leased by the European PO joint venture.

(6) The Tarragona PP facility is located on leased land; the compounds facility is located on co-owned land.

(7) The Panjin facility is owned by the Bora LyondellBasell Petrochemical Co., Ltd. joint venture and is located on land leased by the joint venture.

Other Locations and Properties

We maintain executive offices in London, the United Kingdom; Rotterdam, The Netherlands; Houston, Texas and Hong Kong, China. We maintain research facilities in Lansing, Michigan; Channelview, Texas; Cincinnati, Ohio; Ferrara, Italy and Frankfurt, Germany. Our Asia-Pacific headquarters are in Hong Kong. We also have technical support centers in Bayreuth, Germany; Geelong, Australia and Tarragona, Spain. We have various sales facilities worldwide.

Website Access to SEC Reports

Our Internet website address is *http://www.LyondellBasell.com*. Information contained on our Internet website is not part of this report on Form 10-K.

Our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and any amendments to these reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934 are available on our website, free of charge, as soon as reasonably practicable after such reports are filed with, or furnished to, the U.S. Securities and Exchange Commission ("SEC"). Alternatively, these reports may be accessed at the SEC's website at *http://www.sec.gov.*

Item 1A. Risk Factors.

You should carefully consider the following risk factors in addition to the other information included in this Annual Report on Form 10-K. Each of these risk factors could adversely affect our business, operating results and financial condition, as well as adversely affect the value of an investment in our common stock.

Risks Related to our Business and Industry

The cyclicality and volatility of the industries in which we participate may cause significant fluctuations in our operating results.

Our business operations are subject to the cyclical and volatile nature of the supply-demand balance in the chemical and refining industries. Our future operating results are expected to continue to be affected by this cyclicality and volatility. The chemical and refining industries historically have experienced alternating periods of capacity shortages, causing prices and profit margins to increase, followed by periods of excess capacity, resulting in oversupply, declining capacity utilization rates and declining prices and profit margins.

In addition to changes in the supply and demand for products, changes in energy prices and other worldwide economic conditions can cause volatility. These factors result in significant fluctuations in profits and cash flow from period to period and over business cycles.

New capacity additions around the world may lead to periods of oversupply and lower profitability. The timing and extent of any changes to currently prevailing market conditions are uncertain and supply and demand may be unbalanced at any time. As a consequence, we are unable to accurately predict the extent or duration of future industry cycles or their effect on our business, financial condition or results of operations.

A sustained decrease in the price of crude oil may adversely impact the results of our operations, primarily in North America.

Energy costs generally follow price trends of crude oil and natural gas. These price trends may be highly volatile and cyclical. In the past, raw material and energy costs have experienced significant fluctuations that adversely affected our business segments' results of operations. For example, we have benefited from the favorable ratio of U.S. crude oil prices to natural gas prices in the past. If the price of crude oil remains lower relative to U.S. natural gas prices or if the demand for natural gas and NGLs increases, this may have a negative impact on our results of operations.

Costs and limitations on supply of raw materials and energy may result in increased operating expenses.

The costs of raw materials and energy represent a substantial portion of our operating expenses. Due to the significant competition we face and the commodity nature of many of our products we are not always able to pass on raw material and energy cost increases to our customers. When we do have the ability to pass on the cost increases, we are not always able to do so quickly enough to avoid adverse impacts on our results of operations.

Cost increases for raw materials, energy, or broad-based price inflation, also may increase working capital needs, which could reduce our liquidity and cash flow. Even if we are able to increase our sales prices to reflect these increases, demand for products may decrease as consumers and customers reduce their consumption or use substitute products, which may have an adverse impact on our results of operations. In addition, producers in natural gas cost-advantaged regions, such as the Middle East and North America, benefit from the lower prices of natural gas and NGLs. Competition from producers in these regions may cause us to reduce exports from Europe and elsewhere. Any such reductions may increase competition for product sales within Europe and other markets, which can result in lower margins in those regions.

For some of our raw materials and utilities there are a limited number of suppliers and, in some cases, the supplies are specific to the particular geographic region in which a facility is located. It is also common in the chemical and refining industries for a facility to have a sole, dedicated source for its utilities, such as steam, electricity and gas. Having a sole or limited number of suppliers may limit our negotiating power, particularly in the case of rising raw material costs. Any new supply agreements we enter into may not have terms as favorable as those contained in our current supply agreements.

Additionally, there is growing concern over the reliability of water sources, including around the U.S. Gulf Coast where several of our facilities are located. The decreased availability or less favorable pricing for water as a result of population growth, drought or regulation could negatively impact our operations, including by impacting our ability to produce or transport our products.

If our raw material or utility supplies were disrupted, our businesses may incur increased costs to procure alternative supplies or incur excessive downtime, which would have a negative impact on plant operations. Disruptions of supplies may occur as a result of transportation issues resulting from natural disasters, water levels, and interruptions in marine water routes, among other causes, that can affect the operations of vessels, barges, rails, trucks and pipeline traffic. These risks are particularly prevalent in the U.S. Gulf Coast area. Additionally, increasing exports of NGLs and crude oil from the U.S. or greater restrictions on hydraulic fracturing could restrict the availability of our raw materials, thereby increasing our costs.

With increased volatility in raw material costs, our suppliers could impose more onerous terms on us, resulting in shorter payment cycles and increasing our working capital requirements.

Our ability to source raw materials may be adversely affected by political instability, civil disturbances or other governmental actions.

We obtain a portion of our principal raw materials from sources in the Middle East and Central and South America that may be less politically stable than other areas in which we conduct business. Political instability, civil disturbances and actions by governments in these areas are more likely to substantially increase the price and decrease the supply of raw materials necessary for our operations, which could have a material adverse effect on our results of operations.

Incidents of civil unrest, including terrorist attacks and demonstrations that have been marked by violence, have occurred in a number of countries in the Middle East and South America. Some political regimes in these countries are threatened or have changed as a result of such unrest. Political instability and civil unrest could continue to spread in the region and involve other areas. Such unrest, if it continues to spread or grow in intensity, could lead to civil wars, regional conflicts or regime changes resulting in governments that are hostile to countries in which we conduct substantial business, such as in the U.S., Europe or their respective trading partners.

Our business is capital intensive and we rely on cash generated from operations and external financing to fund our growth and ongoing capital needs. Limitations on access to external financing could adversely affect our operating results.

We require significant capital to operate our current business and fund our growth strategy. Moreover, interest payments, dividends, capital requirements of our joint ventures, the expansion of our current business or other business opportunities may require significant amounts of capital. If we need external financing, our access to credit markets and pricing of our capital is dependent upon maintaining sufficient credit ratings from credit rating agencies and the state of the capital markets generally. There can be no assurances that we would be able to incur indebtedness on terms we deem acceptable, and it is possible that the cost of any financings could increase significantly, thereby increasing our expenses and decreasing our net income. If we are unable to generate sufficient cash flow or raise adequate external financing, including as a result of significant disruptions in the global credit markets, we could be forced to restrict our operations and growth opportunities, which could adversely affect our operating results.

We may use our $3,250 million revolving credit facility, which backs our commercial paper program, to meet our cash needs, to the extent available. As of December 31, 2021, we had no borrowings or letters of credit outstanding under the facility and $204 million, net of discount, outstanding under our commercial paper program, leaving an unused and available credit capacity of $3,046 million. We may also meet our cash needs by selling receivables under our $900 million U.S. Receivables Facility. As of December 31, 2021, we had availability of $900 million under this facility. In the event of a default under our credit facilities or any of our senior notes, we could be required to immediately repay all outstanding borrowings and make cash deposits as collateral for all obligations the facility supports, which we may not be able to do. Any default under any of our credit arrangements could cause a default under many of our other credit agreements and debt instruments. Without waivers from lenders party to those agreements, any such default could have a material adverse effect on our ability to continue to operate.

Risks Related to our Operations

Our operations are subject to risks inherent in chemical and refining businesses, and we could be subject to liabilities for which we are not fully insured or that are not otherwise mitigated.

We maintain property, business interruption, product, general liability, casualty and other types of insurance that we believe are appropriate for our business and operations as well as in line with industry practices. However, we are not fully insured against all potential hazards incident to our business, including losses resulting from natural disasters or climate-related exposures, wars or terrorist acts. Changes in insurance market conditions have caused, and may in the future cause, premiums and deductibles for certain insurance policies to increase substantially and, in some instances, for certain insurance to become unavailable or available only for reduced amounts of coverage. If we were to incur a significant liability for which we were not fully insured, we might not be able to finance the amount of the uninsured liability on terms acceptable to us or at all, and might be obligated to divert a significant portion of our cash flow from normal business operations.

Our business, including our results of operations and reputation, could be adversely affected by safety or product liability issues.

Failure to appropriately manage safety, human health, product liability and environmental risks associated with our products, product life cycles and production processes could adversely impact employees, communities, stakeholders, our reputation and our results of operations. Public perception of the risks associated with our products and production processes could impact product acceptance and influence the regulatory environment in which we operate. While we have procedures and controls to manage safety risks, issues could be created by events outside of our control, including natural disasters, severe weather events and acts of sabotage.

Further, because a part of our business involves licensing polyolefin process technology, our licensees are exposed to similar risks involved in the manufacture and marketing of polyolefins. Hazardous incidents involving our licensees, if they do result or are perceived to result from use of our technologies, may harm our reputation, threaten our relationships with other licensees and/or lead to customer attrition and financial losses. Our policy of covering these risks through contractual limitations of liability and indemnities and through insurance may not always be effective. As a result, our financial condition and results of operation would be adversely affected, and other companies with competing technologies may have the opportunity to secure a competitive advantage.

Interruptions of operations at our facilities may result in increased liabilities or lower operating results.

We own and operate large-scale facilities. Our operating results are dependent on the continued operation of our various production facilities and the ability to complete construction and maintenance projects on schedule. Interruptions at our facilities may materially reduce the productivity and profitability of a particular manufacturing facility, or our business as a whole, during and after the period of such operational difficulties. In recent years, we have had to shut down plants on the U.S. Gulf Coast, including the temporary shutdown of a portion of our Houston refinery, as a result of various hurricanes striking Texas and Louisiana. In addition, because the Houston refinery is our only refining operation, an outage at the refinery could have a particularly negative impact on our operating results as we do not have the ability to increase refining production elsewhere.

Although we take precautions to enhance the safety of our operations and minimize the risk of disruptions, our operations are subject to hazards inherent in chemical manufacturing and refining and the related storage and transportation of raw materials, products and wastes. These potential hazards include:

- pipeline leaks and ruptures;
- explosions;
- fires;
- severe weather and natural disasters;
- mechanical failure;
- unscheduled downtimes;
- supplier disruptions;
- labor shortages or other labor difficulties;
- transportation interruptions;
- remediation complications;
- increased restrictions on, or the unavailability of, water for use at our manufacturing sites or for the transport of our products or raw materials;
- chemical and oil spills;
- discharges or releases of toxic or hazardous substances or gases;
- shipment of incorrect or off-specification product to customers;
- storage tank leaks;
- other environmental risks; and
- cyber attack or other terrorist acts.

Some of these hazards may cause severe damage to or destruction of property and equipment or personal injury and loss of life and may result in suspension of operations or the shutdown of affected facilities.

Large capital projects can take many years to complete, and market conditions could deteriorate significantly between the project approval date and the project startup date, negatively impacting project returns. If we are unable to complete capital projects at their expected costs and in a timely manner, or if the market conditions assumed in our project economics deteriorate, our business, financial condition, results of operations and cash flows could be materially and adversely affected.

Delays or cost increases related to capital spending programs involving engineering, procurement and construction of facilities could materially adversely affect our ability to achieve forecasted internal rates of return and operating results. For example, higher costs arising from the delayed construction of our world-scale PO/TBA plant in Houston due to COVID-19, more extensive civil construction, and unexpected tariffs on materials are expected to add approximately 40 to 50% to our original cost estimate for the project, impacting our projected rate of return on the project. Delays in making required changes or upgrades to our facilities could subject us to fines or penalties as well as affect our ability to contract with our customers and supply certain products we produce. Such delays or cost increases may arise as a result of unpredictable factors, many of which are beyond our control, including:

- denial of or delay in receiving requisite regulatory approvals and/or permits;
- unplanned increases in the cost of construction materials or labor;
- disruptions in transportation of components or construction materials;

- adverse weather conditions, natural disasters or other events (such as equipment malfunctions, explosions, fires or spills) affecting our facilities, or those of vendors or suppliers;
- shortages of sufficiently skilled labor, or labor disagreements resulting in unplanned work stoppages; and
- nonperformance by, or disputes with, vendors, suppliers, contractors or subcontractors.

Any one or more of these factors could have a significant impact on our ongoing capital projects. If we were unable to make up the delays associated with such factors or to recover the related costs, or if market conditions change, it could materially and adversely affect our business, financial condition, results of operations and cash flows.

Shared control or lack of control of joint ventures may delay decisions or actions regarding our joint ventures.

A portion of our operations are conducted through joint ventures, where control may be exercised by or shared with unaffiliated third parties. We cannot control the actions or ownership of our joint venture partners, including any nonperformance, default or bankruptcy of joint venture partners. The joint ventures that we do not control may also lack financial reporting systems to provide adequate and timely information for our reporting purposes.

Our joint venture partners may have different interests or goals than we do and may take actions contrary to our requests, policies or objectives. Differences in views among the joint venture participants also may result in delayed decisions or in failures to agree on major matters, potentially adversely affecting the business and operations of the joint ventures and in turn our business and operations. We may develop a dispute with any of our partners over decisions affecting the venture that may result in litigation, arbitration or some other form of dispute resolution. If a joint venture participant acts contrary to our interest, it could harm our brand, business, results of operations and financial condition.

We may be required to record material charges against our earnings due to any number of events that could cause impairments to our assets.

We may be required to reduce production or idle facilities for extended periods of time or exit certain businesses as a result of the cyclical nature of our industry. Specifically, oversupplies of or lack of demand for particular products or high raw material prices may cause us to reduce production. We may choose to reduce production at certain facilities because we have off-take arrangements at other facilities, which make any reductions or idling unavailable at those facilities. Any decision to permanently close facilities or exit a business would likely result in impairment and other charges to earnings. For example, in the fourth quarter of 2021, our Refining segment recognized a non-cash impairment charge of $624 million related to our Houston refinery driven by our ongoing evaluation of strategic options for the Houston refinery.

Temporary outages at our facilities can last for several quarters and sometimes longer. These outages could cause us to incur significant costs, including the expenses of maintaining and restarting these facilities. In addition, we have significant obligations under take-or-pay agreements. Even though we may reduce production at facilities, we may be required to continue to purchase or pay for utilities or raw materials under these arrangements.

Integration of acquisitions could disrupt our business and harm our financial condition and stock price.

We have made and may continue to make acquisitions in order to enhance our business. Acquisitions involve numerous risks, including meeting our standards for compliance, problems combining the purchased operations, technologies or products, unanticipated costs and liabilities, diversion of management's attention from our core businesses, and potential loss of key employees.

There can be no assurance that we will be able to integrate successfully any businesses, products, technologies, or personnel that we might acquire. The integration of businesses that we may acquire is likely to be a complex, time-consuming, and expensive process and we may not realize the anticipated revenues, synergies, or other benefits associated with our acquisitions if we do not manage and operate the acquired business up to our expectations. If we are unable to efficiently operate as a combined organization utilizing common information and communication systems, operating procedures, financial controls, and human resources practices, our business, financial condition, and results of operations may be adversely affected.

Risks related to the Global Economy and Multinational Operations

Economic disruptions and downturns in general, and particularly continued global economic uncertainty or economic turmoil in emerging markets, could have a material adverse effect on our business, prospects, operating results, financial condition and cash flows.

Our results of operations can be materially affected by adverse conditions in the financial markets and depressed economic conditions generally. Economic downturns in the businesses and geographic areas in which we sell our products could substantially reduce demand for our products and result in decreased sales volumes and increased credit risk. Recessionary environments adversely affect our business because demand for our products is reduced, particularly from our customers in industrial markets generally and the automotive and housing industries specifically, and may result in higher costs of capital. A significant portion of our revenues and earnings are derived from our business in Europe. In addition, most of our European transactions and assets, including cash reserves and receivables, are denominated in euros.

We also derive significant revenues from our business in emerging markets, particularly the emerging markets in Asia and South America. Any broad-based downturn in these emerging markets, or in a key market such as China, could require us to reduce export volumes into these markets and could also require us to divert product sales to less profitable markets. Any of these conditions could ultimately harm our overall business, prospects, operating results, financial condition and cash flows.

We sell products in highly competitive global markets and face significant price pressures.

We sell our products in highly competitive global markets. Due to the commodity nature of many of our products, competition in these markets is based primarily on price and, to a lesser extent, on product performance, product quality, product deliverability, reliability of supply and customer service. Often, we are not able to protect our market position for these products by product differentiation and may not be able to pass on cost increases to our customers due to the significant competition in our business.

In addition, we face increased competition from companies that may have greater financial resources and different cost structures or strategic goals than us. These include large integrated oil companies (some of which also have chemical businesses), government-owned businesses, and companies that receive subsidies or other government incentives to produce certain products in a specified geographic region. Continuing competition from these companies, especially in our olefin and refining businesses, could limit our ability to increase product sales prices in response to raw material and other cost increases, or could cause us to reduce product sales prices to compete effectively, which would reduce our profitability. Competitors with different cost structures or strategic goals than we have may be able to invest significant capital into their businesses, including expenditures for research and development. In addition, specialty products we produce may become commoditized over time. Increased competition could result in lower prices or lower sales volumes, which would have a negative impact on our results of operations.

We operate internationally and are subject to exchange rate fluctuations, exchange controls, political risks and other risks relating to international operations.

We operate internationally and are subject to the risks of doing business on a global level. These risks include fluctuations in currency exchange rates, economic instability and disruptions, restrictions on the transfer of funds and the imposition of trade restrictions or duties and tariffs, and complex regulations concerning privacy and data security. Additional risks from our multinational business include transportation delays and interruptions, war, terrorist activities, epidemics, pandemics, political instability, import and export controls, sanctions, changes in governmental policies, labor unrest and current and changing regulatory environments.

We generate revenues from export sales and operations that may be denominated in currencies other than the relevant functional currency. Exchange rates between these currencies and functional currencies in recent years have fluctuated significantly and may do so in the future. It is possible that fluctuations in exchange rates will result in reduced operating results. Additionally, we operate with the objective of having our worldwide cash available in the locations where it is needed, including the United Kingdom for our parent company's significant cash obligations as a result of dividend payments. It is possible that we may not always be able to provide cash to other jurisdictions when needed or that such transfers of cash could be subject to additional taxes, including withholding taxes.

Our operating results could be negatively affected by the laws, rules and regulations, as well as political environments, in the jurisdictions in which we operate. There could be reduced demand for our products, decreases in the prices at which we can sell our products and disruptions of production or other operations. Trade protection measures such as quotas, duties, tariffs, safeguard measures or anti-dumping duties imposed in the countries in which we operate could negatively impact our business. Additionally, there may be substantial capital and other costs to comply with regulations and/or increased security costs or insurance premiums, any of which could reduce our operating results.

We obtain a portion of our principal raw materials from international sources that are subject to these same risks. Our compliance with applicable customs, currency exchange control regulations, transfer pricing regulations or any other laws or regulations to which we may be subject could be challenged. Furthermore, these laws may be modified, the result of which may be to prevent or limit subsidiaries from transferring cash to us.

Furthermore, we are subject to certain existing, and may be subject to possible future, laws that limit or may limit our activities while some of our competitors may not be subject to such laws, which may adversely affect our competitiveness.

Changes in tax laws and regulations could affect our tax rate and our results of operations.

We are a tax resident in the United Kingdom and are subject to the United Kingdom corporate income tax system. LyondellBasell Industries N.V. has little or no taxable income of its own because, as a holding company, it does not conduct any operations. Through our subsidiaries, we have substantial operations world-wide. Taxes are primarily paid on the earnings generated in various jurisdictions where our subsidiaries operate, including the U.S., The Netherlands, Germany, France and Italy.

There continues to be increased attention to the tax practices of multinational companies, including U.S tax reform proposals, European Union's state aid investigations, Pillar One and Two proposals by the Organization for Economic Cooperation and Development ("OECD") with respect to base erosion and profit shifting, and European Union tax directives and their implementation. Although certain actions have occurred, there continues to be uncertainty as to the enactment and implementation of U.S. tax reform proposals and the OECD's Pillars One and Two. We continue to monitor these and other proposed tax law changes as they could increase our tax liabilities in the future, if enacted.

Risks Related to Health, Safety, and the Environment

We cannot predict with certainty the extent of future costs under environmental, health and safety and other laws and regulations, and cannot guarantee they will not be material.

We may face liability arising out of the normal course of business, including alleged personal injury or property damage due to exposure to chemicals or other hazardous substances at our current or former facilities or chemicals that we manufacture, handle or own. In addition, because our products are components of a variety of other end-use products, we, along with other members of the chemical industry, are subject to potential claims related to those end-use products. Any substantial increase in the success of these types of claims could negatively affect our operating results.

We are subject to extensive national, regional, state and local environmental laws, regulations, directives, rules and ordinances concerning:

- emissions to the air;
- discharges onto land or surface waters or into groundwater; and
- the generation, handling, storage, transportation, treatment, disposal and remediation of hazardous substances and waste materials.

Many of these laws and regulations provide for substantial fines and potential criminal sanctions for violations. Some of these laws and regulations are subject to varying and conflicting interpretations. In addition, some of these laws and regulations require us to meet specific financial responsibility requirements. Any substantial liability for environmental damage could have a material adverse effect on our financial condition, results of operations and cash flows.

Although we have compliance programs and other processes intended to ensure compliance with all such regulations, we are subject to the risk that our compliance with such regulations could be challenged. Non-compliance with certain of these regulations could result in the incurrence of additional costs, penalties or assessments that could be material.

Our industry is subject to extensive government regulation, and existing, or future regulations may restrict our operations, increase our costs of operations or require us to make additional capital expenditures.

Compliance with regulatory requirements will result in higher operating costs, such as regulatory requirements relating to emissions, the security of our facilities, and the transportation, export or registration of our products. We generally expect that regulatory controls worldwide will become increasingly more demanding, but cannot accurately predict future developments.

Increasingly strict environmental laws and inspection and enforcement policies, could affect the handling, manufacture, use, emission or disposal of products, other materials or hazardous and non-hazardous waste. Stricter environmental, safety and health laws, regulations and enforcement policies could result in increased operating costs or capital expenditures to comply with such laws and regulations. Additionally, we are required to have permits for our businesses and are subject to licensing regulations. These permits and licenses are subject to renewal, modification and in some circumstances, revocation. Further, the permits and licenses are often difficult, time consuming and costly to obtain and could contain conditions that limit our operations.

We may incur substantial costs to comply with climate change legislation and related regulatory initiatives.

There has been a broad range of proposed or promulgated international, national and state laws focusing on greenhouse gas ("GHG") reduction. These proposed or promulgated laws apply or could apply in countries where we have interests or may have interests in the future. Laws and regulations in this field continue to evolve and, while they are likely to be increasingly widespread and stringent, at this stage it is not possible to accurately estimate either a timetable for implementation or our future compliance costs relating to implementation. Under the 2015 Paris Agreement, parties to the United Nations Framework Convention on Climate Change agreed to undertake ambitious efforts to reduce GHG emissions and strengthen adaptation to the effects of climate change. In February 2021, the U.S. recommitted to the Paris Agreement after having withdrawn in August 2017. Other regions in which we operate, including, in particular, the European Union, are preparing national legislation and protection plans to implement their emission reduction commitments under the Agreement. In December 2019, the European Union member countries endorsed the objective to make the European Union climate-neutral by 2050 and a year later agreed to cut GHG emissions by at least 55% by 2030 (compared with 1990). Both commitments were enshrined in June 2021 in the European Union Climate Law. In addition, Non-Governmental Organizations have been active in filing lawsuits against governments and private parties in various jurisdictions around the world seeking enforcement of existing laws and new requirements to reduce GHG emissions. In one case decided in the Netherlands in May 2021, plaintiffs obtained a ruling ordering Royal Dutch Shell to reduce its Scope 1, 2 and 3 CO2 emissions by 45% by 2030. These types of laws, regulations, and litigation results could increase the cost of purchased energy and increase costs of compliance in various locations.

Our operations in Europe participate in the European Union Emissions Trading System ("ETS") and we purchase annual emission allowances to meet our obligations. Following the adoption of the Climate Law, additional legislation is proposed to meet the new 2030 goals. In light of these changes resulting from the commencement of ETS Phase IV in 2021, we expect to incur additional costs in relation to future carbon or GHG emission trading schemes.

In the U.S., the EPA promulgated federal GHG regulations under the Clean Air Act affecting certain sources. The EPA issued mandatory GHG reporting requirements, requirements to obtain GHG permits for certain industrial plants and GHG performance standards for some facilities. Addressing climate change is a stated priority of President Biden and as such additional regulations and legislation are likely to be forthcoming at the U.S. federal or state level that could result in increased operating costs for compliance, or required acquisition or trading of emission allowances. Additionally, demand for the products we produce may be reduced.

Compliance with these regulations may result in increased permitting necessary for the operation of our business or for any of our growth plans. Difficulties in obtaining such permits could have an adverse effect on our future growth. Therefore, any future potential regulations, legislation, or litigation results could impose additional operating restrictions or delays in implementing growth projects or other capital investments, require us to incur increased costs, and could have a material adverse effect on our business and results of operations.

Legislation and regulatory initiatives could lead to a decrease in demand for our products.

New or revised governmental regulations and independent studies relating to the effect of our products on health, safety and the environment may affect demand for our products and the cost of producing our products. Initiatives by governments and private interest groups will potentially require increased toxicological testing and risk assessments of a wide variety of chemicals, including chemicals used or produced by us. For example, in the United States, the National Toxicology Program ("NTP") is a federal interagency program that seeks to identify and select for study chemicals and other substances to evaluate potential human health hazards. In the European Union, the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals ("REACH") is regulation designed to identify the intrinsic properties of chemical substances, assess hazards and risks of the substances, and identify and implement the risk management measures to protect humans and the environment. In October 2020, the European Commission published a Chemicals Strategy for Sustainability, which set forth plans for introducing significant changes to REACH that could result in additional restrictions on chemicals used or produced by us.

Assessments under NTP, REACH or similar programs or regulations in other jurisdictions may result in heightened concerns about the chemicals we use or produce and may result in additional requirements being placed on the production, handling, labeling or use of those chemicals. Such concerns and additional requirements could also increase the cost incurred by our customers to use our chemical products and otherwise limit the use of these products, which could lead to a decrease in demand for these products. Such a decrease in demand could have an adverse impact on our business and results of operations.

The physical impacts of climate change can negatively impact our facilities and operations.

Potential physical impacts of climate change include increased frequency and severity of hurricanes and floods as well as freezing conditions, tornadoes, and global sea level rise. Although we have preparedness plans in place designed to minimize impacts and enhance safety, should an event occur, it could have the potential to disrupt our supply chain and operations. A number of our facilities are located on the U.S. Gulf Coast, which has been impacted by hurricanes that have required us to temporarily shut down operations at those sites. Our sites rely on rivers for transportation that may experience restrictions in times of drought or other unseasonal weather variation. In addition, scarcity of water and drought conditions due to climate change could reduce the availability of fresh water needed to produce our products which could increase our costs of operations.

Increased regulation or deselection of plastic could lead to a decrease in demand growth for some of our products.

There is a growing concern with the accumulation of plastic, including microplastics, and other packaging waste in the environment. Additionally, plastics have recently faced increased public backlash and scrutiny. Policy measures to address this concern are being discussed or implemented by governments at all levels. In 2019, the international treaty governing transboundary shipments of waste, the Basel Convention, was amended to clarify its applicability to plastic waste. The European Commission has been undertaking a series of actions under its Strategy for Plastics in a Circular Economy, including adoption of the Single Use Plastics Directive in 2019, which introduced policy measures for single use plastics including bans, product design requirements, extended producer responsibility obligations, and labeling requirements. Member states were required to transpose these measures into national law by July 2021. In addition, a host of single-use plastic bans and taxes have been passed by countries around the world and counties and municipalities throughout the U.S. Increased regulation of, or prohibition on, the use of certain plastic products could increase the costs incurred by our customers to use such products or otherwise limit the use of these products, and could lead to a decrease in demand for PE, PP, and other products we make. Such a decrease in demand could adversely affect our business, operating results, and financial condition.

Failure to effectively and timely achieve our climate-related goals could have an adverse effect on the demand for our products.

In September 2021, we set new sustainability goals for the future, including with respect to circularity and GHG emissions reduction. Our ability to achieve these goals depends on many factors, including our ability to reduce emissions from our operations through modernization and innovation, reduce the emissions intensity of the electricity we buy, and invest in renewables and low carbon energy. In addition, any future decarbonization technologies may increase our costs, or we may be limited in our ability to apply them to commercial scale. We may also not timely adapt to changes or methods in carbon pricing that could increase our costs and reduce our competitiveness. The cost associated with our GHG emissions reduction goals could be significant. Failure to achieve our emissions targets could result in reputational harm, changing investor sentiment regarding investment in LyondellBasell or a negative impact on access to and cost of capital.

General Risk Factors

The COVID-19 pandemic could continue to materially adversely affect our financial condition and results of operations.

In early 2020, the COVID-19 pandemic spread to countries worldwide and resulted in governments and other authorities implementing numerous measures to try to contain the disease, such as travel bans and restrictions, social distancing, quarantines, shelter-in-place orders and business shutdowns, among others. These measures caused significant economic disruption and adversely impacted the global economy, leading to reduced consumer spending and volatility in the global financial and commodities markets. A return to more ordinary course of economic activity is dependent on the duration and severity of the COVID-19 pandemic, including the severity and transmission rate of the virus, the extent and effectiveness of containment efforts, including the spread of virus variants such as Delta and Omicron, the availability and effectiveness of vaccines and treatments, and future policy decisions made by governments across the globe as they react to evolving local and global conditions.

While we continue to work with our stakeholders (including customers, employees, suppliers, business partners, and local communities) to attempt to mitigate the impact of the global pandemic on our business, we cannot assure that these mitigation efforts will continue to be effective or successful. An extended period of global supply chain and economic disruption as a result of the COVID-19 pandemic could have a material negative impact on our business, results of operations, access to sources of liquidity and financial condition.

Increased IT and cybersecurity threats and more sophisticated and targeted computer crime could pose a risk to our systems, networks, data, products, facilities and services.

Increased global information cybersecurity threats and more sophisticated, targeted computer crime pose a risk to the confidentiality, availability and integrity of our data, operations and infrastructure. While we attempt to mitigate these risks by employing a number of measures, including security measures, employee training, comprehensive monitoring of our networks and systems, and maintenance of backup and protective systems, our employees, systems, networks, products, facilities and services remain potentially vulnerable to ransomware, sophisticated espionage or cyber-assault. Depending on their nature and scope, such threats could potentially lead to the compromise of confidential information, improper use of our systems and networks, manipulation and destruction of data, defective products, production downtimes and operational disruptions, which in turn could adversely affect our reputation, competitiveness and results of operations.

Many of our businesses depend on our intellectual property. Our future success will depend in part on our ability to protect our intellectual property rights, and our inability to do so could reduce our ability to maintain our competitiveness and margins.

We have a significant worldwide patent portfolio of issued and pending patents. These patents and patent applications, together with proprietary technical know-how, are significant to our competitive position, particularly with regard to PO, intermediate chemicals, polyolefins, licensing and catalysts. We rely on the patent, copyright and trade secret laws of the countries in which we operate to protect our investment in research and development, manufacturing and marketing. We operate plants, sell catalysts and products, participate in joint ventures, and license our process technology in many foreign jurisdictions, including those having heightened risks for intellectual property. In some of these instances, we must disclose at least a portion of our technology to third parties or regulatory bodies. In these cases, we rely primarily on contracts and trade secret laws to protect the associated trade secrets. However, we may be unable to prevent third parties from using our intellectual property without authorization. Proceedings to protect these rights could be costly, and we may not prevail.

The failure of our patents or confidentiality agreements to protect our processes, apparatuses, technology, trade secrets or proprietary know-how could result in significantly lower revenues, reduced profit margins and cash flows and/or loss of market share. We also may be subject to claims that our technology, patents or other intellectual property infringes on a third party’s intellectual property rights. Unfavorable resolution of these claims could result in restrictions on our ability to deliver the related service or in a settlement that could be material to us.

Adverse results of legal proceedings could materially adversely affect us.

We are subject to and may in the future be subject to a variety of legal proceedings and claims that arise out of the ordinary conduct of our business. Results of legal proceedings cannot be predicted with certainty. Irrespective of its merits, litigation may be both lengthy and disruptive to our operations and may cause significant expenditure and diversion of management attention. We may be faced with significant monetary damages or injunctive relief against us that could have an adverse impact on our business and results of operations should we fail to prevail in certain matters.

If we lose key employees or are unable to attract and retain the employees we need, our business and operating results could be adversely affected.

Our success depends on our ability to attract and retain key personnel, and we rely heavily on our management team. The inability to recruit and retain key personnel or the unexpected loss of key personnel may adversely affect our operations. In addition, because of the reliance on our management team, our future success depends in part on our ability to identify and develop talent to succeed senior management. The retention of key personnel and appropriate senior management succession planning will continue to be critically important to the successful implementation of our strategies.

There is substantial and continuous competition for diverse, talented engineering, manufacturing, and operations employees. We may not be successful in attracting and retaining such personnel, and we may experience increased compensation and training costs that may not be offset by either improved productivity or higher sales. We have from time to time experienced, and we may continue to experience, difficulty in hiring and retaining employees with appropriate qualifications, and may not be able to fill positions in desired geographic areas or at all.

Significant changes in pension fund investment performance or assumptions relating to pension costs may adversely affect the valuation of pension obligations, the funded status of pension plans, and our pension cost.

Our pension cost is materially affected by the discount rates used to measure pension obligations, the level of plan assets available to fund those obligations at the measurement date and the expected long-term rates of return on plan assets. Significant changes in investment performance or a change in the portfolio mix of invested assets may result in corresponding increases and decreases in the value of plan assets, particularly equity securities, or in a change of the expected rate of return on plan assets. Any changes in key actuarial assumptions, such as the discount rate or mortality rate, would impact the valuation of pension obligations, affecting the reported funded status of our pension plans as well as the net periodic pension cost in the following fiscal years.

Nearly all of our current pension plans have projected benefit obligations that exceed the fair value of the plan assets. As of December 31, 2021, the aggregate deficit was $1,015 million. Any declines in the fair values of the pension plans' assets could require additional payments by us in order to maintain specified funding levels.

Our pension plans are subject to legislative and regulatory requirements of applicable jurisdictions, which could include, under certain circumstances, local governmental authority to terminate the plan.

See Note 14 to the Consolidated Financial Statements for additional information regarding pensions and other post-retirement benefits.

Item 1B. Unresolved Staff Comments.

None.

Item 3. Legal Proceedings.

Environmental Matters

From time to time we and our joint ventures receive notices or inquiries from government entities regarding alleged violations of environmental laws and regulations pertaining to, among other things, the disposal, emission and storage of chemical and petroleum substances, including hazardous wastes. U.S. Securities and Exchange Commission rules require disclosure of certain environmental matters when a governmental authority is a party to the proceedings and the proceedings involve potential monetary sanctions that we reasonably believe could exceed $300,000. The matters below are disclosed solely pursuant to that requirement and we do not believe that any of these proceedings will have a material impact on the Company's Consolidated Financial Statements.

In September 2013, the U.S. Environmental Protection Agency ("EPA") Region V issued a Notice and Finding of Violation alleging violations at our Morris, Illinois facility related to flaring activity. The Notice generally alleges failures to monitor steam usage and improper flare operations. In the Fall of 2020, EPA referred the matter to the U.S. Department of Justice ("DOJ") and EPA Headquarters for civil judicial enforcement. We are currently engaged in settlement discussions with EPA and DOJ.

In connection with an enforcement initiative of EPA regarding flare emissions at petrochemical plants, we have settled with EPA and DOJ in order to resolve claims initiated in July 2014, related to alleged improper operation and maintenance of flares at four of our U.S. facilities. The consent decree related to the settlement was entered by the U.S. District Court for the Southern District of Texas in January 2022. Under the terms of the settlement, we paid a penalty of $3.4 million in January 2022 and will conduct fence line monitoring and make investments in equipment at the facilities.

In March 2018, the Cologne, Germany local court issued a regulatory fine notice of €1.8 million arising from a pipeline leak near our Wesseling, Germany facility. We expect the Cologne prosecutor to issue a corresponding payment request, which will resolve the matter.

In February 2020, the State of Texas filed suit against Houston Refining, LP, a subsidiary of LyondellBasell, in Travis County District Court seeking civil penalties and injunctive relief for violations of the Texas Clean Air Act related to several emission events. In July 2020, Harris County, Texas petitioned to intervene in the lawsuit and the State added additional claims to its petition relating to self-reported deviations of Houston Refining's air operating permit.

On July 27, 2021, approximately 160,000 pounds of liquid process material containing primarily acetic acid was released from a reactor at the La Porte acetic acid unit. In October 2021, the Texas Commission on Environmental Quality ("TCEQ") issued a Notice of Enforcement for the incident. In November 2021, the State of Texas filed a petition on behalf of the TCEQ seeking injunctive relief and civil penalties for unauthorized air pollution and regulatory nuisance related to the incident. We are currently engaged in settlement discussions with the State to resolve this matter.

Litigation and Other Matters

Information regarding our litigation and other legal proceedings can be found in Note 17 to the Consolidated Financial Statements.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant's Common Equity, Related Shareholder Matters and Issuer Purchases of Equity Securities.

Market and Dividend Information

Our shares were listed on the New York Stock Exchange ("NYSE") on October 14, 2010 under the symbol "LYB."

The payment of dividends or distributions in the future will be subject to the requirements of Dutch law and the discretion of our Board of Directors. The declaration of any future cash dividends and, if declared, the amount of any such dividends, will depend upon general business conditions, our financial condition, our earnings and cash flow, our capital requirements, financial covenants and other contractual restrictions on the payment of dividends or distributions.

We intend to continue to declare and pay quarterly dividends, with the goal of increasing the dividend over time, after giving consideration to our cash balances and expected results from operations. However, there can be no assurance that any dividends or distributions will be declared or paid in the future.

Holders

As of February 22, 2022, there were approximately 5,700 record holders of our shares, including Cede & Co. as nominee of the Depository Trust Company.

Equity Compensation Plan

See Part III, Item 11. Executive Compensation for information relating to the Company's equity compensation plans.

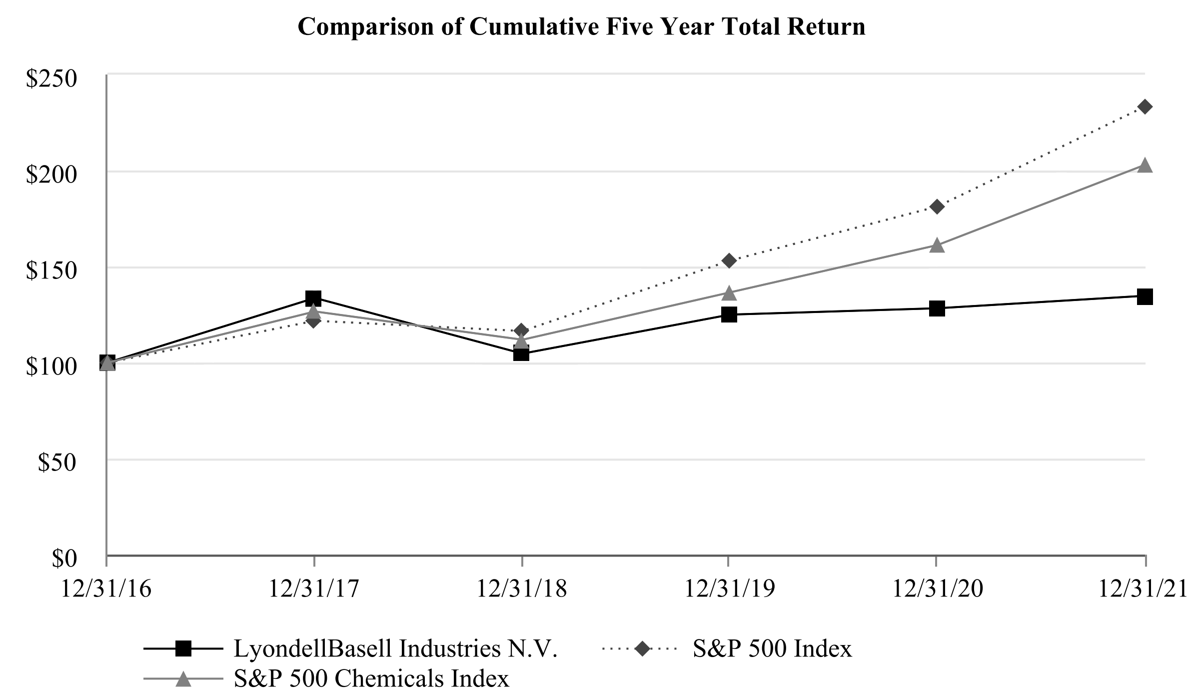
United Kingdom Tax Considerations

As a result of its United Kingdom tax residency, dividend distributions by LyondellBasell Industries N.V. to its shareholders are not subject to withholding tax, as the United Kingdom currently does not levy a withholding tax on dividend distributions.

Performance Graph

The performance graph and the information contained in this section is not "soliciting material," is being furnished, not filed, with the SEC and is not to be incorporated by reference into any of our filings under the Securities Act or the Exchange Act whether made before or after the date hereof and irrespective of any general incorporation language contained in such filing.

The graph below shows the relative investment performance of LyondellBasell Industries N.V. shares, the S&P 500 Index and the S&P 500 Chemicals Index since December 31, 2016. The graph assumes that $100 was invested on December 31, 2016 and any dividends paid were reinvested at the date of payment. The graph is presented pursuant to SEC rules and is not meant to be an indication of our future performance.



	12/31/2016	12/31/2017	12/31/2018	12/31/2019	12/31/2020	12/31/2021
LyondellBasell Industries N.V.	$100.00	$133.72	$104.71	$125.03	$128.34	$134.84
S&P 500 Index	$100.00	$121.83	$116.49	$153.17	$181.35	$233.41
S&P 500 Chemicals Index	$100.00	$126.66	$111.96	$136.61	$161.26	$203.04

Issuer Purchases of Equity Securities

2021 Period	Total Number of Shares Purchased	Average Price Paid per Share	Total Number of Shares Purchased as Part of Publicly Announced Plans or Programs	Maximum Number of Shares That May Yet Be Purchased Under the Plans or Programs
October 1—October 31	960,047	$ 96.78	960,047	32,090,835
November 1—November 30	1,527,113	$ 92.31	1,527,113	30,563,722
December 1—December 31	1,722,493	$ 89.42	1,722,493	28,841,229
Total	4,209,653	$ 92.15	4,209,653	28,841,229

On May 28, 2021, our shareholders approved a share repurchase authorization of up to 34,004,563 of our ordinary shares, through November 28, 2022, which superseded any prior repurchase authorizations. The maximum number of shares that may yet be purchased is not necessarily an indication of the number of shares that will ultimately be purchased.

Item 6. Reserved

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

GENERAL

This discussion should be read in conjunction with the information contained in our Consolidated Financial Statements, and the accompanying notes elsewhere in this report. Unless otherwise indicated, the "Company," "we," "us," "our" or similar words are used to refer to LyondellBasell Industries N.V. together with its consolidated subsidiaries ("LyondellBasell N.V.").

The discussion summarizing the significant factors affecting the results of operations and financial condition for the year ended December 31, 2019, can be found in Part II, "Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations" of our Annual Report on Form 10-K for the year ended December 31, 2020, which was filed with the Securities and Exchange Commission on February 25, 2021, of which Item 7 is incorporated herein by reference.

OVERVIEW

Our 2021 results reflect robust demand for our products and tight market conditions. During 2021 relative to 2020, EBITDA increased largely due to margin improvements in our O&P—Americas, O&P—EAI and I&D segments.

Our 2021 cash generation allowed us to complete our goal of reducing long-term debt by $4 billion during the year and demonstrated our commitment to a solid investment-grade credit rating. We do not plan to pursue further long-term debt reduction in 2022. During 2021, we repurchased 5.2 million shares and increased our annual dividend for the eleventh consecutive year.

During the second quarter of 2021, we invested $104 million to purchase a 50% interest in a joint venture with the China Petroleum & Chemical Corporation ("Sinopec") which will commission a new propylene oxide and styrene monomer unit in China in 2022.

Results of operations for the periods discussed are presented in the table below.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 46,173	$ 27,753
Cost of sales	37,397	24,359
Impairments	624	582
Selling, general and administrative expenses	1,255	1,140
Research and development expenses	124	113
Operating income	6,773	1,559
Interest expense	(519)	(526)
Interest income	9	12
Other income, net	62	85
Income from equity investments	461	256
Income from continuing operations before income taxes	6,786	1,386
Provision for (benefit from) income taxes	1,163	(43)
Income from continuing operations	5,623	1,429
Loss from discontinued operations, net of tax	(6)	(2)
Net income	$ 5,617	$ 1,427

RESULTS OF OPERATIONS

Revenues—Revenues increased $18,420 million, or 66%, in 2021 compared to 2020. Average sales prices in 2021 were higher for many of our products as sales prices generally correlate with crude oil prices, which increased relative to 2020. These higher prices led to a 62% increase in revenue. Higher sales volumes, driven by increased demand, resulted in a revenue increase of 3%. Favorable foreign exchange impacts resulted in a revenue increase of 1%.

Cost of Sales—Cost of sales increased $13,038 million, or 54%, in 2021 compared to 2020. This increase primarily related to higher feedstock and energy costs. Fluctuations in our cost of sales are generally driven by changes in feedstock and energy costs. Feedstock and energy related costs generally represent approximately 70% to 80% of cost of sales, other variable costs account for approximately 10% of cost of sales on an annual basis and fixed operating costs, consisting primarily of expenses associated with employee compensation, depreciation and amortization, and maintenance, range from approximately 15% to 20% in each annual period.

Impairments—Results for our Refining segment include non-cash impairment charges of $624 million and $582 million recognized in 2021 and 2020, respectively. See Note 7 to the Consolidated Financial Statements for additional information regarding impairment charges.

SG&A Expense—Selling, general and administrative ("SG&A") expense increased $115 million, or 10% in 2021 compared to 2020 primarily due to higher employee-related expenses.

Operating Income—Operating income increased by $5,214 million or 334% in 2021 compared to 2020. In 2021, Operating income increased for our O&P—Americas, O&P—EAI, I&D, Refining, Technology and APS segments by $3,382 million, $816 million, $466 million, $328 million, $184 million and $60 million, respectively. Results for each of our business segments are discussed further in the Segment Analysis section below.

Income from Equity Investments—Income from equity method investments increased $205 million, or 80%, in 2021 compared to 2020. Higher demand coupled with industry supply constraints resulted in improved margins for our joint ventures in our O&P—Americas and O&P—EAI segments.

Income Taxes—Our effective income tax rates of 17.1% in 2021 and -3.1% in 2020 resulted in a tax provision of $1,163 million and a tax benefit of $43 million, respectively.

The 2021 effective income tax rate of 17.1%, which is lower than the U.S. statutory tax rate of 21%, was favorably impacted by exempt income (-4.5%), return to accrual adjustments primarily from a tax benefit associated with an election made in 2021 to step-up certain Italian assets to fair market value retroactively (-1.8%) and the impact of the Coronavirus Aid, Relief, and Economic Security ("CARES") Act (-0.9%) partially offset by the effects of earnings in various countries, notably in Europe, with higher statutory tax rates (1.1%) and U.S. state and local income taxes (1.2%).

The 2020 effective income tax rate of -3.1%, which is lower than the U.S. statutory tax rate of 21%, was favorably impacted by tax law changes including the CARES Act (-21.5%) coupled with exempt income (-10.4%), partially offset by changes in unrecognized tax benefits associated with uncertain tax positions (7.0%).

During 2021 and 2020, we recorded an overall tax benefit in relation to the CARES Act of approximately $64 million and $300 million, respectively, due to our 2020 U.S. tax losses which we carried back to tax years with a higher tax rate. For additional information, see Note 16 to our Consolidated Financial Statements.

Comprehensive Income—We had comprehensive income of $5,757 million in 2021 and $1,268 million in 2020. Comprehensive income increased by $4,489 million in 2021 compared to 2020, primarily due to higher net income, net favorable changes in defined pension and other post-retirement benefits, and net favorable impacts of financial derivative instruments primarily driven by periodic changes in benchmark interest rates. These increases were partially offset by net unfavorable impacts of unrealized changes in foreign currency translation adjustments.

We recognized defined benefit pension and other post-retirement benefit plans pre-tax gains of $291 million and pre-tax losses of $51 million in 2021 and 2020, respectively. In 2021, changes in actuarial assumptions, primarily related to an increase in discount rates and higher actual returns versus expected returns on plan assets, resulted in a pre-tax gain of $214 million. In 2021, pre-tax gains of $77 million related to the amortization of accumulated actuarial losses and settlements were reclassified to Other income, net. In 2020, pre-tax losses of $109 million were recognized due to the decrease in discount rates and higher actual returns versus expected returns on plan assets. Pre-tax losses were partially offset by pre-tax gains of $58 million, primarily due to amortization of accumulated actuarial losses reclassified to Other income, net.

In 2021, the cumulative after-tax effect of our derivatives designated as cash flow hedges was a net gain of $72 million. The weakening of the euro against the U.S. dollar in 2021 and periodic changes in benchmark interest rates resulted in a pre-tax gain of $207 million related to our cross-currency swaps. In 2021, pre-tax losses of $216 million related to our cross-currency swaps were reclassified to Other income, net. In 2021, we recognized pre-tax gains of $75 million related to forward-starting interest rate swaps primarily driven by changes in benchmark interest rates. The remaining change relates to our commodity cash flow hedges.

The predominant functional currency for our operations outside of the U.S. is the euro. Relative to the U.S. dollar, the value of the euro weakened during 2021, resulting in net losses related to unrealized changes in foreign currency translation impacts which are reflected in the Consolidated Statements of Comprehensive Income. These losses were partially offset by a pre-tax gain of $199 million related to the effective portion of our net investment hedges.

Segment Analysis

We use earnings from continuing operations before interest, income taxes, and depreciation and amortization ("EBITDA") as our measure of profitability for segment reporting purposes. This measure of segment operating results is used by our chief operating decision maker to assess the performance of, and allocate resources to, our operating segments. Intersegment eliminations and items that are not directly related or allocated to business operations, such as foreign exchange gains (losses) and components of pension and other post-retirement benefit costs other than service cost, are included in "Other." For additional information related to our operating segments, as well as a reconciliation of EBITDA to its nearest generally accepted accounting principles ("GAAP") measure, Income from continuing operations before income taxes, see Note 20 to our Consolidated Financial Statements.

Our continuing operations are managed through six reportable segments: O&P—Americas, O&P—EAI, I&D, APS, Refining and Technology. The following tables reflect selected financial information for our reportable segments.

	Year Ended December 31,	
Millions of dollars	2021	2020
Sales and other operating revenues:		
O&P–Americas	$ 15,002	$ 7,275
O&P–EAI	13,490	8,367
I&D	10,180	6,269
APS	5,145	3,913
Refining	8,002	4,727
Technology	843	659
Other, including segment eliminations	(6,489)	(3,457)
Total	$ 46,173	$ 27,753
Operating income (loss):		
O&P–Americas	$ 4,552	$ 1,170
O&P–EAI	1,228	412
I&D	967	501
APS	286	226
Refining	(696)	(1,024)
Technology	471	287
Other, including segment eliminations	(35)	(13)
Total	$ 6,773	$ 1,559
Depreciation and amortization:		
O&P–Americas	$ 578	$ 525
O&P–EAI	197	214
I&D	379	305
APS	117	152
Refining	79	152
Technology	43	37
Total	$ 1,393	$ 1,385
Income (loss) from equity investments:		
O&P—Americas	$ 115	$ 45
O&P—EAI	313	186
I&D	34	26
APS	(1)	(1)
Total	$ 461	$ 256

Millions of dollars	Year Ended December 31, 2021	2020
Other income (expense), net:		
O&P—Americas	$ 28	$ 70
O&P—EAI	11	14
I&D	(2)	1
APS	7	1
Refining	(7)	1
Other, including intersegment eliminations	25	(2)
Total	$ 62	$ 85
EBITDA:		
O&P—Americas	$ 5,273	$ 1,810
O&P—EAI	1,749	826
I&D	1,378	833
APS	409	378
Refining	(624)	(871)
Technology	514	324
Other, including intersegment eliminations	(10)	(15)
Total	$ 8,689	$ 3,285

Olefins and Polyolefins–Americas Segment

Overview—EBITDA improved in 2021 relative to 2020 driven by olefin and combined polyolefin margin improvements.

In calculating the impact of margin and volume on EBITDA, consistent with industry practice, management offsets revenues and volumes related to ethylene co-products against the cost to produce ethylene. Volume and price impacts of ethylene co-products are reported in margin.

Ethylene Raw Materials—Ethylene and its co-products are produced from two major raw material groups:

- NGLs, principally ethane and propane, the prices of which are generally affected by natural gas prices; and
- crude oil-based liquids (“liquids” or “heavy liquids”), including naphtha, condensates and gas oils, the prices of which are generally related to crude oil prices.

We have flexibility to vary the raw material mix and process conditions in our U.S. olefins plants in order to maximize profitability as market prices fluctuate for both feedstocks and products. Although prices of crude-based liquids and natural gas liquids are generally related to crude oil and natural gas prices, during specific periods the relationships among these materials and benchmarks may vary significantly. In 2021 and 2020, approximately 60% of the raw materials used in our North American crackers was ethane.

The following table sets forth selected financial information for the O&P—Americas segment including Income from equity investments, which is a component of EBITDA.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 15,002	$ 7,275
Income from equity investments	115	45
EBITDA	5,273	1,810

Revenues—Revenues increased by $7,727 million, or 106%, in 2021 compared to 2020. Higher average sales prices resulted in a 92% increase in revenue in 2021, primarily driven by tight market conditions. Volume improvements resulted in a revenue increase of 14% primarily due to the 2020 acquisition of our 50% interest in the Louisiana Joint Venture.

EBITDA—EBITDA increased by $3,463 million, or 191%, in 2021 compared to 2020, largely driven by margin improvements. Olefins results led to a 109% increase in EBITDA driven by higher margins as sales prices outpaced higher feedstock and energy costs. Higher polyethylene and polypropylene results led to a 48% and 29% increase in EBITDA, respectively, primarily due to polyolefin sales price increases which outpaced higher feedstock costs.

Olefins and Polyolefins–Europe, Asia, International Segment

Overview—EBITDA increased in 2021 compared to 2020 mainly as a result of higher combined polyolefins margins due to strong demand and tight markets.

In calculating the impact of margin and volume on EBITDA, consistent with industry practice, management offsets revenues and volumes related to ethylene co-products against the cost to produce ethylene. Volume and price impacts of ethylene co-products are reported in margin.

Ethylene Raw Materials—In Europe, heavy liquids are the primary raw materials for our ethylene production and represents approximately two-thirds of the raw materials used in 2021 and 2020.

The following table sets forth selected financial information for the O&P—EAI segment including Income from equity investments, which is a component of EBITDA.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 13,490	$ 8,367
Income from equity investments	313	186
EBITDA	1,749	826

Revenues—Revenues increased by $5,123 million, or 61%, in 2021 compared to 2020. Average sales prices in 2021 were higher across most products as sales prices generally correlate with crude oil prices, which on average, increased compared to 2020. These higher average sales prices were responsible for a 52% increase in revenue. Volume improvements resulted in a revenue increase of 6% primarily due to strong demand in combination with tight market supply. Favorable foreign exchange impacts resulted in a revenue increase of 3% in 2021.

EBITDA—EBITDA increased by $923 million, or 112%, in 2021 compared to 2020. Polyethylene and polypropylene results improved resulting in an EBITDA increase of 55% and 46%, respectively. These improvements were driven by higher margins as price increases outpaced higher feedstock costs. Higher income from our equity investments led to an increase in EBITDA of 15%, mainly attributable to higher polyolefins margins associated with increased demand. Foreign exchange impacts, which on average were favorable, resulted in a EBITDA increase of 4%.

Intermediates and Derivatives Segment

Overview—EBITDA increased in 2021 compared to 2020, primarily driven by higher margins across most businesses due to tight market supply from industry outages coupled with strong demand.

The following table sets forth selected financial information for the I&D segment including Income from equity investments, which is a component of EBITDA.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 10,180	$ 6,269
Income from equity investments	34	26
EBITDA	1,378	833

Revenues—Revenues increased by $3,911 million, or 62%, in 2021 compared to 2020. Higher average sales prices resulted in a 64% increase in revenue in 2021 as sales prices generally correlate with crude oil prices, which on average, increased compared to 2020. Sales volumes declined in 2021 resulting in a 3% decrease in revenue due to the impact of unusually cold temperatures and associated electrical power outages that led to shutdowns of our manufacturing facilities in Texas in early 2021, coupled with unplanned maintenance activities in 2021. Favorable foreign exchange impacts resulted in a revenue increase of 1% in 2021.

EBITDA—EBITDA increased $545 million, or 65%, in 2021 compared to 2020. Our propylene oxide and derivatives and intermediate chemicals results improved resulting in an EBITDA increase of 54% and 18%, respectively. These improvements were primarily a result of higher margins due to strong demand coupled with tight market supply resulting from industry outages. Higher oxyfuels and related products results led to a 6% increase in EBITDA primarily driven by margin improvement as a result of improved demand and higher gasoline prices. Results declined 4% as a result of site closure costs associated with the exit of our ethanol business.

Advanced Polymer Solutions Segment

Overview—EBITDA for our APS segment increased in 2021 compared to 2020, primarily due to higher advanced polymer margins.

The following table sets forth selected financial information for the APS segment:

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 5,145	$ 3,913
Loss from equity investments	(1)	(1)
EBITDA	409	378

Revenues—Revenues increased in 2021 by $1,232 million, or 31%, compared to 2020. Average sales price increased resulting in a 25% increase in revenue in 2021 as sales prices generally correlate with raw material costs and product demand. Higher sales volumes resulted in a 3% increase in revenue stemming from higher demand. Foreign exchange impacts resulted in a revenue increase of 3% in 2021.

EBITDA—EBITDA increased in 2021 by $31 million, or 8%, compared to 2020. Higher advanced polymers results led to an EBITDA increase of 13% driven by margin improvements resulting from increased construction demand. Results benefited 10% from the absence of integration costs incurred in 2020 associated with the acquisition of A. Schulman Inc. These EBITDA improvements were offset by LIFO inventory charges which resulted in a 12% reduction in EBITDA. Compounding and solutions results remained relatively unchanged during 2021.

Refining Segment

Overview—EBITDA for our Refining segment increased in 2021 relative to 2020 primarily due to higher margins.

The following table sets forth selected financial information and heavy crude oil processing rates for the Refining segment and the U.S. refining market margins for the applicable periods. "Brent" is a light sweet crude oil and is one of the main benchmark prices for purchases of oil worldwide. "Maya" is a heavy sour crude oil grade produced in Mexico that is a relevant benchmark for heavy sour crude oils in the U.S. Gulf Coast market. References to industry benchmarks for refining market margins are to industry prices reported by Platts, a division of S&P Global.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 8,002	$ 4,727
EBITDA	(624)	(871)
Thousands of barrels per day		
Heavy crude oil processing rates	231	223
Market margins, dollars per barrel		
Brent - 2-1-1	$ 14.39	$ 5.74
Brent - Maya differential	6.48	6.89
Total Maya 2-1-1	$ 20.87	$ 12.63

Revenues—Revenues increased by $3,275 million, or 69%, in 2021 compared to 2020. Higher product prices led to a revenue increase of 71% in 2021, due to an average Brent crude oil price increase of approximately $28 per barrel. Sales volume changes resulted in a 2% decline in revenues as higher run rates were offset by changes in product mix.

EBITDA—EBITDA increased by $247 million or 28%,in 2021 compared to 2020. This increase was primarily driven by margin improvements due to an increase in the Maya 2-1-1 market margin resulting from higher demand for refined products. This was partially offset by margin declines driven by higher costs for Renewable Identification Numbers ("RINs") of approximately $1 per gallon.

During 2021 and 2020 we recognized non-cash impairment charges of $624 million and $582 million, respectively. For additional information see Note 7 to our Consolidated Financial Statements.

We are currently weighing strategic options for our Refining segment, including a potential sale of our Houston refinery. Any strategic option pursued for the Houston refinery remains subject to the approval of our Board of Directors and, assuming such approval is obtained, may require certain regulatory approvals or other closing conditions.

Technology Segment

Overview—The Technology segment recognizes revenues related to the sale of polyolefin catalysts and the licensing of chemical and polyolefin process technologies. These revenues are offset in part by the costs incurred in the production of catalysts, licensing and services activities and research and development ("R&D") activities. In 2021 and 2020, our Technology segment incurred approximately half of all R&D costs. EBITDA for our Technology segment increased in 2021 compared to 2020 largely due to higher licensing revenues and catalyst volumes.

The following table sets forth selected financial information for the Technology segment.

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Sales and other operating revenues	$ 843	$ 659
EBITDA	514	324

Revenues—Revenues increased by $184 million, or 28%, in 2021 compared to 2020. Higher catalyst volumes resulted in a 10% increase in revenue in 2021, primarily driven by strong demand. Licensing revenues increased by 15% in 2021. Favorable foreign exchange impacts increased revenue by 3% in 2021.

EBITDA—EBITDA in 2021 increased by $190 million, or 59%, compared to 2020. Higher licensing revenues led to an EBITDA improvement of 40% in 2021. Favorable foreign exchange impacts resulted in an EBITDA increase of 3% in 2021. The remaining increases was largely driven by higher catalyst sales volumes as a result of improved global demand.

FINANCIAL CONDITION

Operating, investing and financing activities of continuing operations, which are discussed below, are presented in the following table:

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Cash provided by (used in):		
Operating activities	$ 7,695	$ 3,404
Investing activities	(1,502)	(4,906)
Financing activities	(6,385)	2,271

Operating Activities—Cash provided by operating activities of $7,695 million in 2021 primarily reflected earnings adjusted for non-cash items and cash used by the main components of working capital–Accounts receivable, Inventories and Accounts payable.

In 2021, the main components of working capital used $960 million of cash driven by an increase in Inventories and Accounts receivable, partially offset by an increase in Accounts payable. The increase in Inventories was primarily due to an increase in raw material costs coupled with an increase in inventory to levels required to support improved demand and in anticipation of turnarounds in 2022. The increase in Accounts receivable was driven by higher revenues across most businesses primarily driven by higher average sales prices. The increase in Accounts payable was primarily driven by increased raw material and energy costs.

Other operating activities in 2021 includes an $870 million tax refund received in the fourth quarter of 2021 and the effects of changes in income tax accruals primarily driven by increased pretax income. For additional information see Note 16 to our Consolidated Financial Statements.

Cash of $3,404 million generated by operating activities in 2020 primarily reflected earnings adjusted for non-cash items and cash provided by the main components of working capital.

In 2020, the main components of working capital provided $311 million of cash driven by a decrease in Inventories and an increase in Accounts payable, partially offset by an increase in Accounts receivable. The decrease in Inventory was primarily driven by company-wide inventory reduction initiatives to maximize liquidity. The increase in Accounts payable was primarily driven by increased raw material purchases during the fourth quarter of 2020. The increase in Accounts receivable was driven by higher sales in the fourth quarter 2020 for our O&P—Americas, O&P—EAI, and I&D segments resulting from demand recovery.

Other operating activities in 2020 includes the effects of changes in tax accruals, primarily driven by a tax refund of $900 million.

Investing Activities—Capital expenditures in 2021 totaled $1,959 million compared to $1,947 million in 2020. Approximately 60% of our capital spending in both periods was for profit-generating growth projects, primarily our PO/TBA plant, with the remaining spending supporting sustaining maintenance. See Note 20 to the Consolidated Financial Statements for additional information regarding capital spending by segment.

We invest cash in investment-grade and other high-quality instruments that provide adequate flexibility to redeploy funds as needed to meet our cash flow requirements while maximizing yield.

We received proceeds of $346 million and $114 million in 2021 and 2020, respectively, upon the sale and maturity of certain of our available-for-sale debt securities. Additionally, in 2021 and 2020, we received proceeds of $335 million and $313 million, respectively, from the sale or liquidation of our investment in equity securities.

In 2020, we invested $270 million in debt securities that are deemed available-for-sale and $608 million in investments in equity securities. Our investments in available-for-sale debt securities and equity securities are classified as Short-term investments.

In 2021, we made an equity contribution of $104 million to form Ningbo ZRCC LyondellBasell New Material Company Limited, a 50/50 joint venture with Sinopec. In 2020, we invested $2,440 million in cash for 50% equity interests in the Bora LyondellBasell Petrochemical Co. Ltd joint venture and the Louisiana Integrated PolyEthylene JV LLC. For additional information related to our Equity investments, see Note 8 to the Consolidated Financial Statements.

In 2021, foreign currency contracts with an aggregate notional value of €300 million expired. Upon settlement of these foreign currency contracts, we paid €300 million ($355 million at the expiry spot rate) to our counterparties and received $358 million from our counterparties.

Financing Activities—In 2021 and 2020, we made payments of $463 million and $4 million to acquire 5.2 million and 0.1 million, respectively, of our outstanding ordinary shares. We also made dividend payments totaling $1,486 million and $1,405 million in 2021 and 2020, respectively. For additional information related to our share repurchases and dividend payments, see Note 18 to the Consolidated Financial Statements.

During 2020, to bolster liquidity we issued long-term debt of $6 billion which was partially offset by repayments of $3 billion during the year. In 2021, we prioritized debt reduction resulting in a $4 billion decrease in our outstanding long-term debt. For a detailed discussion of financing activities for 2021 and 2020, see Note 11 to the Consolidated Financial Statements.

In 2021 and 2020, we made net repayments of $296 million and received net proceeds of $239 million, respectively, through the issuance and repurchase of commercial paper instruments under our commercial paper program.

In November 2021, foreign currency contracts previously designated as cash flow hedges with an aggregate notional value of $855 million expired. Upon settlement of these foreign currency contracts we paid €790 million ($904 million at the expiry spot rate) to our counterparties and received $855 million from our counterparties.

In May 2020, we terminated and cash settled $2,000 million in notional value of our cross-currency interest rate swaps, designated as cash flows hedges, maturing in 2021 and 2024. Upon termination of the swaps, we received $346 million from our counterparties.

In 2020, we posted collateral of $238 million related to positions held with our counterparties for certain forward-starting interest rate swaps.

In November 2020, we paid $882 million to our counterparties and received €750 million ($887 million at the expiry spot rate) from our counterparties upon expiration and settlement of the foreign currency contracts entered to economically hedge the redemption of €750 million aggregate principal amount of our 1.875% guaranteed notes originally due in 2022.

For additional information related to our swaps and currency contracts, see Note 13 to the Consolidated Financial Statements.

Liquidity and Capital Resources

Overview

We plan to fund our ongoing working capital, capital expenditures, debt service, dividends and other cash requirements with our current available liquidity and cash from operations, which could be affected by general economic, financial, competitive, legislative, regulatory, business and other factors, many of which are beyond our control. Cash and cash equivalents, cash from our short-term investments, cash from operating activities, proceeds from the issuance of debt, or a combination thereof, may be used to fund the purchase of shares under our share repurchase authorization.

We intend to continue to declare and pay quarterly dividends, with the goal of increasing the dividend over time, after giving consideration to our cash balances and expected results from operations. Our focus on funding our dividends while remaining committed to a strong investment grade balance sheet continues to be the foundation of our capital allocation strategy.

Cash and Liquid Investments

As of December 31, 2021, we had Cash and cash equivalents and marketable securities classified as Short-term investments totaling $1,481 million, which includes $1,136 million in jurisdictions outside of the U.S., principally in the United Kingdom. There are currently no legal or economic restrictions that would materially impede our transfers of cash.

Credit Arrangements

At December 31, 2021, we had total debt, including current maturities, of $11,614 million, and $218 million of outstanding letters of credit, bank guarantees and surety bonds issued under uncommitted credit facilities.

We had total unused availability under our credit facilities of $3,946 million at December 31, 2021, which included the following:

- $3,046 million under our $3,250 million Senior Revolving Credit Facility, which backs our $2,500 million commercial paper program. In November 2021, we entered into a second amendment and restatement of our credit agreement to increase our availability under the Senior Revolving Credit Facility from $2,500 million to $3,250 million. See Note 11 for additional detail. Availability under this facility is net of outstanding borrowings, outstanding letters of credit provided under the facility and notes issued under our commercial paper program. At December 31, 2021, we had $204 million of outstanding commercial paper, net of discount, and no borrowings or letters of credit outstanding under this facility; and

- $900 million under our $900 million U.S. Receivables Facility. Availability under this facility is subject to a borrowing base of eligible receivables, which is reduced by outstanding borrowings and letters of credit, if any. At December 31, 2021 we had no borrowings or letters of credit outstanding under this facility. In June 2021, we extended the term of the facility to June 2024 in accordance with the terms of the agreement.

At any time and from time to time, we may repay or redeem our outstanding debt, including purchases of our outstanding bonds in the open market, through privately negotiated transactions or a combination thereof, in each case using cash and cash equivalents, cash from our short-term investments, cash from operating activities, proceeds from the issuance of debt or proceeds from asset divestitures. Any repayment or redemption of our debt will depend on prevailing market conditions, our liquidity requirements, contractual restrictions and other factors. In connection with such repurchases or redemptions, we may incur cash and non-cash charges, which could be material in the period in which they are incurred.

In accordance with our current interest rate risk management strategy and subject to management's evaluation of market conditions and the availability of favorable interest rates among other factors, we may from time to time enter into interest rate swap agreements to economically convert a portion of our fixed rate debt to variable rate debt or convert a portion of our variable rate debt to fixed rate debt.

Share Repurchases

In May 2021, our shareholders approved a proposal to authorize us to repurchase up to 34.0 million ordinary shares, through November 28, 2022 ("2021 Share Repurchase Authorization"), which superseded any prior repurchase authorizations. Our share repurchase authorization does not have a stated dollar amount, and purchases may be made through open market purchases, private market transactions or other structured transactions. Repurchased shares could be retired or used for general corporate purposes, including for various employee benefit and compensation plans. The maximum number of shares that may yet be purchased is not necessarily an indication of the number of shares that will ultimately be purchased. In 2021, we purchased 5.2 million shares under our share repurchase authorization for $477 million.

As of February 22, 2022, we had approximately 27.2 million shares remaining under the current authorization. The timing and amounts of additional shares repurchased, if any, will be determined based on our evaluation of market conditions and other factors, including any additional authorizations approved by our shareholders. In addition, cash and cash equivalents, cash from our short-term investments, cash from operating activities, proceeds from the issuance of debt, or a combination thereof, may be used to fund the purchase of shares under our share repurchase authorization. For additional information related to our share repurchase authorization, see Note 18 to the Consolidated Financial Statements.

Capital Budget

In 2022, we are planning to invest approximately $2.1 billion in capital expenditures, which includes approximately $79 million for investments in our U.S. and European PO joint ventures and Louisiana joint venture. Approximately 40% of the 2022 budget is planned for profit-generating growth projects, primarily our PO/TBA plant, with the remaining budget supporting sustaining maintenance.

Cash Requirements from Contractual and Other Obligations

As part of our ongoing operations, we enter into contractual arrangements that may require us to make future cash payments under certain circumstances. Our cash requirements related to contractual and other obligations primarily consist of purchase obligations, principal and interest payments on outstanding debt, lease payments, pension and other post-retirement benefits and income taxes. For more information regarding our debt arrangements, lease obligations, pension and other post-retirement benefits and income taxes see Notes 11, 12, 14 and 16 to the Consolidated Financial Statements, respectively.

We are party to obligations to purchase raw materials, utilities and industrial gases which are designed to ensure sources of supply and are not expected to be in excess of normal requirements. These purchase arrangements include provisions which state minimum purchase quantities; however, in the event we do not take the contractual minimum volumes, we are obligated to compensate the vendor only for any resulting economic losses they suffer. No material fees were paid to vendors for such losses in 2021. Assuming that contractual minimum volumes are purchased at contract prices as of December 31, 2021, these commitments represent approximately 20% of our annual Cost of sales with a weighted average remaining term of 7 years.

We also have purchase obligations under take-or-pay agreements which require us to either buy and take delivery of a minimum quantity of goods or to pay for any shortfall. These arrangements primarily relate to product off-take agreements with joint ventures located in Poland. No material shortfall was paid for quantities not taken under these contracts in 2021. When valued using a contract price as of December 31, 2021, these commitments represent approximately 5% of our annual Cost of sales with a weighted average remaining term of 12 years.

CURRENT BUSINESS OUTLOOK

We expect continued strength in demand for our products. Supply chain disruptions and virus surges have been restraining pent-up consumer demand across the global economy. As vaccinations facilitate a more sustainable global reopening and supply chains normalize, our businesses should benefit from continued strong demand for both goods and services. We are closely monitoring rising feedstock and energy costs, particularly at our European operations. Elevated levels of ethylene industry maintenance activities scheduled for the first half of 2022 are likely to constrain supply. We expect tight markets for acetyls and propylene oxide will continue to drive strong profitability within our I&D segment. Further, we expect to expand our production with the commissioning of new facilities within our I&D segment in China and the U.S. during 2022. In January, our Advanced Polymers Solutions segment benefited from increased order volumes for our products used in automotive production.

Planned maintenance in 2022 for our O&P—Americas, O&P—EAI and I&D segments is expected to impact EBITDA by approximately $125 million, $60 million and $80 million, respectively.

RELATED PARTY TRANSACTIONS

We have related party transactions with our joint venture partners. We believe that such transactions are effected on terms substantially no more or less favorable than those that would have been agreed upon by unrelated parties on an arm's length basis. See Note 4 to the Consolidated Financial Statements for additional related party disclosures.

CRITICAL ACCOUNTING POLICIES AND ESTIMATES

Management applies those accounting policies that it believes best reflect the underlying business and economic events, consistent with accounting principles generally accepted in the U.S., see Note 2 to the Consolidated Financial Statements. Inherent in such policies are certain key assumptions and estimates made by management and updated periodically based on its latest assessment of the current and projected business and general economic environment.

Management believes the following accounting policies and estimates, and the judgments and uncertainties affecting them, are critical in understanding our reported operating results and financial condition.

Inventories—We account for our raw materials, work-in-progress and finished goods inventories using the last-in, first-out ("LIFO") method of accounting.

The cost of raw materials, which represents a substantial portion of our operating expenses, and energy costs generally follow price trends for crude oil and/or natural gas. Crude oil and natural gas prices are subject to many factors, including changes in economic conditions.

Since our inventory consists of manufactured products derived from crude oil, natural gas, natural gas liquids and correlated materials, as well as the associated feedstocks and intermediate chemicals, our inventory market values are generally influenced by changes in the benchmark of crude oil and heavy liquid values and prices for manufactured finished goods. The degree of influence of a particular benchmark may vary from period to period, as the composition of the dollar value LIFO pools change. Due to natural inventory composition changes, variation in pricing from period to period does not necessarily result in a linear lower of cost or market ("LCM") impact. Additionally, an LCM condition may arise due to a volumetric decline in a particular material that had previously provided a positive impact within a pool. As a result, market valuations and LCM conditions are dependent upon the composition and mix of materials on hand at the balance sheet date. In the measurement of an LCM adjustment, the numeric input value for determining the crude oil market price includes pricing that is weighted by volume of inventories held at a point in time, including WTI, Brent and Maya crude oils.

As indicated above, fluctuation in the prices of crude oil, natural gas and correlated products from period to period may result in the recognition of charges to adjust the value of inventory to the lower of cost or market in periods of falling prices and the reversal of those charges in subsequent interim periods as market prices recover. Accordingly, our cost of sales and results of operations may be affected by such fluctuations.

No LCM inventory valuation charge was recorded in 2021, and we do not believe any of our inventory balance at year-end is at risk for impairment. Given the inherent volatility in the prices of our finished goods and raw materials, sustained price declines could result in LCM inventory valuation charges. During 2020, we recognized an LCM inventory valuation charge of $16 million related to the decline in pricing for our raw material and finished goods inventories.

In the first quarter of 2020, we recognized LCM inventory valuation charges of $419 million which was driven by a decline in pricing for many of our raw material and finished goods inventories. During the second, third and fourth quarters of 2020, we recognized LCM inventory valuation benefits of $96 million, $160 million and $147 million, respectively, as market prices began to recover subsequent to the first quarter of 2020.

Market price volatility for crude oil, heavy liquids and ethylene were the primary contributors to the LCM inventory valuation charges, and representative prices used to determine the LCM inventory valuation charges recognized during 2020 ranged from $12.14 to $41.75 per barrel for crude oil, $13.50 to $51.07 per barrel for heavy liquids and $205 to $767 per ton for ethylene.

Long-Lived Assets Impairment Assessment—The need to test for impairment can be based on several indicators, including a significant reduction in prices of or demand for products produced, a weakened outlook for profitability, a significant reduction in margins, an expectation that a long-lived asset will be sold or otherwise disposed of significantly before the end of its previously estimated useful life, other changes to contracts or changes in the regulatory environment. If the sum of the undiscounted estimated pre-tax cash flows for an asset group is less than the asset group's carrying value, fair value is calculated for the asset group using an income approach or a market approach when appropriate, and the carrying value is written down to the calculated fair value. For purposes of impairment evaluation, long-lived assets including finite-lived intangible assets must be grouped at the lowest level for which independent cash flows can be identified.

Significant judgment is involved in developing estimates of future cash flows since the results are based on forecasted financial information prepared using significant assumptions which may include, among other things, projected changes in supply and demand fundamentals (including industry-wide capacity, our planned utilization rate and end-user demand), new technological developments, capital expenditures, new competitors with significant raw material or other cost advantages, changes associated with world economies, the cyclical nature of the chemical and refining industries, uncertainties associated with governmental actions and other economic conditions. Such estimates are consistent with those used in our planning and capital investment and business performance reviews.

When an income approach is used to estimate fair value of our long-lived assets, the cash flows are discounted using a rate that is based on a variety of factors, including market and economic conditions, operational risk, regulatory risk and political risk. This discount rate is also compared to recent observable market transactions, if possible.

Houston Refinery Impairment—During the fourth quarter of 2021 and during the third quarter of 2020, we identified impairment triggers relating to our Houston refinery's asset group which resulted in non-cash impairment charges of $624 million and $582 million, respectively. Refer to Note 7 to our Consolidated Financial Statements.

In 2021, the estimate of the Houston refinery's undiscounted pre-tax cash flows utilized significant assumptions including management's best estimates of the expected future cash flows, the estimated useful lives of the asset group, and the residual value of the refinery. These estimates required considerable judgment and are sensitive to changes in underlying assumptions such as future commodity prices, margins on refined products, operating rates and capital expenditures including repairs and maintenance. As a result, there can be no assurance that the estimates and assumptions made for purposes of our impairment determination will prove to be an accurate prediction of the future. The Houston refinery's estimated fair value was calculated using a market approach which utilized unobservable inputs, which generally consist of market information provided by unrelated third parties.

In 2020, the estimates of the Houston refinery's undiscounted pre-tax cash flows utilized significant assumptions similar to those utilized during 2021. The Houston refinery's estimated fair value was determined using an income approach that was based on projected financial information and significant inputs that were not observable in the market.

Should our estimates and assumptions significantly change in future periods, it is possible that we may determine future impairment charges.

An estimate of the sensitivity to net income resulting from impairment calculations is not practicable, given the numerous assumptions, including pricing, volumes, discount rates, and market information provided by unrelated third parties that can materially affect our estimates. That is, unfavorable adjustments to some of the above listed assumptions may be offset by favorable adjustments in other assumptions.

Equity Method Investments Impairment—Investments in nonconsolidated entities accounted for under the equity method are assessed for impairment when there are indicators of a loss in value, such as a lack of sustained earnings capacity or a current fair value less than the investment's carrying amount.

When it is determined such a loss in value is other than temporary, an impairment charge is recognized for the difference between the investment's carrying value and its estimated fair value. When determining whether a decline in value is other than temporary, management considers factors such as the length of time and extent of the decline, the investee's financial condition and near-term prospects, and our ability and intention to retain our investment for a period that will be sufficient to allow for any anticipated recovery in the value of the investment. Management's estimate of fair value of an investment is based on the income approach and/or market approach. For the income approach, the fair value is typically based on the present value of expected future cash flows using discount rates believed to be consistent with those used by principal market participants. For the market approach, since quoted market prices are usually not available, we utilize market multiples of revenue and earnings derived from comparable publicly-traded industrial gases companies.

Goodwill—As of December 31, 2021, we had goodwill of $1,875 million. Of this amount, $1,357 million is related to the acquisition of A. Schulman in 2018, which is included in our APS segment, and is mainly attributed to acquired workforce and expected synergies. The remaining goodwill at December 31, 2021 primarily represents the tax effect of the differences between the tax and book basis of our assets and liabilities resulting from the revaluation of those assets and liabilities to fair value in connection with the Company's emergence from bankruptcy and fresh-start accounting in 2010. Additional information on the amount of goodwill allocated to our reporting units appears in Note 7 and Note 20 to the Consolidated Financial Statements.

We evaluate the recoverability of the carrying value of goodwill annually or more frequently if events or changes in circumstances indicate that the carrying amount of the goodwill of a reporting unit may not be fully recoverable. We have the option to first assess qualitative factors to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying value. Qualitative factors assessed for each of the reporting units include, but are not limited to, changes in long-term commodity prices, discount rates, competitive environments, planned capacity, cost factors such as raw material prices, and financial performance of the reporting units. If the qualitative assessment indicates that it is more likely than not that the carrying value of a reporting unit exceeds its estimated fair value, a quantitative test is required.

We also have the option to proceed directly to the quantitative impairment test. Under the quantitative impairment test, the fair value of each reporting unit, calculated using a discounted cash flow model, is compared to its carrying value, including goodwill. The discounted cash flow model inherently utilizes a significant number of estimates and assumptions, including operating margins, tax rates, discount rates, capital expenditures and working capital changes. If the carrying value of the reporting unit including goodwill exceeds its fair value, an impairment charge equal to the excess would be recognized, up to a maximum amount of goodwill allocated to that reporting unit.

For 2021 and 2020, management performed a qualitative impairment assessment of our reporting units, which indicated that the fair value of our reporting units was greater than their carrying value including goodwill. Accordingly, a quantitative goodwill impairment test was not required, and no goodwill impairment was recognized in 2021 or 2020.

Long-Term Employee Benefit Costs—Our costs for long-term employee benefits, particularly pension and other post-retirement medical and life insurance benefits, are incurred over long periods of time, and involve many uncertainties over those periods. The net periodic benefit cost attributable to current periods is based on several assumptions about such future uncertainties and is sensitive to changes in those assumptions. It is management's responsibility, often with the assistance of independent experts, to select assumptions that in its judgment represent its best estimates of the future effects of those uncertainties and to review those assumptions periodically to reflect changes in economic or other factors.

The current benefit service costs, as well as the existing liabilities, for pensions and other post-retirement benefits are measured on a discounted present value basis. The discount rate is a current rate, related to the rate at which the liabilities could be settled. Our assumed discount rate is based on yield information for high-quality corporate bonds with durations comparable to the expected cash settlement of our obligations. For the purpose of measuring the benefit obligations at December 31, 2021, we used a weighted average discount rate of 2.80% for the U.S. plans, which reflects the different terms of the related benefit obligations. The weighted average discount rate used to measure obligations for non-U.S. plans at December 31, 2021, was 1.45%, reflecting market interest rates. The discount rates in effect at December 31, 2021 will be used to measure net periodic benefit cost during 2022.

The benefit obligation and the net periodic benefit cost of other post-retirement medical benefits are also measured based on assumed rates of future increase in the per capita cost of covered health care benefits. As of December 31, 2021, the assumed rate of increase for our U.S. plans was 6.3%, decreasing to 4.5% in 2029 and thereafter.

The net periodic benefit cost of pension benefits included in expense is affected by the expected long-term rate of return on plan assets assumption. Investment returns that are recognized currently in net income represent the expected long-term rate of return on plan assets applied to a market-related value of plan assets, which is defined as the market value of assets. The expected rate of return on plan assets is a longer-term rate and is expected to change less frequently than the current assumed discount rate, reflecting long-term market expectations, rather than current fluctuations in market conditions.

The weighted average expected long-term rate of return on assets in our U.S. plans of 7.25% is based on the average level of earnings that our independent pension investment advisor advised could be expected to be earned over time. The weighted average expected long-term rate of return on assets in our non-U.S. plans of 1.44% is based on expectations and asset allocations that vary by region. The asset allocations are summarized in Note 14 to the Consolidated Financial Statements.

The actual rate of return on plan assets may differ from the expected rate due to the volatility normally experienced in capital markets. Management's goal is to manage the investments over the long term to achieve optimal returns with an acceptable level of risk and volatility.

Net periodic pension cost recognized each year includes the expected asset earnings, rather than the actual earnings or loss. Along with other gains and losses, this unrecognized amount, to the extent it cumulatively exceeds 10% of the greater of the projected benefit obligation or the market related value of the plan assets for the respective plan, is recognized as additional net periodic benefit cost over the average remaining service period of the participants in each plan.

The following table reflects the sensitivity of the benefit obligations and the net periodic benefit costs of our pension plans to changes in the actuarial assumptions:

	Effects on Benefit Obligations in 2021		Effects on Net Periodic Pension Costs in 2022	
Millions of dollars	**U.S.**	**Non-U.S.**	**U.S.**	**Non-U.S.**
Projected benefit obligations at December 31, 2021	$ 1,916	$ 1,924	$ —	$ —
Projected net periodic pension costs in 2022	—	—	(1)	57
Discount rate increases by 100 basis points	(176)	(253)	(9)	(6)
Discount rate decreases by 100 basis points	212	318	11	13

The sensitivity of our post-retirement benefit plans obligations and net periodic benefit costs to changes in actuarial assumptions are reflected in the following table:

	Effects on Benefit Obligations in 2021		Effects on Net Periodic Benefit Costs in 2022	
Millions of dollars	**U.S.**	**Non-U.S.**	**U.S.**	**Non-U.S.**
Projected benefit obligations at December 31, 2021	$ 203	$ 68	$ —	$ —
Projected net periodic benefit costs in 2022	—	—	—	4
Discount rate increases by 100 basis points	(17)	—	(1)	—
Discount rate decreases by 100 basis points	21	—	2	—

Additional information on the key assumptions underlying these benefit costs appears in Note 14 to the Consolidated Financial Statements.

Accruals for Taxes Based on Income—The determination of our provision for income taxes and the calculation of our tax benefits and liabilities is subject to management's estimates and judgments due to the complexity of the tax laws and regulations in the tax jurisdictions in which we operate. Uncertainties exist with respect to interpretation of these complex laws and regulations.

Deferred tax assets and liabilities are determined based on temporary differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax basis, and are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to reverse.

We recognize future tax benefits to the extent that the realization of these benefits is more likely than not. Our current provision for income taxes is impacted by the recognition and release of valuation allowances related to net deferred tax assets in certain jurisdictions. Further changes to these valuation allowances may impact our future provision for income taxes, which will include no tax benefit with respect to losses incurred and no tax expense with respect to income generated in these countries until the respective valuation allowance is eliminated.

We recognize the financial statement benefits with respect to an uncertain income tax position that we have taken or may take on an income tax return when we believe it is more likely than not that the position will be sustained with the tax authorities.

ACCOUNTING AND REPORTING CHANGES

For a discussion of the potential impact of new accounting pronouncements on our Consolidated Financial Statements, see Note 2 to the Consolidated Financial Statements.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

See Note 13 to the Consolidated Financial Statements for further discussion of our management of commodity price risk, foreign exchange risk and interest rate risk.

Commodity Price Risk—Prices for our products and raw materials are subject to changes in supply and demand. Natural gas, crude oil and refined products, along with feedstocks for ethylene and propylene production, constitute the main commodity exposures. Pricing terms in our raw material contracts are generally indexed to market prices. Changes in market prices for raw materials generally correlate with market prices for our products. In certain sales contracts, we may negotiate pricing terms to better align with changes in raw material costs. We also selectively enter commodity swap and futures contracts to manage commodity price risk. The impact of a 10% change in commodity prices at December 31, 2021 and 2020 would not materially impact the fair values of our commodity derivative contracts.

Foreign Exchange Risk—We manufacture and market our products in many countries throughout the world and, as a result, are exposed to changes in foreign currency exchange rates. Our reporting currency is the U.S. dollar. Many of our operating entities use the euro as their functional currency. Translation adjustments are deferred in Accumulated other comprehensive income.

We enter foreign currency derivatives that are designated as net investment hedges to reduce the volatility in Shareholders' equity resulting from translation adjustments associated with our net investments in foreign operations. We also enter foreign currency contracts that are designated as cash flow hedges to manage the variability in cash flows associated with intercompany debt balances. The table below illustrates the impact on Other comprehensive loss of a 10% fluctuation in the foreign currency rate associated with the hedges at December 31:

Millions of euro/dollars	Notional Amount 2021	Notional Amount 2020	10% Variance on Foreign Currency Rate	Impact on Other Comprehensive Loss 2021	Impact on Other Comprehensive Loss 2020
Net investment hedges:					
Cross currency basis swaps	€ 617	€ 617	euro/U.S. dollar rate	$ 71	$ 77
Cross currency swaps	€ 750	€ 750	euro/U.S. dollar rate	$ 92	$ 101
Forward exchange contracts	€ 1,250	€ 300	euro/U.S. dollar rate	$ 142	$ 37
Cash flow hedges:					
Cross currency swaps	€ 1,051	€ 1,841	euro/U.S. dollar rate	$ 134	$ 250

Some of our consolidated entities enter transactions that are not denominated in their functional currency. This results in exposure to foreign currency risk for financial instruments, including, but not limited to, third-party and intercompany receivables and payables and intercompany loans.

Our policy is to maintain a balanced position in foreign currencies to minimize exchange gains and losses arising from changes in exchange rates. We maintain risk management control practices to monitor the foreign currency risk attributable to our inter-company and third party outstanding foreign currency balances. These practices involve the centralization of our exposure to underlying currencies that are not subject to central bank and/or country specific restrictions. By centralizing most of our foreign currency exposure into one subsidiary, we are able to take advantage of natural offsets thereby reducing the overall impact of changes in foreign currency rates on our earnings.

To minimize the effects of our net currency exchange exposures, we enter into forward exchange contracts and cross-currency swaps. We also engage in short-term forward exchange contracts to manage our net exposure to foreign currencies as economic hedges. Changes in the fair value of these foreign currency contracts are reporting in the Consolidated Statements of Income and offset the currency exchange results recognized on foreign currency balances.

Other income, net, in the Consolidated Statements of Income reflects net foreign currency losses of $2 million and $7 million in 2021 and 2020, respectively. As of December 31, 2021, our foreign currency contracts that are accounted for as economic hedges mature between January 2022 and March 2022, inclusively, had an aggregate notional amount of $222 million and the fair value was a net liability of $1 million. A 10% fluctuation compared to the U.S. dollar would have resulted in an additional impact to earnings of approximately $4 million and $5 million in 2021 and 2020, respectively.

Interest Rate Risk—We are exposed to interest rate risk with respect to our fixed-rate and variable-rate debt. Fluctuations in interest rates impact the fair value of fixed-rate debt and expose us to the risk that we may need to refinance debt at higher rates. Fluctuations in interest rates impact interest expense from our variable-rate debt. To minimize earnings at risk as part of our interest rate risk management strategy, we target to maintain floating-rate debt, through the use of interest rate swaps and issuance of variable-rate debt, equal to our cash and cash equivalents, as those assets earn interest based on floating-rates.

Pre-issuance interest rate—To mitigate the risk that benchmark interest rates may increase in connection with future financing activities, we adopted a pre-issuance interest rate strategy, under which we entered forward-starting interest rate swaps that are designated as cash flow hedges. We estimate that a 10% change in market interest rates as of December 31, 2021 and 2020, would change the fair value of these forward-starting interest rate swaps by approximately $48 million and $44 million, respectively.

Fixed-rate debt—We enter into interest rate swaps that effectively convert our fixed-rate debt to variable-rate debt. These interest rate swaps are designated as fair value hedges. At December 31, 2021 and 2020, the total notional amount of these interest rate swaps was $1,163 million and $122 million, respectively.

At December 31, 2021, after giving consideration to the fixed-rate debt that we have effectively converted to variable-rate debt, approximately 90% of our debt portfolio, on a gross basis, incurred interest at a fixed-rate and the remaining 10% of the portfolio incurred interest at a variable-rate. We estimate that a 10% change in market interest rates as of December 31, 2021 and 2020, would not materially impact the fair value of these interest rate swaps.

Variable-rate debt—At December 31, 2021, our variable rate-debt consisted of $204 million outstanding under our Commercial Paper Program. We also have available borrowing capacity under our $3,250 million Senior Revolving Credit Facility and our $900 million U.S. Receivables Facility. At December 31, 2021, there were no outstanding borrowings under these facilities. Based on our average variable-rate debt outstanding per year, we estimate that a 10% change in market interest rates as of December 31, 2021 and 2020 would not materially impact the fair value of these facilities.

Item 8. Financial Statements and Supplementary Data.

Index to the Consolidated Financial Statements

	Page
LYONDELLBASELL INDUSTRIES N.V.	
Management's Report on Internal Control over Financial Reporting	58
Report of Independent Registered Public Accounting Firm	59
Consolidated Financial Statements:	
Consolidated Statements of Income	62
Consolidated Statements of Comprehensive Income	63
Consolidated Balance Sheets	64
Consolidated Statements of Cash Flows	66
Consolidated Statements of Shareholders' Equity	68
Notes to the Consolidated Financial Statements	69

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Management of the Company, including the Chief Executive Officer and the Chief Financial Officer, is responsible for establishing and maintaining adequate internal control over financial reporting, as defined in Rules 13a-15(f) and 15d-15(f) of the Securities Exchange Act of 1934, as amended. Internal control over financial reporting is a process designed by, or under the supervision of, our Chief Executive Officer and Chief Financial Officer, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. Our internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of our assets; (ii) provide reasonable assurance that transactions are recorded as necessary to permit the preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures are being made only in accordance with authorizations of our management and directors; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on the financial statements.

We conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2021 based on the Internal Control—Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission in 2013. Based on our evaluation, management has concluded that our internal control over financial reporting was effective as of December 31, 2021.

The effectiveness of our internal control over financial reporting as of December 31, 2021 has been audited by PricewaterhouseCoopers LLP (PCAOB ID 238), an independent registered public accounting firm, as stated in their report which is included herein.

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of LyondellBasell Industries N.V.

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of LyondellBasell Industries N.V. and its subsidiaries (the "Company") as of December 31, 2021 and 2020, and the related consolidated statements of income, of comprehensive income, of shareholders' equity and of cash flows for each of the three years in the period ended December 31, 2021, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2021, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2021 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2021, based on criteria established in I*nternal Control - Integrated Framework* (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Taxation - Provisions for unrecognized tax benefits

As described in Notes 2, 9, 10, and 16 to the consolidated financial statements, as of December 31, 2021, the Company has recorded an income tax provision of $1,163 million, income tax receivables of $263 million, income tax payables of $402 million, and net deferred tax liabilities of $2,160 million related to which they have reported $327 million of unrecognized tax benefits. The Company operates in multiple jurisdictions throughout the world, and its tax returns are periodically audited or subjected to review by tax authorities. As a result, there is an uncertainty in income taxes recognized in the Company's consolidated financial statements. Management recognizes uncertain income tax positions when it is more likely than not, based on the technical merits, that the position or a portion thereof will be sustained upon examination. As disclosed by management, there continues to be increased attention to the tax practices of multinational companies, including U.S. tax reform proposals, European Union's state aid investigations, Pillar One and Two proposals by the Organization for Economic Cooperation and Development (OECD) with respect to base erosion and profit shifting, and European Union tax directives and their implementation.

The principal considerations for our determination that performing procedures relating to the provision for unrecognized tax benefits is a critical audit matter are (i) the significant judgment by management when determining provisions for unrecognized tax benefits, including a high degree of estimation uncertainty relative to the complexity of tax laws, frequency of tax audits, and potential for adjustments as a result of such tax audits; (ii) a high degree of auditor judgment, subjectivity and effort in performing procedures and evaluating management's timely identification of tax uncertainties; and (iii) the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to the identification and recognition of the liabilities for unrecognized tax benefits and controls addressing completeness of the uncertain tax positions. These procedures also included, among others (i) testing management's assessment of the technical merits of tax positions and estimates of the amount of tax benefit expected to be sustained; (ii) testing the completeness of management's assessment of both the identification and possible outcomes of uncertain tax positions; and (iii) evaluating the status and results of tax audits with the relevant tax authorities. Professionals with specialized skill and knowledge were used to assist in evaluating the completeness of the Company's uncertain tax positions, including evaluating the reasonableness of management's assessment of whether tax positions are more likely than not of being sustained and the amount of potential benefit to be realized, as well as the determination and the application of relevant tax laws.

/s/ PricewaterhouseCoopers LLP
Houston, Texas
February 24, 2022

We have served as the Company's auditor since 2008.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF INCOME

Millions of dollars, except earnings per share	Year Ended December 31, 2021	2020	2019
Sales and other operating revenues:			
Trade	$ 45,135	$ 26,995	$ 33,908
Related parties	1,038	758	819
	46,173	27,753	34,727
Operating costs and expenses:			
Cost of sales	37,397	24,359	29,301
Impairments	624	582	—
Selling, general and administrative expenses	1,255	1,140	1,199
Research and development expenses	124	113	111
	39,400	26,194	30,611
Operating income	6,773	1,559	4,116
Interest expense	(519)	(526)	(347)
Interest income	9	12	19
Other income, net	62	85	39
Income from continuing operations before equity investments and income taxes	6,325	1,130	3,827
Income from equity investments	461	256	225
Income from continuing operations before income taxes	6,786	1,386	4,052
Provision for (benefit from) income taxes	1,163	(43)	648
Income from continuing operations	5,623	1,429	3,404
Loss from discontinued operations, net of tax	(6)	(2)	(7)
Net income	5,617	1,427	3,397
Dividends on redeemable non-controlling interests	(7)	(7)	(7)
Net income attributable to the Company shareholders	$ 5,610	$ 1,420	$ 3,390
Earnings per share:			
Net income (loss) attributable to the Company shareholders —			
Basic:			
Continuing operations	$ 16.79	$ 4.25	$ 9.61
Discontinued operations	(0.02)	(0.01)	(0.02)
	$ 16.77	$ 4.24	$ 9.59
Diluted:			
Continuing operations	$ 16.77	$ 4.25	$ 9.60
Discontinued operations	(0.02)	(0.01)	(0.02)
	$ 16.75	$ 4.24	$ 9.58

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

Millions of dollars	Year Ended December 31, 2021	2020	2019
Net income	$ 5,617	$ 1,427	$ 3,397
Other comprehensive income (loss), net of tax—			
Financial derivatives	72	(226)	(132)
Unrealized (losses) gains on available-for-sale debt securities	(1)	1	—
Defined benefit pension and other post-retirement benefit plans	224	(41)	(269)
Foreign currency translations	(155)	107	(20)
Total other comprehensive income (loss), net of tax	140	(159)	(421)
Comprehensive income	5,757	1,268	2,976
Dividends on redeemable non-controlling interests	(7)	(7)	(7)
Comprehensive income attributable to the Company shareholders	$ 5,750	$ 1,261	$ 2,969

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED BALANCE SHEETS

	December 31,	
Millions of dollars	2021	2020
ASSETS		
Current assets:		
Cash and cash equivalents	$ 1,472	$ 1,763
Restricted cash	5	2
Short-term investments	9	702
Accounts receivable:		
Trade, net	4,565	3,291
Related parties	243	150
Inventories	4,901	4,344
Prepaid expenses and other current assets	1,022	1,382
Total current assets	12,217	11,634
Operating lease assets	1,946	1,492
Property, plant and equipment, net	14,556	14,386
Equity investments	4,786	4,729
Goodwill	1,875	1,953
Intangible assets, net	695	751
Other assets	667	458
Total assets	$ 36,742	$ 35,403

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED BALANCE SHEETS

Millions of dollars, except shares and par value data	December 31, 2021	December 31, 2020
LIABILITIES, REDEEMABLE NON-CONTROLLING INTERESTS AND EQUITY		
Current liabilities:		
Current maturities of long-term debt	$ 6	$ 8
Short-term debt	362	663
Accounts payable:		
Trade	3,460	2,398
Related parties	831	550
Accrued liabilities	2,571	1,883
Total current liabilities	7,230	5,502
Long-term debt	11,246	15,286
Operating lease liabilities	1,649	1,222
Other liabilities	2,295	2,957
Deferred income taxes	2,334	2,332
Commitments and contingencies		
Redeemable non-controlling interests	116	116
Shareholders' equity:		
Ordinary shares, €0.04 par value, 1,275 million shares authorized, 329,536,389 and 334,015,220 shares outstanding, respectively	19	19
Additional paid-in capital	6,044	5,986
Retained earnings	8,563	4,440
Accumulated other comprehensive loss	(1,803)	(1,943)
Treasury stock, at cost, 10,675,605 and 6,030,408 ordinary shares, respectively	(965)	(531)
Total Company share of shareholders' equity	11,858	7,971
Non-controlling interests	14	17
Total equity	11,872	7,988
Total liabilities, redeemable non-controlling interests and equity	$ 36,742	$ 35,403

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
Millions of dollars	2021	2020	2019
Cash flows from operating activities:			
Net income	$ 5,617	$ 1,427	$ 3,397
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	1,393	1,385	1,312
Impairments	624	582	—
Amortization of debt-related costs	35	21	11
Share-based compensation	66	55	48
Inventory valuation charges	—	16	33
Equity investments—			
Equity income	(461)	(256)	(225)
Distributions of earnings, net of tax	315	159	247
Deferred income tax (benefit) provision	(198)	331	209
Changes in assets and liabilities that provided (used) cash:			
Accounts receivable	(1,519)	(246)	367
Inventories	(742)	340	(129)
Accounts payable	1,301	217	(251)
Other, net	1,264	(627)	(58)
Net cash provided by operating activities	7,695	3,404	4,961
Cash flows from investing activities:			
Expenditures for property, plant and equipment	(1,959)	(1,947)	(2,694)
Proceeds from repurchase agreements	—	—	527
Purchases of available-for-sale debt securities	—	(270)	(108)
Proceeds from sales and maturities of available-for-sale debt securities	346	114	511
Purchases of equity securities	—	(608)	(33)
Proceeds from equity securities	335	313	332
Acquisition of equity method investment	(106)	(2,440)	—
Proceeds from settlement of net investment hedges	358	—	—
Payments for settlement of net investment hedges	(355)	—	—
Other, net	(121)	(68)	(170)
Net cash used in investing activities	$ (1,502)	$ (4,906)	$ (1,635)

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF CASH FLOWS

Millions of dollars	Year Ended December 31, 2021	2020	2019
Cash flows from financing activities:			
Repurchases of Company ordinary shares	$ (463)	$ (4)	$ (3,752)
Dividends paid - common stock	(1,486)	(1,405)	(1,462)
Purchase of non-controlling interest	—	(30)	(63)
Issuance of long-term debt	—	6,378	5,031
Payments of debt issuance costs	(3)	(63)	(22)
Repayments of long-term debt	(3,925)	(2,880)	(2,974)
Debt extinguishment costs	(150)	(77)	—
Issuance of short-term debt	—	521	2,500
Repayments of short-term debt	—	(506)	(1,526)
Net (repayments of) proceeds from commercial paper	(296)	239	(549)
Collateral paid for interest rate derivatives	—	(238)	—
Proceeds from settlement of cash flow hedges	855	346	—
Payment for settlement of cash flow hedges	(904)	—	—
Proceeds from settlement of foreign currency contract	—	887	—
Payments for settlement of foreign currency contract	—	(882)	—
Other, net	(13)	(15)	(18)
Net cash (used in) provided by financing activities	(6,385)	2,271	(2,835)
Effect of exchange rate changes on cash	(96)	108	(4)
(Decrease) increase in cash and cash equivalents and restricted cash	(288)	877	487
Cash and cash equivalents and restricted cash at beginning of period	1,765	888	401
Cash and cash equivalents and restricted cash at end of period	$ 1,477	$ 1,765	$ 888
Supplemental Cash Flow Information:			
Interest paid, net of capitalized interest	$ 414	$ 498	$ 318
Net income taxes paid	310	176	403

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

Millions of dollars	Ordinary Shares Issued	Ordinary Shares Treasury	Additional Paid-in Capital	Retained Earnings	Accumulated Other Comprehensive Loss	Company Share of Shareholders' Equity	Non-Controlling Interests
Balance, December 31, 2018	$ 22	$ (2,206)	$ 7,041	$ 6,763	$ (1,363)	$ 10,257	$ 23
Net income	—	—	—	3,397	—	3,397	—
Other comprehensive loss	—	—	—	—	(421)	(421)	—
Share-based compensation	—	42	33	(3)	—	72	—
Dividends - common stock ($4.15 per share)	—	—	—	(1,462)	—	(1,462)	—
Dividends - redeemable non-controlling interests ($60.00 per share)	—	—	—	(7)	—	(7)	—
Repurchases of Company ordinary shares	—	(3,728)	—	—	—	(3,728)	—
Purchase of non-controlling interests	—	—	(64)	—	—	(64)	—
Distribution to non-controlling interests	—	—	—	—	—	—	(4)
Cancellation of Treasury shares	(3)	5,312	(1,056)	(4,253)	—	—	—
Balance, December 31, 2019	$ 19	$ (580)	$ 5,954	$ 4,435	$ (1,784)	$ 8,044	$ 19
Net income	—	—	—	1,427	—	1,427	—
Other comprehensive loss	—	—	—	—	(159)	(159)	—
Share-based compensation	—	53	25	(10)	—	68	—
Dividends - common stock ($4.20 per share)	—	—	—	(1,405)	—	(1,405)	—
Dividends - redeemable non-controlling interests ($60.00 per share)	—	—	—	(7)	—	(7)	—
Repurchases of Company ordinary shares	—	(4)	—	—	—	(4)	—
Purchase of non-controlling interests	—	—	7	—	—	7	—
Distribution to non-controlling interests	—	—	—	—	—	—	(2)
Balance, December 31, 2020	$ 19	$ (531)	$ 5,986	$ 4,440	$ (1,943)	$ 7,971	$ 17
Net income	—	—	—	5,617	—	5,617	—
Other comprehensive income	—	—	—	—	140	140	—
Share-based compensation	—	43	58	(1)	—	100	—
Dividends - common stock ($4.44 per share)	—	—	—	(1,486)	—	(1,486)	—
Dividends - redeemable non-controlling interests ($60.00 per share)	—	—	—	(7)	—	(7)	—
Repurchases of Company ordinary shares	—	(477)	—	—	—	(477)	—
Sales of non-controlling interests	—	—	—	—	—	—	(3)
Balance, December 31, 2021	$ 19	$ (965)	$ 6,044	$ 8,563	$ (1,803)	$ 11,858	$ 14

See Notes to the Consolidated Financial Statements.

LYONDELLBASELL INDUSTRIES N.V.

NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS

TABLE OF CONTENTS

		Page
1.	Description of Company and Operations	70
2.	Summary of Significant Accounting Policies	70
3.	Revenues	80
4.	Related Party Transactions	81
5.	Accounts Receivable	82
6.	Inventories	82
7.	Property, Plant and Equipment, Goodwill and Intangible Assets	83
8.	Equity Investments	86
9.	Prepaid Expenses, Other Current Assets and Other Assets	88
10.	Accrued Liabilities	89
11.	Debt	90
12.	Leases	95
13.	Financial Instruments and Fair Value Measurements	97
14.	Pension and Other Post-retirement Benefits	102
15.	Incentive and Share-Based Compensation	113
16.	Income Taxes	116
17.	Commitments and Contingencies	122
18.	Shareholders’ Equity and Redeemable Non-controlling Interests	124
19.	Per Share Data	128
20.	Segment and Related Information	129

1. Description of Company and Operations

LyondellBasell Industries N.V. is a limited liability company (*Naamloze Vennootschap*) incorporated under Dutch law by deed of incorporation dated October 15, 2009. Unless otherwise indicated, the "Company," "we," "us," "our" or similar words are used to refer to LyondellBasell Industries N.V. together with its consolidated subsidiaries ("LyondellBasell N.V.").

LyondellBasell N.V. is a worldwide manufacturer of chemicals and polymers, a refiner of crude oil, a significant producer of gasoline blending components and a developer and licensor of technologies for the production of polymers.

2. Summary of Significant Accounting Policies

Basis of Preparation and Consolidation

The accompanying Consolidated Financial Statements have been prepared from the books and records of LyondellBasell N.V. under accounting principles generally accepted in the United States ("U.S. GAAP"). Subsidiaries are defined as being those companies over which we, either directly or indirectly, have control through a majority of the voting rights or the right to exercise control or to obtain the majority of the benefits and be exposed to the majority of the risks. Subsidiaries are consolidated from the date on which control is obtained until the date that such control ceases. All intercompany transactions and balances have been eliminated in consolidation.

Cash and Cash Equivalents

Our cash equivalents consist of highly liquid debt instruments such as certificates of deposit, commercial paper and money market accounts with major international banks and financial institutions. Cash equivalents include instruments with maturities of three months or less when acquired and exclude restricted cash.

Short-Term Investments

Our investments in debt securities are classified as available-for-sale and held-to-maturity on the basis of our intent and ability to hold the investments. Investments classified as available-for-sale are carried at fair value with changes reflected in other comprehensive income. Credit-related impairment, measured using the expected cash flows and limited to the amount by which the amortized cost basis of a security exceeds its fair value, is recognized through an allowance for expected credit losses, and adjusted subsequently if conditions change, with a corresponding impact in earnings. Where there is an intention or a requirement to sell an impaired available-for-sale debt security, the entire impairment is recognized in earnings with a corresponding adjustment to the amortized cost basis of the security.

Investments classified as held-to-maturity are carried at amortized cost less allowance for credit losses recorded through net income.

Trade Receivables

Trade receivables are amounts due from customers for merchandise sold or services performed in the ordinary course of business and are carried at transaction price net of allowance for credit losses. Allowance for credit losses is measured using historical loss rates for the respective risk categories and incorporating forward-looking estimates. The corresponding expense for the loss allowance is reflected in Selling, general and administrative expenses.

Inventories

Cost of our raw materials, work-in-progress and finished goods inventories is determined using the last-in, first-out ("LIFO") method and is carried at the lower of cost or market value. Cost of our materials and supplies inventory is determined using the moving average cost method and is carried at the lower of cost and net realizable value.

Inventory exchange transactions, which involve fungible commodities, are not accounted for as purchases and sales. Any resulting volumetric exchange balances are accounted for as inventory, with cost determined using the LIFO method.

Property, Plant and Equipment

Property, plant and equipment are recorded at historical cost. Historical cost includes expenditures that are directly attributable to the acquisition of the items. Costs may also include borrowing costs incurred on debt during construction of major projects exceeding one year, costs of major maintenance arising from turnarounds of major units and legally obligated decommissioning costs. Routine maintenance costs are expensed as incurred.

Depreciation is computed using the straight-line method over the estimated useful lives of assets to their residual values. The residual values and useful lives of assets are reviewed, and adjusted if appropriate, whenever events or circumstances indicate that a revision is warranted. Land is not depreciated.

We evaluate property, plant and equipment for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. Long-lived assets are grouped at the lowest level for which there are identifiable cash flows that are largely independent of the cash flows of other groups of assets, which, for us, is generally at the plant group level (or, at times, individual plants in certain circumstances where we have isolated production units with separately identifiable cash flows). If it is determined that an asset or asset group's carrying value exceeded its undiscounted estimated pre-tax cash flows and estimated fair value, the asset is written down to its estimated fair value.

Gain or loss on retirement or sale of property, plant and equipment is recognized in Other income (expense), net.

Equity Investments

We account for equity method investments ("equity investments") using the equity method of accounting if we have the ability to exercise significant influence over, but not control of, an investee. Significant influence generally exists if we have an ownership interest representing between 20% and 50% of the voting rights. Under the equity method of accounting, investments are stated initially at cost and are adjusted for subsequent additional investments and our proportionate share of profit or losses and distributions.

We record our share of the profits or losses of the equity investments, net of income taxes, in the Consolidated Statements of Income. When our share of losses in an equity investment equals or exceeds the carrying amount of our investment including advances made by us, we do not recognize further losses, unless we have guaranteed obligations or are otherwise committed to provide further financial support to the investee.

We assess our equity investments for impairment whenever events or changes in circumstances indicate that the carrying amount of the investment may not be recoverable. If the decline in value is considered to be other-than-temporary, the investment is written down to its estimated fair value.

Investments in PO Joint Ventures and the Louisiana Joint Venture—We share ownership with Covestro PO LLC, a subsidiary of Covestro AG (collectively "Covestro"), in a U.S. propylene oxide ("PO") manufacturing joint venture (the "U.S. PO Joint Venture"). The U.S. PO Joint Venture owns a PO/styrene monomer ("SM" or "styrene") and a PO/tertiary butyl alcohol ("TBA") manufacturing facility. Covestro's ownership interest in Series A partnership units represents an undivided interest in certain U.S. PO Joint Venture assets with correlative PO capacity reservation that resulted in ownership of annual in-kind cost-based PO production of approximately 680 thousand tons in 2021 and 2020. Our ownership interest in Series A and Series B partnership units conveys us an undivided interest in certain U.S. PO Joint Venture assets with correlative PO and co-product capacity, respectively, resulting in the ownership of annual in-kind cost-based PO and co-product production.

In addition, each partner has a 50% interest in a separate manufacturing joint venture (the "European PO Joint Venture"), which owns a PO/SM plant at Maasvlakte near Rotterdam, The Netherlands. In substance, each partner's ownership interest represents an undivided interest in all of the European PO Joint Venture assets with correlative capacity reservation resulting in ownership of annual in-kind cost-based PO and SM production.

We do not share marketing or product sales under the U.S. PO Joint Venture. We operate the U.S. PO Joint Venture's and the European PO Joint Venture's (collectively the "PO Joint Ventures") plants and arrange and coordinate the logistics of product delivery. The partners' share in the cost of production and logistics is based on their product off-take.

During the fourth quarter of 2020, we executed a joint venture agreement with Sasol Chemicals (USA) LLC ("Sasol") to form the Louisiana Integrated PolyEthylene JV LLC joint venture (the "Louisiana Joint Venture"). Under this arrangement, we acquired a 50% ownership interest in an ethane cracker, a low-density and linear-low density polyethylene plants, and associated infrastructure. Under the terms of the joint venture agreement, each partner provides pro-rata share of ethane feedstocks and off-takes pro-rata shares of cracker and polyethylene products. We operate the Louisiana Joint Venture assets and market the polyethylene off-take for all partners through our global sales team.

We account for the PO Joint Ventures and the Louisiana Joint Venture using the equity method. We report the cost of our product off-take as inventory and the equity loss as cost of sales in our Consolidated Financial Statements. Related production cash flows are reported in the operating cash flow section of the Consolidated Statements of Cash Flows.

Our equity investment in the PO Joint Ventures and the Louisiana Joint Venture represents our share of the manufacturing plants and is decreased by recognition of our share of equity loss, which is equal to the depreciation of the assets of these joint ventures. Other changes in the investment balance are principally due to our additional capital contributions to these joint ventures to fund capital expenditures. Such contributions are reported in the investing cash flow section of the Consolidated Statements of Cash Flows.

Our product off-take of PO and its co-products from the PO Joint Ventures was 2.6 million tons in 2021, 2.6 million tons in 2020 and 2.4 million tons in 2019. Our product off-take of ethylene and polyethylene produced from the Louisiana Joint Venture in 2021 was 1.1 million tons. The product off-take in 2020 for the period subsequent to the formation of the joint venture was immaterial.

Redeemable Non-controlling Interests

Our redeemable non-controlling interests relate to shares of cumulative perpetual special stock ("redeemable non-controlling interest stock") issued by our consolidated subsidiary, formerly known as A. Schulman, Inc. ("A. Schulman"). Holders of redeemable non-controlling interest stock are entitled to receive cumulative dividends at the rate of 6% per share on the liquidation preference of $1,000 per share. Redeemable non-controlling interest stock may be redeemed at any time at the discretion of the holders and is reported in the Consolidated Balance Sheets outside of permanent equity.

The redeemable non-controlling interests were recorded at fair value at the date of acquisition and are subsequently carried at the greater of estimated redemption value at the end of each reporting period or the initial amount recorded at the date of acquisition adjusted for subsequent redemptions. Dividends on these shares are deducted from or added to the amount of Income (loss) attributable to the Company shareholders if and when declared by the Company.

Goodwill

Goodwill is tested for impairment annually in the fourth quarter or whenever events or changes in circumstances indicate that the fair value of a reporting unit with goodwill is below its carrying amount.

We first assess qualitative factors to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying value. Qualitative factors assessed for each of the reporting units include, but are not limited to, changes in long-term commodity prices, discount rates, competitive environments, planned capacity, cost factors such as raw material prices, and financial performance of the reporting units. If the qualitative assessment indicates that it is more likely than not that the carrying value of a reporting unit exceeds its estimated fair value, a quantitative test is required. If the carrying value of the reporting unit including goodwill exceeds its fair value, an impairment charge equal to the excess would be recognized up to a maximum amount of goodwill allocated to that reporting unit.

For 2021 and 2020, management performed qualitative impairment assessments of our reporting units, which indicated that the fair value of our reporting units was greater than their carrying value including goodwill. Based on this assessment, our historical assessment for impairment and forecasted demand for our products, a quantitative goodwill impairment test was not required and no goodwill impairment was recognized.

Intangible Assets

Intangible assets consist of customer relationships, trade names and trademarks, know-how, emission allowances, various contracts, in-process research and development costs and software costs. These assets are amortized using the straight-line method over their estimated useful lives or over the term of the related agreement. We evaluate definite-lived intangible assets with the associated long-lived asset group for impairment whenever impairment indicators are present.

Research and Development

Research and development ("R&D") costs are expensed when incurred. Subsidies for R&D are included in Other income (expense), net. Depreciation expense related to assets employed in R&D is included as a cost of R&D.

Income Taxes

The income tax for the period comprises current and deferred tax. Income tax is recognized in the Consolidated Statements of Income, except to the extent that it relates to items recognized in other comprehensive income or directly in equity. In these cases, the applicable tax amount is recognized in other comprehensive income or directly in equity, respectively.

Deferred income taxes reflect the tax effects of temporary differences between the carrying amounts of assets and liabilities for financial reporting purposes and the amounts recognized for income tax purposes, as well as the net tax effects of net operating loss carryforwards. Valuation allowances are provided against deferred tax assets when it is more likely than not that some portion or all of the deferred tax asset will not be realized.

We recognize uncertain income tax positions in our financial statements when we believe it is more likely than not, based on the technical merits, that the position or a portion thereof will be sustained upon examination. For a position that is more likely than not to be sustained, the benefit recognized is measured at the largest cumulative amount that is greater than 50 percent likely of being realized.

Other Provisions

Environmental Remediation Costs—Environmental remediation liabilities include liabilities related to sites we currently own, sites we no longer own, as well as sites where we have operated that belong to other parties. Liabilities for anticipated expenditures related to investigation and remediation of contaminated sites are accrued when it is probable a liability has been incurred and the amount of the liability can be reasonably estimated. Only certain post-remediation monitoring costs, the timing of which can be determined with reasonable certainty, are discounted to present value.

Asset Retirement Obligations—At some sites, we are legally obligated to decommission our plants upon site exit. Asset retirement obligations are recorded at the fair value using the present value of the estimated costs to retire the asset at the time the obligation is incurred. That cost, which is capitalized as part of the related long-lived asset, is depreciated on a straight-line basis over the remaining useful life of the related asset. Accretion expense in connection with the discounted liability is also recognized over the remaining useful life of the related asset. Such depreciation and accretion expenses are included in Cost of sales.

Foreign Currency Translation and Remeasurement

Functional and Reporting Currency—Items included in the financial information of each of LyondellBasell N.V.'s entities are measured using the currency of the primary economic environment in which the entity operates ("the functional currency") and then translated to the U.S. dollar ("the reporting currency") as follows:

- Assets and liabilities for each balance sheet presented are translated at the closing rate at the date of that balance sheet;
- Income and expenses for each income statement are translated at monthly average exchange rates; and
- All resulting exchange differences are recognized as a separate component within Other comprehensive income (foreign currency translation adjustments).

Transactions and Balances—Foreign currency transactions are recorded in their respective functional currency using exchange rates prevailing at the dates of the transactions. Exchange gains and losses resulting from the settlement of such transactions and from remeasurement of monetary assets and liabilities denominated in foreign currencies at the balance sheet date are recognized in earnings.

Revenue Recognition

Substantially all our revenues are derived from contracts with customers. We account for contracts when both parties have approved the contract and are committed to perform, the rights of the parties and payment terms have been identified, the contract has commercial substance and collectability is probable.

Revenue is recognized when obligations under the terms of a contract with our customer are satisfied. This generally occurs at the point in time when performance obligations are fulfilled and control transfers to the customer. In most instances, control transfers upon transfer of risk of loss and title to the customer, which usually occurs when we ship products to the customer from our manufacturing facility. Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods. Customer incentives are generally based on volumes purchased and recognized over the period earned. Sales, value-added, and other taxes that we collect concurrent with revenue-producing activities are excluded from the transaction price as they represent amounts collected on behalf of third parties. We apply the practical expedient to recognize the incremental costs of obtaining a contract as an expense when incurred if the amortization period of the asset that we otherwise would have recognized is one year or less. Shipping and handling costs are treated as a fulfillment cost and not a separate performance obligation.

We have marketing arrangements to off-take and sell the production of some of our joint ventures in return for a percentage of the price realized on the sales to the end customer. In such arrangements, when we obtain control of the product, revenue and cost of sales are presented on a gross basis. Otherwise, we recognize revenue, net of amounts due to the joint venture, which represents commissions earned.

Payments are typically required within a short period following the transfer of control of the product to the customer. We occasionally require customers to prepay purchases to ensure collectability. Such prepayments do not represent financing arrangements, since payment occurs within a short time frame. We apply the practical expedient which permits us to disregard the effects of a significant financing component when, at contract inception, we expect the period between the payment and fulfillment of the performance obligation will be one year or less.

Contract balances typically arise when a difference in timing between the transfer of control to the customer and receipt of consideration occurs. Our contract liabilities, which are reflected in our Consolidated Financial Statements as Accrued liabilities and Other liabilities, consist primarily of customer payments for products or services received before the transfer of control to the customer occurs.

Share-Based Compensation

The Company recognizes compensation expense in the financial statements for equity-classified share-based compensation awards based upon the grant date fair value over the vesting period. See Note 15 to the Consolidated Financial Statements for additional information.

Leases

Leases with a term longer than 12 months are recorded on the balance sheet as a lease asset and lease liability. If at inception of a contract, a lease is identified, we recognize a lease asset and a corresponding lease liability based on the present value of the lease payments over the lease term, discounted using our incremental borrowing rate, unless an implicit rate is readily determinable. Lease payments include fixed and variable lease components derived from usage or market-based indices, such as the consumer price index. Other variable lease payments may fluctuate for a variety of reasons including usage, output, insurance or taxes. These variable amounts are expensed as incurred and not included in the lease assets or lease liabilities. Options to extend or terminate a lease are reflected in the lease payments and lease term when it is reasonably certain that we will exercise those options. Leases are classified as either finance or operating, with classification affecting the pattern of expense recognition in the Consolidated Statements of Income. The majority of our leases are operating leases for which we recognize lease expense on a straight-line basis over the lease term. We apply the practical expedient to account for lease and associated non-lease components as a single lease component for all asset classes with the exception of utilities and pipeline assets within major manufacturing equipment. For these assets, non-lease components are separated from lease components and accounted for as normal operating expenses. Leases with an initial term of 12 months or less are recognized in the Consolidated Statements of Income on a straight-line basis over the lease term.

Financial Instruments and Hedging Activities

Pursuant to our risk management policies, we selectively enter into derivative transactions to manage market risk volatility associated with changes in commodity pricing, currency exchange rates and interest rates. Certain derivatives used for this purpose are designated as net investment hedges, cash flow hedges or fair value hedges. Derivative instruments are recorded at fair value on the balance sheet. Gains and losses related to changes in the fair value of derivative instruments not designated as hedges are recorded in earnings.

Cash flows from derivatives designated as hedges are reported in our Consolidated Statements of Cash Flows under the same category as the cash flows from the hedged items unless the derivative contract contains a significant financing element. Cash flows for derivatives with a significant financing element are classified as Cash flows from financing activities. Cash flows related to economic hedges are classified consistent with the cash flows of the economic hedged items.

Net Investment Hedges—We enter into foreign currency derivatives and foreign currency denominated debt to reduce the volatility in shareholders' equity resulting from changes in currency exchange rates of our foreign subsidiaries with respect to the U.S. dollar. Our foreign currency derivatives consist of cross-currency contracts and forward exchange contracts.

We use the critical terms approach through the application of the spot method to assess hedge effectiveness at least quarterly. For derivatives designated as net investment hedges, gains or losses attributable to changes in spot foreign exchange rates over the designation period are reflected in foreign currency translation adjustments within Other comprehensive income (loss). Recognition in earnings is delayed until the net investment is sold or liquidated. At that time, the amount recognized is reported in the same line item as the gain or loss on the liquidation of the hedged foreign operations. For our cross-currency swaps, the associated interest receipts and payments are recorded in interest expense. For our foreign currency forward contracts, we amortize initial forward point values on a straight-line basis to interest expense over the life of the hedging instrument. We monitor on a quarterly basis for any over-hedged positions requiring re-designation and re-designation of the hedge to remove such over-hedged condition.

Cash Flow Hedges—We enter into cash flow hedges to manage the variability in cash flows of a future transaction. Our cash flow hedges include cross currency swaps, forward starting interest rate swaps and commodity futures, options and swaps. For derivatives designated as cash flow hedges, the gains and losses are recorded in other comprehensive income (loss) and released to earnings in the same line item and in the same period during which the hedged item affects earnings.

We use the critical terms and the quantitative long-haul methods to assess hedge effectiveness and monitor, at least quarterly, any change in effectiveness.

We have cross-currency swap contracts designated as cash flow hedges to reduce our exposure to the foreign currency exchange risk associated with certain intercompany loans. Under the terms of these contracts, we make interest payments in euros and receive interest in U.S. dollars. Upon the maturities of these contracts, we will pay the principal amount of the loans in euros and receive U.S. dollars from our counterparties.

We enter into forward-starting interest rate contracts to mitigate the risk of adverse changes in benchmark interest rates on future anticipated debt issuances.

We also execute commodity futures, options and swaps to manage the volatility of the commodity price related to anticipated purchases of raw materials and product sales. We enter into over-the-counter commodity swaps and options with one or more counterparties whereby we pay a predetermined fixed price and receive a price based on the average monthly rate of a specified index for the specified nominated volumes.

Fair Value Hedges—We use interest rate swaps as part of our current interest rate risk management strategy to achieve a desired proportion of variable versus fixed rate debt. Under these arrangements, we exchange fixed-rate for floating-rate interest payments to effectively convert our fixed-rate debt to floating-rate debt. For derivatives that have been designated as fair value hedges, the gains and losses of the derivatives and hedged items are recorded in earnings.

We use the long-haul method to assess hedge effectiveness using a regression analysis approach at least quarterly. We perform the regression analysis over an observation period of three years, utilizing data that is relevant to the hedge duration.

Fair Value Measurements

We categorize assets and liabilities, measured at fair value, into one of three different levels depending on the observability of the inputs employed in the measurement. Level 1 inputs are quoted prices for identical instruments in active markets. Level 2 inputs are quoted prices for similar instruments in active markets; quoted prices for identical or similar instruments in markets that are not active; and model-derived valuations in which all significant inputs or significant value-drivers are observable. Level 3 inputs are model-derived valuations in which one or more significant inputs or significant value-drivers are unobservable.

Fair value measurements are classified according to the lowest level input or value-driver that is significant to the valuation. A measurement may therefore be classified within Level 3 even though there may be significant inputs that are readily observable.

Changes in Fair Value Levels—Management reviews the disclosures regarding fair value measurements at least quarterly. If an instrument classified as Level 1 subsequently ceases to be actively traded, it is transferred out of Level 1. In such cases, instruments are reclassified as Level 2, unless the measurement of its fair value requires the use of significant unobservable inputs, in which case it is reclassified as Level 3.

We use the following inputs and valuation techniques to estimate the fair value of our financial instruments disclosed in Note 13 to the Consolidated Financial Statements:

Cross-Currency Swaps—The fair value of our cross-currency swaps is calculated using the present value of future cash flows discounted using observable inputs such as known notional value amounts, yield curves, basis curves, as applicable, and with the foreign currency leg revalued using published spot and forward exchange rates on the valuation date.

Forward-Starting and Fixed-for-Floating Interest Rate Swaps—The fair value of our forward-starting and fixed-for-floating interest rate swaps is calculated using the present value of future cash flows using observable inputs such as benchmark interest rates and market yield curves.

Commodity Derivatives—The fair values of our commodity derivatives are measured using closing market prices of public exchanges and from third-party broker quotes and pricing providers.

The fair value of our commodity swaps classified as Level 2 is determined using a combination of observable and unobservable inputs. The observable inputs consist of future market values of various crude and heavy fuel oils, which are readily available through public data sources. The unobservable input, which is the estimated discount or premium used in the market pricing, is calculated using an internally-developed, multi-linear regression model based on the observable prices of the known components and their relationships to historical prices. A significant change in this unobservable input would not have a material impact on the fair value measurement of our Level 2 commodity swaps.

Forward Exchange Contracts—The fair value of our forward exchange contracts is based on forward market rates.

Available-for-Sale Debt Securities—The fair value of our available-for-sale debt securities is calculated using observable market data for similar securities and broker quotes from recognized purveyors of market data.

Equity Securities—The fair value of our investment in equity securities is based on the net asset value provided by the fund administrator.

Short-Term Debt—The fair value of short-term borrowings related to precious metal financing arrangements accounted for as embedded derivatives are determined based on the future price of the associated precious metal.

Long-Term Debt—The fair value of our senior and guaranteed notes is calculated using pricing data obtained from well-established and recognized vendors of market data for debt valuations. The fair value of our term loan was determined based on a discounted cash flow model using observable inputs such as benchmark interest rates and public information regarding our credit risk.

We use the following inputs and valuation techniques to estimate the fair value of our pension assets disclosed in Note 14 to the Consolidated Financial Statements:

Common and Preferred Stock—Valued at the closing price reported on the market on which the individual securities are traded.

Fixed Income Securities—Certain securities that are not traded on an exchange are valued at the closing price reported by pricing services. Other securities are valued based on yields currently available on comparable securities of issuers with similar credit ratings.

Commingled Funds—Valued based upon the unit values of such collective trust funds held at year end by the pension plans. Unit values are based on the fair value of the underlying assets of the fund derived from inputs principally from, or corroborated by, observable market data by correlation or other means.

Real Estate—Valued on the basis of a discounted cash flow approach, which includes the future rental receipts, expenses, and residual values as the highest and best use of the real estate from a market participant view as rental property.

Hedge Funds—Valued based upon the unit values of such alternative investments held at year end by the pension plans. Unit values are based on the fair value of the underlying assets of the fund.

Private Equity—Valued based upon the unit values of such alternative investments held at year end by the pension plans. Unit values are based on the fair value of the underlying assets of the fund. Certain securities held in the fund are valued at the closing price reported on an exchange or other established quotation service for over-the-counter securities. Other assets held in the fund are valued based on the most recent financial statements prepared by the fund manager.

Convertible Securities—Valued at the quoted prices for similar assets or liabilities in active markets.

U.S. Government Securities—Certain securities are valued at the closing price reported on the active market on which the individual securities are traded. Other securities are valued based on yields currently available on comparable securities of issuers with similar credit ratings.

Cash and Cash Equivalents—Valued at the quoted prices for identical assets or liabilities in active markets.

Non-U.S. Insurance Arrangements—Valued based upon the estimated cash surrender value of the underlying insurance contract, which is derived from an actuarial determination of the discounted benefits cash flows.

Employee Benefits

Pension Plans—We have funded and unfunded defined benefit plans and defined contribution plans. For the defined benefit plans, a projected benefit obligation is calculated annually by independent actuaries using the projected unit credit method. Pension costs primarily represent the increase in the actuarial present value of the obligation for pension benefits based on employee service during the year and the interest on this obligation in respect of employee service in previous years, net of expected return on plan assets.

Actuarial gains and losses arising from experience adjustments and changes in actuarial assumptions are charged or credited to equity and are reflected in Accumulated other comprehensive income in the period in which they arise.

Other Post-Employment Obligations—Certain employees are entitled to post-retirement medical benefits upon retirement. The entitlement to these benefits is usually conditional on the employee remaining in service up to retirement age and the completion of a minimum service period. The expected costs of these benefits are accrued over the period of employment applying the same accounting methodology used for defined benefit plans.

Termination Benefits—Contractual termination benefits are payable when employment is terminated due to an event specified in the provisions of a social/labor plan or statutory law. A liability is recognized for one-time termination benefits when we are committed to (i) make payments and the number of affected employees and the benefits to be received are known to both parties, and (ii) terminating the employment of current employees according to a detailed formal plan without possibility of withdrawal and can reasonably estimate such amount. Benefits falling due more than 12 months after the balance sheet date are discounted to present value.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates.

Events surrounding the COVID-19 pandemic continue to evolve and negatively impact global markets and demand for our products. We continue to assess the potential financial statement impacts of COVID-19 and commodity price volatility throughout the duration of the pandemic. The extent of the impact of the pandemic on our operational and financial performance will depend on future developments which are uncertain and cannot be predicted. An extended period of economic disruption could have a material adverse impact on our business, results of operations, access to sources of liquidity and financial condition.

Recently Adopted Guidance

Equity Method and Joint Ventures—In January 2020, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") 2020-01, *Investments—Equity Securities (Topic 321), Investments— Equity Method and Joint Ventures (Topic 323), and Derivatives and Hedging (Topic 815): Clarifying the Interactions between Topic 321, Topic 323, and Topic 815.*

The guidance clarifies that an entity should consider observable transactions that require it to either apply or discontinue the equity method of accounting for the purposes of applying the measurement alternative in accordance with Topic 321. The standard also includes scope considerations for entities that hold certain non-derivative forward contracts and purchased options to acquire equity securities that, upon settlement of the forward contract or exercise of the purchase option, would be accounted for under the equity method of accounting. This guidance is effective for fiscal years beginning after December 15, 2020, and interim periods within those fiscal years.

The prospective adoption of this guidance from January 1, 2021 did not have a material impact on our Consolidated Financial Statements.

Convertible Instruments—In August 2020, the FASB issued ASU 2020-06, *Debt—Debt with Conversion and Other Options (Subtopic 470-20) and Derivatives and Hedging— Contracts in Entity's Own Equity (Subtopic 815-40): Accounting for Convertible Instruments and Contracts in an Entity's Own Equity.*

The guidance simplifies the accounting for convertible instruments and the application of the derivatives scope exception for contracts in an entity's own equity. The standard also amends the accounting for convertible instruments in the diluted earnings per share calculation and requires enhanced disclosures of convertible instruments and contracts in an entity's own equity. The guidance is effective for fiscal years beginning after December 15, 2021 and may be applied on a modified or fully retrospective basis.

The early adoption of this guidance on a modified retrospective basis from January 1, 2021 did not have a material impact on our Consolidated Financial Statements.

Debt—In October 2021, the FASB issued ASU 2020-09, *Debt (Topic 470): Amendments to SEC Paragraphs Pursuant to SEC Release No. 33-10762.*

This guidance amends and supersedes SEC paragraphs in the Accounting Standards Codification to reflect the issuance of SEC Release No. 33-10762 related to financial disclosure requirements for subsidiary issuers and guarantors of registered debt securities and affiliates whose securities are pledged as collateral for registered securities. The guidance is effective for annual and interim periods ending after January 4, 2021.

The adoption of this guidance from January 1, 2021 did not have a material impact on our Consolidated Financial Statements.

Accounting Guidance Issued But Not Adopted as of December 31, 2021

Government Assistance—In November 2021, the FASB issued ASU 2021-10, *Government Assistance (Topic 832): Disclosures by Business Entities about Government Assistance.* The guidance requires disclosures about assistance received from the government that have been accounted for by analogizing to a grant or contribution accounting model including the nature and form of assistance, the accounting policies used to account for the assistance and its impact on the entity's financial statements. The guidance is effective for annual periods beginning after December 15, 2021, with early application permitted.

The adoption of this guidance will not have a material impact on our Consolidated Financial Statements.

3. Revenues

Contract Balances—Contract liabilities were $169 million and $194 million at December 31, 2021 and 2020, respectively. Revenue recognized in each reporting period, included in the contract liability balance at the beginning of the period, was immaterial.

Disaggregation of Revenues—We participate globally across the petrochemical value chain and are an industry leader in many of our product lines. Our chemicals businesses consist primarily of large processing plants that convert large volumes of liquid and gaseous hydrocarbon feedstocks into plastic resins and other chemicals. Our chemical products tend to be basic building blocks for other chemicals and plastics. Our plastic products are used in large volumes as well as smaller specialty applications. Our refining business consists of our Houston refinery, which processes crude oil into refined products such as gasoline and distillates.

Revenues disaggregated by key products are summarized below:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Sales and other operating revenues:			
Olefins & co-products	$ 5,008	$ 2,432	$ 2,957
Polyethylene	10,134	5,842	6,070
Polypropylene	7,994	4,525	5,010
Propylene oxide and derivatives	2,885	1,714	1,924
Oxyfuels and related products	3,587	2,278	3,116
Intermediate chemicals	3,415	2,080	2,516
Compounding and solutions	4,132	3,223	4,096
Advanced polymers	1,001	680	750
Refined products	7,178	4,346	7,599
Other	839	633	689
Total	$ 46,173	$ 27,753	$ 34,727

The following table presents our revenues disaggregated by geography, based upon the location of the customer:

	Year Ended December 31,		
Millions of dollars	2021	2020	2019
Sales and other operating revenues:			
United States	$ 22,526	$ 12,113	$ 16,349
Germany	3,395	2,113	2,708
China	2,322	1,474	1,225
Italy	1,828	1,175	1,435
Mexico	1,572	1,197	1,634
France	1,431	875	1,345
Japan	1,417	876	1,039
The Netherlands	1,390	785	929
Poland	1,169	926	960
Other	9,123	6,219	7,103
Total	$ 46,173	$ 27,753	$ 34,727

Transaction Price Allocated to the Remaining Performance Obligations—We have elected to exclude contracts which have an initial term of one year or less from this disclosure. Our contracts with customers are commodity supply arrangements that settle based on market prices at future delivery dates; therefore, transaction prices are entirely variable. Transaction prices are known at the time revenue is recognized since they are generally determined by the commodity price index at a specific date, at month-end or at the month average once products are shipped to our customers. Future estimates of transaction prices for disclosure purposes are substantially constrained as they are highly susceptible to factors outside our influence, including volatility in commodity markets, industry production capacities and operating rates, planned and unplanned industry operating interruptions, foreign exchange rates and worldwide geopolitical trends.

4. Related Party Transactions

We have related party transactions with our joint venture partners, which are classified as equity investees (see Note 8 to the Consolidated Financial Statements). These related party transactions include the sales and purchases of goods in the normal course of business as well as certain financing arrangements. In addition, under contractual arrangements with certain of our equity investees, we receive certain services, utilities and materials at some of our manufacturing sites, and we provide certain services to our equity investees.

We have guaranteed $30 million of the indebtedness of two of our joint ventures as of December 31, 2021.

Related party transactions are summarized as follows:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
The Company billed related parties for:			
Sales of products—			
Joint venture partners	$ 1,038	$ 758	$ 819
Shared service agreements—			
Joint venture partners	13	6	8
Related parties billed the Company for:			
Sales of products—			
Joint venture partners	$ 4,348	$ 2,682	$ 2,830
Shared service agreements—			
Joint venture partners	85	75	71

5. Accounts Receivable

We sell our products primarily to other industrial concerns in the petrochemical and refining industries. We perform ongoing credit evaluations of our customers' financial condition and, in certain circumstances, require letters of credit or corporate guarantees from them. Our Accounts receivable are reflected in the Consolidated Balance Sheets net of allowance for credit losses of $6 million and $15 million as of December 31, 2021 and 2020, respectively. We recorded allowance for credit losses for receivables, which are reflected in the Consolidated Statements of Income, however, such amounts were immaterial for each of the years ended December 31, 2021, 2020 and 2019.

6. Inventories

Inventories consisted of the following components at December 31:

Millions of dollars	**2021**	**2020**
Finished goods	$ 3,329	$ 2,816
Work-in-process	178	144
Raw materials and supplies	1,394	1,384
Total inventories	$ 4,901	$ 4,344

At December 31, 2021 and 2020, approximately 80% and 81%, respectively, of our inventories were valued using the last in, first out ("LIFO") method and the remaining inventories, consisting primarily of materials and supplies, were valued at the moving average cost method. At December 31, 2021 and 2020, our LIFO cost exceeded current replacement cost under the first-in first-out method.

The excess of our inventories at estimated net realizable value over LIFO cost after lower of cost or market ("LCM") charges was approximately $2,503 million and $601 million at December 31, 2021 and 2020, respectively. We recognized an LCM inventory valuation charge of $16 million and $33 million during 2020 and 2019, respectively. These charges primarily related to the decline in pricing for our raw material and finished goods inventories and in domestic polyethylene prices, respectively.

7. Property, Plant and Equipment, Goodwill and Intangible Assets

Property, Plant and Equipment—The components of property, plant and equipment, at cost, and the related accumulated depreciation are as follows at December 31:

Millions of dollars	Estimated Useful Life (years)	2021	2020
Land		$ 334	$ 376
Major manufacturing equipment	25	11,614	11,698
Buildings	30	1,228	1,241
Light equipment and instrumentation	5 - 20	3,347	3,279
Office furniture	15	24	24
Major turnarounds	4 - 7	1,652	1,697
Information system equipment	3 - 5	63	66
Construction in progress		4,120	3,103
Total property, plant and equipment		22,382	21,484
Less accumulated depreciation		(7,826)	(7,098)
Property, plant and equipment, net		$ 14,556	$ 14,386

Capitalized Interest—We capitalize interest costs incurred on funds used to construct property, plant and equipment. In 2021, 2020 and 2019, we capitalized interest of $97 million, $40 million and $87 million, respectively.

Intangible Assets—The components of identifiable intangible assets, at cost, and the related accumulated amortization are as follows at December 31:

	2021			2020		
Millions of dollars	Cost	Accumulated Amortization	Net	Cost	Accumulated Amortization	Net
Emission allowances	$ 740	$ (504)	$ 236	$ 846	$ (611)	$ 235
Various contracts	435	(357)	78	456	(351)	105
Customer relationships	303	(68)	235	308	(51)	257
In-process research and development costs	109	(97)	12	117	(96)	21
Trade name and trademarks	104	(93)	11	108	(88)	20
Know-how	83	(37)	46	86	(27)	59
Software costs	158	(81)	77	122	(68)	54
Total intangible assets	$ 1,932	$ (1,237)	$ 695	$ 2,043	$ (1,292)	$ 751

Amortization of these identifiable intangible assets for the next five years is expected to be $83 million in 2022, $76 million in 2023, $67 million in 2024, $64 million in 2025 and $46 million in 2026.

Impairments—During the fourth quarter of 2021 and during the third quarter of 2020, we identified impairment triggers relating to our Houston refinery's asset group which resulted in non-cash impairment charges of $624 million and $582 million, respectively.

In September 2021, we announced we were weighing strategic options, including a potential sale, for our Houston refinery. The subsequent evaluation of strategic options during the fourth quarter of 2021 increased the likelihood of the asset's disposal prior to the end of its expected useful life. As a result of this impairment indicator, we assessed the Houston refinery for impairment in the fourth quarter of 2021 and determined that its carrying value exceeded its estimated undiscounted pre-tax cash flows. We estimated the fair values of the Houston refinery's property, plant and equipment, materials and supplies and intangible assets were all zero as of December 31, 2021. Given this, our Refining segment recognized a $624 million non-cash impairment charge in the fourth quarter of 2021 that includes a $549 million impairment of property, plant and equipment, a $43 million impairment of materials and supplies and a $32 million impairment of intangible assets, which reduced the assets' carrying values to their fair values. The fair values of the impaired assets were determined using market information provided by unrelated third parties. The fair value measurement for the asset group is classified as Level 3.

During 2020, prior to the Company's evaluation of strategic options for the Houston refinery, we identified impairment triggers relating to our Houston refinery's asset group as a result of significant negative impacts to the Refining segment forecasted cash flows resulting from the COVID-19 pandemic. We assessed the Houston refinery for impairment and determined that the asset group carrying value exceeded its undiscounted estimated pre-tax cash flows. As of September 30, 2020, we estimated the fair value of the Houston refinery's property, plant and equipment to be $550 million, and fair value of contract intangible assets to be $10 million, which was less than the carrying value. As a result, our Refining segment recognized a non-cash impairment charge in the third quarter of 2020 of $582 million, which included a $570 million impairment of property, plant and equipment and a $12 million impairment of contract intangible assets, which reduced the assets' carrying values to their fair values. The fair value of the impaired assets was determined using an income approach that was based on significant inputs that were not observable in the market. The fair value measurement for the asset group is classified as Level 3.

Depreciation and Amortization Expense—Depreciation and amortization expense is summarized as follows:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Property, plant and equipment	$ 1,146	$ 1,143	$ 1,092
PO Joint Ventures and Louisiana Joint Venture	156	72	49
Emission allowances	12	58	63
Various contracts	20	20	32
Customer relationships	20	20	24
In-process research and development costs	8	8	8
Trade name and trademarks	8	45	30
Know-how	11	11	12
Software costs	12	8	2
Total depreciation and amortization	$ 1,393	$ 1,385	$ 1,312

Asset Retirement Obligations—In certain cases, we are contractually obligated to decommission our plants upon site exit. In such cases, we have accrued the net present value of the estimated costs. The majority of our asset retirement obligations are related to facilities in Europe. The changes in our asset retirement obligations are as follows:

	Year Ended December 31,	
Millions of dollars	2021	2020
Beginning balance	$ 64	$ 65
Payments	(3)	(6)
Changes in estimates	3	(2)
Accretion expense	2	2
Effects of exchange rate changes	(4)	5
Ending balance	$ 62	$ 64

Although we may have asset retirement obligations associated with some of our other facilities, the present value of those obligations is not material in the context of an indefinite expected life of the facilities. We continually review the optimal future alternatives for our facilities. Any decision to retire one or more facilities may result in an increase in the present value of such obligations.

Discontinued Operations—We began reporting the Berre refinery as a discontinued operation in the second quarter of 2012. The estimated cost and associated cash flows pertaining to the final closure and dismantlement of our Berre refinery from the Prefect of Bouches du Rhone are not deemed to be material.

Goodwill—The changes in the carrying amount of goodwill in each of the Company's reportable segments for the years ended December 31, 2021 and 2020 were as follows:

Millions of dollars	O&P – Americas	O&P – EAI	I&D	APS	Technology	Total
December 31, 2019	$ 162	$ 112	$ 228	$ 1,380	$ 9	$ 1,891
Foreign currency translation adjustments	—	30	31	(1)	2	62
December 31, 2020	162	142	259	1,379	11	1,953
Foreign currency translation adjustments	—	(33)	(34)	(8)	(3)	(78)
December 31, 2021	$ 162	$ 109	$ 225	$ 1,371	$ 8	$ 1,875

8. Equity Investments

Our principal direct and indirect equity investments are as follows at December 31:

Percent of Ownership	2021	2020
PO Joint Ventures—		
European PO Joint Venture	50.00 %	50.00 %
U.S. PO Joint Venture - Series A	23.71 %	23.71 %
U.S. PO Joint Venture - Series B	100.00 %	100.00 %
Louisiana Joint Venture	50.00 %	50.00 %
Bora LyondellBasell Petrochemical Co. Ltd.	50.00 %	50.00 %
Basell Orlen Polyolefins Sp. Z.o.o.	50.00 %	50.00 %
Saudi Polyolefins Company	25.00 %	25.00 %
Saudi Ethylene & Polyethylene Company Ltd.	25.00 %	25.00 %
Al-Waha Petrochemicals Ltd.	25.00 %	25.00 %
Polymirae Co. Ltd.	50.00 %	50.00 %
HMC Polymers Company Ltd.	28.56 %	28.56 %
Indelpro S.A. de C.V.	49.00 %	49.00 %
Ningbo ZRCC Lyondell Chemical Co. Ltd.	26.65 %	26.65 %
Ningbo ZRCC LyondellBasell New Material Co. Ltd.	50.00 %	— %

The changes in our equity investments are as follows at December 31:

Millions of dollars	2021	2020
Beginning balance	$ 4,729	$ 2,106
Capital contributions	61	96
Income from equity investments	461	256
Acquisition of equity investments	106	2,438
Distribution of earnings, net of tax	(315)	(159)
Depreciation of PO Joint Ventures and Louisiana Joint Venture	(156)	(72)
Currency exchange effects	(55)	62
Other	(45)	2
Ending balance	$ 4,786	$ 4,729

Capital contributions in 2021 and 2020 include $54 million and $83 million, respectively, related to our PO Joint Ventures.

In January 2021, we executed a joint venture agreement with China Petroleum & Chemical Corporation ("Sinopec") to form the Ningbo ZRCC LyondellBasell New Material Company Limited joint venture. We contributed $104 million for a 50% equity interest in the joint venture. The joint venture constructed a new PO and SM unit in Zhenhai Ningbo, China which began production in January 2022. The unit utilizes LyondellBasell's leading PO/SM technology and has the capacity to produce 275 thousand tons of PO and 600 thousand tons of SM per year. Products produced by the joint venture will be marketed equally by both partners, expanding our respective participation in the Chinese market. The joint venture is included within our Intermediates & Derivatives segment.

During the third quarter of 2020, we executed a joint venture agreement with the Liaoning Bora Enterprise Group ("Bora") to form the Bora LyondellBasell Petrochemical Co. Ltd ("BLYB") joint venture. We contributed $472 million for a 50% equity interest in the joint venture. This joint venture is included in our Olefins and Polyolefins–Europe, Asia, International segment. Production began at the BLYB complex during the third quarter of 2020.

BLYB's manufacturing facility located in Panjin, China includes a 1.1 million tons per annum flexible naphtha / liquefied petroleum gas cracker and associated polyethylene production capacity of 0.8 million tons per annum and 0.6 million tons per annum of polypropylene. The materials produced at the facility serve various industries in China, including packaging, transportation, building and construction, healthcare and hygiene. The complex utilizes LyondellBasell's *Spheripol* and *Spherizone* polypropylene technologies along with the company's *Hostalen* ACP polyethylene technology. We market all the polypropylene and high-density polyethylene produced.

In December 2020 we executed a joint venture agreement with Sasol to form the Louisiana Joint Venture, acquiring a 50% equity interest in the 1.5 million ton ethane cracker, 0.9 million ton low and linear-low density polyethylene plants and associated infrastructure located in Lake Charles, Louisiana, for total consideration of $2 billion. This joint venture is included within our Olefins and Polyolefins–Americas segment. Under the terms of the arrangement, each joint venture partner will provide pro-rata shares of ethane feedstocks and will off-take pro-rata shares of cracker and polyethylene products. We operate the Louisiana Joint Venture assets and market the polyethylene off-take for all partners through our global sales team.

Summarized balance sheet information of our investments accounted for under the equity method (presented at 100%) at December 31 are as follows:

Millions of dollars	2021	2020
Current assets	$ 5,488	$ 4,396
Noncurrent assets	11,521	11,613
Total assets	17,009	16,009
Current liabilities	3,589	3,081
Noncurrent liabilities	2,544	2,562
Net assets	$ 10,876	$ 10,366

Summarized income statement information of our investments accounted for under the equity method (presented at 100%) at December 31 are as follows:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Revenues	$ 15,456	$ 9,172	$ 9,222
Cost of sales	(13,269)	(7,883)	(7,992)
Gross profit	2,187	1,289	1,230
Net operating expenses	(497)	(320)	(296)
Operating income	1,690	969	934
Interest income	—	1	5
Interest expense	(48)	(70)	(64)
Foreign currency translation	(5)	5	4
Other (expense) income, net	(21)	2	(24)
Income before income taxes	1,616	907	855
Provision for income taxes	(337)	(183)	(194)
Net income	$ 1,279	$ 724	$ 661

The difference between our carrying value and the underlying equity in the net assets of our equity investments are assigned to the assets and liabilities of the investment, based on an analysis of the factors giving rise to the basis difference. The amortization of the basis difference included in Income from equity investments in the Consolidated Statements of Income for the years ended December 31, 2021, 2020 and 2019, was $6 million, $5 million and $4 million, respectively.

9. Prepaid Expenses, Other Current Assets and Other Assets

The components of Prepaid expenses and other current assets were as follows at December 31:

Millions of dollars	**2021**	**2020**
Renewable identification numbers	$ 305	$ 63
Income tax receivable	263	890
VAT receivables	141	158
Financial derivatives	125	41
Advances to suppliers	57	61
Prepaid insurance	33	28
Other	98	141
Total prepaid expenses and other current assets	$ 1,022	$ 1,382

For additional information regarding Income tax receivable, see Note 16 to our Consolidated Financial Statements.

The components of Other assets were as follows at December 31:

Millions of dollars	2021	2020
Financial derivatives	$ 282	$ 244
Deferred tax assets	174	39
Pension assets	67	23
Company-owned life insurance	61	61
Debt issuance costs	7	10
Other	76	81
Total other assets	$ 667	$ 458

10. Accrued Liabilities

Accrued liabilities consisted of the following components at December 31:

Millions of dollars	2021	2020
Payroll and benefits	$ 539	$ 370
Income taxes	402	67
Renewable identification numbers	340	95
Operating lease liabilities	336	310
Taxes other than income taxes	211	232
Product sales rebates	178	149
Contract liabilities	169	157
Interest	145	169
Financial derivatives	3	139
Other	248	195
Total accrued liabilities	$ 2,571	$ 1,883

11. Debt

Long-term loans, notes and other debt, net of unamortized discount, debt issuance cost and cumulative fair value hedging adjustments, consisted of the following at December 31:

Millions of dollars	2021	2020
Senior Notes due 2024, $1,000 million, 5.75% ($2 million of debt issuance cost)	$ 773	$ 996
Senior Notes due 2055, $1,000 million, 4.625% ($15 million of discount; $11 million of debt issuance cost)	974	974
Term Loan due 2022, $4,000 million	—	1,448
Guaranteed Notes due 2027, $300 million, 8.1%	300	300
Issued by LYB International Finance B.V.:		
Guaranteed Notes due 2023, $750 million, 4.0% ($1 million of discount; $1 million of debt issuance cost)	423	745
Guaranteed Notes due 2043, $750 million, 5.25% ($19 million of discount; $7 million of debt issuance cost)	724	723
Guaranteed Notes due 2044, $1,000 million, 4.875% ($10 million of discount; $9 million of debt issuance cost)	981	981
Issued by LYB International Finance II B.V.:		
Guaranteed Notes due 2026, €500 million, 0.875% ($1 million of discount; $2 million of debt issuance cost)	562	608
Guaranteed Notes due 2027, $1,000 million 3.5% ($3 million of discount; $3 million of debt issuance cost)	631	1,090
Guaranteed Notes due 2031, €500 million, 1.625% ($5 million of discount; $3 million of debt issuance cost)	558	602
Issued by LYB International Finance III, LLC:		
Guaranteed Floating Rate Notes due 2023, $650 million	—	646
Guaranteed Notes due 2025, $500 million, 2.875%	—	496
Guaranteed Notes due 2025, $500 million, 1.25% ($1 million of discount; $3 million of debt issuance cost)	486	495
Guaranteed Notes due 2030, $500 million, 3.375% ($1 million of debt issuance cost)	143	495
Guaranteed Notes due 2030, $500 million, 2.25% ($4 million of discount; $4 million of debt issuance cost)	490	492
Guaranteed Notes due 2040, $750 million, 3.375% ($2 million of discount; $7 million of debt issuance cost)	741	740
Guaranteed Notes due 2049, $1,000 million, 4.2% ($15 million of discount; $10 million of debt issuance cost)	975	975
Guaranteed Notes due 2050, $1,000 million, 4.2% ($6 million of discount; $10 million of debt issuance cost)	981	984
Guaranteed Notes due 2051, $1,000 million, 3.625% ($3 million of discount; $11 million of debt issuance cost)	986	986
Guaranteed Notes due 2060, $500 million, 3.8% ($4 million of discount; $6 million of debt issuance cost)	490	490
Other	34	28
Total	11,252	15,294
Less current maturities	(6)	(8)
Long-term debt	$ 11,246	$ 15,286

Fair value hedging adjustments associated with the fair value hedge accounting of our fixed-for-floating interest rate swaps for the applicable periods are as follows:

	Gains (Losses)		Cumulative Fair Value Hedging Adjustments Included in Carrying Amount of Debt	
	Year Ended December 31,		December 31,	
Millions of dollars	2021	2020	2021	2020
Senior Notes due 2021, 6.0%	$ —	$ 1	$ —	$ —
Guaranteed Notes due 2022, 1.875%	—	2	—	—
Guaranteed Notes due 2025, 1.25%	2	—	2	—
Guaranteed Notes due 2026, 0.875%	3	(2)	1	(2)
Guaranteed Notes due 2027, 3.5%	56	(65)	(46)	(102)
Guaranteed Notes due 2030, 3.375%	(2)	—	(2)	—
Guaranteed Notes due 2030, 2.25%	2	—	2	—
Guaranteed Notes due 2050, 4.2%	3	—	3	—
Total	$ 64	$ (64)	$ (40)	$ (104)

Fair value adjustments are recognized in Interest expense in the Consolidated Statements of Income.

Short-term loans, notes and other debt consisted of the following at December 31:

Millions of dollars	2021	2020
U.S. Receivables Facility	$ —	$ —
Commercial paper	204	500
Precious metal financings	155	140
Other	3	23
Total Short-term debt	$ 362	$ 663

Aggregate maturities of debt during the next five years are $368 million in 2022, $443 million in 2023, $780 million in 2024, $496 million in 2025, $566 million in 2026 and $9,100 million thereafter.

Long-Term Debt

Senior Revolving Credit Facility—In November 2021, we entered into a second amendment and restatement of our credit agreement (the "Amended and Restated Credit Agreement") to provide for a $3,250 million senior unsecured revolving credit facility (the "Senior Revolving Credit Facility") that matures in November 2026. Our Senior Revolving Credit Facility which may be used for dollar and euro denominated borrowings, has a $200 million sub-limit for dollar and euro denominated letters of credit, a $1,000 million uncommitted accordion feature, and supports our commercial paper program. Borrowings under the facility bear interest at either a base rate, LIBOR rate or EURIBOR rate, plus an applicable margin. Additional fees are incurred for the average daily unused commitments. At December 31, 2021, we had no borrowings or letters of credit outstanding and $3,046 million of unused availability under this facility.

The facility contains customary covenants and warranties, including specified restrictions on indebtedness and liens. Additionally, we are required to maintain a maximum leverage ratio (calculated as the ratio of total net funded debt to consolidated earnings before interest, taxes and depreciation and amortization, both as defined in the Amended and Restated Credit Agreement) financial covenant of (i) 4.00 to 1.00 for the fiscal quarter ending March 31, 2022; and (ii) 3.50 to 1.00 for the fiscal quarter ending June 30, 2022 and thereafter. In the event an acquisition meeting certain thresholds is consummated at any time after March 31, 2022 we can elect to increase the maximum leverage ratio for each of the first six fiscal quarters ending after such acquisition as indicated in the Amended and Restated Credit Agreement. The Amended and Restated Credit Agreement also removes minimum liquidity requirements for dividends and share repurchases contained in the previous agreement.

Term Loan due 2022—In March 2019, LYB Americas Finance Company LLC ("LYB Americas Finance"), a wholly owned subsidiary of LyondellBasell Industries N.V., entered into a $4,000 million senior unsecured delayed draw term loan credit facility that matures in March 2022. Borrowings under the credit agreement were available through December 31, 2019, subsequent to which no further borrowings could be made under the agreement. In October 2020 we repaid $500 million of the indebtedness outstanding under this Term Loan, using the proceeds from guaranteed notes issued in October 2020 as discussed below. In 2021, we repaid the remaining $1,450 million outstanding under our Term Loan due 2022.

Outstanding borrowings bore interest at either a base rate or LIBOR rate, as defined, plus in each case, an applicable margin determined by reference to LyondellBasell N.V.'s current credit ratings. The credit agreement contained customary representations and warranties and contained certain restrictive covenants regarding, among other things, secured indebtedness, subsidiary indebtedness, mergers and sales of assets.

Covenants and Provisions—Our $300 million 8.1% Guaranteed Notes due 2027, which are guaranteed by LyondellBasell Industries Holdings B.V., a wholly owned subsidiary of LyondellBasell Industries N.V., contain certain restrictions with respect to the level of maximum debt that can be incurred and security that can be granted by certain operating companies that are direct or indirect wholly owned subsidiaries of LyondellBasell Industries Holdings B.V. These notes contain customary provisions for default, including, among others, the non-payment of principal and interest, certain failures to perform or observe obligations under the Agreement on the notes, the occurrence of certain defaults under other indebtedness, failure to pay certain indebtedness and the insolvency or bankruptcy of certain LyondellBasell Industries N.V. subsidiaries.

The indentures governing all other notes contain limited covenants, including those restricting our ability and the ability of our subsidiaries to incur indebtedness secured by significant property or by capital stock of subsidiaries that own significant property, enter into certain sale and lease-back transactions with respect to any significant property or enter into consolidations, mergers or sales of all or substantially all of our assets.

We may redeem some of our notes in whole or in part, prior to their respective maturity dates, at a redemption price equal to the greater of (i) 100% of the principal amount of the notes redeemed and (ii) the sum of the present values of the remaining scheduled payments of principal and interest (discounted at the applicable treasury yield or comparable government bond rate plus their respective basis points) on the notes to be redeemed. Some of our notes may also be redeemed prior to their respective maturity dates, at a redemption price equal to 100% of the principal amount of the notes redeemed plus accrued and unpaid interest. Certain notes are also redeemable upon certain tax events.

Additionally, our Senior Notes due 2024 may be redeemed and repaid, in whole at any time or in part from time to time prior to the date that is 90 days prior to the scheduled maturity date of the notes at a redemption price equal to 100% of the principal amount of the notes redeemed plus a premium for each note redeemed equal to the greater of 1.00% of the then outstanding principal amount of the note and the excess of: (a) the present value at such redemption date of (i) the principal amount of the note at maturity plus (ii) all required interest payments due on the note through maturity (excluding accrued but unpaid interest), computed using a discount rate equal to the Treasury Rate as of such redemption date plus 50 basis points; over (b) the outstanding principal amount of the note. These notes may also be redeemed, in whole or in part, at any time on or after the date which is 90 days prior to the final maturity date of the notes, at a redemption price equal to 100% of the principal amount of the notes redeemed plus accrued and unpaid interest.

As of December 31, 2021, we are in compliance with our debt covenants.

Guaranteed Notes—In June 2021, we redeemed $325 million of the outstanding $750 million 4.0% guaranteed notes due 2023. In conjunction with the partial redemption, we recognized $25 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $23 million paid for make-whole premiums and non-cash charges of $2 million for the write-off of unamortized debt discount and issuance costs.

In September 2021, we redeemed the entire $500 million outstanding of 2.875% guaranteed notes due 2025. In conjunction with the redemption, we recognized $37 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $34 million paid for make-whole premiums and non-cash charges of $3 million for the write-off of unamortized debt issuance costs.

In October 2021, we redeemed the entire $650 million outstanding guaranteed floating rate notes due 2023. In conjunction with the redemption, we recognized $3 million of debt extinguishment costs related to the non-cash write-off of unamortized debt issuance costs which are reflected in Interest expense in the Consolidated Statements of Income.

Pursuant to a cash tender offer, in December 2021 we repaid $775 million principal outstanding of our guaranteed notes, comprising $409 million of our $1,000 million 3.5% guaranteed notes due 2027, $358 million of our $500 million 3.375% guaranteed notes due 2030, and $8 million of our $500 million 1.25% guaranteed notes due 2025. In conjunction with the tender offer, we recognized $42 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $71 million paid for make-whole premiums and non-cash charges of $7 million for the write-off of unamortized debt discount and issuance costs, partially offset by $36 million in gains resulting from the write-off of the cumulative fair value hedge accounting adjustments.

In April 2020, LYB International Finance III, LLC ("LYB Finance III") a wholly owned finance subsidiary of LyondellBasell Industries N.V., as defined in Rule 3-10(b) of Regulation S-X, issued $500 million of 2.875% guaranteed notes due 2025 (the "2025 Notes") at a discounted price of 99.911%, $500 million of 3.375% guaranteed notes due 2030 (the "2030 Notes") at a discounted price of 99.813% and $1,000 million of 4.2% guaranteed notes due 2050 (the "2050 Notes") at a discounted price of 99.373%. Net proceeds from the sale of the notes totaled $1,974 million. We used the net proceeds from the sale of the notes for general corporate purposes, including to increase our liquidity and manage short-term debt maturities.

In October 2020, LYB Finance III, issued $3.9 billion of guaranteed notes. The notes included $500 million of 1.25% guaranteed notes due 2025 (the "1.25% 2025 Notes") at a discounted price of 99.683%; $500 million of 2.25% guaranteed notes due 2030 (the "2.25% 2030 Notes") at a discounted price of 99.203%; $750 million of 3.375% guaranteed notes due 2040 (the "2040 Notes") at a discounted price of 99.77%; $1,000 million of 3.625% guaranteed notes due 2051 (the "2051 Notes") at a discounted price of 99.707%; $500 million of 3.8% guaranteed notes due 2060 (the "2060 Notes") at a discounted price of 99.166% and $650 million of guaranteed floating rate notes due 2023 (the "Floating Rate Notes"). The Floating Rate Notes will bear interest equal to the three-month LIBOR rate, plus 1.000% per annum.

The net proceeds of the Floating Rate Notes, 1.25% 2025 Notes, 2.25% 2030 Notes, 2040 Notes, 2051 Notes and 2060 Notes (collectively, the "October Notes") were $3,848 million. We used the proceeds to repay debt as discussed below and the remaining proceeds were used to fund a portion of the purchase price for the Louisiana Joint Venture.

In October 2020, we used $500 million of the net proceeds to repay a portion of the indebtedness outstanding under our Term Loan due 2022. In November 2020, proceeds from the October Notes were used to redeem €750 million aggregate principal amount of our 1.875% guaranteed notes due 2022. In conjunction with the redemption of these notes, we recognized $23 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $22 million paid for make-whole premiums and non-cash charges of $2 million for the write-off of unamortized debt discount and issuance costs, partially offset by $1 million in gains resulting from the write-off of the cumulative fair value hedge accounting adjustments.

Senior Notes—Pursuant to a cash tender offer, in December 2021 we repaid $225 million principal outstanding of our $1,000 million 5.75% senior notes due 2024. In conjunction with the tender offer, we recognized $23 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $22 million paid for make-whole premiums and non-cash charges of $1 million for the write-off of unamortized debt issuance costs.

In November 2020, proceeds from the October Notes were used to redeem $1,000 million aggregate principal amount of our 6% senior notes due 2021. In conjunction with the redemption of these notes, we recognized $46 million of debt extinguishment costs which are reflected in Interest expense in the Consolidated Statements of Income. The debt extinguishment costs include $55 million paid for make-whole premiums and non-cash charges of $2 million for the write-off of unamortized debt discount and issuance costs, partially offset by $11 million in gains resulting from the write-off of the cumulative fair value hedge accounting adjustments.

Short-Term Debt

U.S. Receivables Facility—Our U.S. Receivables Facility has a purchase limit of $900 million in addition to a $300 million uncommitted accordion feature. In June 2021, we extended the term of the facility to June 2024 in accordance with the terms of the agreement. This facility provides liquidity through the sale or contribution of trade receivables by certain of our U.S. subsidiaries to a wholly owned, bankruptcy-remote subsidiary on an ongoing basis and without recourse. The bankruptcy-remote subsidiary may then, at its option and subject to a borrowing base of eligible receivables, sell undivided interests in the pool of trade receivables to financial institutions participating in the facility ("Purchasers"). The sale of the undivided interest in the pool of trade receivables is accounted for as a secured borrowing in the Consolidated Balance Sheets. We are responsible for servicing the receivables. We pay variable interest rates on our secured borrowings. Additional fees are incurred for the average daily unused commitments. In the event of liquidation, the bankruptcy-remote subsidiary's assets will be used to satisfy the claims of the Purchasers prior to any assets or value in the bankruptcy-remote subsidiary becoming available to us. This facility also provides for the issuance of letters of credit up to $200 million. Performance obligations under the facility are guaranteed by LyondellBasell Industries N.V. The term of the facility may be extended in accordance with the terms of the agreement. The facility is also subject to customary warranties and covenants, including limits and reserves and the maintenance of specified financial ratios. Under the terms of the U.S. Receivable Facility we are required to maintain a maximum leverage ratio consistent with the terms of the Senior Revolving Credit Facility as discussed above. At December 31, 2021, there were no borrowings or letters of credit outstanding and $900 million unused availability under the facility.

Commercial Paper Program—We have a commercial paper program under which we may issue up to $2,500 million of privately placed, unsecured, short-term promissory notes ("commercial paper"). This program is backed by our $3,250 million Senior Revolving Credit Facility. Proceeds from the issuance of commercial paper may be used for general corporate purposes, including dividends and share repurchases. Interest rates on the commercial paper outstanding at December 31, 2021 are based on the terms of the notes and range from 0.11% to 0.21%. At December 31, 2021, we had $204 million of outstanding commercial paper.

Precious Metal Financings—We enter into lease agreements for precious metals which are used in our production processes. All precious metal borrowings are classified as Short-term debt.

Weighted Average Interest Rate—At December 31, 2021 and 2020, our weighted average interest rate on outstanding Short-term debt was 0.9%.

Additional Information

Debt Discount and Issuance Costs—Amortization of debt discount and debt issuance costs resulted in amortization expense of $35 million, $21 million and $11 million for the years ended December 31, 2021, 2020 and 2019, respectively, which is included in Interest expense in the Consolidated Statements of Income.

Other Information—LYB International Finance B.V., LYB International Finance II B.V., LYB International Finance III, LLC and LYB Americas Finance Company LLC (“LYB Finance subsidiaries”) are wholly owned finance subsidiaries of LyondellBasell Industries N.V., as defined in Rule 3-10(b) of Regulation S-X. Any debt securities issued by LYB Finance subsidiaries will be fully and unconditionally guaranteed by LyondellBasell Industries N.V., and no other subsidiaries of LyondellBasell Industries N.V. guarantees these securities. Our unsecured notes rank equally in right of payment to each respective finance subsidiary’s existing and future unsecured indebtedness and to all of LyondellBasell Industries N.V.’s existing and future unsubordinated indebtedness. There are no significant restrictions that would impede LyondellBasell Industries N.V., as guarantor, from obtaining funds by dividend or loan from its subsidiaries.

12. Leases

Operating Leases—The majority of our leases are operating leases. We lease storage tanks, terminal facilities, land, office facilities, railcars, pipelines, barges, plant equipment and other equipment. As of December 31, 2021 and 2020, our Operating lease assets were $1,946 million and $1,492 million, respectively. As of December 31, 2021 and 2020, Operating lease liabilities totaled $1,985 million and $1,532 million of which $336 million and $310 million, respectively, are current and recorded in Accrued liabilities. These values were derived using a weighted average discount rate of 3.3% and 3.9% as of December 31, 2021 and 2020, respectively.

Substantially all of our operating leases have remaining lease terms of 22 years or less and have a weighted-average remaining lease term of 10 years. Certain lease agreements include options to renew the lease, at our discretion, for approximately 1 year to 20 years and do not materially impact our operating lease assets or operating lease liabilities.

Maturities of operating lease liabilities as of December 31, 2021, are as follows:

Millions of dollars	
2022	$ 393
2023	330
2024	273
2025	235
2026	210
Thereafter	922
Total lease payments	2,363
Less: Imputed interest	(378)
Present value of lease liabilities	$ 1,985

The following table presents the components of operating lease cost:

	Year Ended December 31,		
Millions of dollars	2021	2020	2019
Operating lease cost	$ 418	$ 393	$ 366
Short-term lease cost	153	154	152
Variable lease cost	124	118	134
Net operating lease cost	$ 695	$ 665	$ 652

Cash paid for amounts included in the measurement of operating lease liabilities totaled $406 million, $383 million, and $363 million for the years ended December 31, 2021, 2020 and 2019, respectively. Leased assets obtained in exchange for new operating lease liabilities totaled $822 million and $351 million for the years ended December 31, 2021 and 2020, respectively. Leased assets obtained in exchange for new operating lease liabilities, including all leases recognized upon adoption of the new lease accounting standard, totaled $1,833 million for the year ended December 31, 2019.

As of December 31, 2021, we have entered into additional operating leases, with an undiscounted value of $67 million, primarily for storage tanks. These leases, which will commence in 2022, have lease terms ranging from 2 to 8 years.

13. Financial Instruments and Fair Value Measurements

Financial Instruments Measured at Fair Value on a Recurring Basis—The following table summarizes outstanding financial instruments that are measured at fair value on a recurring basis:

	December 31, 2021		December 31, 2020		
Millions of dollars	Notional Amount	Fair Value	Notional Amount	Fair Value	Balance Sheet Classification
Assets—					
Derivatives designated as hedges:					
Commodities	$ 41	$ 24	$ 19	$ 3	Prepaid expenses and other current assets
Commodities	—	—	41	4	Other assets
Foreign currency	614	63	—	26	Prepaid expenses and other current assets
Foreign currency	1,785	43	—	—	Other assets
Interest rates	—	7	—	—	Prepaid expenses and other current assets
Interest rates	300	1	122	2	Other assets
Derivatives not designated as hedges:					
Commodities	221	30	71	2	Prepaid expenses and other current assets
Foreign currency	34	1	149	—	Prepaid expenses and other current assets
Non-derivatives:					
Available-for-sale debt securities	—	—	348	349	Short-term investments
Equity securities	9	8	353	353	Short-term investments
Total	$ 3,004	$ 177	$ 1,103	$ 739	
Liabilities—					
Derivatives designated as hedges:					
Commodities	$ —	$ —	$ —	$ 2	Accrued liabilities
Foreign currency	—	14	1,213	146	Accrued liabilities
Foreign currency	1,800	99	2,682	302	Other liabilities
Interest rates	—	3	—	—	Accrued liabilities
Interest rates	1,863	280	1,000	343	Other liabilities
Derivatives not designated as hedges:					
Commodities	24	1	113	14	Accrued liabilities
Foreign currency	188	2	76	1	Accrued liabilities
Total	$ 3,875	$ 399	$ 5,084	$ 808	

The financial instruments in the table above are classified as Level 2, except for our investment in equity securities which are measured at fair value using the net asset value per share, or its equivalent, practical expedient and are not classified in the fair value hierarchy at December 31, 2021. We present the gross assets and liabilities of our derivative instruments on the Consolidated Balance Sheets.

Financial Instruments Not Measured at Fair Value on a Recurring Basis—Our derivative instruments are recorded at fair value and precious metal financings are recorded at amortized cost. Our other financial instruments classified within Current assets and Current liabilities have a short maturity and their carrying value generally approximates fair value. Our Long-term debt is recorded at amortized cost.

The following table presents the carrying value and estimated fair value of our Precious metal financings and Long-term debt:

	December 31, 2021		December 31, 2020	
Millions of dollars	Carrying Value	Fair Value	Carrying Value	Fair Value
Precious metal financings	$ 155	$ 130	$ 140	$ 154
Long-term debt	11,218	12,756	15,266	17,290
Total	$ 11,373	$ 12,886	$ 15,406	$ 17,444

The financial instruments in the table above are classified as Level 2.

Derivative Instruments:

We are exposed to market risks, such as changes in commodity prices, interest rates and currency exchange rates. We enter into derivative contracts pursuant to our risk management policies to manage these risks.

Commodity Prices—We are exposed to commodity price volatility related to purchases of various feedstocks and sales of our products. We use over-the-counter commodity swaps, options and exchange traded futures contracts to manage these risks, including through cash flow hedging relationships.

The following table presents the notional amounts of our outstanding commodity derivative instruments:

	December 31, 2021	December 31, 2020	
Millions of dollars	Notional Amount	Notional Amount	Maturity Date
Derivatives designated as hedges:			
Cash flow hedges	$ 41	$ 60	2022
Derivatives not designated as hedges:			
Commodity contracts	245	184	2022

Interest Rates—We are exposed to interest rate risk with respect to our fixed-rate and variable-rate debt. Fluctuations in interest rates impact the fair value of fixed-rate debt and expose us to the risk that we may need to refinance debt at higher rates. Fluctuations in interest rates also impact interest expense from our variable-rate debt. We use forward-starting interest rate swaps that are designated as cash flow hedges to mitigate the risk that benchmark rates will increase in connection with future financing activities. As of December 31, 2021 and 2020, Other assets included $238 million of collateral related to these forward-starting interest swaps, representing the maximum amount of collateral that may be required under these contracts. We also use interest rate swaps that are designated as fair value hedges to mitigate the changes in the fair value of our fixed-rate debt by effectively converting it to variable-rate debt. See Note 11 to the Consolidated Financial Statements for additional information.

The following table presents the notional amounts of our outstanding interest rate derivative instruments:

	December 31, 2021	December 31, 2020	
Millions of dollars	**Notional Amount**	**Notional Amount**	**Maturity Date**
Cash flow hedges	$ 1,000	$ 1,000	2023 to 2024
Fair value hedges	1,163	122	2025 to 2030

Foreign Currency Rates—We have significant worldwide operations. The functional currencies of our operating subsidiaries are primarily the U.S. dollar and the euro. We enter into transactions denominated in currencies other than our designated functional currencies that create foreign currency exposure. We enter foreign currency contracts to economically hedge foreign currency risk related to recognized foreign currency monetary assets and liabilities. Changes in the fair value of such forward and swap contracts are reported in the Consolidated Statements of Income and offset, in part, currency remeasurement results. In the past, we have entered euro-denominated debt that was designated as a net investment hedge. Other income, net, in the Consolidated Statements of Income reflected foreign currency losses of $2 million, losses of $7 million and gains of $9 million in 2021, 2020 and 2019, respectively.

We enter foreign currency contracts that are designated as net investment hedges to manage the impacts of foreign currency translation of our net investments in foreign operations. We also enter foreign currency contracts that are designated as cash flow hedges to manage the variability in cash flows associated with intercompany debt balances.

The following table presents the notional amounts of our outstanding foreign currency derivative instruments:

	December 31, 2021	December 31, 2020	
Millions of dollars	**Notional Amount**	**Notional Amount**	**Maturity Date**
Net investment hedges	$ 3,048	$ 1,890	2022 to 2030
Cash flow hedges	1,150	2,005	2024 to 2027
Not designated	222	225	2022

Impact on Earnings and Other Comprehensive Income—The following tables summarize the pre-tax effect of derivative and non-derivative instruments recorded in Accumulated other comprehensive loss ("AOCI"), the gains (losses) reclassified to earnings from AOCI and additional gains (losses) recognized directly in earnings:

	Effect of Derivative Instruments			
	Year Ended December 31, 2021			
	Balance Sheet	Income Statement		
Millions of dollars	Gain (Loss) Recognized in AOCI	Gain (Loss) Reclassified to Income from AOCI	Additional Gain (Loss) Recognized in Income	Income Statement Classification
Derivatives designated as hedges:				
Commodities	$ 54	$ 34	$ —	Cost of sales
Foreign currency	406	216	37	Interest expense
Interest rates	75	(6)	(7)	Interest expense
Derivatives not designated as hedges:				
Commodities	—	—	20	Sales and other operating revenues
Commodities	—	—	69	Cost of sales
Foreign currency	—	—	(35)	Other income, net
Total	$ 535	$ 244	$ 84	

	Year Ended December 31, 2020			
	Balance Sheet	Income Statement		
Millions of dollars	Gain (Loss) Recognized in AOCI	Gain (Loss) Reclassified to Income from AOCI	Additional Gain (Loss) Recognized in Income	Income Statement Classification
Derivatives designated as hedges:				
Commodities	$ 5	$ —	$ —	Cost of sales
Foreign currency	(253)	(170)	46	Interest expense
Interest rates	(347)	(5)	95	Interest expense
Derivatives not designated as hedges:				
Commodities	—	—	4	Sales and other operating revenues
Commodities	—	—	115	Cost of sales
Foreign currency	—	—	(14)	Other income, net
Non-derivatives designated as hedges:				
Long-term debt	(42)	—	—	Other income, net
Total	$ (637)	$ (175)	$ 246	

	Year Ended December 31, 2019			
	Balance Sheet	Income Statement		
Millions of dollars	Gain (Loss) Recognized in AOCI	Gain (Loss) Reclassified to Income from AOCI	Additional Gain (Loss) Recognized in Income	Income Statement Classification
Derivatives designated as hedges:				
Commodities	$ (34)	$ 26	$ —	Sales and other operating revenues
Commodities	28	(20)	—	Cost of sales
Foreign currency	119	40	65	Interest expense
Interest rates	(223)	4	75	Interest expense
Derivatives not designated as hedges:				
Commodities	—	—	3	Sales and other operating revenues
Commodities	—	—	(34)	Cost of sales
Foreign currency	—	—	33	Other income, net
Non-derivatives designated as hedges:				
Long-term debt	16	—	—	Other income, net
Total	$ (94)	$ 50	$ 142	

Amounts excluded from the assessment of effectiveness for foreign currency contracts designated as net investment hedges recognized in Other comprehensive income or Interest expense for the years ended December 31, 2021, 2020 and 2019 were immaterial.

As of December 31, 2021, on a pre-tax basis, $6 million is scheduled to be reclassified from Accumulated other comprehensive loss as an increase to interest expense over the next twelve months.

Other Financial Instruments:

Cash and Cash Equivalents—At December 31, 2021 and 2020, we had marketable securities classified as Cash and cash equivalents of $438 million and $682 million, respectively.

Investments in Available-for-Sale Debt Securities—The following table summarizes the cost basis, gross unrealized gains and losses, and fair value of our outstanding available-for-sale debt securities:

Millions of dollars	Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
Debt securities at December 31, 2021	$ —	$ —	$ —	$ —
Debt securities at December 31, 2020	348	1	—	349

No allowance for credit losses related to our investments in available-for-sale debt securities was recorded for the years ended December 31, 2021, 2020 and 2019.

Proceeds from our investments in available-for-sale debt securities are summarized in the following table:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Proceeds from maturities of available-for-sale debt securities	$ 346	$ 24	$ 331
Proceeds from sales of available-for-sale debt securities	—	90	180

Gross realized gains and losses associated with the sale of available-for-sale debt securities during the years ended December 31, 2021, 2020 and 2019, were less than $1 million, respectively.

Investments in Equity Securities—The cost basis of our investment in equity securities was $9 million and $353 million as of December 31, 2021 and 2020, respectively. The investment was under an orderly voluntary liquidation by the fund administrator in 2021. We received proceeds of $335 million, $313 million and $332 million from the sale or liquidation of this investment during the years ended December 31, 2021, 2020 and 2019, respectively. The investment was fully liquidated in January 2022.

14. Pension and Other Post-retirement Benefits

We have defined benefit pension plans which cover employees in the U.S. and various other countries. We also sponsor post-retirement benefit plans other than pensions that provide medical benefits to certain of our U.S., Canadian and French employees. In addition, we provide other post-employment benefits such as early retirement and deferred compensation severance benefits to employees of certain non-U.S. countries. We use a measurement date of December 31 for all of our benefit plans.

Pension Benefits—The following tables provide a reconciliation of projected benefit obligations, plan assets and the funded status of our U.S. and non-U.S. defined benefit pension plans:

	Year Ended December 31,			
	2021		2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Change in benefit obligation:				
Benefit obligation, beginning of period	$ 2,039	$ 2,159	$ 1,965	$ 2,017
Service cost	60	42	63	46
Interest cost	36	20	53	21
Actuarial loss (gain)	(29)	(107)	133	(21)
Plan amendments	—	1	—	—
Benefits paid	(71)	(50)	(140)	(47)
Participant contributions	—	2	—	2
Settlement	(119)	(8)	(35)	(11)
Curtailment	—	—	—	(4)
Foreign exchange effects	—	(135)	—	156
Benefit obligation, end of period	1,916	1,924	2,039	2,159
Change in plan assets:				
Fair value of plan assets, beginning of period	1,548	1,168	1,637	1,058
Actual return on plan assets	229	(29)	76	26
Company contributions	156	62	10	64
Benefits paid	(71)	(50)	(140)	(47)
Participant contributions	—	2	—	2
Settlement	(119)	(8)	(35)	(11)
Foreign exchange effects	—	(63)	—	76
Fair value of plan assets, end of period	1,743	1,082	1,548	1,168
Funded status of continuing operations, end of period	$ (173)	$ (842)	$ (491)	$ (991)

Amounts recognized in the Consolidated Balance Sheets consists of the following:

	December 31, 2021		December 31, 2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Prepaid benefit cost, long-term	$ 7	$ 60	$ —	$ 23
Accrued benefit liability, current	—	(31)	—	(33)
Accrued benefit liability, long-term	(180)	(871)	(491)	(981)
Funded status of continuing operations, end of period	$ (173)	$ (842)	$ (491)	$ (991)

Amounts recognized in Accumulated other comprehensive loss include the following:

	December 31, 2021		December 31, 2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Actuarial and investment loss	$ 450	$ 273	$ 655	$ 353
Prior service cost	—	29	1	29
Balance, end of period	$ 450	$ 302	$ 656	$ 382

The following additional information is presented for our U.S. and non-U.S. pension plans:

	December 31, 2021		December 31, 2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Accumulated benefit obligation for defined benefit plans	$ 1,854	$ 1,783	$ 1,961	$ 2,003

Pension plans with projected benefit obligations in excess of the fair value of assets are summarized as follows:

	December 31, 2021		December 31, 2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Projected benefit obligations	$ 1,909	$ 1,152	$ 1,899	$ 1,276
Fair value of assets	1,729	250	1,408	261

Pension plans with accumulated benefit obligations in excess of the fair value of assets are summarized as follows:

	December 31, 2021		December 31, 2020	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Accumulated benefit obligations	$ 1,086	$ 1,005	$ 1,826	$ 1,123
Fair value of assets	966	215	1,408	231

Components of net periodic pension costs for our U.S. and non-U.S. plans are as follows:

	U.S. Plans		
	Year Ended December 31,		
Millions of dollars	2021	2020	2019
Service cost	$ 60	$ 63	$ 53
Interest cost	36	53	70
Expected return on plan assets	(114)	(115)	(112)
Settlement loss	27	4	—
Actuarial loss amortization	35	29	18
Net periodic benefit cost	$ 44	$ 34	$ 29

	Non-U.S. Plans		
	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Service cost	$ 42	$ 46	$ 36
Interest cost	20	21	33
Expected return on plan assets	(17)	(19)	(24)
Settlement loss	1	2	1
Curtailment gain	—	(4)	—
Prior service cost amortization	3	3	2
Actuarial loss amortization	15	23	12
Net periodic benefit cost	$ 64	$ 72	$ 60

The actual and target asset allocations for our plans are as follows:

	2021		2020	
	Actual	Target	Actual	Target
Canada				
Fixed income	100 %	100 %	100 %	100 %
United Kingdom—Lyondell Chemical Plans				
Equity securities	39 %	38 %	37 %	37 %
Fixed income	61 %	62 %	63 %	63 %
United Kingdom—Basell Plans				
Equity securities	40 %	40 %	40 %	40 %
Fixed income	60 %	60 %	60 %	60 %
United Kingdom—A. Schulman Plans				
Equity securities and growth assets	51 %	50 %	76 %	76 %
Fixed income and matching assets	49 %	50 %	24 %	24 %
United States				
Equity securities	32 %	35 %	37 %	35 %
Fixed income	40 %	39 %	41 %	39 %
Alternatives	28 %	26 %	22 %	26 %

We estimate the following contributions to our pension plans in 2022:

Millions of dollars	**U.S.**	**Non-U.S.**
Defined benefit plans	$ —	$ 69
Multi-employer plans	—	6
Total	$ —	$ 75

As of December 31, 2021, future expected benefit payments by our pension plans which reflect expected future service, as appropriate, are as follows:

Millions of dollars	U.S.	Non-U.S.
2022	$ 145	$ 62
2023	143	64
2024	142	65
2025	138	67
2026	138	68
2027 through 2031	644	355

The following tables set forth the principal assumptions on discount rates, projected rates of compensation increase and expected rates of return on plan assets, where applicable. These assumptions vary for the different plans, as they are determined in consideration of local conditions.

The weighted average assumptions used in determining the net benefit liabilities for our pension plans were as follows at December 31:

	2021		2020	
	U.S.	Non-U.S.	U.S.	Non-U.S.
Discount rate	2.80 %	1.45 %	2.54 %	0.99 %
Rate of compensation increase	4.74 %	2.64 %	4.63 %	2.55 %
Cash balance interest credit rate	1.78 %	— %	1.58 %	— %

The weighted average assumptions used in determining net benefit costs for our pension plans were as follows:

	Year Ended December 31,					
	2021		2020		2019	
	U.S.	Non-U.S.	U.S.	Non-U.S.	U.S.	Non-U.S.
Discount rate	2.54 %	0.99 %	3.16 %	1.03 %	4.51 %	2.07 %
Expected return on plan assets	7.25 %	1.44 %	7.25 %	1.79 %	7.50 %	2.79 %
Rate of compensation increase	4.63 %	2.55 %	4.83 %	2.59 %	4.83 %	2.54 %

The discount rate assumptions reflect the rates at which the benefit obligations could be effectively settled, based on the yields of high quality long-term bonds where the term closely matches the term of the benefit obligations. We measure service and interest costs by applying the specific spot rates along that same yield curve to the projected cash flows of the plans. This approach provides a more precise measurement of service and interest costs. The weighted average expected long-term rate of return on assets in our U.S. plans of 7.25% is based on the average level of earnings that our independent pension investment adviser had advised could be expected to be earned over a fifteen to twenty year time period consistent with the target asset allocation of the plans, historical capital market performance, historical plan performance (since the 1997 inception of the U.S. Master Trust) and a forecast of expected future asset returns. The weighted average expected long-term rate of return on assets in our non-U.S. plans of 1.44% is based on expectations and asset allocations that vary by region. We review these long-term assumptions on a periodic basis.

Actual rates of return may differ from the expected rate due to the volatility normally experienced in capital markets. Assets are externally managed by professional investment firms over the long term to achieve optimal returns with an acceptable level of risk and volatility in order to meet the benefit obligations of the plans as they come due.

Our pension plans have not directly invested in securities of LyondellBasell N.V., and there have been no significant transactions between any of the pension plans and the Company or related parties thereof.

The pension investments that are measured at fair value are summarized below:

	December 31, 2021			
Millions of dollars	**Fair Value**	**Level 1**	**Level 2**	**Level 3**
U.S.				
Common and preferred stock	$ 279	$ 279	$ —	$ —
Commingled funds measured at net asset value	523			
Real estate measured at net asset value	113			
Hedge funds measured at net asset value	171			
Private equity measured at net asset value	203			
U.S. government securities	401	401	—	—
Cash and cash equivalents	64	64	—	—
Total U.S. Pension Assets	$ 1,754	$ 744	$ —	$ —

	December 31, 2021			
Millions of dollars	**Fair Value**	**Level 1**	**Level 2**	**Level 3**
Non-U.S.				
Insurance arrangements	$ 737	$ —	$ —	$ 737
Commingled funds measured at net asset value	341			
Cash and cash equivalents	2	2	—	—
Total Non-U.S. Pension Assets	$ 1,080	$ 2	$ —	$ 737

	December 31, 2020			
Millions of dollars	**Fair Value**	**Level 1**	**Level 2**	**Level 3**
U.S.				
Common and preferred stock	$ 281	$ 281	$ —	$ —
Commingled funds measured at net asset value	555			
Real estate measured at net asset value	100			
Hedge funds measured at net asset value	114			
Private equity measured at net asset value	137			
U.S. government securities	339	339	—	—
Cash and cash equivalents	43	43	—	—
Total U.S. Pension Assets	$ 1,569	$ 663	$ —	$ —

	December 31, 2020			
Millions of dollars	Fair Value	Level 1	Level 2	Level 3
Non-U.S.				
Insurance arrangements	$ 825	$ —	$ —	$ 825
Commingled funds measured at net asset value	339			
Cash and cash equivalents	2	2	—	—
Total Non-U.S. Pension Assets	$ 1,166	$ 2	$ —	$ 825

Certain non-U.S. plans have investments in a pooled asset portfolio which are treated as a nonparticipating insurance contract. The associated plan assets underlying the insurance arrangement are measured at the cash surrender value, which is derived primarily from an actuarial determination of the discounted benefits cash flows. As such, these assets are considered as using significant unobservable inputs (Level 3). These defined benefits pension plan assets at December 31, 2020 were valued at $825 million and has decreased to $737 million at December 31, 2021. The change is due primarily to the depreciation of assets as well as an increase of the discount rate from 2020 to 2021.

The fair value measurements of the investments in certain entities that calculate net asset value per share as of December 31, 2021 are as follows:

Millions of dollars	Fair Value	Unfunded Commitments	Remaining Life	Redemption Frequency (if currently eligible)	Trade to Settlement Terms	Redemption Notice Period
U.S.						
Commingled fund investing in Domestic Equity	$ 148	$ —	N/A	daily	1 to 3 days	3 to 4 days
Commingled fund investing in International Equity	128	—	N/A	daily	1 to 3 days	3 days
Commingled fund investing in Fixed Income	247	—	N/A	daily	1 to 3 days	3 to 7 days
Real Estate	113	14	10 years	quarterly	15 to 25 days	45 to 90 days
Hedge Funds	171	—	N/A	quarterly	10 to 30 days	20 to 90 days
Private Equity	203	72	10 years	Not eligible	N/A	N/A
Total U.S.	$ 1,010	$ 86				

Millions of dollars	Fair Value	Unfunded Commitments	Remaining Life	Redemption Frequency (if currently eligible)	Trade to Settlement Terms	Redemption Notice Period
Non-U.S.						
Commingled fund investing in Domestic Equity	$ 35	$ —	N/A	1 to 7 days	1 to 3 days	1 to 3 days
Commingled fund investing in International Equity	67	—	N/A	1 to 7 days	1 to 3 days	1 to 3 days
Commingled fund investing in Fixed Income	239	—	N/A	daily	1 to 3 days	3 days
Total Non-U.S.	$ 341	$ —				

The fair value measurements of the investments in certain entities that calculate net asset value per share as of December 31, 2020 are as follows:

Millions of dollars	Fair Value	Unfunded Commitments	Remaining Life	Redemption Frequency (if currently eligible)	Trade to Settlement Terms	Redemption Notice Period
U.S.						
Commingled fund investing in Domestic Equity	$ 179	$ —	N/A	daily	1 to 3 days	3 to 4 days
Commingled fund investing in International Equity	118	—	N/A	daily	1 to 3 days	3 days
Commingled fund investing in Fixed Income	258	—	N/A	daily	1 to 3 days	3 to 7 days
Real Estate	100	19	10 years	quarterly	15 to 25 days	45 to 90 days
Hedge Funds	114	—	N/A	quarterly	10 to 30 days	20 to 90 days
Private Equity	137	79	10 years	Not eligible	N/A	N/A
Total U.S.	$ 906	$ 98				

Millions of dollars	Fair Value	Unfunded Commitments	Remaining Life	Redemption Frequency (if currently eligible)	Trade to Settlement Terms	Redemption Notice Period
Non-U.S.						
Commingled fund investing in Domestic Equity	$ 24	$ —	N/A	1 to 7 days	1 to 3 days	1 to 3 days
Commingled fund investing in International Equity	68	—	N/A	1 to 7 days	1 to 3 days	1 to 3 days
Commingled fund investing in Fixed Income	247	—	N/A	daily	1 to 3 days	3 days
Total Non-U.S.	$ 339	$ —				

Multi-employer Plan—The Company participates in a multi-employer arrangement with Pensionskasse der BASF WaG V.VaG (“Pensionskasse”) which provides for benefits to the majority of our employees in Germany. Up to a certain salary level, the benefit obligations are covered by contributions of the Company and the employees to the plan. Contributions made to the multi-employer plan are expensed as incurred.

The following table provides disclosure related to the Company’s multi-employer plan:

	Company Contributions		
Millions of dollars	2021	2020	2019
Pensionskasse	$ 6	$ 7	$ 8

The Company-specific plan information for the Pensionskasse is not publicly available and the plan is not subject to a collective-bargaining agreement. The plan provides fixed, monthly retirement payments on the basis of the credits earned by the participating employees. To the extent that the Pensionskasse is underfunded, the future contributions to the plan may increase and may be used to fund retirement benefits for employees related to other employers. The Pensionskasse financial statements for the years ended December 31, 2020 and 2019 indicated total assets of $10,257 million and $10,712 million, respectively; total actuarial present value of accumulated plan benefits of $9,828 million and $10,259 million, respectively; and total contributions for all participating employers of $254 million and $260 million, respectively. Our plan contributions did not exceed 5 percent of the total contributions in 2021, 2020 or 2019.

Other Post-retirement Benefits—We sponsor unfunded health care and life insurance plans covering certain eligible retired employees and their eligible dependents. Generally, the medical plans pay a stated percentage of medical expenses reduced by deductibles and other coverage. Life insurance benefits are generally provided by insurance contracts. We retain the right, subject to existing agreements, to modify or eliminate these benefits.

The following tables provide a reconciliation of benefit obligations of our unfunded other post-retirement benefit plans:

	Year Ended December 31,			
	2021		2020	
Millions of dollars	**U.S.**	**Non-U.S.**	**U.S.**	**Non-U.S.**
Change in benefit obligation:				
Benefit obligation, beginning of period	$ 211	$ 86	$ 251	$ 79
Service cost	1	3	1	3
Interest cost	4	1	7	1
Actuarial (gain) loss	8	(17)	(30)	(2)
Benefits paid	(28)	(1)	(25)	(1)
Participant contributions	7	—	7	—
Plan amendments	—	2	—	—
Foreign exchange effects	—	(6)	—	6
Benefit obligation, end of period	203	68	211	86
Change in plan assets:				
Fair value of plan assets, beginning of period	—	—	—	—
Employer contributions	21	1	18	1
Participant contributions	7	—	7	—
Benefits paid	(28)	(1)	(25)	(1)
Fair value of plan assets, end of period	—	—	—	—
Funded status, end of period	$ (203)	$ (68)	$ (211)	$ (86)

Amounts recognized in the Consolidated Balance Sheets are as follows:

	December 31, 2021		December 31, 2020	
Millions of dollars	**U.S.**	**Non-U.S.**	**U.S.**	**Non-U.S.**
Accrued benefit liability, current	$ (15)	$ (1)	$ (14)	$ (1)
Accrued benefit liability, long-term	(188)	(67)	(197)	(85)
Funded status, end of period	$ (203)	$ (68)	$ (211)	$ (86)

Amounts recognized in Accumulated other comprehensive loss are as follows:

	December 31, 2021		December 31, 2020	
Millions of dollars	**U.S.**	**Non-U.S.**	**U.S.**	**Non-U.S.**
Actuarial and investment income (loss)	$ 54	$ (7)	$ 68	$ (27)
Prior service cost	—	(1)	—	—
Balance, end of period	$ 54	$ (8)	$ 68	$ (27)

The components of net periodic other post-retirement costs are as follows:

	U.S. Plans		
	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Service cost	$ 1	$ 1	$ 1
Interest cost	4	7	9
Actuarial gain amortization	(6)	(2)	(5)
Net periodic benefit cost	$ (1)	$ 6	$ 5

	Non-U.S. Plans		
	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Service cost	$ 3	$ 3	$ 2
Interest cost	1	1	1
Actuarial loss amortization	2	3	1
Net periodic benefit cost	$ 6	$ 7	$ 4

The following tables set forth the assumed health care cost trend rates for our U.S. and Non-U.S. Plans:

	U.S. Plans	
	December 31,	
	2021	**2020**
Immediate trend rate	6.3 %	6.5 %
Ultimate trend rate (the rate to which the cost trend rate is assumed to decline)	4.5 %	4.5 %
Year that the rate reaches the ultimate trend rate	2029	2029

	Non-U.S. Plans			
	Canada		France	
	December 31,		December 31,	
	2021	**2020**	**2021**	**2020**
Immediate trend rate	4.5 %	4.5 %	4.5 %	4.5 %
Ultimate trend rate (the rate to which the cost trend rate is assumed to decline)	4.5 %	4.5 %	4.5 %	4.5 %
Year that the rate reaches the ultimate trend rate	—	—	—	—

The health care cost trend rate assumption does not typically have a significant effect on the amounts reported due to limits on maximum contribution levels to the medical plans.

The weighted average assumptions used in determining the net benefit liabilities for our other post-retirement benefit plans were as follows:

	December 31,			
	2021		2020	
	U.S.	Non-U.S.	U.S.	Non-U.S.
Discount rate	2.75 %	1.47 %	2.48 %	1.10 %
Rate of compensation increase	4.18 %	—	4.19 %	—

The weighted average assumptions used in determining the net benefit costs for our other post-retirement benefit plans were as follows:

	Year Ended December 31,					
	2021		2020		2019	
	U.S.	Non-U.S.	U.S.	Non-U.S.	U.S.	Non-U.S.
Discount rate	2.48 %	1.10 %	3.12 %	1.20 %	4.47 %	2.30 %
Rate of compensation increase	4.19 %	—	4.50 %	—	4.50 %	—

As of December 31, 2021, future expected benefit payments by our other post-retirement benefit plans, which reflect expected future service, as appropriate, were as follows:

Millions of dollars	U.S.	Non-U.S.
2022	$ 15	$ 1
2023	14	1
2024	14	1
2025	14	1
2026	14	1
2027 through 2031	64	8

Accumulated Other Comprehensive Loss—In 2021, pension benefits actuarial gain and other post-retirement benefits actuarial gain of $205 million and $9 million, respectively, are primarily due to changes in discount rate assumption and updated actuarial assumptions. In 2020, pension benefits actuarial loss and other post-retirement benefits actuarial gain of $141 million and $32 million, respectively, are primarily due to changes in discount rate assumption and updated actuarial assumptions.

Deferred income taxes related to amounts in Accumulated other comprehensive loss include provisions of $178 million and $246 million as of December 31, 2021 and 2020, respectively.

Defined Contribution Plans—Most employees in the U.S. and certain non-U.S. countries are eligible to participate in defined contribution plans ("Employee Savings Plan") by contributing a portion of their compensation. We make employer contributions, such as matching contributions, to certain of these plans. The Company also has a nonqualified deferred compensation plan that covers senior management in the U.S. This plan was amended in April 2013 to provide for Company contributions on behalf of certain eligible employees who earn base pay above the IRS annual compensation limit.

The following table provides the Company contributions to the Employee Savings Plans:

	Company Contributions					
	2021		2020		2019	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.	U.S.	Non-U.S.
Employee Savings Plans	$ 51	$ 8	$ 48	$ 8	$ 46	$ 7

15. Incentive and Share-Based Compensation

We are authorized to grant restricted stock units, stock options, performance share units, and other cash and stock awards under our Long-Term Incentive Plan ("LTIP"). The Compensation and Talent Development Committee oversees our equity award grants, the type of awards, the required performance measures and the timing and duration of each grant. The maximum number of shares of our common stock reserved for issuance under the LTIP is 30,000,000 shares. As of December 31, 2021, there were 10,068,676 shares remaining available for issuance assuming maximum payout for performance share units awards.

Our share-based compensation awards, which are subject to customary partial or accelerated vesting or forfeiture in the event of certain termination events, are accounted for as equity awards with compensation cost recognized over the vesting period in the income statement. We use a straight-line vesting method for cliff-vested awards and a graded vesting method for step-vested awards. We have elected to recognize forfeitures as they occur for stock-based compensation. When options are exercised and awards are paid out, shares are issued from our treasury shares.

Total share-based compensation expense and the associated tax benefits are as follows:

	Year Ended December 31,		
Millions of dollars	2021	2020	2019
Compensation Expense:			
Restricted stock units	$ 30	$ 26	$ 21
Stock options	9	8	7
Performance share units	27	21	20
Total	$ 66	$ 55	$ 48
Tax Benefit:			
Restricted stock units	$ 7	$ 6	$ 5
Stock options	2	2	2
Performance share units	6	5	4
Total	$ 15	$ 13	$ 11

Restricted Stock Unit Awards ("RSUs")—RSUs entitle the recipient to be paid out an equal number of ordinary shares upon vesting. RSUs generally cliff vest on the third anniversary of the grant date.

The holders of RSUs are entitled to nonforfeitable dividend equivalents settled in the form of cash payments, which are recognized as dividends in Retained earnings.

The fair value of RSUs is based on the market price of the underlying stock on the date of grant. The weighted average grant date fair value for RSUs granted during the years ended December 31, 2021, 2020 and 2019 was $104.43, $79.58 and $87.36, respectively. The total fair value of RSUs vested was $27 million, $18 million and $13 million during 2021, 2020 and 2019, respectively.

The following table summarizes RSU activity:

	Number of Units (in thousands)	Weighted Average Grant Date Fair Value (per share)
Outstanding at January 1, 2021	693	$ 88.45
Granted	390	104.43
Vested	(270)	96.29
Forfeited	(75)	94.38
Outstanding at December 31, 2021	738	$ 93.43

As of December 31, 2021, the unrecognized compensation cost related to RSUs was $29 million, which is expected to be recognized over a weighted average period of two years.

Stock Option Awards ("Stock Options")—Stock Options allow employees the opportunity in the future to purchase ordinary shares of stock at an exercise price equal to the market price at the date of grant. The awards generally have a three-year vesting period that vests in equal increments on the first, second and third anniversary of the grant date and have a contractual term of ten years. None of the Stock Options are designed to qualify as incentive Stock Options as defined in Section 422 of the Internal Revenue Code.

The fair value of each Stock Option is estimated, based on several assumptions, on the date of grant using the Black-Scholes option valuation model. The principal assumptions utilized in valuing Stock Options include the expected stock price volatility (based on our historical stock price volatility over the expected term); the expected dividend yield; and the risk-free interest rate (an estimate based on the yield of a United States Treasury zero coupon bond with a maturity equal to the expected term of the option).

The expected term of Stock Options granted in 2021 is estimated based on the weighted average of historical exercise patterns and the midpoint of the remaining expected life. Prior to 2021, the expected term of Stock Options granted was estimated based on a simplified approach, which was consistent with the historical exercise pattern.

The weighted average fair value of Stock Options granted and the assumptions used in estimating those fair value are as follows:

	Year Ended December 31,		
	2021	2020	2019
Weighted average fair value	$ 20.49	$ 12.18	$ 15.76
Fair value assumptions:			
Dividend yield	5.9 %	5.0 %	4.2 %
Expected volatility	39.1-39.4%	28.3-38.4%	27.2-28.1%
Risk-free interest rate	0.9-1.0%	0.3-1.4%	1.5-2.6%
Weighted average expected term, in years	5.6	6.0	6.0

The following table summarizes Stock Option activity:

	Number of Shares (in thousands)	Weighted Average Exercise Price	Weighted Average Remaining Term	Aggregate Intrinsic Value (millions of dollars)
Outstanding at January 1, 2021	2,404	$ 88.36		
Granted	537	104.48		
Exercised	(356)	87.83		
Forfeited	(135)	96.89		
Expired	(1)	103.71		
Outstanding at December 31, 2021	2,449	$ 91.50	7.4 years	$ 13
Exercisable at December 31, 2021	1,741	$ 90.14	5.4 years	$ 10

The aggregate intrinsic value of Stock Options exercised during the years ended December 31, 2021, 2020 and 2019 was $7 million, $1 million and less than $1 million, respectively.

As of December 31, 2021, the unrecognized compensation cost related to Stock Options was $5 million, which is expected to be recognized over one year. During 2021, cash received from the exercise of Stock Options was $24 million and the tax benefit associated with these exercises was $2 million.

Performance Share Units Awards (“PSUs”)—A target number of PSUs is granted to participants at the beginning of a three-year performance period. Final payout of awards, which can range from 0% to 200% of target shares granted, is determined and paid after the performance period. These awards are settled in shares of common stock, and each unit is equivalent to one share of our common stock.

The payout for PSUs granted after February 2021 will be equally based on Total Shareholder Return (“TSR”) relative to our peers and a performance metric. The fair value of the portion of the award that vests based on TSR is estimated using a Monte-Carlo simulation. For the other portion of the award, the fair value is determined based on our stock price and the number of target shares expected to vest at the end of each reporting period. Prior to 2021, all our PSUs vesting was based on TSR relative to our peers, and the fair value was estimated using a Monte-Carlo simulation.

Outstanding PSUs accrue dividend equivalent units, which will be converted to shares upon payment at the end of the performance period and are classified as Accrued liabilities and Other liabilities on the Consolidated Balance Sheets. Dividend equivalents for PSUs are recorded in Retained earnings.

The weighted average fair value and the assumptions used in estimating those fair value using a Monte-Carlo simulation are as follows:

	Year Ended December 31,		
	2021	2020	2019
Weighted average fair value	$ 169.57	$ 82.70	$ 76.35
Fair value assumptions:			
Expected volatility of LyondellBasell N.V. common stock	48.05 %	25.96-41.50%	24.11 %
Expected volatility of peer companies	24.30-59.44%	16.13-50.42%	14.57-40.55%
Average correlation coefficient of peer companies	0.59	0.45-0.58	0.50
Risk-free interest rate	0.31 %	0.23-1.35%	2.48 %

The following table summarizes PSU activity assuming payout at 100% of target shares:

	Number of Units (in thousands)	Weighted Average Grant Date Fair Value (per share)
Outstanding at January 1, 2021	749	$ 82.07
Granted	288	130.85
Vested	—	—
Forfeited	(283)	95.99
Outstanding at December 31, 2021	754	$ 95.45

The total fair value of PSUs vested during 2020 and 2019 was $9 million and $22 million, respectively. As of December 31, 2021, the unrecognized compensation cost related to PSUs was $25 million, which is expected to be recognized over a weighted average period of two years.

Employee Stock Purchase Plan—We have an Employee Share Purchase Plan (“ESPP”) which allows participants to purchase our stock at a 10% discount on the lower of the fair market value at either the beginning or end of the purchase period. As a result of the 10% discount and the look-back provision, the ESPP is considered a compensatory plan under generally accepted accounting principles. Total expense related to our ESPP for 2021, 2020 and 2019 was $3 million, $4 million and $2 million, respectively.

16. Income Taxes

LyondellBasell Industries N.V. is tax resident in the United Kingdom pursuant to a mutual agreement procedure determination ruling between the Dutch and United Kingdom competent authorities and therefore subject solely to the United Kingdom corporate income tax system.

LyondellBasell Industries N.V. has little or no taxable income of its own because, as a holding company, it does not conduct any operations. Through our subsidiaries, we have substantial operations world-wide. Taxes are paid on the earnings generated in various jurisdictions where our subsidiaries operate, including primarily the U.S., The Netherlands, Germany, France, and Italy.

The Company operates in multiple jurisdictions with complex legal and tax regulatory environments and our tax returns are periodically audited or subjected to review by tax authorities. We monitor tax law changes and the potential impact to our results of operations. There continues to be increased attention to the tax practices of multinational companies, including U.S tax reform proposals, European Union’s state aid investigations, Pillar One and Two proposals by the Organization for Economic Cooperation and Development (“OECD”) with respect to base erosion and profit shifting, and European Union tax directives and their implementation. Although certain actions have occurred, there continues to be uncertainty as to the enactment and implementation of U.S. tax reform proposals and the OECD’s Pillars One and Two. Management continues to monitor these and other proposed tax law changes as they could increase our tax liabilities in the future, if enacted.

The Company considered the impact of the CARES Act, enacted March 27, 2020, in the period of enactment. Several of the tax measures favorably impacted our income tax provision in 2020. Based on return filings in 2021, we recorded an overall tax benefit related to the carryback of U.S. tax net operating losses (“NOL”) of approximately $300 million and $64 million in 2020 and 2021, respectively. Our anticipated refund increased from last year after the return filing and we have received approximately $870 million and $100 million of an anticipated $1.1 billion cash refund in the fourth quarter of 2021 and first quarter of 2022, respectively. We anticipate the remaining refund to be received in 2022.

The significant components of the provision for income taxes are as follows:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Current:			
U.S. federal	$ 669	$ (774)	$ 122
Non-U.S.	617	399	296
State	75	1	21
Total current	1,361	(374)	439
Deferred:			
U.S. federal	(103)	415	124
Non-U.S.	(114)	(76)	75
State	19	(8)	10
Total deferred	(198)	331	209
Provision for (benefit from) income taxes before tax effects of other comprehensive income	1,163	(43)	648
Tax effects of elements of other comprehensive income:			
Pension and post-retirement liabilities	67	(10)	(92)
Financial derivatives	20	(70)	(38)
Foreign currency translation	45	(30)	8
Total income tax expense (benefit) in other comprehensive income	$ 1,295	$ (153)	$ 526

Since the proportion of U.S. revenues, assets, operating income and associated tax provisions is significantly greater than any other single taxing jurisdiction within the worldwide group, the reconciliation of the differences between the provision for income taxes and the statutory rate is presented on the basis of the U.S. statutory federal income tax rate of 21% as opposed to the United Kingdom statutory rate of 19%. Our effective tax rate for the year ended December 31, 2021 is 17.1%.

Our effective income tax rate fluctuates based on, among other factors, changes in pre-tax income in countries with varying statutory tax rates, changes in valuation allowances, changes in foreign exchange gains/losses, the amount of exempt income, changes in unrecognized tax benefits associated with uncertain tax positions and changes in tax laws.

The following table reconciles the expected tax expense (benefit) at the U.S. statutory federal income tax rate to the total income tax provision as calculated:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Income (loss) before income taxes:			
U.S.	$ 3,458	$ (456)	$ 1,581
Non-U.S.	3,328	1,842	2,471
Total	$ 6,786	$ 1,386	$ 4,052
Income tax at U.S. statutory rate	$ 1,425	$ 291	$ 851
Increase (reduction) resulting from:			
Non-U.S. income taxed at different statutory rates	73	14	64
Changes in tax laws	(6)	(298)	1
Return to accrual adjustments	(179)	(50)	9
State income taxes, net of federal benefit	82	(2)	29
Exempt income	(303)	(144)	(182)
Liquidation loss	—	—	(51)
Patent box ruling	—	—	(65)
Uncertain tax positions	19	97	(42)
Other, net	52	49	34
Income tax provision	$ 1,163	$ (43)	$ 648

Our return to accrual adjustments primarily include the tax benefits associated with an election made in 2021 to step-up of certain Italian assets to fair market value retroactively and the impact of certain retroactive elections made with respect to the CARES Act in the U.S.

Our exempt income primarily includes interest income, export incentives, and equity earnings of joint ventures. Interest income earned by certain of our European subsidiaries through intercompany financings is taxed at rates substantially lower than the U.S. statutory rate. Export incentives relate to tax benefits derived from elections and structures available for U.S. exports. Equity earnings attributable to the earnings of our joint ventures, when paid through dividends to certain European subsidiaries, are exempt from all or portions of normal statutory income tax rates. We currently anticipate the favorable treatment for interest income, dividends, and export incentives to continue in the near term; however, this treatment is based on current law and tax rulings, which could change if the tax reform proposals in the U.S. and the Pillar Two proposals by the OECD are enacted.

The deferred tax effects of tax loss, credit and interest carryforwards ("tax attributes") and the tax effects of temporary differences between the tax basis of assets and liabilities and their reported amounts in the Consolidated Financial Statements, reduced by a valuation allowance where appropriate, are presented below.

	December 31,	
Millions of dollars	**2021**	**2020**
Deferred tax liabilities:		
Accelerated tax depreciation	$ 1,838	$ 1,992
Investment in joint venture partnerships	525	532
Intangible assets	39	75
Inventory	192	323
Operating lease assets	423	335
Other liabilities	103	89
Total deferred tax liabilities	$ 3,120	$ 3,346
Deferred tax assets:		
Tax attributes	$ 182	$ 242
Employee benefit plans	339	426
Operating lease liabilities	429	341
Other assets	136	176
Total deferred tax assets	1,086	1,185
Deferred tax asset valuation allowances	(126)	(132)
Net deferred tax assets	960	1,053
Net deferred tax liabilities	$ 2,160	$ 2,293

	December 31,	
Millions of dollars	**2021**	**2020**
Balance sheet classifications:		
Deferred tax assets—long-term	$ 174	$ 39
Deferred tax liabilities—long-term	2,334	2,332
Net deferred tax liabilities	$ 2,160	$ 2,293

Deferred taxes on the unremitted earnings of certain equity joint ventures and subsidiaries of $94 million and $89 million at December 31, 2021 and 2020, respectively, have been provided. The Company intends to permanently reinvest approximately $550 million of our non-U.S. earnings. Repatriation of these earnings to the U.S. in the future could result in a tax impact of approximately $60 million.

At December 31, 2021 and 2020, we had total tax attributes available in the amount of $943 million and $1,221 million, respectively, for which a deferred tax asset was recognized at December 31, 2021 and 2020 of $182 million and $242 million, respectively.

The scheduled expiration of the tax attributes and the related deferred tax assets, before valuation allowance, as of December 31, 2021 are as follows:

Millions of dollars	Tax Attributes	Deferred Tax on Tax Attributes
2022	$ 26	$ 1
2023	8	—
2024	31	1
2025	18	1
2026	3	1
Thereafter	301	25
Indefinite	556	153
Total	$ 943	$ 182

The tax attributes are primarily related to operations in The Netherlands, France, United Kingdom and United States. The related deferred tax assets by primary jurisdictions are shown below:

	December 31,		
Millions of dollars	2021	2020	2019
The Netherlands	$ 81	$ 103	$ 4
United Kingdom	31	30	36
France	26	58	30
United States	25	25	68
Spain	—	6	8
Other	19	20	22
Total	$ 182	$ 242	$ 168

To fully realize these net deferred tax assets, we will need to generate sufficient future taxable income in the countries where these tax attributes exist during the periods in which the attributes can be utilized. Based upon projections of future taxable income over the periods in which the attributes can be utilized and/or temporary differences are expected to reverse, management believes it is more likely than not that $56 million of these deferred tax assets at December 31, 2021 will be realized.

As of each reporting date, management considers the weight of all evidence, both positive and negative, to determine if a valuation allowance is necessary for each jurisdictions' net deferred tax assets. We place greater weight on historical evidence over future predictions of our ability to utilize net deferred tax assets. We consider future reversals of existing taxable temporary differences, future taxable income exclusive of reversing temporary differences, and taxable income in prior carryback year(s) if carryback is permitted under applicable law, as well as available prudent and feasible tax planning strategies that would, if necessary, be implemented to ensure realization of the net deferred tax asset.

A summary of the valuation allowances by primary jurisdiction is shown below, reflecting the valuation allowances for all the net deferred tax assets, including deferred tax assets for tax attributes and other temporary differences.

	December 31,		
Millions of dollars	**2021**	**2020**	**2019**
The Netherlands	$ 55	$ 57	$ 3
United Kingdom	31	30	36
France	26	26	23
United States	12	14	13
Other	2	5	10
	$ 126	$ 132	$ 85

During 2020, the valuation allowance in The Netherlands increased with respect to tax attributes for which we do not expect we can realize the benefit in the foreseeable future or before expiration.

Tax benefits totaling $327 million, $339 million and $238 million relating to uncertain tax positions were unrecognized as of December 31, 2021, 2020 and 2019, respectively. The following table presents a reconciliation of the beginning and ending amounts of unrecognized tax benefits:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
Balance, beginning of period	$ 339	$ 238	$ 269
Additions for tax positions of current year	—	1	49
Additions for tax positions of prior years	20	113	20
Reductions for tax positions of prior years	(21)	(12)	(100)
Settlements (payments/refunds)	(11)	(1)	—
Balance, end of period	$ 327	$ 339	$ 238

The majority of the uncertain tax positions, if recognized, will affect the effective tax rate. We operate in multiple jurisdictions throughout the world, and our tax returns are periodically audited or subjected to review by tax authorities. We are currently under examination in a number of tax jurisdictions. As a result, there is an uncertainty in income taxes recognized in our financial statements. Positions challenged by the tax authorities may be settled or appealed by us.

During 2020, we accrued a $113 million non-cash tax expense to our effective tax rate as an addition for tax positions of prior years. During 2019, we recognized a $113 million non-cash benefit to our effective tax rate consisting of $100 million of previously unrecognized tax benefits as a reduction for tax positions of a prior year and the release of $13 million of previously accrued interest. These benefits were largely due to the expiration of certain statutes of limitations. These non-cash reductions in unrecognized tax benefits are reflected on our Consolidated Balance Sheets in Other liabilities and on our Consolidated Statements of Cash Flows in Other operating activities.

We are no longer subject to any significant income tax examinations by tax authorities for the years prior to 2018 in The Netherlands, prior to 2014 in Italy, prior to 2005 in Germany, prior to 2019 in France, prior to 2016 in the United Kingdom, and prior to 2014 in the U.S., our principal tax jurisdictions. It is reasonably possible that, within the next twelve months, due to the settlement of uncertain tax positions with various tax authorities and the expiration of statutes of limitations, unrecognized tax benefits could decrease by up to approximately $100 million.

We recognize interest associated with unrecognized tax benefits in income tax expense. Income tax expense includes an expense of interest and penalties of $25 million in 2021, an expense of interest and penalties of $1 million in 2020, and a benefit of interest and penalties of $1 million in 2019.

We had accrued approximately $40 million, $16 million and $15 million for interest and penalties as of December 31, 2021, 2020 and 2019, respectively.

17. Commitments and Contingencies

Commitments—We have various purchase commitments for materials, supplies and services incidental to the ordinary conduct of business, generally for quantities required for our businesses and at prevailing market prices. These commitments are designed to assure sources of supply and are not expected to be in excess of normal requirements. As of December 31, 2021, we had capital expenditure commitments, which we incurred in our normal course of business, including commitments of approximately $276 million related to building our new PO/TBA plant in Houston, Texas.

Financial Assurance Instruments—We have obtained letters of credit, performance and surety bonds and have issued financial and performance guarantees to support trade payables, potential liabilities and other obligations. Considering the frequency of claims made against the financial instruments we use to support our obligations, and the magnitude of those financial instruments in light of our current financial position, management does not expect that any claims against or draws on these instruments would have a material adverse effect on our Consolidated Financial Statements. We have not experienced any unmanageable difficulties in obtaining the required financial assurance instruments for our current operations.

Environmental Remediation—Our accrued liability for future environmental remediation costs at current and former plant sites and other remediation sites totaled $138 million and $133 million as of December 31, 2021 and 2020, respectively. At December 31, 2021, the accrued liabilities for individual sites range from less than $1 million to $27 million. The remediation expenditures are expected to occur over a number of years, and not concentrated in any single year. In our opinion, it is reasonably possible that losses in excess of the liabilities recorded may have been incurred. However, we cannot estimate any amount or range of such possible additional losses. New information about sites, new technology or future developments such as involvement in investigations by regulatory agencies, could require us to reassess our potential exposure related to environmental matters.

The following table summarizes the activity in our accrued environmental liability included in “Accrued liabilities” and “Other liabilities:”

	Year Ended December 31,	
Millions of dollars	**2021**	**2020**
Beginning balance	$ 133	$ 132
Changes in estimates	25	3
Amounts paid	(14)	(8)
Foreign exchange effects	(5)	6
Other	(1)	—
Ending balance	$ 138	$ 133

Indemnification—We are parties to various indemnification arrangements, including arrangements entered into in connection with acquisitions, divestitures and the formation and dissolution of joint ventures. Pursuant to these arrangements, we provide indemnification to and/or receive indemnification from other parties in connection with liabilities that may arise in connection with the transactions and in connection with activities prior to completion of the transactions. These indemnification arrangements typically include provisions pertaining to third party claims relating to environmental and tax matters and various types of litigation. As of December 31, 2021, we had not accrued any significant amounts for our indemnification obligations, and we are not aware of other circumstances that would likely lead to significant future indemnification obligations. We cannot determine with certainty the potential amount of future payments under the indemnification arrangements until events arise that would trigger a liability under the arrangements.

As part of our technology licensing contracts, we give indemnifications to our licensees for liabilities arising from possible patent infringement claims with respect to certain proprietary licensed technologies. Such indemnifications have a stated maximum amount and generally cover a period of 5 to 10 years.

Legal Proceedings—We are subject to various lawsuits and claims, including but not limited to, matters involving contract disputes, environmental damages, personal injury and property damage. We vigorously defend ourselves and prosecute these matters as appropriate.

Our legal organization applies its knowledge, experience and professional judgment to the specific characteristics of our cases, employing a litigation management process to manage and monitor legal proceedings in which we are a party. Our process facilitates the early evaluation and quantification of potential exposures in individual cases. This process also enables us to track those cases that have been scheduled for trial, mediation or other resolution. We regularly assess the adequacy of legal accruals based on our professional judgment, experience and the information available regarding our cases.

Based on a consideration of all relevant facts and circumstances, we do not believe the ultimate outcome of any currently pending lawsuit against us will have a material adverse effect upon our operations, financial condition or Consolidated Financial Statements.

18. Shareholders' Equity and Redeemable Non-controlling Interests

Shareholders' Equity

Dividend Distributions—The following table summarizes the dividends paid to common shareholders in the periods presented:

Millions of dollars, except per share amounts	Dividend Per Ordinary Share	Aggregate Dividends Paid	Date of Record
For the year 2021:			
March	$ 1.05	$ 352	March 8, 2021
June	1.13	378	June 7, 2021
September	1.13	380	August 30, 2021
December	1.13	376	November 29, 2021
	$ 4.44	$ 1,486	
For the year 2020:			
March	$ 1.05	$ 351	March 2, 2020
June	1.05	350	June 8, 2020
September	1.05	352	August 31, 2020
December	1.05	352	November 30, 2020
	$ 4.20	$ 1,405	

Share Repurchase Authorization—In May 2021, our shareholders approved a proposal to authorize us to repurchase up to 34.0 million ordinary shares, through November 28, 2022 ("2021 Share Repurchase Authorization"), which superseded any prior repurchase authorizations. The timing and amount of these repurchases, which are determined based on our evaluation of market conditions and other factors, may be executed from time to time through open market or privately negotiated transactions. The repurchased shares, which are recorded at cost, are classified as Treasury stock and may be retired or used for general corporate purposes, including for various employee benefit and compensation plans.

In May 2020, our shareholders approved a proposal to authorize us to repurchase up to 34.0 million ordinary shares through November 29, 2021 ("2020 Share Repurchase Authorization"), which superseded our prior repurchase authorizations. As of December 31, 2020, there were no repurchases under the 2020 Share Repurchase Authorization.

In September 2019, our shareholders approved a proposal to authorize us to repurchase up to 33.3 million ordinary shares through March 12, 2021 ("September 2019 Share Repurchase Authorization"), which superseded any prior repurchase authorizations.

In May 2019, our shareholders approved a proposal to authorize us to repurchase up to 37.0 million of our ordinary shares through November 30, 2020 ("May 2019 Share Repurchase Authorization"), which superseded the remaining authorizations. In July 2019, upon the completion of the tender offer, we repurchased 35.1 million ordinary shares under the May 2019 Share Repurchase Authorization for a total of $3,099 million, including $6 million of fees and expenses related to the tender offer. The remaining 1.9 million shares under the May 2019 Share Repurchase Authorization were repurchased from the open market in August 2019.

The following table summarizes our share repurchase activity for the periods presented:

Millions of dollars, except shares and per share amounts	Shares Repurchased	Average Purchase Price	Total Purchase Price, Including Commissions and Fees
For the year 2021:			
2021 Share Repurchase Authorization	5,163,334	$ 92.37	$ 477
	5,163,334	$ 92.37	$ 477
For the year 2020:			
September 2019 Share Repurchase Authorization	50,685	$ 78.93	$ 4
2020 Share Repurchase Authorization	—	—	—
	50,685	$ 78.93	$ 4
For the year 2019:			
2018 Share Repurchase Authorization	5,648,900	$ 86.38	$ 488
May 2019 Share Repurchase Authorization	37,032,594	87.50	3,240
	42,681,494	$ 87.35	$ 3,728

Total cash paid for share repurchases for the years ended December 31, 2021, 2020 and 2019 was $463 million, $4 million and $3,752 million, respectively. Cash payments made during the reporting period may differ from the total purchase price, including commissions and fees, due to the timing of payments.

Ordinary Shares—The changes in the outstanding amounts of ordinary shares are as follows:

	Year Ended December 31,		
	2021	2020	2019
Ordinary shares outstanding:			
Beginning balance	334,015,220	333,476,883	375,696,661
Share-based compensation	468,131	263,786	295,984
Employee stock purchase plan	216,372	325,236	165,743
Purchase of ordinary shares	(5,163,334)	(50,685)	(42,681,505)
Ending balance	329,536,389	334,015,220	333,476,883

Treasury Shares—The changes in the amounts of treasury shares held by the Company are as follows:

	Year Ended December 31,		
	2021	2020	2019
Ordinary shares held as treasury shares:			
Beginning balance	6,030,408	6,568,745	24,513,619
Share-based compensation	(468,131)	(263,786)	(295,984)
Employee stock purchase plan	(50,006)	(325,236)	(165,743)
Purchase of ordinary shares	5,163,334	50,685	42,681,505
Treasury shares canceled	—	—	(60,164,652)
Ending balance	10,675,605	6,030,408	6,568,745

During 2019, following approval by our management and shareholders, we canceled 60,164,652 ordinary shares held in our treasury account in accordance with cancellation requirements under Dutch law.

Purchase of ordinary shares during 2019 includes 11 shares that were returned to us at no cost resulting from unclaimed distributions to creditors.

Accumulated Other Comprehensive Loss—The components of, and after-tax changes in, Accumulated other comprehensive loss as of and for the years ended December 31, 2021, 2020 and 2019 are presented in the following table:

Millions of dollars	Financial Derivatives	Unrealized Gains (Losses) on Available-for-Sale Debt Securities	Defined Benefit Pension and Other Post-retirement Benefit Plans	Foreign Currency Translation Adjustments	Total
Balance—December 31, 2018	$ (68)	$ —	$ (442)	$ (853)	$ (1,363)
Other comprehensive loss before reclassifications	(120)	—	(390)	(12)	(522)
Tax (expense) benefit before reclassifications	25	—	98	(8)	115
Amounts reclassified from accumulated other comprehensive loss	(50)	—	29	—	(21)
Tax (expense) benefit	13	—	(6)	—	7
Net other comprehensive loss	(132)	—	(269)	(20)	(421)
Balance—December 31, 2019	$ (200)	$ —	$ (711)	$ (873)	$ (1,784)
Other comprehensive income (loss) before reclassifications	$ (471)	$ 1	$ (109)	$ 77	$ (502)
Tax benefit before reclassifications	110	—	25	30	165
Amounts reclassified from accumulated other comprehensive loss	175	—	58	—	233
Tax expense	(40)	—	(15)	—	(55)
Net other comprehensive income (loss)	(226)	1	(41)	107	(159)
Balance—December 31, 2020	$ (426)	$ 1	$ (752)	$ (766)	$ (1,943)
Other comprehensive income (loss) before reclassifications	$ 336	$ (1)	$ 214	$ (110)	$ 439
Tax expense before reclassifications	(64)	—	(50)	(45)	(159)
Amounts reclassified from accumulated other comprehensive loss	(244)	—	77	—	(167)
Tax (expense) benefit	44	—	(17)	—	27
Net other comprehensive income (loss)	72	(1)	224	(155)	140
Balance—December 31, 2021	$ (354)	$ —	$ (528)	$ (921)	$ (1,803)

The amounts reclassified out of each component of Accumulated other comprehensive loss are as follows:

Millions of dollars	Year Ended December 31, 2021	2020	2019	Affected Line Items on the Consolidated Statements of Income
Reclassification adjustments for:				
Financial derivatives:				
Commodities	$ —	$ —	$ (26)	Sales and other operating expenses
Commodities	(34)	—	20	Cost of sales
Foreign currency	(216)	170	(40)	Interest expense
Interest rates	6	5	(4)	Interest expense
Income tax (expense) benefit	44	(40)	13	Provision for income taxes
Financial derivatives, net of tax	(200)	135	(37)	
Amortization of defined pension items:				
Prior service cost	3	3	2	Other income, net
Actuarial loss	46	53	26	Other income, net
Settlement loss	28	6	1	Other income, net
Curtailment gain	—	(4)	—	Other income, net
Income tax expense	(17)	(15)	(6)	Provision for income taxes
Defined pension items, net of tax	60	43	23	
Total reclassifications, before tax	(167)	233	(21)	
Income tax (expense) benefit	27	(55)	7	Provision for income taxes
Total reclassifications, after tax	$ (140)	$ 178	$ (14)	Amount included in net income

Amortization of prior service cost and actuarial loss are included in the computation of net periodic pension and other post-retirement benefit costs, see Note 14 to the Consolidated Financial Statements.

Non-Controlling Interests—In February 2019, we increased our interest in our subsidiary La Porte Methanol Company, L.P., from 85% to 100%, for cash consideration of $63 million.

Redeemable Non-controlling Interests

Our redeemable non-controlling interests relate to shares of cumulative perpetual special stock issued by a consolidated subsidiary. As of December 31, 2021 and 2020, we had 115,374 shares of redeemable non-controlling interest stock outstanding.

In February, May, August and November 2021, we paid cash dividends of $15.00 per share to our redeemable non-controlling interest shareholders of record as of January 15, 2021, April 15, 2021, July 15, 2021, and October 15, 2021, respectively. In 2021, 2020 and 2019, these dividends were $7 million for each year.

19. Per Share Data

Basic earnings per share is based upon the weighted average number of shares of common stock outstanding during the periods. Diluted earnings per share includes the effect of certain stock options awards and other equity-based compensation awards. Our unvested restricted stock units contain non-forfeitable rights to dividend equivalents, and are considered participating securities. As such, we calculate basic and diluted earnings per share under the two-class method.

Earnings per share data are as follows:

	Year Ended December 31,					
	2021		2020		2019	
Millions of dollars	Continuing Operations	Discontinued Operations	Continuing Operations	Discontinued Operations	Continuing Operations	Discontinued Operations
Net income (loss)	$ 5,623	$ (6)	$ 1,429	$ (2)	$ 3,404	$ (7)
Dividends on redeemable non-controlling interests	(7)	—	(7)	—	(7)	—
Net income attributable to participating securities	(14)	—	(3)	—	(6)	—
Net income (loss) attributable to ordinary shareholders—basic and diluted	$ 5,602	$ (6)	$ 1,419	$ (2)	$ 3,391	$ (7)
Millions of shares, except per share amounts						
Basic weighted average common stock outstanding	334	334	334	334	353	353
Effect of dilutive securities	—	—	—	—	—	—
Potential dilutive shares	334	334	334	334	353	353
Earnings (loss) per share:						
Basic	$ 16.79	$ (0.02)	$ 4.25	$ (0.01)	$ 9.61	$ (0.02)
Diluted	$ 16.77	$ (0.02)	$ 4.25	$ (0.01)	$ 9.60	$ (0.02)

20. Segment and Related Information

Our operations are managed by senior executives who report to our Chief Executive Officer, the chief operating decision maker. Discrete financial information is available for each of the segments, and our Chief Executive Officer uses the operating results of each of the operating segments for performance evaluation and resource allocation. The activities of each of our segments from which they earn revenues and incur expenses are described below:

- *Olefins and Polyolefins—Americas* ("O&P—Americas"). Our O&P—Americas segment produces and markets olefins and co-products, polyethylene and polypropylene.
- *Olefins and Polyolefins—Europe, Asia, International* ("O&P—EAI"). Our O&P—EAI segment produces and markets olefins and co-products, polyethylene, and polypropylene.
- *Intermediates and Derivatives* ("I&D"). Our I&D segment produces and markets propylene oxide and its derivatives; oxyfuels and related products; and intermediate chemicals such as styrene monomer, acetyls, ethylene oxide and ethylene glycol.
- *Advanced Polymer Solutions* ("APS"). Our APS segment produces and markets compounding and solutions, such as polypropylene compounds, engineered plastics, masterbatches, engineered composites, colors and powders, and advanced polymers, which includes *Catalloy* and polybutene-1.
- *Refining*. Our Refining segment refines heavy, high-sulfur crude oil and other crude oils of varied types and sources available on the U.S. Gulf Coast into refined products, including gasoline and distillates.
- *Technology*. Our Technology segment develops and licenses chemical and polyolefin process technologies and manufactures and sells polyolefin catalysts.

Our chief operating decision maker uses EBITDA as the primary measure for reviewing profitability of our segments, and therefore, we have presented EBITDA for all segments. We define EBITDA as earnings from continuing operations before interest, income taxes, and depreciation and amortization.

"Other" includes intersegment eliminations and items that are not directly related or allocated to business operations, such as foreign exchange gains or losses and components of pension and other post-retirement benefit costs other than service costs. Sales between segments are made primarily at prices approximating prevailing market prices.

Summarized financial information concerning reportable segments is shown in the following tables for the periods presented:

	Year Ended December 31, 2021							
Millions of dollars	O&P – Americas	O&P – EAI	I&D	APS	Refining	Technology	Other	Total
Sales and other operating revenues:								
Customers	$ 10,502	$ 12,685	$ 9,968	$ 5,133	$ 7,178	$ 707	$ —	$ 46,173
Intersegment	4,500	805	212	12	824	136	(6,489)	—
	15,002	13,490	10,180	5,145	8,002	843	(6,489)	46,173
Depreciation and amortization expense	578	197	379	117	79	43	—	1,393
Other income (expense), net	28	11	(2)	7	(7)	—	25	62
Income (loss) from equity investments	115	313	34	(1)	—	—	—	461
EBITDA	5,273	1,749	1,378	409	(624)	514	(10)	8,689
Capital expenditures	319	249	1,112	85	74	91	29	1,959

	Year Ended December 31, 2020							
Millions of dollars	O&P – Americas	O&P – EAI	I&D	APS	Refining	Technology	Other	Total
Sales and other operating revenues:								
Customers	$ 5,032	$ 7,809	$ 6,144	$ 3,903	$ 4,346	$ 519	$ —	$ 27,753
Intersegment	2,243	558	125	10	381	140	(3,457)	—
	7,275	8,367	6,269	3,913	4,727	659	(3,457)	27,753
Depreciation and amortization expense	525	214	305	152	152	37	—	1,385
Other income (expense), net	70	14	1	1	1	—	(2)	85
Income (loss) from equity investments	45	186	26	(1)	—	—	—	256
EBITDA	1,810	826	833	378	(871)	324	(15)	3,285
Capital expenditures	543	166	880	63	63	111	121	1,947

	Year Ended December 31, 2019							
Millions of dollars	O&P – Americas	O&P – EAI	I&D	APS	Refining	Technology	Other	Total
Sales and other operating revenues:								
Customers	$ 5,311	$ 8,764	$ 7,642	$ 4,846	$ 7,599	$ 565	$ —	$ 34,727
Intersegment	3,124	740	192	4	652	98	(4,810)	—
	8,435	9,504	7,834	4,850	8,251	663	(4,810)	34,727
Depreciation and amortization expense	470	208	295	133	169	37	—	1,312
Other income, net	9	9	6	1	6	—	8	39
Income from equity investments	46	172	7	—	—	—	—	225
EBITDA	2,302	1,062	1,557	424	(65)	411	1	5,692
Capital expenditures	1,099	213	1,064	59	149	94	16	2,694

Operating results for our APS segment include integration costs of $37 million and $116 million in 2020 and 2019, respectively, associated with our acquisition of A. Schulman in August 2018. Integration activities related to our acquisition of A. Schulman were substantially completed by the third quarter of 2020.

Operating results for our Refining segment include non-cash impairment charges of $624 million and $582 million recognized in 2021 and 2020, respectively. See Note 7 to the Consolidated Financial Statements for additional information regarding impairment charges.

A reconciliation of EBITDA to Income from continuing operations before income taxes is shown in the following table for each of the periods presented:

	Year Ended December 31,		
Millions of dollars	**2021**	**2020**	**2019**
EBITDA:			
Total segment EBITDA	$ 8,699	$ 3,300	$ 5,691
Other EBITDA	(10)	(15)	1
Less:			
Depreciation and amortization expense	(1,393)	(1,385)	(1,312)
Interest expense	(519)	(526)	(347)
Add:			
Interest income	9	12	19
Income from continuing operations before income taxes	$ 6,786	$ 1,386	$ 4,052

The following assets are summarized and reconciled to consolidated totals in the following table:

Millions of dollars	**O&P – Americas**	**O&P – EAI**	**I&D**	**APS**	**Refining**	**Technology**	**Total**
December 31, 2021							
Property, plant and equipment, net	$ 6,398	$ 1,782	$ 5,118	$ 811	$ —	$ 447	$ 14,556
Equity investments	2,122	1,983	679	2	—	—	4,786
Goodwill	162	109	225	1,371	—	8	1,875
December 31, 2020							
Property, plant and equipment, net	$ 6,537	$ 1,820	$ 4,245	$ 818	$ 555	$ 411	$ 14,386
Equity investments	2,167	1,929	631	2	—	—	4,729
Goodwill	162	142	259	1,379	—	11	1,953

Long-lived assets include Property, plant and equipment, net, Intangible assets, net and Equity investments, see Notes 7 and 8 to the Consolidated Financial Statements. The following long-lived assets data is based upon the location of the assets:

	December 31,	
Millions of dollars	2021	2020
Long-lived assets:		
United States	$ 13,955	$ 13,940
Germany	1,460	1,517
The Netherlands	887	921
China	799	697
France	676	594
Mexico	306	257
Italy	300	338
Other	1,654	1,602
Total	$ 20,037	$ 19,866

Item 9. Changes in and Disagreements With Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

Effectiveness of Controls and Procedures

Our management, with the participation of our Chief Executive Officer (principal executive officer) and our Chief Financial Officer (principal financial officer) has evaluated the effectiveness of our disclosure controls and procedures in ensuring that the information required to be disclosed in reports that we file or submit under the Securities Exchange Act of 1934, as amended, is recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms, including ensuring that such information is accumulated and communicated to management (including the principal executive and financial officers) as appropriate to allow timely decisions regarding required disclosure. Based on such evaluation, our principal executive and financial officers have concluded that such disclosure controls and procedures were effective as of December 31, 2021, the end of the period covered by this Annual Report on Form 10-K.

Management’s Report on Internal Control over Financial Reporting

Management’s report on our internal control over financial reporting can be found in Item 8, *Financial Statements and Supplementary Data,* of this report.

Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting, as defined in Rule 13a-15(f) of the Act, in our fourth fiscal quarter of 2021 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

We have a Code of Conduct for all employees and directors, including our principal executive officer, principal financial officer, principal accounting officer and persons performing similar functions. We also have a Financial Code of Ethics specifically for our principal executive officer, principal financial officer, principal accounting officer and persons performing similar functions. We have posted copies of these codes on the "Corporate Governance" section of our website at www.LyondellBasell.com (within the Investor Relations section). Any waivers of the codes must be approved, in advance, by our Board of Directors. Any amendments to, or waivers from, the codes that apply to our executive officers and directors will be posted on the "Corporate Governance" section of our website.

Information regarding our executive officers is reported under the caption "Information about our Executive Officers" in Part I of this report, which is incorporated herein by reference.

All other information required by this Item will be included in our Proxy Statement relating to our 2022 Annual General Meeting of Shareholders and is incorporated herein by reference.*

Item 11. Executive Compensation.

All information required by this Item will be included in our Proxy Statement relating to our 2022 Annual General Meeting of Shareholders and is incorporated herein by reference.*

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

All information required by this Item will be included in our Proxy Statement relating to our 2022 Annual General Meeting of Shareholders and is incorporated herein by reference.*

Item 13. Certain Relationships and Related Transactions, and Director Independence.

All information required by this Item will be included in our Proxy Statement relating to our 2022 Annual General Meeting of Shareholders and is incorporated herein by reference.*

Item 14. Principal Accounting Fees and Services.

All information required by this Item will be included in our Proxy Statement relating to our 2022 Annual General Meeting of Shareholders and is incorporated herein by reference.*

* *Except for information or data specifically incorporated herein by reference under Items 10 through 14, other information and data appearing in our 2022 Proxy Statement are not deemed to be a part of this Annual Report on Form 10-K or deemed to be filed with the Commission as a part of this report.*

PART IV

Item 15. Exhibits, Financial Statement Schedules.

(a) (1) *Consolidated Financial Statements:* The financial statements and supplementary information listed in the Index to Financial Statements, included in Item 8.

(a) (2) *Consolidated Financial Statement Schedules:* Schedules are omitted because they either are not required or are not applicable or because equivalent information has been included in the financial statements, the notes thereto or elsewhere herein.

(b) Exhibits:

Exhibit Number	Description
3	Articles of Association of LyondellBasell Industries N.V., as amended on June 1, 2018 (incorporated by reference to Exhibit 3.1 of our Current Report on Form 8-K filed with the SEC on June 5, 2018)
4.1	Description of the Company's Securities Registered Pursuant to Section 12 of the Securities Exchange Act of 1934 (incorporated by reference to Exhibit 4.1 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
4.2	Specimen certificate for Class A ordinary shares, par value €0.04 per share, of LyondellBasell Industries N.V. (incorporated by reference to Exhibit 4.1 to our Annual Report on Form 10-K filed with the SEC on February 16, 2016)
4.3	Registration Rights Agreement by and among LyondellBasell Industries N.V. and the Holders (as defined therein), dated as of April 30, 2010 (incorporated by reference to Exhibit 4.7 to Amendment No. 2 to Form 10 filed with the SEC on July 26, 2010)
4.4	Second Amended and Restated Nomination Agreement, dated June 1, 2018, between AI International Chemicals S.à R.L. and LyondellBasell Industries N.V. (incorporated by reference to Exhibit 10.1 of our Current Report on Form 8-K filed with the SEC on June 5, 2018)
4.5	Indenture relating to 5.750% Senior Notes due 2024, among LyondellBasell Industries N.V., as issuer, each of the Guarantors named therein, as guarantors, Wells Fargo Bank, National Association, as trustee, registrar and paying agent, dated as of April 9, 2012 (including form of 5.750% Senior Note due 2024) (incorporated by reference to Exhibit 4.3 to our Current Report on Form 8-K filed with the SEC on April 10, 2012)
4.6	First Supplemental Indenture, dated as of December 10, 2015, to Indenture dated as of April 9, 2012, between LyondellBasell Industries N.V. and Wells Fargo Bank, National Association, as trustee (incorporated by reference to Exhibit 4.1 to our Current Report on Form 8-K filed with the SEC on December 14, 2015)
4.7	Indenture, between LyondellBasell Industries N.V. as Company and Wells Fargo Bank, National Association, as Trustee dated as of March 5, 2015 (incorporated by reference to Exhibit 4.1 to our Current Report on Form 8-K filed with the SEC on March 5, 2015)
4.8	Officer's Certificate of LyondellBasell Industries, N.V. relating to the 4.625% Senior Notes due 2055, dated as of March 5, 2015 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on March 5, 2015)

Exhibit Number	Description
4.9	Form of LyondellBasell Industries N.V.’s 4.625% Senior Notes due 2055 (incorporated by reference to Exhibit 4.3 to our Current Report on Form 8-K filed with the SEC on March 5, 2015 and included in Exhibit 4.2 thereto)
4.10	Indenture, among LYB International Finance B.V., as issuer, LyondellBasell Industries N.V., as guarantor, and Wells Fargo Bank, National Association, as trustee, dated as of July 16, 2013 (incorporated by reference to Exhibit 4.1 to our Form 8-K filed with the SEC on July 16, 2013)
4.11	Officer’s Certificate of LYB International Finance B.V. relating to the 4.000% Guaranteed Notes due 2023, dated as of July 16, 2013 (incorporated by reference to Exhibit 4.2 to our Form 8-K filed with the SEC on July 16, 2013)
4.12	Form of LYB International Finance B.V.’s 4.000% Guaranteed Notes due 2023 (incorporated by reference to Exhibit 4.2 to our Form 8-K filed with the SEC on July 16, 2013)
4.13	Officer’s Certificate of LYB International Finance B.V. relating to the 5.250% Guaranteed Notes due 2043, dated as of July 16, 2013 (incorporated by reference to Exhibit 4.3 to our Form 8-K filed with the SEC on July 16, 2013)
4.14	Form of LYB International Finance B.V.’s 5.250% Guaranteed Notes due 2043 (incorporated by reference to Exhibit 4.3 to our Form 8-K filed with the SEC on July 16, 2013)
4.15	Officer’s Certificate of LYB International Finance B.V. relating to the 4.875% Guaranteed Notes due 2044, dated as of February 28, 2014 (incorporated by reference to Exhibit 4.2 to our Form 8-K filed with the SEC on February 28. 2014)
4.16	Form of LYB International Finance B.V.’s 4.875% Guaranteed Notes due 2044 (incorporated by reference to Exhibit 4.2 to our Form 8-K filed with the SEC on February 28. 2014)
4.17	Indenture, among LYB International Finance II B.V., as Issuer, LyondellBasell Industries N.V., as Guarantor, and Deutsche Bank Trust Company Americas, as Trustee, dated as of March 2, 2016 (incorporated by reference to Exhibit 4.1 to our Current Report on Form 8-K filed with the SEC on March 2, 2016)
4.18	Officer’s Certificate of LYB International Finance II B.V. relating to the 3.500% Guaranteed Notes due 2027, dated as of March 2, 2017 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on March 2, 2017)
4.19	Form of LYB International Finance II B.V.’s 3.500% Guaranteed Notes due 2027 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on March 2, 2017 and included in Exhibit A thereto)
4.20	Supplemental Indenture, among LYB International Finance II B.V., as Issuer, LyondellBasell Industries N.V., as Guarantor, and Deutsche Bank Trust Company Americas, as Trustee, dated as of September 17, 2019 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on September 17, 2019)
4.21	Form of LYB International Finance II B.V.’s 0.875% Guaranteed Notes due 2026 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on September 17, 2019)

Exhibit Number	Description
4.22	Form of LYB International Finance II B.V.'s 1.625% Guaranteed Notes due 2031 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on September 17, 2019)
4.23	Indenture, among LYB International Finance III, LLC, as Issuer, LyondellBasell Industries N.V., as Guarantor, and Wells Fargo Bank, National Association, as Trustee, dated as of October 10, 2019 (incorporated by reference to Exhibit 4.1 to our Current Report on Form 8-K filed with the SEC on October 10, 2019)
4.24	Officer's Certificate of LYB International Finance III, LLC relating to the 4.200% Guaranteed Notes due 2049, dated as of October 10, 2019 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 10, 2019)
4.25	Form of LYB International Finance III, LLC's 4.200% Guaranteed Notes due 2049 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 10, 2019)
4.26	Officer's Certificate of LYB International Finance III, LLC relating to the 3.375% Guaranteed Notes due 2030, and 4.200% Guaranteed Notes due 2050 dated as of April 20, 2020 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on April 21, 2020)
4.27	Form of LYB International Finance III, LLC's 3.375% Guaranteed Notes due 2030 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on April 21, 2020)
4.28	Form of LYB International Finance III, LLC's 4.200% Guaranteed Notes due 2050 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on April 21, 2020)
4.29	Officer's Certificate of LYB International Finance III, LLC relating to the 1.250% Guaranteed Notes due 2025, 2.250% Guaranteed Notes due 2030, 3.375% Guaranteed Notes due 2040, 3.625% Guaranteed Notes due 2051, and 3.800% Guaranteed Notes due 2060, dated as of October 8, 2020 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
4.30	Form of LYB International Finance III, LLC's 1.250% Guaranteed Notes due 2025 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
4.31	Form of LYB International Finance III, LLC's 2.250% Guaranteed Notes due 2030 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
4.32	Form of LYB International Finance III, LLC's 3.375% Guaranteed Notes due 2040 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
4.33	Form of LYB International Finance III, LLC's 3.625% Guaranteed Notes due 2051 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
4.34	Form of LYB International Finance III, LLC's 3.800% Guaranteed Notes due 2060 (incorporated by reference to Exhibit 4.2 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)
10.1+	Offer Letter dated December 8, 2021 between Peter Vanacker and LyondellBasell Industries N.V. (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on December 13, 2021)
10.2+	Offer Letter dated October 10, 2019 between Michael McMurray and Lyondell Chemical Company (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on October 15, 2019)

Exhibit Number	Description
10.3+	Offer Letter dated May 17, 2019 between Kenneth T. Lane and Lyondell Chemical Company (incorporated by reference to Exhibit 10.6 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
10.4+	Offer Letter dated May 17, 2019 between Torkel Rhenman and Lyondell Chemical Company (incorporated by reference to Exhibit 10.7 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
10.5+	Letter to Torkel Rhenman dated July 22, 2020 (incorporated by reference to Exhibit 10.5 to our Quarterly Report on Form 10-Q filed with the SEC on October 30, 2020)
10.6+	LyondellBasell U.S. Senior Management Deferral Plan dated effective as of May 1, 2012 (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on March 1, 2012)
10.7+	First Amendment to the LyondellBasell U.S. Senior Management Deferral Plan dated effective as of January 1, 2013 (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on April 30, 2013)
10.8+	LyondellBasell Executive Severance Plan, Amended & Restated, effective as of December 13, 2021 and Form of Participation Agreement (incorporated by reference to Exhibit 10.3 to our Current Report on Form 8-K filed with the SEC on December 13, 2021)
10.9+	Form of Executive Severance Plan Participation Agreement between Lyondell Chemical Company and Peter Vanacker (incorporated by reference to Exhibit 10.4 to our Current Report on Form 8-K filed with the SEC on December 13, 2021)
10.10+	Form of Officer and Director Indemnification Agreement (incorporated by reference to Exhibit 10.12 to our Annual Report on Form 10-K filed with the SEC on February 21, 2019)
10.11+	LyondellBasell Industries Long Term Incentive Plan (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on May 28, 2021)
10.12+	2020 Form of Restricted Stock Unit Award Agreement (incorporated by reference to Exhibit 10.19 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
10.13+	2020 Form of Performance Share Unit Award Agreement (incorporated by reference to Exhibit 10.20 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
10.14+	2020 Form of Non-Qualified Stock Option Award Agreement (incorporated by reference to Exhibit 10.21 of our Annual Report on Form 10-K filed with the SEC on February 20, 2020)
10.15+	2021 Form of Restricted Stock Unit Award Agreement (incorporated by reference to Exhibit 10.1 to our Quarterly Report on Form 10-Q filed with the SEC on April 30, 2021)
10.16+	2021 Form of Performance Share Unit Award Agreement (incorporated by reference to Exhibit 10.2 to our Quarterly Report on Form 10-Q filed with the SEC on April 30, 2021)
10.17+	2021 Form of Non-Qualified Stock Option Award Agreement (incorporated by reference to Exhibit 10.3 to our Quarterly Report on Form 10-Q filed with the SEC on April 30, 2021)
10.18+*	2022 Form of Restricted Stock Unit Award Agreement

Exhibit Number	Description
10.19+*	2022 Form of Performance Share Unit Award Agreement
10.20+*	2022 Form of Non-Qualified Stock Option Award Agreement
10.21+	Form of 2021 Cash Incentive Award Agreement (incorporated by reference to our Current Report on Form 8-K filed with the SEC on August 27, 2021)
10.22+	Form of Director Restricted Stock Unit Award Agreement (incorporated by reference to Exhibit 10.1 of our Quarterly Report on Form 10-Q filed with the SEC on July 31, 2020)
10.23	Second Amended and Restated Credit Agreement, dated November 23, 2021, among LyondellBasell Industries N.V. and LYB Americas Finance Company LLC, as Borrowers, the Lenders from time to time party thereto , Citibank, N.A., as Administrative Agent, Wells Fargo Bank, National Association as Syndication Agent and the other parties thereto (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on November 24, 2021)
10.24	Receivables Purchase Agreement, dated September 11, 2012, by and among Lyondell Chemical Company, as initial servicer, and LYB Receivables LLC, as seller, PNC National Association, as Administrator and LC Bank, certain conduit purchasers, committed purchasers, LC participants and purchaser agents that are parties thereto from time to time (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on September 14, 2012)
10.25	Second Amendment to Receivables Purchase Agreement, dated August 26, 2015, among Lyondell Chemical Company, as servicer, LYB Receivables LLC, as seller, the conduit purchasers, related committed purchasers, LC participants and purchaser agents party thereto, the other parties thereto and Mizuho Bank, Ltd., as Administrator and LC Bank (incorporated by reference to Exhibit 10 to our Current Report on Form 8-K filed with the SEC on August 28, 2015)
10.26	Third Amendment to Receivables Purchase Agreement, dated July 24, 2018, among Lyondell Chemical Company, as servicer, LYB Receivables LLC, as seller, the conduit purchasers, related committed purchasers, LC participants and purchaser agents party thereto, the other parties thereto and Mizuho Bank, Ltd., as Administrator and LC Bank (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on July 27, 2018)
10.27	Fourth Amendment to Receivables Purchase Agreement, dated as of June 30, 2021, among Lyondell Chemical Company, as servicer, LYB Receivables LLC, as seller, the conduit purchasers, related committed purchasers, LC participants and purchaser agents party thereto, the other parties thereto and Mizuho Bank, Ltd., as Administrator and LC Bank (incorporated by reference to Exhibit 10.1 to our Current Report on Form 8-K filed with the SEC on July 2, 2021)
10.28	Acknowledgement of Amendment to Receivables Purchase Agreement, dated April 14, 2020, among Lyondell Chemical Company, as servicer, LYB Receivables LLC, as seller, the conduit purchasers, related committed purchasers, LC participants and purchaser agents party thereto, the other parties thereto and Mizuho Bank, Ltd., as Administrator and LC Bank (incorporated by reference to Exhibit 10.3 of our Current Report on Form 8-K filed with the SEC on April 15, 2020)
10.29	Acknowledgement of Amendment to Receivables Purchase Agreement, dated October 8, 2020, among Lyondell Chemical Company, as servicer, LYB Receivables LLC, as seller, the conduit purchasers, related committed purchasers, LC participants and purchaser agents party thereto, the other parties thereto and Mizuho Bank, Ltd., as Administrator and LC Bank (incorporated by reference to Exhibit 10.3 to our Current Report on Form 8-K filed with the SEC on October 8, 2020)

Exhibit Number	Description
10.30	Purchase and Sale Agreement, dated September 11, 2012, by and among Lyondell Chemical Company, Equistar Chemicals, LP and LyondellBasell Acetyls, LLC, the other originators from time to time parties thereto, Lyondell Chemical Company, as initial servicer and LYB Receivables LLC, as buyer (incorporated by reference to Exhibit 10.2 to our Current Report on Form 8-K filed with the SEC on September 14, 2012)
21*	List of subsidiaries of the registrant
23*	Consent of PricewaterhouseCoopers LLP, Independent Registered Public Accounting Firm
31.1*	Certification of Chief Executive Officer pursuant to Rule 13a-14(a) under the Securities Exchange Act of 1934
31.2*	Certification of Chief Financial Officer pursuant to Rule 13a-14(a) under the Securities Exchange Act of 1934
32*	Certifications pursuant to 18 U.S.C. Section 1350
101.INS*	XBRL Instance Document
101.SCH*	XBRL Schema Document
101.CAL*	XBRL Calculation Linkbase Document
101.DEF*	XBRL Definition Linkbase Document
101.LAB*	XBRL Labels Linkbase Document
101.PRE*	XBRL Presentation Linkbase Document
104*	Cover Page Interactive Data File (formatted as inline XBRL and contained in Exhibit 101)

+ Management contract or compensatory plan, contract or arrangement.

* Filed herewith.

Item 16. Form 10-K Summary.

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

LYONDELLBASELL INDUSTRIES N.V.

Date: February 24, 2022

/s/Kenneth Lane

Name:	Kenneth Lane
Title:	Interim Chief Executive Officer

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Signature	Title	Date
/s/ KENNETH LANE **Kenneth Lane**	Interim Chief Executive Officer (*Principal Executive Officer*)	February 24, 2022
/s/ MICHAEL C. MCMURRAY **Michael C. McMurray**	Executive Vice President and Chief Financial Officer (*Principal Financial Officer*)	February 24, 2022
/s/ CHUKWUEMEKA A. OYOLU **Chukwuemeka A. Oyolu**	Senior Vice President, Chief Accounting Officer & Investor Relations (*Principal Accounting Officer*)	February 24, 2022
/s/ JACQUES AIGRAIN **Jacques Aigrain**	Chairman of the Board and Director	February 24, 2022
/s/ LINCOLN BENET **Lincoln Benet**	Director	February 24, 2022
/s/ JAGJEET S. BINDRA **Jagjeet S. Bindra**	Director	February 24, 2022
/s/ ROBIN W.T. BUCHANAN **Robin W.T. Buchanan**	Director	February 24, 2022
/s/ ANTHONY R. CHASE **Anthony R. Chase**	Director	February 24, 2022
/s/ STEPHEN F. COOPER **Stephen F. Cooper**	Director	February 24, 2022
/s/ NANCE K. DICCIANI **Nance K. Dicciani**	Director	February 24, 2022
/s/ ROBERT W. DUDLEY **Robert W. Dudley**	Director	February 24, 2022
/s/ CLAIRE S. FARLEY **Claire S. Farley**	Director	February 24, 2022
/s/ MICHAEL S. HANLEY **Michael S. Hanley**	Director	February 24, 2022
/s/ ALBERT J. MANIFOLD **Albert J. Manifold**	Director	February 24, 2022

RECONCILIATIONS FOR NON-GAAP MEASURES

Throughout this publication we use several non-GAAP financial measures, including EBITDA, which means net income from continuing operations plus interest expense (net), provision for (benefit from) income taxes, and depreciation and amortization. We also present EBITDA and diluted EPS exclusive of adjustments for LCM and impairment.

Reconciliation of Net Income to EBITDA, including and excluding LCM and Impairment

	Year Ended December 31,				
Millions of dollars	**2017**	**2018**	**2019**	**2020**	**2021**
Net income	$ 4,877	$ 4,690	$ 3,397	$ 1,427	$ 5,617
Loss from discontinued operations, net of tax	18	8	7	2	6
Income from continuing operations	4,895	4,698	3,404	1,429	5,623
Provision for (benefit from) income taxes	598	613	648	(43)	1,163
Depreciation and amortization	1,174	1,241	1,312	1,385	1,393
Interest expense, net	467	315	328	514	510
add: LCM charges, pre-tax	—	—	33	16	—
add: Impairments, pre-tax	—	—	—	582	624
EBITDA excluding LCM and impairment	7,134	6,867	5,725	3,883	9,313
less: LCM charges, pre-tax	—	—	(33)	(16)	—
less: Impairments, pre-tax	—	—	—	(582)	(624)
EBITDA	$ 7,134	$ 6,867	$ 5,692	$ 3,285	$ 8,689

	Year Ended December 31,					
Millions of dollars	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Net income	$ 2,140	$ 2,834	$ 3,853	$ 4,168	$ 4,474	$ 3,837
Loss from discontinued operations, net of tax	332	24	7	4	5	10
Income from continuing operations	2,472	2,858	3,860	4,172	4,479	3,847
Provision for income taxes	1,059	1,327	1,136	1,540	1,730	1,386
Depreciation and amortization	931	983	1,021	1,019	1,047	1,064
Interest expense, net	1,007	640	294	319	277	305
add: LCM charges, pre-tax	—	—	—	760	548	29
add: Impairments, pre-tax	23	22	—	—	—	—
EBITDA excluding LCM and impairment	5,492	5,830	6,311	7,810	8,081	6,631
less: LCM charges, pre-tax	—	—	—	(760)	(548)	(29)
less: Impairments, pre-tax	(23)	(22)	—	—	—	—
EBITDA	$ 5,469	$ 5,808	$ 6,311	$ 7,050	$ 7,533	$ 6,602

Reconciliation of Diluted EPS to Diluted EPS Excluding LCM and Impairment

	Year Ended December 31,		
	2019	2020	2021
Diluted earnings per share	$ 9.58	$ 4.24	$ 16.75
Add:			
LCM charges	0.07	0.03	—
Impairments	—	1.34	1.44
Diluted earnings per share excluding LCM and impairment	$ 9.65	$ 5.61	$ 18.19

lyondellbasell
Advancing Possible

LONDON
4th Floor, One Vine Street
London W1J 0AH
United Kingdom
Tel: +44 207 220 2600

ROTTERDAM
Delftseplein 27E
3013 AA Rotterdam
Netherlands
Tel: +31 10 275 5500

HOUSTON
LyondellBasell Tower
1221 McKinney Street,
Ste 300
Houston, TX 77010
Tel: +1 713 309 7200

HONG KONG
32/F, Dorset House
Taikoo Place
979 King's Road
Quarry Bay, Hong Kong
China
Tel: +852 2577 3855

Responsible Care® OUR COMMITMENT TO SUSTAINABILITY

LYB LISTED NYSE

FORTUNE THE WORLD'S MOST ADMIRED COMPANIES® 2022

www.lyondellbasell.com