LyondellBasell Industries N.V.
Form 10-K
February 21, 2019
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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549
Form 10-K
(Mark One)
þ ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018
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)

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

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

(Address of principal executive offices) (Zip Code)
(713) 309-7200 +44 (0) 207 220 2600 +31 (0)10 275 5500
(Registrant's telephone numbers, including area codes)
Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Name of Each Exchange On Which Registered
Ordinary Shares, €0.04 Par Value	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. þ 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 þ 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. þ 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 and post such files). þ Yes ¨ No
Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of the registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. þ
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 þ 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 is a shell company (as defined in Rule 12b-2 of the Act). ¨ Yes þ No

The aggregate market value of common stock held by non-affiliates of the registrant on June 29, 2018, the last business day of the registrant’s most recently completed second fiscal quarter, based on the closing price on that date of $109.85, was $35.0 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 371,156,998 shares outstanding at February 19, 2019 (excluding 29,053,282 treasury shares).

Documents incorporated by reference:

Portions of the Notice of the 2019 Annual Meeting of Shareholders and 2019 Proxy Statement, in connection with the Company’s 2019 Annual Meeting of Shareholders (in Part III), as indicated herein.

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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 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 "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 fall materially, or decrease 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; for example, substantial capacity expansions are underway in the U.S. olefins industry;
- 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; for example, because the Houston refinery is our only refining operation, we would not have the ability to increase production elsewhere to mitigate the impact of any outage at that facility;
- 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;
- execution of our organic growth plans may be negatively affected by our ability to complete projects on time and on budget;
- our growth depends on the opportunities available to acquire new businesses and assets and our ability to integrate them into our existing 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;
- 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;

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- 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 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 on page 18.

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PART I

Items 1 and 2. Business and Properties

OVERVIEW

LyondellBasell Industries N.V. is a global, independent chemical company and was incorporated under Dutch law on October 15, 2009. Unless otherwise indicated, the "Company," "we," "our," "us" and "LyondellBasell" are used in this report t 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, while 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, diesel and jet fuel. 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, 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. We also purchase large quantities of natural gas liquids and crude oil derivatives which we use as feedstocks. During recent years 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. While new facilities and increased supply has reduced the North American feedstock advantage, improved product supply and demand fundamentals in several businesses, notably global polyolefins products, have partially offset the decline.

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 22, Segment and Related Information, to the Consolidated Financial Statements. Information about the locations where we produce our primary products

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can be found under “Description of Properties.” No single customer accounted for 10% or more of our total revenues in 2018, 2017 and 2016.

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.

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. PE sales accounted for approximately 19%, 21% and 24% of our total revenues in 2018, 2017 and 2016, respectively.

Polypropylene—We produce PP homopolymers and copolymers. PP sales accounted for approximately 15% of our total revenues in 2018 and 17% in each of 2017 and 2016.

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. In 2017 and 2018, we added a total of 230 million pounds of ethylene capacity at our facilities in North America.

We use all the propylene we produce in the production of PP, propylene oxide and other derivatives of those products. As a result, 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 lower-cost production.

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 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

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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. We also consume PP in our PP compounds business, which is managed worldwide by our APS segment.

Joint Venture Relationships

We participate in a joint venture in Mexico, which provides us with capacity for approximately 640 million pounds of PP production. The capacity is based on our percentage ownership of the joint venture’s total capacity. We do not hold a majority interest in or have operational control of this joint venture.

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 worldwide demographic and 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, we believe as of December 31, 2018 we were:

- the second largest producer of ethylene in North America, with ethylene capacity of 12.0 billion pounds per year;
- the third largest producer of PE in North America with 6.4 billion pounds per year of capacity; and
- the largest producer of PP in North America, with 4.0 billion pounds, including our share of our Mexican joint venture capacity and approximately 620 million pounds of Catalloy capacity reported within our Advanced Polymer Solutions segment.

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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, Asia and Africa. Our joint ventures described below typically manage their domestic sales and marketing efforts independently, and we typically operate as their agent/distributor for all or a portion of their exports.
Joint Venture Relationships
We participate in several manufacturing joint ventures in Saudi Arabia, Thailand, Poland, Australia and South Korea. We do not hold majority interests in any of these joint ventures, nor do we have operational control. These ventures provide us with additional production capacity of approximately 2.4 billion pounds of PP, approximately 1.4 billion pounds of olefins, and approximately 0.9 billion pounds of PE. These capacities are based on our percentage ownership interest in the joint ventures' total capacities. We realize profits or losses from these ventures as income or loss on the equity basis of accounting.
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. Historically, the primary raw material used in our European olefin facilities was naphtha; however, in recent years we increased our use of advantaged NGLs. For our Saudi Arabian joint venture facilities, locally sourced and cost advantaged NGLs, including ethane, propane and butane are used. 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. Some of our joint ventures receive propylene and ethylene from their local shareholders under long-term contracts.
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 relative to the pricing of the underlying naphtha raw materials, most of which are priced in U.S. dollars. There can be a lag between naphtha 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

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divisions of large oil companies. The petrochemical market in the European Union (“EU”) has been affected by the price volatility of naphtha, the primary feedstock for olefins in the region, as well as fluctuating demand as a result of changing European and global economic conditions.

Based on published capacity data and including our proportionate share of our joint ventures, we believe as of December 31, 2018 we were:

- the fifth largest producer of ethylene in Europe with an ethylene capacity of 4.3 billion pounds per year;
- the largest producer of PP in Europe with 5.8 billion pounds per year of capacity, including our share of our joint venture in Poland and approximately 580 million pounds of Catalloy capacity reported within our Advanced Polymer Solutions segment; and
- the largest producer of PE in Europe with 4.8 billion pounds per year of capacity, including our share of our joint venture in Poland.

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.

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 United States due to their blending characteristics and emission benefits. C4 chemicals, such as high-purity isobutylene, are

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sold to producers of synthetic rubber and other chemical products primarily in the United States 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 four of the U.S. PO production facilities for the U.S. PO joint venture. Covestro's interest represents ownership of an in-kind portion of the PO production of 1.5 billion pounds per year. We take, in-kind, the remaining PO production and all co-product production. The parties' rights in the joint venture are based on off-take volumes related to actual production of PO as opposed to ownership percentages. 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 340 million pounds of PO and approximately 750 million pounds of SM. We do not share marketing or product sales with Covestro under either of these PO joint ventures.

We also have a joint venture manufacturing relationship in China. This venture provides us with additional production capacity of approximately 115 million pounds of PO. This capacity is based on our operational share of the joint venture's total capacity.

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 purchase carbon monoxide pursuant to a long-term contract with pricing primarily based on the cost of production. The methanol required for our downstream production of acetyls is internally sourced from a partnership and from our methanol plant at 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.

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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, excluding our partners' shares of joint venture capacity, we believe as of December 31, 2018 we were:

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

Advanced Polymer Solutions Segment

Overview

We formed the APS segment following our acquisition of A. Schulman Inc. in August 2018. 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 polyolefin resins.

Compounding and Solutions—Our polypropylene compounds are produced from blends of polyolefins and additives and 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 APS 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.

Joint Venture Relationships

We participate in several manufacturing joint ventures in Australia, Malaysia, Saudi Arabia, Hong Kong, Thailand, Indonesia and Argentina. We do not hold majority interests in any of these joint ventures, nor do we have operational control. These ventures provide us with additional production capacity of approximately 170 million pounds of PP compounds, approximately 20 million pounds of engineered composites, approximately 35 million pounds of specialty powders and approximately 25 million pounds of masterbatch solutions. These capacities are based on our percentage ownership interest in the joint ventures' total capacities.

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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, 2018 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 other 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 21%, 18% and 16% of our total revenues in 2018, 2017 and 2016, respectively.

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 268,000 barrels per day on a calendar day basis (normal operating basis), or approximately 292,000 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 dense 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, Venezuela 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.

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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 2018, there were 135 operable crude oil refineries in the U.S., and total U.S. refinery capacity was approximately 18.6 million barrels per day. During 2018, the Houston refinery processed an average of approximately 231,000 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 as a result of the changing global economy 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, 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 Gulf Coast price of two barrels of Maya crude oil as set by Petróleos Mexicanos (“Pemex”) and one barrel each of U.S. Gulf Coast Reformulated Gasoline Blendstock for Oxygen Blending (“RBOB”) Gasoline and of U.S. Gulf Coast Ultra Low Sulfur Diesel (“ULSD”). 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. Approximately 25% of our catalyst sales are intercompany.

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 2018, 2017 and 2016, our R&D expenditures were $115 million, $106 million, and $99 million, respectively. A portion of these expenses are related to technical support and customer service and are allocated to the other business segments. In 2018, 2017 and 2016, approximately 45% of all R&D costs were allocated to business segments other than Technology.

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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, 2018, we owned approximately 5,770 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. We own globally registered and unregistered trademarks including marks for “LyondellBasell,” “Lyondell,” “Basell” and “Equistar.” 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 heritage 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 Operations; and Notes 2 and 19 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 $212 million in 2018 for health, safety and environmental compliance purposes and improvement programs, and estimate such expenditures to be approximately $230 million in each of 2019 and 2020.

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.

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

Employee Relations

As of December 31, 2018, we employed approximately 19,450 full-time and part-time employees around the world. Of this total, 8,900 were located in North America and another 8,100 were located in Europe. The remainder of our employees are in other global locations.

As of December 31, 2018, approximately 900 of our employees in North America were represented by labor unions. The vast majority of our employees in Europe and South America are subject to staff council or works council coverage or collective bargaining agreements.

In addition to our own employees, we use the services of contractors in the routine conduct of our businesses.

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EXECUTIVE OFFICERS OF THE REGISTRANT

Our executive officers as of February 1, 2019 were as follows:

Name and Age	Significant Experience
Bhavesh V. ("Bob") Patel, 52	Chief Executive Officer since January 2015 and member of the Board of Directors since June 2018. Executive Vice President, Olefins and Polyolefins–EAI and Technology from October 2013 to January 2015. Senior Vice President, Olefins and Polyolefins–EAI and Technology from November 2010 to October 2013. Senior Vice President, Olefins and Polyolefins–Americas from March 2010 to June 2011.
Thomas Aebischer, 57	Executive Vice President and Chief Financial Officer since January 2016. Chief Financial Officer of LafargeHolcim from July 2015 to December 2015. Chief Financial Officer of Holcim Ltd. from January 2011 to June 2015.
Paul Augustowski, 58	Senior Vice President, Olefins & Polyolefins–Americas since January 2016. Vice President, Polymer Sales–Americas from January 2015 to January 2016. Director, Polypropylene and Catalloy–Americas from November 2011 to January 2015.
Darleen Caron, 54	Executive Vice President and Chief Human Resources Officer since October 2017. Executive Vice President of Global Human Resources and Member of The Office of The President at SNC Lavalin Group, Inc. from December 2010 to December 2015.
Daniel Coombs, 62	Executive Vice President, Global Manufacturing, Projects and Refining since October 2018. Executive Vice President, Global Manufacturing, Projects, Refining and Technology from February 2017 to October 2018. Executive Vice President, Global Olefins and Polyolefins, and Technology from January 2016 to February 2017. Executive Vice President, Intermediates and Derivatives from May 2015 to January 2016. Senior Vice President of Manufacturing for Chevron Phillips Chemical from December 2013 to May 2015. Senior Vice President for Specialties, Aromatics and Styrenics for Chevron Phillips Chemical from December 2011 to November 2013.

	Vice President of Corporate Planning and Development for Chevron Phillips Chemical from September 2011 to November 2011.
Massimo Covezzi, 61	Senior Vice President, Research and Development since January 2008.

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Name and Age	Significant Experience
Stephen Doktycz, 57	Senior Vice President, Strategic Planning and Transactions since March 2017. Corporate Director and Executive Project Lead at The Dow Chemical Company from 2013 to March 2017. Global Director, Corporate and Strategic Development at The Dow Chemical Company from 2011 to 2013.
Dale Friedrichs, 55	Vice President, Health, Safety, Environment and Security since February 2017. Site Manager of various facilities from January 1995 to February 2017.
James Guilfoyle, 48	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 and 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, 50	Executive Vice President and Chief Legal Officer since March 2015. Deputy General Counsel from December 2009 to March 2015.
Richard Roudeix, 56	Senior Vice President, Olefins & Polyolefins, Europe, Asia and International since February 2017. Senior Vice President, Olefins & Polyolefins, Europe from March 2015 to February 2017. Director, Olefins Europe from May 2009 to March 2015.

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Description of Properties

Our principal manufacturing facilities as of December 31, 2018 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(2)	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)(4)	I&D
Lake Charles, Louisiana	O&P–Americas
Matagorda, Texas	O&P–Americas
Morris, Illinois	O&P–Americas
Tuscola, 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
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

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Location	Segment
Asia Pacific	
Geelong, Australia†	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 styrene maleic anhydride unit and a polybutadiene unit, which are owned by an unrelated party and are located within the Channelview facility on property leased from Equistar Chemicals, LP.

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

(4) The La Porte Methanol facility is owned by La Porte Methanol Company, a partnership owned 85% by us.

(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.

Other Locations and Properties

We maintain executive offices in London, the United Kingdom; Rotterdam, The Netherlands; and Houston, Texas. 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.lyb.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. Alternatively, you may access these reports at the SEC's website at http://www.sec.gov.

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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.

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.

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, 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.

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.

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 recent years. 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.

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Cost increases for raw materials also may increase working capital needs, which could reduce our liquidity and cash flow. Even if we increase our sales prices to reflect rising raw material and energy costs, demand for products may decrease as 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 Texas 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.

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 direct 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, such as Europe or the U.S. 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.

Increased 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 Europe, the U.S., or their respective trading partners.

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, including southern

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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.

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 in Asia, the Middle East and North America may lead to periods of oversupply and lower profitability. A sizable number of expansions have recently started up in North America. 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.

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.

Interruptions of operations at our facilities may result in 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 the past, we 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 hurricanes striking the Texas coast. In addition, because the Houston refinery is our only refining operation, an outage at the refinery could have a particularly

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negative impact on our operating results. Unlike our chemical and polymer production facilities, which may have sufficient excess capacity to mitigate the negative impact of lost production at other facilities, 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
- 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. Delays in making required changes or upgrades to our facilities could subject us to fines or penalties as well as affect our ability to 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;

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- 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.

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

Increased global information security 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 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.

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. Additional risks from our multinational business include transportation delays and interruptions, war, terrorist activities, epidemics, pandemics, political instability, import and export controls, 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 and interest 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 global 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.

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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, including the U.S., The Netherlands, Germany, France and Italy.

In 2017, the U.S. enacted "H.R.1," also known as the "Tax Cuts and Jobs Act" (the "Tax Act") materially impacting our Consolidated Financial Statements by, among other things, decreasing the tax rate, and significantly affecting future periods. To determine the full effects of the tax law for 2018, we are awaiting the finalization of several proposed U.S. Treasury regulations under the Tax Act that were issued during 2018, as well as additional regulations to be proposed and finalized pursuant to the U.S. Treasury's expanded regulatory authority under the Tax Act. It is also possible that technical correction legislation concerning the Tax Act could retroactively affect tax liabilities for 2018. We will continue to analyze the Tax Act to determine the full effects of the new law as additional regulations are proposed and finalized.

Interest income earned by certain of our European subsidiaries through intercompany financings is either untaxed or taxed at rates substantially lower than the U.S. statutory rate. Tax regulations proposed in 2018 may affect tax deductible interest in the U.S. in future periods; however, we do not believe they will have a material impact as proposed. In addition, in 2016 the U.S. Treasury issued final Section 385 debt-equity regulations that impact our internal financings beginning in 2017. Pursuant to a 2017 Executive Order, the Treasury Department reviewed these regulations and determined that they should be retained, subject to further review following the enactment of U.S. tax reform. We are awaiting the U.S. Treasury's review of the existing Section 385 debt-equity regulations which could impact our internal financings in future years as well as any final regulations impacting interest deductions under the Tax Act. In addition, there has been an increased attention, both in the U.S. and globally, to the tax practices of multinational companies, including the European Union's state aid investigations, proposals by the Organization for Economic Cooperation and Development with respect to base erosion and profit shifting, and European Union tax directives. Such attention may result in further legislative changes that could adversely affect our tax rate. Other than the Tax Act, management does not believe that recent changes in income tax laws will have a material impact on our Consolidated Financial Statements, although new or proposed changes to tax laws could affect our tax liabilities in the future.

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. 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.

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 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.

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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 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 could 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 state, national and international 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. While the U.S. notified the United Nations in August 2017 that it will be withdrawing from the Agreement, other countries in which we operate, including Germany, France, and the Netherlands, are preparing national climate acts and protection plans to implement their emission reduction commitments under the Agreement. These actions could result in increased cost of purchased energy and increased costs of compliance for impacted locations. Within the framework of the EU emissions trading scheme ("ETS"), we were allocated certain allowances of carbon dioxide for the affected plants of our European sites for the period from 2008 to 2012 ("ETS II period"). The ETS II period did not bring additional cost to us as the allowance allocation was sufficient to cover the actual emissions of the affected plants. We were able to build an allowance surplus during the ETS II period which has been banked to the scheme for the period from 2013 to 2020 ("ETS III period"). We expect to incur additional costs for the ETS III period, despite the allowance surplus accrued over the ETS II period, as allowance allocations have been reduced for the ETS III period and more of our plants are affected by the scheme. We maintain an active hedging strategy to cover these additional costs. We expect to incur additional costs in relation to future carbon or GHG emission trading schemes.

In the U.S., the EPA has promulgated federal GHG regulations under the Clean Air Act affecting certain sources. The EPA has issued mandatory GHG reporting requirements, requirements to obtain GHG permits for certain industrial plants and GHG performance standards for some facilities. Although the EPA recently proposed to repeal and replace certain GHG requirements, additional GHG regulation may be forthcoming at the U.S. federal or state level that could result in the creation of additional costs in the form of taxes or required acquisition or trading of emission allowances. Compliance with these or other changes in laws, regulations and obligations that create a GHG emissions trading scheme or GHG reduction policies generally could significantly increase our costs or reduce demand for products we produce. Additionally, 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 and legislation could result in increased compliance costs, additional operating restrictions or delays in implementing growth projects or other capital investments, and could have a material adverse effect on our business and results of operations. In addition, climate changes, such as drought conditions or increased frequency and severity of hurricanes and floods, could have an adverse effect on our assets and operations.

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 likely would result in impairment and other charges to earnings.

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, even though we may reduce production at facilities, we may be required to continue to purchase or pay for utilities or raw materials under take-or-pay supply agreements.

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

In 2018, the European Union proposed rules to target the plastic products most often found on beaches and in seas. In addition, local and other governments have increasingly proposed or implemented bans on plastic items such as disposable bags and straws, as well as other food packaging. Additionally, plastics have recently faced increased public backlash and scrutiny. Increased regulation of, or prohibition on, the use of plastics 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.

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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 and the expansion of our business or other business opportunities may require significant amounts of capital. We believe that our cash from operations currently will be sufficient to meet these needs. However, 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 five-year, $2.5 billion revolving credit facility, which backs our commercial paper program, to meet our cash needs, to the extent available. As of December 31, 2018, we had no borrowings or letters of credit outstanding under the facility and $809 million, net of discount, outstanding under our commercial paper program, leaving an unused and available credit capacity of $1,688 million. We may also meet our cash needs by selling receivables under our $900 million U.S. accounts receivable facility. In the event of a default under our credit facility 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.

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.

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.

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.

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.

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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, 2018, the aggregate deficit was $992 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.

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

We have and may continue to make acquisitions in order to enhance our business. Acquisitions involve numerous risks, including with respect to 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.

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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. Item 103 of the SEC's Regulation S-K requires 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 $100,000. The matters below are disclosed solely pursuant to that requirement.

In September 2013, the 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. Region V indicated at a December 2017 meeting that it intends to issue an administrative enforcement order in 2018. We reasonably believe that EPA Region V may assert a penalty demand in excess of $100,000. A Tolling Agreement was signed in November 2018.

In June 2014, EPA Region V issued a Notice and Finding of Violation alleging violations at our Tuscola, Illinois facility related to flaring activity. The notice generally alleges failure to conduct a valid performance test and improper flare operations. In June 2018, Region V issued a draft administrative consent order that requires the completion of certain activities. We are currently engaged in discussions with Region V regarding a proposed penalty. We reasonably believe that the penalty may exceed $100,000. A Tolling Agreement was signed in November 2018.

The EPA has been conducting an enforcement initiative regarding flare emissions at petrochemical plants. In July 2014, we received Clean Air Act section 114 information request regarding flares at four U.S. facilities. In response to the information we provided and subsequent discussions, the EPA and Department of Justice (the "DOJ") have indicated that they are seeking a consent decree that would require certain corrective measures. We reasonably believe that resolution of this matter will involve payment of a monetary sanction in excess of $100,000. We continue to work with the EPA and DOJ to resolve this matter.

In January 2018, Houston Refining, LP learned that the Texas Commission on Environmental Quality had referred an environmental matter to the Texas Attorney General's office ("TAGO") for enforcement. The environmental matter referred to TAGO for enforcement stems from air emissions events sustained at the refinery. In June 2018, Houston Refining, LP and TAGO agreed to a settlement involving $680,000 in penalties, plus attorneys' fees and certain injunctive relief. To effectuate the settlement, the TAGO filed a complaint along with the proposed agreed final judgment in Travis County Court. The court entered the Agreed Final Judgment in October 2018 and the penalty has been paid in full.

In March 2018, the Morris facility learned that the Illinois EPA referred an environmental matter to the Illinois Attorney General's Office. The matters referred for enforcement relate to air emission events at the facility. In June 2018, the parties agreed to resolve the matter for a penalty of $125,000, and in August 2018, a consent order requiring the same was entered in Grundy County Court.

On March 21, 2018, the Cologne, Germany local court issued a regulatory fine notice of €1,800,000 arising from a pipeline leak in our Wesseling, Germany facility. We expect the Cologne prosecutor to issue a corresponding payment request, which will resolve the matter.

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Litigation and Other Matters

Information regarding our litigation and other legal proceedings can be found in Note 19, Commitments and Contingencies, to the Consolidated Financial Statements.

Item 4. Mine Safety Disclosures.

Not applicable.

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PART II

Item 5. Market for Registrant’s Common Equity, Related Stockholder 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.

There can be no assurance that any dividends or distributions will be declared or paid in the future.

Holders

As of February 19, 2019, there were approximately 5,600 record holders of our shares, including Cede & Co. as nominee of the Depository Trust Company.

United Kingdom Tax Considerations

In May 2013, we announced the planned migration of the tax domicile of LyondellBasell Industries N.V. from The Netherlands, where LyondellBasell Industries N.V. is incorporated, to the United Kingdom. On August 28, 2013, the Dutch and the United Kingdom competent authorities completed a mutual agreement procedure and issued a ruling that retroactively as of July 1, 2013 LyondellBasell Industries N.V. should be treated solely as a tax resident in the United Kingdom and is subject to the United Kingdom corporate income tax system.

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.

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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, 2013. The graph assumes that $100 was invested on December 31, 2013 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.

	12/31/2013	12/31/2014	12/31/2015	12/31/2016	12/31/2017	12/31/2018
LyondellBasell Industries N.V.	$100.00	$101.83	$115.20	$118.38	$157.99	$123.97
S&P 500 Index	$100.00	$113.69	$115.26	$129.05	$157.22	$150.33
S&P 500 Chemicals Index	$100.00	$110.70	$106.07	$116.85	$148.01	$130.83

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Issuer Purchases of Equity Securities

2018 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	4,414,939	$ 94.34	4,414,939	49,755,015
November 1—November 30	4,498,765	$ 93.37	4,498,765	45,256,250
December 1—December 31	2,628,200	$ 83.69	2,628,200	42,628,050
Total	11,541,904	$ 91.54	11,541,904	42,628,050

On June 1, 2018, we announced a share repurchase program of up to 57,844,016 of our ordinary shares through December 1, 2019, 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.

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Item 6. Selected Financial Data.

The following selected financial data was derived from our consolidated financial statements, which were prepared from our books and records. This data should be read in conjunction with the Consolidated Financial Statements and related notes thereto and "Management's Discussion and Analysis of Financial Condition and Results of Operations," below, which includes a discussion of factors that will enhance an understanding of this data.

	Year Ended December 31,				
In millions of dollars, except per share data	2018	2017	2016	2015	2014
Results of operations data:					
Sales and other operating revenues	$39,004	$34,484	$29,183	$32,735	$45,608
Operating income[(a)]	5,231	5,460	5,060	6,122	5,736
Interest expense[(b)]	(360)	(491)	(322)	(310)	(352)
Income from equity investments	289	321	367	339	257
Income from continuing operations[(a)(b)(c)]	4,698	4,895	3,847	4,479	4,172
Earnings per share from continuing operations:					
Basic	12.06	12.28	9.17	9.63	8.04
Diluted	12.03	12.28	9.15	9.60	8.00
Loss from discontinued operations, net of tax	(8)	(18)	(10)	(5)	(4)
Loss per share from discontinued operations:					
Basic	(0.02)	(0.05)	(0.02)	(0.01)	(0.01)
Diluted	(0.02)	(0.05)	(0.02)	(0.01)	(0.01)
Balance sheet data:					
Total assets	28,278	26,206	23,442	22,757	24,221
Short-term debt	885	68	594	353	346
Long-term debt[(d)]	8,502	8,551	8,387	7,675	6,699
Cash and cash equivalents	332	1,523	875	924	1,031
Short-term investments	892	1,307	1,147	1,064	1,593
Accounts receivable	3,503	3,539	2,842	2,517	3,448
Inventories	4,515	4,217	3,809	4,051	4,517
Working capital	4,931	4,861	4,122	4,386	4,901
Cash flow data:					
Cash provided by (used in):					
Operating activities	5,471	5,206	5,606	5,842	6,048
Investing activities	(3,559)	(1,756)	(2,301)	(1,046)	(3,539)
Expenditures for property, plant and equipment	(2,105)	(1,547)	(2,243)	(1,440)	(1,499)
Financing activities	(3,008)	(2,859)	(3,349)	(4,850)	(5,907)
Dividends declared per share	4.00	3.55	3.33	3.04	2.70

(a) Operating income and Income from continuing operations in 2018 include charges totaling $73 million ($57 million, after tax) for acquisition-related transaction and integration costs associated with our acquisition of A. Schulman Inc. and a pre-tax gain of $36 million ($34 million, after tax) on the sale of our carbon black subsidiary in France. In 2017, we had a pre-tax gain of $108 million ($103 million, after tax) on the sale of our 27% interest in Geosel, a joint venture in France; a pretax gain of $31 million ($20 million, after tax) on the sale of property in Lake Charles, Louisiana; and a pre-tax, non-cash gain of $21 million ($14 million, after tax) related to the elimination of an obligation associated with a

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lease. In 2016, we had a pre-tax and after-tax gain of $78 million on the sale of our wholly owned Argentine subsidiary and a pre-tax charge of $58 million ($37 million, after tax) for a pension settlement. Operating income and Income from continuing operations in 2016, 2015 and 2014 included pre-tax, non-cash charges of $29 million ($18 million, after tax), $548 million ($351 million, after tax) and $760 million ($483 million, after tax), respectively, related to lower of cost or market (“LCM”) inventory valuation adjustments.

(b) Interest expense and Income from continuing operations in 2017 included pre-tax charges of $113 million ($106 million, after tax) related to the redemption of $1,000 million aggregate principal amount of our then outstanding 5% senior notes due 2019.

(c) Income from continuing operations in 2018 includes a $358 million benefit related to $299 million of previously unrecognized tax benefits and the release of $59 million of associated accrued interest. In 2017, it included an $819 million non-cash tax benefit related to the lower federal income tax rate resulting from the enactment of the U.S. Tax Cuts and Jobs Act. In 2016, it included $135 million of out of period adjustments related to taxes on our cross-currency swaps and deferred liabilities related to some of our consolidated subsidiaries.

(d) Long-term debt includes current maturities of long-term debt.

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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. When we use the terms “we,” “us,” “our” or similar words in this discussion, unless the context otherwise requires, we are referring to LyondellBasell Industries N.V. and its consolidated subsidiaries (“LyondellBasell N.V.”).

OVERVIEW

During 2018, we continued to deliver strong earnings despite market challenges in the second half of the year and planned and unplanned downtime that negatively impacted fourth quarter 2018 results by approximately $225 million. Noteworthy annual results for our I&D segment driven by market improvements and targeted contracting strategies and in our Technology segment due to an increased number of polyolefin technology licenses were partially offset by declines in our O&P–Americas and O&P–EAI results. With our acquisition of A. Schulman Inc. (“A. Schulman”) in August 2018, we captured an opportunity to expand into new markets and created an additional platform for growth. We continued to manage our business portfolio by, among other things, investing in a recycling joint venture, and divesting our carbon black subsidiary in France.

As oil prices fell by 40% during the fourth quarter 2018, our O&P–EAI segment experienced declining demand as customers delayed orders and destocked inventories in expectations of lower pricing. This destocking and associated pricing pressures compounded the effects of typical fourth quarter seasonality. Our O&P–EAI segment was also impacted by low water levels on the Rhine River, extended maintenance at our Wesseling, Germany cracker and feedstock supply constraints at our Münchsmünster, Germany cracker during the fourth quarter. Our APS segment volumes were affected by decreased automotive demand in recent quarters and our Refining segment’s fourth quarter margins were negatively impacted by high gasoline inventories and unusually weak discounts for Maya crude oil.

Significant items that affected EBITDA in 2018 relative to 2017 include:

- Lower Olefins and Polyolefins–Americas (“O&P–Americas”) segment results with lower ethylene margins and higher fixed costs, offset by higher polyolefins margins;
- Lower Olefins and Polyolefins–Europe, Asia, International (“O&P–EAI”) segment results with lower margins and volumes in Europe, partly offset by favorable foreign exchange impacts;
- Higher Intermediates and Derivatives (“I&D”) segment results with increased margins and volumes;
- Lower Advanced Polymer Solutions (“APS”) segment results as lower margins and the impact of acquisition-related transaction and integration costs were partly offset by the contribution of results from A. Schulman product lines following the August 21, 2018 acquisition;
- Higher Refining segment results with higher refining margins and better yields; and
- Higher Technology segment results due mostly to increased licensing revenue.

Other noteworthy items in 2018 include the following:

- Completion of the $1.9 billion acquisition of A. Schulman, a leading global supplier of high-performance plastic compounds, composites and powders, on August 21, 2018;
- Groundbreaking for our new $2.4 billion PO/TBA plant at our Channelview, Texas facility on August 22, 2018;
- Construction of our Hyperzone high density polyethylene plant on track for planned start-up in the third quarter of 2019;

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- Non-cash income tax benefit of $346 million related to an audit settlement associated with specific uncertain tax positions recognized in the second quarter of 2018;
- Acquisition of a 50% interest in Quality Circular Polymers, a premium plastics recycling company in Sittard-Geleen, Netherlands on March 14, 2018; and
- Increase in quarterly dividend from $0.90 to $1.00 in February 2018.

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

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Sales and other operating revenues	$39,004	$34,484	$29,183
Cost of sales	32,529	28,059	23,191
Selling, general and administrative expenses	1,129	859	833
Research and development expenses	115	106	99
Operating income	5,231	5,460	5,060
Interest expense	(360)	(491)	(322)
Interest income	45	24	17
Other income, net	106	179	111
Income from equity investments	289	321	367
Provision for income taxes	613	598	1,386
Income from continuing operations	4,698	4,895	3,847
Loss from discontinued operations, net of tax	(8)	(18)	(10)
Net income	$4,690	$4,877	$3,837

RESULTS OF OPERATIONS

Revenues—We had revenues of $39,004 million in 2018, $34,484 million in 2017 and $29,183 million in 2016.

2018 versus 2017—Revenues increased by $4,520 million, or 13%, in 2018 compared to 2017.

Higher average sales prices led to a revenue increase of 11% in 2018. Average sales prices in 2018 were higher for most of our products as sales prices generally correlate with crude oil prices, which increased relative to 2017, despite a 40% decrease in oil prices during the fourth quarter 2018. A revenue decrease of 1% in 2018 reflects lower sales volumes for our O&P–Americas, O&P–EAI and APS segments, which were partly offset by an improvement in Refining and I&D segment sales volumes. Favorable foreign exchange impacts in 2018 resulted in a revenue increase of 1% relative to the prior year period. The operations of A. Schulman contributed $846 million of revenues following the acquisition which accounts for the remaining improvement in revenues for 2018.

2017 versus 2016—Revenues increased by $5,301 million, or 18%, in 2017 compared to 2016.

Average sales prices in 2017 were higher across most products as sales prices generally correlate with crude oil and natural gas prices, which on average, increased compared to the corresponding period in 2016. These higher prices led to a 15% increase in revenues. Higher sales volumes in our O&P–Americas, O&P–EAI and Refining segments, which were partly offset by lower I&D segment volumes, led to a revenue increase in 2017 of 2%. Favorable foreign exchange impacts were responsible for a 1% revenue increase in 2017.

Cost of Sales—Cost of sales were $32,529 million in 2018, $28,059 million in 2017 and $23,191 million in 2016.

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Fluctuations in our cost of sales are generally driven by changes in feedstock and energy costs, as all other material components remain relatively flat from year to year. Feedstock and energy related costs generally represent approximately 75% 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 10% to 15% in each annual period.

2018 versus 2017—Cost of sales increased by $4,470 million, or 16%, in 2018 compared to 2017. This increase in cost of sales is primarily due to increases in feedstock and energy costs. Costs for crude oil, heavy liquid feedstocks and natural gas liquids ("NGLs") and other feedstocks were higher in 2018 relative to 2017.

2017 versus 2016—Cost of sales increased by $4,868 million, or 21%, in 2017 compared to 2016. This increase was primarily due to higher feedstock and energy costs. Costs for crude oil, heavy liquid feedstocks, NGLs and natural gas were higher in 2017 relative to 2016.

SG&A Expense—Selling, general and administrative ("SG&A") expenses were $1,129 million in 2018, $859 million in 2017 and $833 million in 2016.

2018 versus 2017—SG&A expenses increased by $270 million in 2018 compared to 2017.

The $105 million of SG&A expenses incurred by the operations of A. Schulman following the acquisition together with $73 million of acquisition and integration costs associated with the acquisition accounted for approximately 66% of the 2018 increase in SG&A expenses. Higher employee-related expenses accounted for approximately 26% of the increase in 2018 SG&A expense.

Operating Income—Our operating income was $5,231 million in 2018, $5,460 million in 2017 and $5,060 million in 2016.

2018 versus 2017—Operating income decreased by $229 million in 2018 compared to 2017.

Operating income for our O&P–EAI, O&P–Americas, APS and Refining segments declined $626 million, $131 million, $76 million and $6 million, respectively, over 2017. These declines were partially offset by increases in operating income of $514 million and $101 million, in our I&D and Technology segments respectively.

2017 versus 2016—Operating income increased by $400 million in 2017. This improvement over 2016 was primarily due to increases of $144 million, $101 million and $74 million in operating income for our I&D, O&P–EAI and O&P–Americas segments, respectively, and $77 million of lower operating losses for our Refining segment.

Operating results for each of our business segments are reviewed further in the "Segment Analysis" section below.

Interest Expense—Interest expense was $360 million in 2018, $491 million in 2017 and $322 million in 2016.

In 2017, we recognized charges totaling $113 million related to the March 2017 redemption of $1,000 million of our outstanding 5% senior notes due 2019. These charges included $65 million of prepayment premiums, $44 million for adjustments associated with fair value hedges and $4 million for the write-off of associated unamortized debt issuance costs.

2018 versus 2017—Interest expense decreased by $131 million in 2018 compared to 2017 primarily due to the 2017 redemption of $1,000 million of our 5% senior notes due 2019 as discussed above. Higher capitalized interest accounted for $25 million of lower interest expense relative to 2017.

2017 versus 2016—In 2017, interest expense increased $169 million in 2017 compared to 2016 primarily due to the 2017 redemption of $1,000 of our 5% senior notes due 2019 as discussed above. A reduction in the amount of capitalized interest and increased charges from our fair value hedges resulted in incremental increases in interest expense of $13 million and $45 million respectively, relative to 2016.

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For additional information related to our fair value hedges, see Notes 13 and 15 to the Consolidated Financial Statements.

Other Income, Net—Other income, net, was $106 million in 2018, $179 million in 2017 and $111 million in 2016.

2018 versus 2017—Other income, net decreased by $73 million in 2018 compared to 2017. In 2018, we recognized a $36 million gain in our O&P–EAI segment related to the sale of our carbon black subsidiary in France. We also recognized $24 million of foreign exchange gains and approximately $45 million of other income primarily related to gains on investments, dividend income and pension benefits. In 2017, we recognized gains of $108 million on the sale of our O&P–EAI segment's interest in its Geosel joint venture and $31 million on the sale of a portion of property in Lake Charles, Louisiana. We also recognized a $21 million non-cash gain in our O&P–EAI segment related to the elimination of an obligation related to a lease in 2017.

2017 versus 2016—The $68 million increase in Other income, net, is primarily due to the gains discussed above related to the sales of our joint venture interest, a property in Lake Charles, Louisiana and the elimination of the obligation associated with a lease discussed above, as compared to the gain recognized in 2016 related to the sale of our wholly owned Argentine subsidiary. We allocated $57 million and $21 million of that gain to our O&P–Americas and APS segments, respectively.

Income from Equity Investments—Our income from equity investments was $289 million in 2018, $321 million in 2017 and $367 million in 2016.

2018 versus 2017—Income from our equity investments decreased in 2018 largely as a result of reduced polyolefin spreads.

2017 versus 2016—Income from our equity investments decreased in 2017 mainly due to lower results for our joint ventures in Poland, Asia and Mexico.

Income Taxes—Our effective income tax rates of 11.5% in 2018, 10.9% in 2017 and 26.5% in 2016 resulted in tax provisions of $613 million, $598 million and $1,386 million, respectively.

In 2017, the U.S. enacted "H.R.1," also known as the "Tax Cuts and Jobs Act" (the "Tax Act") materially impacting our Consolidated Financial Statements by, among other things, decreasing the tax rate and significantly affecting future periods. To determine the full effects of the tax law for 2018, we are awaiting the finalization of several proposed U.S. Treasury regulations under the Tax Act that were issued during 2018, as well as additional regulations to be proposed and finalized pursuant to the Treasury's expanded regulatory authority under the Tax Act. It is also possible that technical correction legislation concerning the Tax Act could retroactively affect tax liabilities for 2018. The Tax Act reduced the federal corporate tax rate from 35% to 21% for years beginning after 2017, which resulted in the remeasurement of our U.S. net deferred income tax liabilities. As a result, we recognized a tax benefit of $819 million in 2017. Including subsequent adjustments made in 2018, the cumulative impact of the remeasurement of our U.S. net deferred income tax liabilities and tax accruals was an $814 million income tax benefit.

Our effective income tax rate fluctuates based on, among other factors, changes in pre-tax income in countries with varying statutory tax rates, the U.S. domestic production activity deduction that applied to periods prior to 2018, changes in valuation allowances, changes in foreign exchange gains/losses, the amount of exempt income, and changes in unrecognized tax benefits associated with uncertain tax positions.

Our exempt income primarily includes interest income, export incentives, and equity earnings of our joint ventures. Interest income earned by certain of our European subsidiaries through intercompany financings is either untaxed or taxed at rates substantially lower than the U.S. statutory rate. Tax regulations proposed in 2018 may affect tax deductible interest in the U.S. in future periods; however, we do not believe they will have a material impact as proposed. 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, including changes with respect to proposed Treasury regulations under the Tax Act if finalized. Foreign exchange gains/losses have a

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permanent impact on our effective income tax rate that can cause unpredictable movement in our effective income tax rate. We continue to maintain valuation allowances in various jurisdictions totaling $120 million as of 2018, which could impact our effective income tax rate in the future. We believe our effective income tax rate for 2019 will be approximately 20%.

In 2016, the U.S. Treasury issued final Section 385 debt-equity regulations that impact our internal financings beginning in 2017. Pursuant to a 2017 Executive Order, the Treasury Department reviewed these regulations and determined that they should be retained, subject to further review following the enactment of U.S. tax reform. We are awaiting the U.S. Treasury's review of the existing Section 385 debt-equity regulations which could impact our internal financings in future years as well as any final regulations impacting interest deductions under the Tax Act.

2018—The 2018 effective income tax rate, which was lower than the U.S. statutory tax rate of 21%, was favorably impacted by changes in unrecognized tax benefits associated with uncertain tax positions (-6.0%) and exempt income (-5.6%). These favorable items were partially offset by the effects of earnings in various countries, notably in Europe, with higher statutory tax rates (1.7%) and U.S. state and local income taxes (1.0%).

During 2018, we entered into various audit settlements impacting specific uncertain tax positions. These audit settlements resulted in a $358 million non-cash benefit to our effective tax rate consisting of the recognition of $299 million of previously unrecognized tax benefits as a reduction for tax positions of prior years and the release of $59 million of previously accrued interest.

2017—The 2017 effective income tax rate, which was lower than the U.S. statutory tax rate of 35%, was favorably impacted by the remeasurement of U.S. net deferred tax liabilities due to the enactment of the Tax Act (-14.9%), exempt income (-7.0%), earnings in various countries, notably in Europe, with lower statutory tax rates (-3.0%), and the U.S. domestic production activity deduction (-1.0%). These favorable items were partially offset by the effects of U.S. state and local income taxes (0.7%) and changes in uncertain tax positions (0.5%). Although the Tax Act lowered the U.S. statutory federal income tax rate to 21% for tax years beginning after 2017, the reconciliation uses the 35% rate in effect for the year ended December 31, 2017.

2016—The 2016 effective income tax rate, which was lower than the U.S. statutory tax rate of 35%, was favorably impacted by exempt income (-6.7%), earnings in various countries, notably in Europe, with lower statutory tax rates (-3.0%), the impact of a change in non-U.S. tax law on our deferred tax liabilities (-1.0%) and the U.S. domestic production activity deduction (-0.8%). These favorable items were partially offset by the effects of non-cash out-of-period adjustments (2.5%) and U.S. state and local income taxes (0.5%).

Our 2016 income tax provision included $135 million of non-cash out of period adjustments from prior years. For further information on these adjustments, please see Note 18 to our Consolidated Financial Statements.

Comprehensive Income—We had comprehensive income of $4,682 million in 2018, $5,103 million in 2017 and $3,764 million in 2016.

2018 versus 2017—Comprehensive income decreased by $421 million in 2018 compared to 2017 primarily due to unfavorable net changes in foreign currency translations, lower net income and defined pension and other postretirement benefits. These decreases were offset by favorable impacts of financial derivatives primarily driven by periodic changes in benchmark interest rates.

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 decreased during 2018 resulting in net losses as reflected in the Consolidated Statements of Comprehensive Income. These net losses include pre-tax gains of $124 million in 2018, which represent the effective portion of our net investment hedges.

In 2018, the cumulative after-tax effect of our derivatives designated as cash flow hedges was a net gain of $54 million. The strengthening of the U.S. dollar against the euro in 2018 and periodic changes in benchmark interest rates resulted in a pre-tax gain of $107 million related to our cross-currency swaps. A $100 million pre-tax loss related to our cross-currency swaps represents reclassification adjustments included in Other income, net in 2018. In 2018, a pre-tax gain of $43 million related to

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forward-starting interest rate swaps was driven by changes in benchmark interest rates. A $30 million pre-tax gain related to our commodity hedges was also recognized in 2018. An $11 million pre-tax loss related to our commodity hedges represents reclassification adjustments included in Cost of sales in 2018.

We recognized defined benefit pension and other post-retirement benefit pre-tax losses of $41 million and $106 million in 2018 and 2017, respectively. See Note 16 to the Consolidated Financial Statements for additional information regarding net actuarial gains.

2017 versus 2016—The $1,339 million increase in Comprehensive income in 2017 relative to 2016 reflects higher net income, the net favorable impacts of unrealized net changes in foreign currency translation adjustments and actuarial losses related to our defined benefit pension and other postretirement benefit plans. These increases were offset by an unfavorable impact of financial derivative instruments recognized in 2017.

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 increased during 2017 resulting in net gains as reflected in the Consolidated Statements of Comprehensive Income. These net gains in 2017 include pre-tax losses of $288 million, which represent the effective portion of our net investment hedges.

We recognized net actuarial gains of $74 million in 2017 and net actuarial losses of $188 million in 2016. The $74 million net gain in 2017 reflects $74 million of gains due to changes in pension and other postretirement benefit discount rate assumptions and $6 million of gains due to favorable postretirement liability experience and other immaterial items. These gains were partly offset by $7 million of losses due to pension asset experience (actual asset return compared to expected return). In 2016, the $188 million net loss was primarily attributable to $279 million of losses due to pension and other postretirement benefit discount rate decreases, which was offset by $79 million of gains related to pension asset experience and $10 million due to favorable postretirement liability experience and other immaterial items. In 2016, we also recognized a $61 million reclassification adjustment related primarily to a voluntary lump sum program offered to certain former employees in select U.S. pension plans. Total lump sum payments from these plans exceeded annual service and interest cost in 2016 resulting in this loss.

The cumulative effects of our derivatives designated as cash flow hedges were losses of $323 million. The euro strengthened against the U.S. dollar in 2017 resulting in pre-tax losses of $287 million in 2017 related to our cross-currency swaps. Pre-tax gains of $264 million related to our cross-currency swaps were reclassification adjustments included in 2017 net income. Unrealized pre-tax losses of $25 million in 2017 related to forward-starting interest rate swaps were driven by increases in benchmark interest rates during those periods.

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Segment Analysis

We use earnings 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 postretirement 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 22, Segment and Related Information, to our Consolidated Financial Statements.

Following our acquisition of A. Schulman, our continuing operations are managed through six reportable segments: O&P–Americas, O&P–EAI, I&D, APS, Refining and Technology.

Our new 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. Polypropylene compounds, Catalloy and polybutene-1 were previously reported in our O&P–EAI and O&P–Americas segments. Accordingly, the historical results of our O&P–EAI and O&P–Americas segments have been recast for all comparable periods presented. For additional information related to our segments, see Note 3, Business Combination and Dispositions and Note 22, Segment and Related Information to the Consolidated Financial Statements. The following tables reflect selected financial information for our reportable segments.

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Sales and other operating revenues:			
O&P–Americas segment	$10,408	$10,004	$8,722
O&P–EAI segment	10,838	10,218	8,718
I&D segment	9,588	8,472	7,226
APS segment	4,024	2,922	2,601
Refining segment	9,157	6,848	5,135
Technology segment	583	450	479
Other, including segment eliminations	(5,594)	(4,430)	(3,698)
Total	$39,004	$34,484	$29,183
Operating income (loss):			
O&P–Americas segment	$2,251	$2,382	$2,308
O&P–EAI segment	682	1,308	1,207
I&D segment	1,716	1,202	1,058
APS segment	329	405	372
Refining segment	(28)	(22)	(99)
Technology segment	284	183	221
Other, including segment eliminations	(3)	2	(7)
Total	$5,231	$5,460	$5,060

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Millions of dollars	Year Ended December 31, 2018	2017	2016
Depreciation and amortization:			
O&P–Americas segment	$442	$433	$359
O&P–EAI segment	208	210	201
I&D segment	287	279	269
APS segment	69	35	31
Refining segment	192	177	163
Technology segment	43	40	41
Total	$1,241	$1,174	$1,064
Income from equity investments:			
O&P—Americas segment	$58	$42	$59
O&P—EAI segment	225	271	302
I&D segment	6	8	6
Total	$289	$321	$367
Other income (expense), net:			
O&P—Americas segment	$11	$42	$62
O&P—EAI segment	48	138	19
I&D segment	2	1	—
APS segment	2	(2)	24
Refining segment	3	2	8
Technology segment	1	—	—
Other, including intersegment eliminations	39	(2)	(2)
Total	$106	$179	$111
EBITDA:			
O&P—Americas segment	$2,762	$2,899	$2,788
O&P—EAI segment	1,163	1,927	1,729
I&D segment	2,011	1,490	1,333
APS segment	400	438	427
Refining segment	167	157	72
Technology segment	328	223	262
Other, including intersegment eliminations	36	—	(9)
Total	$6,867	$7,134	$6,602

Olefins and Polyolefins–Americas Segment

Overview—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 is a major building block of olefins and polyolefins and as such, ethylene sales volumes and prices and our internal cost of ethylene production are included in management’s assessment of the segment’s performance.

2018 versus 2017—EBITDA declined in 2018 as lower ethylene margins more than offset the improvement in polyolefins margins relative to 2017. EBITDA for 2017 also included a $31 million gain resulting from the sale of property in Lake Charles, Louisiana.

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2017 versus 2016—EBITDA improved in 2017 due to higher olefins volumes stemming from the expansion of our Corpus Christi, Texas olefins facility in late 2016. Higher olefins and polyethylene margins in 2017 were offset by lower polypropylene margins. EBITDA for 2017 was favorably impacted by the gain related to the sale of property in Lake Charles, Louisiana mentioned above. EBITDA for 2016 was also impacted by a $57 million gain on the first quarter sale of our wholly owned Argentine subsidiary and a $26 million non-cash lower of cost or market ("LCM") inventory valuation charge recognized in the fourth quarter due primarily to a reduction in polypropylene prices.

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.

Although prices of these raw materials are generally related to crude oil and natural gas prices, during specific periods the relationships among these materials and benchmarks may vary significantly. We have significant flexibility to vary the raw material mix and process conditions in our U.S. olefins plants in order to maximize profitability as market prices for both feedstocks and products change.

As in recent years, strong supplies from the U.S. shale gas/oil boom resulted in ethane being a preferred feedstock in our U.S. plants in 2018. Ethane remained the preferred U.S. feedstock for ethylene despite higher recent prices driven by increased demand from newly-constructed U.S. olefins units and supply constraints in the Gulf Coast NGL fractionation and pipeline systems. In 2018, we produced approximately 80% of our ethylene from ethane compared to approximately 75% and 70% in 2017 and 2016, respectively. Despite generally higher liquid feedstock prices, strong propylene and butadiene coproduct prices at various points in the year also brought liquids into our feedslate.

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	2018	2017	2016
Sales and other operating revenues	$10,408	$10,004	$8,722
Income from equity investments	58	42	59
EBITDA	2,762	2,899	2,788

Revenues—Revenues increased by $404 million, or 4%, in 2018 compared to 2017 and by $1,282 million, or 15%, in 2017 compared to 2016.

2018 versus 2017—Average polyethylene and polypropylene sales prices, supported globally by higher crude oil prices, increased relative to 2017. This favorable impact was partly offset by a 6 cents decline in ethylene prices resulting from increased supply driven by the start-up of new U.S. ethylene capacity. The overall average increase in sales prices was responsible for an 8% increase in 2018 revenues.

Segment volumes declined in 2018 mainly due to lower sales of purchased feedstock and the negative impact of planned and unplanned maintenance on polypropylene and polyethylene sales. These lower sales volumes were responsible for a revenue decrease of 4% in 2018.

2017 versus 2016—Average sales prices for most products increased in 2017, consistent with feedstock prices that are correlated with crude oil and natural gas prices, which on average increased relative to 2016. These higher sales prices were responsible for a 14% increase in 2017 revenues.

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Operating rates and product volumes improved in 2017 due to turnaround activities and the expansion at our Corpus Christi, Texas facility during 2016. These increased volumes were responsible for a revenue increase of 1% in 2017.
EBITDA—EBITDA decreased by $137 million, or 5%, in 2018 compared to 2017 and increased by $111 million, or 4%, in 2017 compared to 2016.
2018 versus 2017—Lower olefins margins and higher fixed costs, which were partly offset by higher polyethylene and polypropylene margins, led to a 3% decline in 2018 EBITDA. Ethylene margins decreased by 5 cents per pound largely due to the decline in ethylene sales prices discussed above. Polyethylene and polypropylene margins reflect per pound increases in price spreads over ethylene and propylene of 7 cents and 3 cents, respectively, driven by higher sales prices and in the case of polyethylene, also by the lower cost of ethylene feedstock. The increase in polyethylene and polypropylene margins stem from strong demand and industry supply constraints. Lower polyethylene and polypropylene volumes also resulted in a 2% decline in 2018 EBITDA. An additional 1% decrease in EBITDA relative to 2017 was related to the gain on the sale of property in Lake Charles, Louisiana.
The remaining change in 2018 EBITDA was attributed to an increase in income from our equity investments.
2017 versus 2016—Increased volumes in 2017 due largely to the expansion of our Corpus Christi, Texas olefins facility was responsible for a 5% improvement in EBITDA. Margins were relatively unchanged in 2017 compared to 2016 due to an approximate 4 cents per pound decrease in polypropylene spreads that substantially offset per pound increases in olefins and polyethylene spreads of a half cent and 2 cents, respectively. Polypropylene margins declined from the high levels in 2016 on the higher cost of propylene feedstocks, while the increase in olefins and polyethylene margins was attributable to higher average sales prices that more than offset the increased cost of ethylene. Lower income from our joint venture relative to the prior year led to a 1% decline in EBITDA. The net impact to EBITDA of the gain on sale of our wholly owned Argentine subsidiary in the first quarter of 2016 and the fourth quarter LCM inventory valuation adjustment mentioned above was offset by the first quarter 2017 gain on sale of property in Lake Charles, Louisiana.
Olefins and Polyolefins–Europe, Asia, International Segment
Overview—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 is a major building block of our olefins and polyolefins and as such, ethylene sales volumes and prices and our internal cost of ethylene production are included in management's assessment of the segment's performance.
2018 versus 2017—EBITDA in 2018 declined largely as a result of lower margins and volumes in Europe compared to a strong 2017. EBITDA for 2018 includes a $36 million gain from the fourth quarter 2018 sale of our carbon black subsidiary in France. In 2017, EBITDA included a $108 million gain on the third quarter 2017 sale of our 27% interest in Geosel and the $21 million beneficial impact related to the elimination of an obligation associated with a lease.
2017 versus 2016—EBITDA increased in 2017 compared to 2016. This improvement was driven by higher olefins margins and the impact of higher volumes across most products, partly offset by lower polyethylene margins and lower income from our equity investments.
EBITDA for 2017 also included the gain on the sale of our interest in Geosel and the beneficial impact related to the elimination of an obligation associated with a lease discussed above. In 2016, EBITDA reflected gains totaling $11 million from the sales of our joint venture in Japan and idled assets in Australia.
Ethylene Raw Materials—In Europe, heavy liquids are the primary raw materials for our ethylene production. In 2018, 2017 and 2016, we continued to benefit by sourcing advantaged NGLs as market opportunities arose.

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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	2018	2017	2016
Sales and other operating revenues	$10,838	$10,218	$8,718
Income from equity investments	225	271	302
EBITDA	1,163	1,927	1,729

Revenues—Revenues in 2018 increased by $620 million, or 6%, compared to 2017 and by $1,500 million, or 17%, in 2017 compared to 2016.

2018 versus 2017—Average sales prices in 2018 were higher across most products as sales prices generally correlate with crude oil prices, which were significantly higher compared to 2017. These higher average sales prices were responsible for a revenue increase of 7% in 2018. Planned and unplanned maintenance, a weaker market and low Rhine River levels in the second half of 2018, compared to the prior year, led to lower sales volumes across most products. These decreased volumes resulted in a revenue decrease of 4% in 2018. Foreign exchange impacts in 2018, which were favorable on average compared to 2017, led to a revenue increase of 3%.

2017 versus 2016—Average sales prices in 2017 were higher across most products as sales prices generally correlate with crude oil prices, which on average, increased compared to 2016. These higher average sales prices were responsible for a revenue increase of 12% in 2017. Better product availability compared to 2016, which was affected by turnaround activity and inventory requirements, led to higher sales volumes across most products. These increased volumes resulted in a revenue increase of 3% in 2017. Foreign exchange impacts that, on average, were favorable for 2017 resulted in a revenue increase of 2% compared to the prior year.

EBITDA—EBITDA decreased by $764 million, or 40%, in 2018 compared to 2017 and increased by $198 million, or 11%, in 2017 compared to 2016.

2018 versus 2017—Olefins and polyolefins margins in Europe declined in 2018. Olefins margins decreased as the improvement in ethylene prices lagged a 10 cents per pound increase in the weighted average cost of ethylene production due to higher prices for naphtha and other olefin feedstocks. A decline in 2018 polyolefins margins reflected lower per pound price spreads over ethylene and propylene of 3 cents and 2 cents, respectively. These lower margins were due to weaker supply/demand balances in Europe and led to a decline in EBITDA of 29%, in comparison to a strong 2017. The impact of the lower volumes discussed above also led to a 9% decrease in 2018 EBITDA. A reduction in income from our equity investments resulted in an additional 2% decrease in EBITDA relative to 2017. The net impact of the 2018 gain on the sale of our carbon black subsidiary in France and the 2017 benefits related to the sale of our interest in Geosel and the elimination of an obligation associated with a lease discussed above resulted in a further 5% decline in EBITDA.

These unfavorable impacts were offset in part by a 5% increase to EBITDA due to favorable foreign exchange impacts in 2018.

2017 versus 2016—An increase in olefin margins driven largely by a 6 cents per pound increase in ethylene sales prices was partly offset in 2017 by a 3 cents per pound decrease in European polyethylene spreads due to a more balanced European market compared to the prior year. This net increase resulted in a 1% improvement in 2017 EBITDA compared to 2016. The higher 2017 volumes discussed above added another 5% to EBITDA. Favorable foreign exchange impacts in 2017 also contributed an additional 1% to EBITDA. The net beneficial impact of the transactions in 2016 and 2017 discussed above related to the sales of our joint venture interests and idled assets, and the elimination of a lease-related obligation, resulted in an additional 6% increase in EBITDA. These increases were partially offset by a 2% decrease in EBITDA driven by a reduction in income from equity investments in Poland and Asia in 2017 relative to very strong 2016 results.

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Intermediates and Derivatives Segment

Overview—EBITDA for our I&D segment was higher across all businesses in 2018 compared to 2017, which included an approximate $50 million unfavorable impact related to precious metal catalysts.

2018 versus 2017—EBITDA improved in 2018 relative to 2017 as higher margins across most products benefited from industry supply constraints and strong demand.

2017 versus 2016—EBITDA was higher for our I&D segment in 2017 relative to 2016 due to stronger margins for intermediate chemicals products supported by reduced market supply stemming from industry outages and increased demand in Asia.

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	2018	2017	2016
Sales and other operating revenues	$9,588	$8,472	$7,226
Income from equity investments	6	8	6
EBITDA	2,011	1,490	1,333

Revenues—Revenues for 2018 increased by $1,116 million, or 13%, compared to 2017 and increased by $1,246 million, or 17%, in 2017 compared to 2016.

2018 versus 2017—Higher average sales prices in 2018 for most products, which reflect the impacts of higher feedstock and energy costs and industry supply constraints, were responsible for a revenue increase of 10%. Higher sales volumes resulted in a revenue increase of 2% in 2018, primarily due to hurricane Harvey impacts and major turnarounds at our Botlek, Netherlands and Channelview, Texas facilities in 2017. Foreign exchange impacts that, on average, were favorably higher relative to 2017 resulted in a revenue increase of 1%.

2017 versus 2016—Higher average sales prices in 2017 for most products, which reflect the impacts of higher feedstock and energy costs and industry supply constraints, were responsible for a revenue increase of 17%. Favorable foreign exchange impacts also led to a 1% revenue increase in 2017. These increases were partially offset by a revenue decrease of 1% in 2017, primarily due to lower sales volumes for intermediate chemicals and oxyfuels and related products. This volume-driven decline was largely due to reduced production associated with two major turnarounds at our Botlek, Netherlands, and Channelview, Texas, facilities.

EBITDA—EBITDA increased by $521 million, or 35%, in 2018 compared to 2017 and increased by $157 million, or 12%, in 2017 compared to 2016.

2018 versus 2017—Higher margins were responsible for an improvement in EBITDA of 27% in 2018 relative to 2017. Industry outages and other supply constraints for several intermediate chemicals products, along with strong demand for PO and derivatives products, led to tight supplies and higher sales prices. Intermediate chemicals products accounted for approximately two thirds of the margin improvement in 2018 as most intermediate chemical products benefited from lower ethylene raw material costs and tight industry supply. PO and derivatives and oxyfuels and related products each accounted for approximately half of the remaining increase in 2018 margins. Margins for oxyfuels and related products improved with higher crude oil pricing which outpaced butane.

The impact of higher volumes as discussed above added 3% to EBITDA in 2018 while favorable foreign exchange impacts added 2%. An additional 3% increase in EBITDA, as compared to the prior year period, stems from the absence of the unfavorable impact associated with precious metal catalysts in 2017.

2017 versus 2016—Higher intermediate chemicals and PO and derivative product margins driven by higher average sales prices resulted in a 19% increase in EBITDA. This increase was offset in part by a 2% decline in margins for oxyfuels and related products primarily due to higher butane pricing. This margin improvement was partly offset by decreases in EBITDA of 4% and 1%, respectively, stemming from the unfavorable impacts associated with charges related to precious metals catalyst financings and the lower volumes discussed above.

Advanced Polymer Solutions Segment

Overview

2018 versus 2017—EBITDA for our APS segment declined relative to 2017 as lower margins and $69 million of acquisition-related transaction and integration costs were offset by $58 million of EBITDA stemming from the acquisition of A. Schulman.

2017 versus 2016—EBITDA improved slightly in 2017 with higher compounding and solutions volumes and improved advanced polymers margins relative to 2016, which included a $21 million gain on the sale of our wholly owned Argentine subsidiary.

The following table sets forth selected financial information for the APS segment including Income from equity investments, which is a component of EBITDA:

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Sales and other operating revenues	$4,024	$2,922	$2,601
EBITDA	400	438	427

Revenues—Revenues increased in 2018 by $1,102 million, or 38%, compared to 2017 and by $321 million, or 12%, in 2017 compared to 2016.

2018 versus 2017—The acquisition of A. Schulman contributed $846 million to revenues of the APS segment, which accounts for a revenue increase in 2018 of approximately 29% relative to 2017. Higher average sales prices, which were driven by the increased cost of raw materials, also led to a revenue increase of 8% in 2018. Foreign exchange impacts, which on average, were favorable in 2018 also resulted in a revenue increase of 2%.

A decline in compounding and solutions product volumes in 2018 stemming from lower automotive production in Europe was substantially offset by higher advanced polymers product volumes due to strong demand in Europe and North America leading to a 1% decline in revenues.

2017 versus 2016—Higher average sales prices across all products in 2017 led to a revenue increase of 8% relative to 2016. An increase in 2017 compounding and solutions volumes driven by higher automotive demand in South America resulted in a 3% revenue increase. Another 1% increase in revenues stemmed from foreign exchange impacts, which on average, were favorable in 2017 relative to 2016.

EBITDA—EBITDA decreased in 2018 by $38 million, or 9%, compared to 2017 and increased by $11 million, or 3%, in 2017 compared to 2016.

2018 versus 2017—EBITDA declined by 16% in 2018 as a result of the $69 million of costs associated with the acquisition and integration of A. Schulman. The operations of A. Schulman following the acquisition contributed $58 million of EBITDA to the results of the APS segment leading to an increase in EBITDA of 13%.

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Margins for compounding and solutions products declined in 2018 due primarily to increases in raw material costs in South America and Asia that outpaced increases in average sales prices. These lower margins and the decline in volumes discussed above resulted in decreases of 8% and 1%, respectively, in EBITDA.
Favorable foreign exchange impacts partly offset these declines with a 3% increase in 2018 EBITDA.
2017 versus 2016—The volume-driven increase related to our compounding and solutions products discussed above led to a 4% increase in 2018 EBITDA. Increased margins for advanced polymers driven by sales prices that increased more than raw material prices resulted in an additional increase in EBITDA of 3%. Favorable foreign exchange impacts in 2017 contributed another 1% to EBITDA. These favorable impacts were offset in part by a 5% decline relative to EBITDA in 2016, which included the gain on sale of our Argentine subsidiary discussed above.

Refining Segment

Overview

2018 versus 2017—EBITDA for our Refining segment benefited in 2018 from improved refining margins primarily driven by favorable crude oil discounts in Western Canadian Select and improved rates on our fluid catalytic converter leading to better yields.
2017 versus 2016—EBITDA benefited from higher crude processing rates in 2017 as the impacts of planned and unplanned maintenance outages were less than in 2016. Higher industry margins were offset by higher maintenance-related fixed costs in 2017.
The following table sets forth selected financial information and heavy crude processing rates for the Refining segment and the U.S. refining market margins for the applicable periods. “LLS” is a light crude oil, while “Maya” is a heavy crude oil.

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Sales and other operating revenues	$ 9,157	$ 6,848	$ 5,135
EBITDA	167	157	72
Heavy crude oil processing rates, thousands of barrels per day	231	236	201
Market margins, dollars per barrel			
Light crude oil—2-1-1	$ 12.35	$ 13.54	$ 10.73
Light crude oil—Maya differential	7.50	7.02	8.51
Total Maya 2-1-1	$ 19.85	$ 20.56	$ 19.24

Revenues—Revenues increased by $2,309 million, or 34%, in 2018 compared to 2017 and by $1,713 million, or 33%, in 2017 compared to 2016.
2018 versus 2017—Higher product prices led to a revenue increase of 26% relative to 2017 due to a per barrel increase in average crude oil prices of approximately $16 in 2018. Heavy crude oil processing rates in 2018 decreased 2% relative to 2017, with both comparative periods impacted by turnaround activity. Sales volumes increased in 2018 leading to a revenue increase of 8%, compared to the 2017 period due to an increase in downstream processing of intermediate oils.
2017 versus 2016—Higher product prices in 2017 largely driven by an increase in average crude oil prices of approximately $10 per barrel led to a revenue increase of 26% relative to 2016. Heavy crude oil processing rates increased by 17% in 2017, leading to a volume driven revenue increase of 7%, as the impacts of planned and unplanned outages and the effects of Hurricane Harvey in 2017 had less of an impact on processing rates than the unplanned outages in 2016 related to a

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coker fire, downtime at crude units with reduced processing and several utility interruptions. In 2017, we completed planned turnarounds on one of our crude units and our fluid catalytic converter.

EBITDA—EBITDA increased by $10 million, or 6%, in 2018 compared to 2017 and by $85 million, or 118%, in 2017 compared to 2016.

2018 versus 2017—Advantaged pricing for Canadian crude oil and better yields equally contributed to the improvement in 2018 refining margins relative to 2017, which was negatively impacted by planned turnaround activity on our fluid catalytic cracking unit. These higher margins accounted for a 12% improvement in 2018 EBITDA. These margin improvements were offset by a 2% decrease in heavy crude oil processing rates which resulted in a volume-driven 6% decrease in EBITDA.

2017 versus 2016—Increased production accounted for approximately 90% of the improvement in 2017 EBITDA. Crude oil processing rates in 2017 were higher than 2016 as discussed above. Higher refining margins, which were partly offset by higher maintenance-related fixed costs, accounted for the remaining 10% improvement in 2017 EBITDA.

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 2018, 2017 and 2016, our Technology segment incurred approximately 55% of all R&D costs.

2018 versus 2017—EBITDA improved in 2018 primarily due to higher licensing revenues.

2017 versus 2016—A decline in 2017 EBITDA reflects lower licensing revenues, partially offset by higher catalyst sales volumes, compared to 2016.

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

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Sales and other operating revenues	$583	$450	$479
EBITDA	328	223	262

Revenues—Revenues increased by $133 million, or 30%, in 2018 compared to 2017 and decreased by $29 million, or 6%, in 2017 compared to 2016.

2018 versus 2017—Higher licensing revenues were responsible for a revenue increase of 23% in 2018, relative to the corresponding period in 2017. Higher customer demand led to increased catalyst volumes in 2018 resulting in a revenue increase of 3%. Favorable foreign exchange impacts in 2018 led to an additional revenue increase of 4%.

2017 versus 2016—Lower licensing revenues were responsible for a revenue decrease of 12% in 2017 relative to 2016. This decrease was partially offset by revenue increases of 3% and 1%, respectively, related to increased catalyst sales volumes and higher average sales prices. Favorable foreign exchange impacts were responsible for an additional 2% increase in EBITDA.

EBITDA—EBITDA in 2018 increased by $105 million, or 47%, compared to 2017 and decreased by $39 million, or 15%, in 2017, compared to 2016.

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2018 versus 2017—Higher licensing revenues resulted in EBITDA improvements of 38% in 2018. The catalyst sales volume increase in 2018 discussed above was responsible for a 5% increase in EBITDA. The remaining 4% increase in 2018 EBITDA was due to favorable foreign exchange impacts.
2017 versus 2016—Lower licensing revenues were largely responsible for a 20% decrease in 2017 EBITDA. This decline was partly offset by a 5% improvement in EBITDA resulting from an increase in catalyst volumes during 2017.

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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	2018	2017	2016
Source (use) of cash:			
Operating activities	$5,471	$5,206	$5,606
Investing activities	(3,559)	(1,756)	(2,301)
Financing activities	(3,008)	(2,859)	(3,349)

Operating Activities—Cash of $5,471 million generated by operating activities in 2018 reflected earnings adjusted for non-cash items and net cash provided by the main components of working capital–accounts receivable, inventories and accounts payable. A $358 million non-cash reduction in unrecognized tax benefits is reflected in Other operating activities in 2018. For additional information on this matter, see Note 18 to the Consolidated Financial Statements.

In 2018, the main components of working capital provided $93 million of cash. Lower accounts receivable due primarily to lower sales volumes in our O&P–Americas, O&P–EAI and I&D segments at year end and higher accounts payable due to higher feedstock prices were partially offset by an increase in inventory primarily due to the lower sales volumes at year end.

Cash of $5,206 million generated in 2017 primarily reflected earnings adjusted for non-cash items partly offset by $593 million of cash used by the main components of working capital. Higher sales prices across all of our segments in the fourth quarter of 2017 and brief delays in the receipt of payments for products in our Refining and I&D segments led to the increase in accounts receivable. Inventories increased for most products in our O&P–EAI and O&P–Americas segments and included an inventory build in our O&P–Americas segment in anticipation of first quarter 2018 turnaround activities. These increases were partly offset by an increase in feedstock prices in the fourth quarter of 2017 in our O&P–Americas, O&P–EAI and Refining segments which led to an increase in accounts payable.

Cash of $5,606 million generated in 2016 primarily reflected earnings adjusted for non-cash items and cash generated by the main components of working capital. The non-cash items in 2016 included a $78 million gain related to the sale of our wholly owned Argentine subsidiary with adjustments for related working capital and gains totaling $11 million related to sales of our joint venture in Japan and idled assets in Australia.

The main components of working capital generated cash of $123 million in 2016. Higher product sales prices in the fourth quarter of 2016 across all segments combined with the impact of higher fourth quarter 2016 sales volumes in our O&P–Americas, Refining and I&D segments led to an increase in accounts receivable. This increase in accounts receivable was offset by higher accounts payable, which was driven by the higher prices of crude oil and other feedstocks. The level of inventories fell in our O&P–Americas segment following the completion of turnaround activities in the fourth quarter of 2016 and in our Refining segment, which had higher crude oil inventories at the end of 2015 due to operational issues during the fourth quarter.

Investing Activities—We invested cash of $3,559 million, $1,756 million and $2,301 million in 2018, 2017 and 2016, respectively.

In August 2018, we acquired A. Schulman for $1,776 million, which is net of $81 million of cash acquired and a liability deemed as a component of the purchase price. For additional information on this transaction, see Note 3 to the Consolidated Financial Statements.

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.

In 2018, 2017 and 2016, we invested $50 million, $653 million and $688 million, respectively, in debt securities that are deemed available-for-sale. We also invested $64 million in equity securities in 2018 and $76 million in held-to-maturity securities in 2016. These investments are classified as Short-term investments. In 2017 and 2016, we invested $512 million and $674 million, respectively, in tri-party repurchase agreements.

We received proceeds of $423 million, $574 million and $674 million in 2018, 2017 and 2016, respectively, upon the sale and maturity of certain of our Short-term investments. In 2018, we also received proceeds of $97 million on the sale of a portion of our investment in equity securities. In 2017 and 2016, we received proceeds of $381 million and $685 million, respectively, upon the maturity of certain of our repurchase agreements. See Note 15 to the Consolidated Financial Statements for additional information regarding these investments.

Joint Venture Activity—In September 2017, we sold our 27% interest in our Geosel joint venture and received proceeds of $155 million.

Financial Instruments Activity—Upon expiration in 2018, 2017 and 2016, we settled foreign currency contracts with notional values totaling €925 million, €550 million and €1,200 million, respectively, which were designated as net investment hedges of our investments in foreign subsidiaries. Payments to and proceeds from our counterparties resulted in a net cash inflow of $30 million in 2018 and net cash outflows of $49 million and $61 million during 2017 and 2016, respectively. See Note 15 to the Consolidated Financial Statements for additional information regarding these foreign currency contracts.

Sales of Subsidiaries—In October 2018, we received net cash proceeds of $37 million for the sale of our carbon black subsidiary in France.

In February 2016, we received net cash proceeds of $137 million for the sale of our wholly owned Argentine subsidiary.

The following table summarizes our capital expenditures for continuing operations for the periods from 2016 through 2018:

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Capital expenditures by segment:			
O&P—Americas	$ 1,079	$ 741	$ 1,370
O&P—EAI	248	163	229
I&D	409	332	333
APS	62	55	38
Refining	250	213	224
Technology	48	32	36
Other	9	11	13
Consolidated capital expenditures of continuing operations	$ 2,105	$ 1,547	$ 2,243

In 2019, we expect to spend approximately $2.8 billion for capital expenditures and contributions to our PO joint ventures. The higher levels of expected capital expenditures in 2019 and 2018 relative to their respective comparative periods are largely driven by construction related to our new Hyperzone polyethylene plant at our La Porte, Texas facility and for the construction related to our new PO/TBA plant in Texas.

Financing Activities—Financing activities used cash of $3,008 million, $2,859 million and $3,349 million in 2018, 2017 and 2016, respectively.

We made payments totaling $1,854 million, $866 million and $2,938 million in 2018, 2017 and 2016, respectively, to repurchase a portion of our outstanding ordinary shares. We also made dividend payments to holders of our ordinary shares totaling $1,554 million, $1,415 million and $1,395 million in 2018, 2017 and 2016, respectively. For additional information related to these share repurchases and dividend payments, see Note 20 to the Consolidated Financial Statements.

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In September 2018, we repaid the $375 million 6.875% Senior Notes due June 2023 assumed in the acquisition of A. Schulman for a price of 105.156% of par.

In March 2017, we issued $1,000 million of 3.5% guaranteed notes due 2027 and received net proceeds of $990 million. The proceeds from these notes, together with available cash, were used to repay $1,000 million of our outstanding 5% senior notes due 2019. We paid $65 million in premiums in connection with this prepayment.

In March 2016, we issued €750 million of 1.875% guaranteed notes due 2022 and received net proceeds of $812 million.

Through the issuance and repurchase of commercial paper instruments under our commercial paper program, we received net proceeds of $810 million and $177 million in 2018 and 2016, respectively. We made net repayments of $493 million in 2017.

Additional information related to our commercial paper program and the issuance and repayment of debt can be found in the Liquidity and Capital Resources section below and in Note 13 to the Consolidated Financial Statements.

Liquidity and Capital Resources—As of December 31, 2018, we had $1,224 million of unrestricted cash and cash equivalents and marketable securities classified as Short-term investments. We also held $544 million of tri-party repurchase agreements classified as Prepaid expenses and other current assets at December 31, 2018. For additional information related to our purchases of marketable securities, which currently include time deposits, certificates of deposit, commercial paper, bonds and limited partnership investments, and our investments in tri-party repurchase agreements, see "Investing Activities" above and Note 15 to the Consolidated Financial Statements.

At December 31, 2018, we held $269 million of cash in jurisdictions outside the U.S., principally Europe and Asia. There are currently no material legal or economic restrictions that would impede our transfers of cash.

We also had total unused availability under our credit facilities of $2,517 million at December 31, 2018, which included the following:

- $1,688 million under our $2,500 million revolving credit facility, which backs our $2,500 million commercial paper program. 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. A small portion of our availability under this facility is impacted by changes in the euro/U.S. dollar exchange rate. At December 31, 2018, we had $809 million of outstanding commercial paper, net of discount, no outstanding letters of credit and no outstanding borrowings under the facility; and
- $829 million under our $900 million U.S. accounts receivable 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. This facility had no outstanding borrowings or letters of credit at December 31, 2018.

At December 31, 2018, we had total debt, including current maturities, of $9,387 million, and $214 million of outstanding letters of credit, bank guarantees and surety bonds issued under uncommitted credit facilities.

In February 2019, LYB Americas Finance Company LLC ("LYB Americas Finance), a direct, 100% owned finance subsidiary of LyondellBasell Industries N.V., entered into a 364-day, $2,000 million senior unsecured term loan credit facility and borrowed the entire amount. The proceeds of this term loan, which is fully and unconditionally guaranteed by LyondellBasell Industries N.V. are intended for general corporate purposes, including the repayment of debt. Borrowings under the credit agreement will bear interest at either a LIBOR rate or a base rate, as defined, plus in each case, an applicable margin determined by reference to LyondellBasell N.V.'s current credit ratings.

The credit agreement contains customary covenants and warranties, including specified restrictions on indebtedness, including secured and subsidiary indebtedness, and merger and sales of assets. In addition, we are required to maintain a leverage ratio at the end of every fiscal quarter of 3.50 to 1.00 or less.

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In February 2019, proceeds from the credit facility were used to redeem the remaining $1,000 million outstanding of our 5% Senior Notes due 2019 at par. In conjunction with the redemption of these notes, we recognized non-cash charges of less than $1 million for the write-off of unamortized debt issuance costs and $8 million for the write-off of the cumulative fair value hedge accounting adjustment related to the redeemed notes.

In July 2018, we amended our $900 million U.S. accounts receivable facility. This amendment, among other things, extended the term of the facility to July 2021.

For additional information related to our credit facilities discussed above, see Note 13 to the Consolidated Financial Statements.

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 variable rate debt to fixed rate debt.

In 2018, our shareholders approved a proposal to authorize us to repurchase up to an additional 10%, or 57,844,016, of our ordinary shares through December 2019 ("2018 Share Repurchase Program"). As a result, the authorization of the remaining unpurchased shares under the share repurchase program approved by our shareholders in May 2017 ("2017 Share Repurchase Program") was superseded. Our share repurchase program 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. In 2018, we purchased approximately 19 million shares under these programs for approximately $1,878 million. As of February 19, 2019, we had approximately 38 million shares remaining under the current authorization. The timing and amounts of additional shares repurchased will be determined based on our evaluation of market conditions and other factors. For additional information related to our share repurchase programs, see Note 20 to the Consolidated Financial Statements.

We may repay or redeem our debt, including purchases of our outstanding bonds in the open market, using cash and cash equivalents, cash from our short-term investments and tri-party repurchase agreements, cash from operating activities, proceeds from the issuance of debt, proceeds from asset divestitures, or a combination thereof. In connection with any repayment or redemption of our debt, we may incur cash and non-cash charges, which could be material in the period in which they are incurred.

Construction of our Hyperzone high density polyethylene plant at our La Porte, Texas site, which commenced in May 2017, is on track for planned start-up in the third quarter of 2019.

In July 2017, we announced our final investment decision to build a world-scale PO/TBA plant in Texas with a capacity of 1.0 billion pounds of PO and 2.2 billion pounds of TBA. In August 2018, we broke ground on this project, which is estimated to cost approximately $2.4 billion. We anticipate the project to be completed in the third quarter of 2021.

We plan to fund our ongoing working capital, capital expenditures, debt service and other funding requirements with cash from operating activities, 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 and tri-party repurchase agreements, 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 program.

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.

We believe that our current liquidity availability and cash from operating activities provide us with sufficient financial resources to meet our anticipated capital requirements and obligations as they come due.

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Contractual and Other Obligations—The following table summarizes, as of December 31, 2018, our minimum payments for long-term debt, including current maturities, short-term debt, and contractual and other obligations for the next five years and thereafter:

Millions of dollars	Total	Payments Due By Period					
		2019	2020	2021	2022	2023	Thereafter
Total debt	$9,554	$891	$1,001	$1,001	$859	$751	$ 5,051
Interest on total debt	5,155	382	357	357	298	281	3,480
Contract liabilities	138	128	1	—	—	—	9
Other	1,886	1,405	124	48	16	28	265
Deferred income taxes	1,975	318	118	112	117	66	1,244
Other obligations:							
Purchase obligations:							
Take-or-pay contracts	25,378	3,022	3,000	2,849	2,563	2,537	11,407
Other contracts	10,827	5,357	2,408	1,462	248	235	1,117
Operating leases	2,475	365	288	256	236	204	1,126
Total	$57,388	$11,868	$7,297	$6,085	$4,337	$4,102	$ 23,699

Total Debt—Our debt includes unsecured senior notes, guaranteed notes and various other U.S. and non-U.S. loans. See Note 13 to the Consolidated Financial Statements for a discussion of covenant requirements under the credit facilities and indentures and additional information regarding our debt facilities.

Interest on Total Debt—Our debt and related party debt agreements contain provisions for the payment of monthly, quarterly or semi-annual interest at a stated rate of interest over the term of the debt.

Pension and other Postretirement Benefits—We maintain several defined benefit pension plans, as described in Note 16 to the Consolidated Financial Statements. Many of our U.S. and non-U.S. plans are subject to minimum funding requirements; however, the amounts of required future contributions for all our plans are not fixed and can vary significantly due to changes in economic assumptions, liability experience and investment return on plan assets. As a result, we have excluded pension and other postretirement benefit obligations from the Contractual and Other Obligations table above. Our annual contributions may include amounts in excess of minimum required funding levels. Contributions to our non-U.S. plans in years beyond 2019 are not expected to be materially different than the expected 2019 contributions disclosed in Note 16 to the Consolidated Financial Statements. At December 31, 2018, the projected benefit obligation for our pension plans exceeded the fair value of plan assets by $992 million. Subject to future actuarial gains and losses, as well as future asset earnings, we, together with our consolidated subsidiaries, will be required to fund the discounted obligation of $992 million in future years. We contributed $100 million, $103 million and $114 million to our pension plans in 2018, 2017 and 2016, respectively. We provide other postretirement benefits, primarily medical benefits to eligible participants, as described in Note 16 to the Consolidated Financial Statements. We pay other unfunded postretirement benefits as incurred.

Contract Liabilities—We are obligated to deliver products or services in connection with sales agreements under which customer payments were received before transfer of control to the customers occurs. These contract liabilities will be recognized in earnings when control of the product or service is transferred to the customer, which range predominantly from 1 to 15 years. The unamortized long-term portion of such advances totaled $10 million as of December 31, 2018.

Other—Other primarily consists of accruals for environmental remediation costs, obligations under deferred compensation arrangements, and anticipated asset retirement obligations. See “Critical Accounting Policies” below for a discussion of obligations for environmental remediation costs.

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Deferred Income Taxes—The scheduled settlement of the deferred tax liabilities shown in the table is based on the scheduled reversal of the underlying temporary differences. Actual cash tax payments will vary depending upon future taxable income. See Note 18 to the Consolidated Financial Statements for additional information related to our deferred tax liabilities.

Purchase Obligations—We are party to various obligations to purchase products and services, principally for raw materials, utilities and industrial gases. These commitments are designed to assure sources of supply and are not expected to be in excess of normal requirements. The commitments are segregated into take-or-pay contracts and other contracts. Under the take-or-pay contracts, we are obligated to make minimum payments whether or not we take the product or service. Other contracts include contracts that specify minimum quantities; however, in the event that we do not take the contractual minimum, we are only obligated for any resulting economic loss suffered by the vendor. The payments shown for the other contracts assume that minimum quantities are purchased. For contracts with variable pricing terms, the minimum payments reflect the contract price at December 31, 2018.

Operating Leases—We lease various facilities and equipment under noncancelable lease arrangements for various periods. See Note 14 to the Consolidated Financial Statements for related lease disclosures.

CURRENT BUSINESS OUTLOOK

During the first month of 2019, we have seen normalization of markets with increased polymer demand. We expect our growth to accelerate in 2019 with the planned start-up of our new Hyperzone polyethylene plant in the third quarter and continued construction of our new PO/TBA plant which is on track for completion in 2021. Global polyethylene capacity additions are expected to moderate during 2019 and 2020, providing support for high industry operating rates and ethylene chain profitability.

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 5 to the Consolidated Financial Statements for additional related party disclosures.

CRITICAL ACCOUNTING POLICIES

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). Our more critical accounting policies include those related to the valuation of inventory, long-lived assets, the valuation of goodwill, accruals for long-term employee benefit costs such as pension and other postretirement costs, and accruals for taxes based on income. Inherent in such policies are certain key assumptions and estimates made by management. Management periodically updates its estimates used in the preparation of the financial statements based on its latest assessment of the current and projected business and general economic environment.

Inventory—We account for our inventory 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 benchmark 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.

While prices for our products and raw materials are inherently volatile and therefore no prediction can be given with certainty, we do not believe any of our inventory is at risk for impairment at this time.

Goodwill—As of December 31, 2018, we recognized $1,814 million of goodwill. Of this amount, $1,271 million was recognized as a result of the acquisition of A. Schulman, which mainly relates to acquired workforce and synergies expected from the acquisition. All of the goodwill was assigned to our APS segment. The remaining goodwill at December 31, 2018 primarily represents the tax effect of the differences between the tax and book bases 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. 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.

Additional information on the amount of goodwill allocated to our reporting units appears in Note 3 and Note 22 to the Consolidated Financial Statements.

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 is compared to its carrying value, including goodwill. For the quantitative impairment test, the fair value of the reporting unit is calculated using a discounted cash-flow model. Such a 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 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 2018 and 2017, 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. Accordingly, a quantitative goodwill impairment test was not required. Accordingly, no goodwill impairment was recognized in 2018 or 2017.

Long-Term Employee Benefit Costs—Our costs for long-term employee benefits, particularly pension and other postretirement 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. It also is management's responsibility to review those assumptions periodically to reflect changes in economic or other factors that affect those assumptions.

The current benefit service costs, as well as the existing liabilities, for pensions and other postretirement 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, 2018, we used a weighted average discount rate of 4.51% 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, 2018 was

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2.07%, reflecting market interest rates. The discount rates in effect at December 31, 2018 will be used to measure net periodic benefit cost during 2019.

The benefit obligation and the periodic cost of other postretirement 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, 2018, the assumed rate of increase for our U.S. plans was 6.4%, decreasing to 4.5% in 2038 and thereafter. A one hundred basis point change in the health care cost trend rate assumption as of December 31, 2018 would have resulted in a $17 million increase or $12 million decrease in the accumulated other postretirement benefit liability for our non-U.S. plans and would have resulted in an increase or decrease of less than $1 million for U.S. plans. Due to limits on our maximum contribution level under the medical plan, there would have been no significant effect on either our benefit liability or net periodic cost.

The net periodic cost of pension benefits included in expense also 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, for us, 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 7.50% is based on the average level of earnings that our independent pension investment advisor had advised could be expected to be earned over time and 2.92%, for our non-U.S. plan assets is based on an expectation and asset allocation that varies by region. The asset allocations are summarized in Note 16 to the Consolidated Financial Statements. The actual returns in 2018 was a loss of 1.91% and gain of 0.89% for our U.S. and non-U.S. plan assets, respectively.

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 projected benefit obligation 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 2018		Effects on Net Periodic Pension Costs in 2019	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Projected benefit obligations at December 31, 2018	$ 1,752	$ 1,659	$ —	$ —
Projected net periodic pension costs in 2019			28	60
Discount rate increases by 100 basis points	(148)	(183)	(5)	(8)
Discount rate decreases by 100 basis points	179	221	6	12

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

	Effects on Benefit Obligations in 2018		Effects on Net Periodic Benefit Costs in 2019	
Millions of dollars	U.S.	Non-U.S.	U.S.	Non-U.S.
Projected benefit obligations at December 31, 2018	$ 234	$ 59	$ —	$ —
Projected net periodic benefit costs in 2019			5	4
Discount rate increases by 100 basis points	(19)	—	2	—
Discount rate decreases by 100 basis points	23	—	(2)	—

Additional information on the key assumptions underlying these benefit costs appears in Note 16 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 bases, 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. At December 31, 2017, the measurement of our deferred tax balances was materially affected by the U.S. enactment of "H.R.1," also known as the Tax Act, as explained in Note 18 to the Consolidated Financial Statements.

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 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 15 to the Consolidated Financial Statements for discussion of LyondellBasell Industries N.V.'s management of commodity price risk, foreign currency exposure and interest rate risk through its use of derivative instruments and hedging activities.

Commodity Price Risk

A substantial portion of our products and raw materials are commodities whose prices fluctuate as market supply and demand fundamentals change. Accordingly, product margins and the level of our profitability tend to fluctuate with changes in

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the business cycle. Natural gas, crude oil and refined products, along with feedstocks for ethylene and propylene production, constitutes the main commodity exposures. We try to protect against such instability through various business strategies including provisions in sales contracts which allows us to pass on higher raw material costs to our customers through timely price increases and through the use of commodity swap and futures contracts.

We use Value at Risk (“VaR”), stress testing and scenario analysis for risk measurement and control purposes. VaR estimates the maximum potential loss in fair market values for our commodity derivative instruments, given a certain move in prices over a certain period of time, using specified confidence levels. Utilizing a Monte Carlo simulation with a 95 percent confidence level over a 3-day time horizon, the effect on our pre-tax income and cash flows for the years ended December 31, 2018 and 2017 would be immaterial.

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.

A significant portion of our reporting entities use the euro as their functional currency. Our reporting currency is the U.S. dollar. The translation gains or losses that result from the process of translating the euro denominated financial statements to U.S. dollars are deferred in accumulated other comprehensive income (“AOCI”) until such time as those entities may be liquidated or sold. Changes in the value of the U.S. dollar relative to the euro can therefore have a significant impact on comprehensive income.

We have entered into hedging arrangements designated as net investment hedges to reduce the volatility in stockholders’ equity resulting from foreign currency fluctuation associated with our net investments in foreign operations. The table below illustrates the impact on Other comprehensive loss of a 10% fluctuation in the foreign currency rate associated with each net investment hedge and the EURIBOR and LIBOR rates associated with basis swaps are shown in the table below:

	December 31, 2018		
Net Investment Hedges	Notional Amount	10% Variance on Foreign Currency Rate	Impact on Other Comprehensive Loss
Basis Swaps	€617 million	euro/U.S. dollar rate	$69 million
		EURIBOR and LIBOR rates	Less than $1 million
Guaranteed Euro Notes Due 2022	€750 million	euro/U.S. dollar rate	$86 million

Some of our operations enter into 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.

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 any natural offsets thereby reducing the overall impact of changes in foreign currency rates on our earnings. At December 31, 2018, a 10% fluctuation compared to the U.S. dollar in the underlying currencies that have no central bank or other currency restrictions related to non-hedged monetary net assets would have had a resulting additional impact to earnings of approximately $3 million.

Our policy is to maintain an approximately balanced position in foreign currencies to minimize exchange gains and losses arising from changes in exchange rates. To minimize the effects of our net currency exchange exposures, we enter into foreign currency spot and forward contracts and, in some cases, cross-currency swaps.

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We also engage in short-term foreign exchange swaps in order to roll certain hedge positions and to make funds available for intercompany financing. Our net position in foreign currencies is monitored daily.

We have entered into $2,300 million of non-cancellable cross-currency swaps, which we designated as foreign currency cash flow hedges, to reduce the variability in the functional currency equivalent cash flows of certain foreign currency denominated intercompany notes. At December 31, 2018, these foreign currency contracts have maturity dates ranging from 2021 to 2027 and their fair value was a net asset of $96 million. A 10% fluctuation compared to the U.S. dollar would have had a resulting additional impact to Other comprehensive loss of approximately $243 million.

Other income, net, in the Consolidated Statements of Income reflected net exchange rate foreign currency gains of $24 million in 2018, and foreign currency losses of $1 million in 2017, and $4 million in 2016. For forward contracts, including swap transactions, that economically hedge recognized monetary assets and liabilities in foreign currencies, no hedge accounting is applied. Changes in the fair value of foreign currency forward and swap contracts are reported in the Consolidated Statements of Income and offset the currency exchange results recognized on the assets and liabilities. At December 31, 2018, these foreign currency contracts, which will mature between January 2019 and August 2019, inclusively, had an aggregated notional amount of $1,764 million and the fair value was a net liability of $4 million. A 10% fluctuation compared to the U.S. dollar would have had a resulting additional impact to earnings of approximately $96 million.

Interest Rate Risk

Interest rate risk management is viewed as a trade-off between cost and risk. The cost of interest is generally lower for short-term debt and higher for long-term debt, and lower for floating rate debt and higher for fixed rate debt. However, the risk associated with interest rates is inversely related to the cost, with short-term debt carrying a higher refinancing risk and floating rate debt having higher interest rate volatility. Our interest rate risk management strategy attempts to optimize this cost/risk/reward tradeoff.

We are exposed to interest rate risk with respect to our fixed and variable rate debt. Fluctuations in interest rates impact the fair value of fixed-rate debt as well as pre-tax earnings stemming from interest expense on 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, equal to our cash and cash equivalents, marketable securities and tri-party repurchase agreements, as those assets are invested in floating rate instruments.

Pre-issuance interest rate—A pre-issuance interest rate strategy is utilized to mitigate the risk that benchmark interest rates (i.e. U.S. Treasury, mid-swaps, etc.) will increase between the time a decision has been made to issue debt and when the actual debt offering is issued. In 2015 and 2018 we entered into forward-starting interest rate swaps to mitigate the risk of adverse changes in the benchmark interest rates on the anticipated refinancing of our senior notes due 2019 and 2021, respectively. These interest rate swaps will be terminated upon debt issuance. At December 31, 2018, the total notional amount of these interest rate contracts designated as cash flow hedges was $1,000 million and $500 million, respectively, and their fair values were a net asset of $7 million and net liability of $5 million, respectively. We estimate that a 10% change in market interest rates as of December 31, 2018 would change the fair value of our forward-starting interest rate swaps outstanding and would have had a resulting impact on Other comprehensive loss of approximately $71 million.

Fixed-rate debt—We enter into interest rate swaps as part of our interest rate risk management strategy. At December 31, 2018, the total notional amount of interest rate swaps designated as fair value hedges, which have maturity dates ranging from 2019 to 2027, was $3,143 million and their fair value was a net liability of $42 million.

At December 31, 2018, after giving consideration to the $3,143 million of fixed-rate debt that we have effectively converted to floating through these U.S. dollar fixed-for-floating interest rate swaps, approximately 58% of our debt portfolio, on a gross basis, incurred interest at a fixed-rate and the remaining 42% of the portfolio incurred interest at a variable-rate. We estimate that a 10% change in market interest rates as of December 31, 2018 would change the fair value of our interest rate swaps outstanding and would have had a resulting impact on our pre-tax income of approximately $26 million.

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Variable-rate debt—Our variable rate debt consists of our $2,500 million Senior Revolving Credit Facility, our $900 million U.S. Receivables Securitization Facility and our Commercial Paper Program. At December 31, 2018, there were no outstanding borrowings under our Senior Revolving Credit Facility nor U.S. Receivables Securitization facility. Our Commercial Paper Program had outstanding borrowings of $809 million at December 31, 2018. We estimate that a 10% change in interest rates would have had a $2 million impact on earnings based on our average variable-rate debt outstanding per year.

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Item 8. Financial Statements and Supplementary Data.

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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, 2018 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, 2018.

We completed the acquisition of A. Schulman Inc. ("A. Schulman") on August 21, 2018. We are in the process of assessing the internal controls of A. Schulman as part of the post-close integration process and have excluded A. Schulman from our assessment of internal control over financial reporting as of December 31, 2018. The total assets and revenues excluded from management's assessment represent 5% and 2%, respectively, of the related consolidated financial statements as of and for the year ended December 31, 2018.

The effectiveness of our internal control over financial reporting as of December 31, 2018 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report which is included herein.

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders 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, 2018 and 2017, and the related consolidated statements of income, comprehensive income, stockholders’ equity and cash flows for each of the three years in the period ended December 31, 2018, 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, 2018, 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, 2018 and 2017, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2018 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, 2018, based on criteria established in Internal 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.

As described in Management’s Report on Internal Control Over Financial Reporting, management has excluded A. Schulman Inc. (“A. Schulman”) from its assessment of internal control over financial reporting as of December 31, 2018, because it was acquired by the Company in a purchase business combination during 2018. We have also excluded A. Schulman from our audit of internal control over financial reporting. A. Schulman is a wholly-owned subsidiary whose total assets and total revenues excluded from management’s assessment and our audit of internal control over financial reporting represent 5% and 2%, respectively, of the related consolidated financial statement amounts as of and for the year ended December 31, 2018.

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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.

/s/ PricewaterhouseCoopers LLP
Houston, Texas
February 21, 2019
We have served as the Company's auditor since 2008.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF INCOME

	Year Ended December 31,		
Millions of dollars, except earnings per share	2018	2017	2016
Sales and other operating revenues:			
Trade	$38,126	$33,705	$28,454
Related parties	878	779	729
	39,004	34,484	29,183
Operating costs and expenses:			
Cost of sales	32,529	28,059	23,191
Selling, general and administrative expenses	1,129	859	833
Research and development expenses	115	106	99
	33,773	29,024	24,123
Operating income	5,231	5,460	5,060
Interest expense	(360)	(491)	(322)
Interest income	45	24	17
Other income, net	106	179	111
Income from continuing operations before equity investments and income taxes	5,022	5,172	4,866
Income from equity investments	289	321	367
Income from continuing operations before income taxes	5,311	5,493	5,233
Provision for income taxes	613	598	1,386
Income from continuing operations	4,698	4,895	3,847
Loss from discontinued operations, net of tax	(8)	(18)	(10)
Net income	4,690	4,877	3,837
Net (income) loss attributable to non-controlling interests	—	2	(1)
Net income attributable to LyondellBasell Industries N.V.	4,690	4,879	3,836
Dividends on A. Schulman Special Stock	(2)	—	—
Net income attributable to the Company shareholders	$4,688	$4,879	$3,836
Earnings per share:			
Net income (loss) attributable to the Company shareholders —			
Basic:			
Continuing operations	$12.06	$12.28	$9.17
Discontinued operations	(0.02)	(0.05)	(0.02)
	$12.04	$12.23	$9.15
Diluted:			
Continuing operations	$12.03	$12.28	$9.15
Discontinued operations	(0.02)	(0.05)	(0.02)
	$12.01	$12.23	$9.13

See Notes to the Consolidated Financial Statements.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Net income	$4,690	$4,877	$3,837
Other comprehensive income (loss), net of tax—			
Financial derivatives	54	(45)	4
Unrealized gains (losses) on available-for-sale debt securities	—	(1)	6
Unrealized gains on equity securities and equity securities held by equity investees	—	17	—
Defined benefit pension and other postretirement benefit plans	30	77	(70)
Foreign currency translations	(92)	178	(13)
Total other comprehensive income (loss), net of tax	(8)	226	(73)
Comprehensive income	4,682	5,103	3,764
Dividends on A. Schulman Special Stock	(2)	—	—
Comprehensive (income) loss attributable to non-controlling interests	—	2	(1)
Comprehensive income attributable to the Company shareholders	$4,680	$5,105	$3,763

See Notes to the Consolidated Financial Statements.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED BALANCE SHEETS

	December 31,	
Millions of dollars	2018	2017
ASSETS		
Current assets:		
Cash and cash equivalents	$332	$1,523
Restricted cash	69	5
Short-term investments	892	1,307
Accounts receivable:		
Trade, net	3,355	3,359
Related parties	148	180
Inventories	4,515	4,217
Prepaid expenses and other current assets	1,255	1,147
Total current assets	10,566	11,738
Property, plant and equipment, net	12,477	10,997
Investments and long-term receivables:		
Investment in PO joint ventures	469	420
Equity investments	1,611	1,635
Other investments and long-term receivables	23	17
Goodwill	1,814	570
Intangible assets, net	965	568
Other assets	353	261
Total assets	$28,278	$26,206

See Notes to the Consolidated Financial Statements.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED BALANCE SHEETS

	December 31,	
Millions of dollars, except shares and par value data	2018	2017
LIABILITIES, REDEEMABLE NON-CONTROLLING INTERESTS AND EQUITY		
Current liabilities:		
Current maturities of long-term debt	$5	$2
Short-term debt	885	68
Accounts payable:		
Trade	2,560	2,258
Related parties	527	637
Accrued liabilities	1,536	1,812
Total current liabilities	5,513	4,777
Long-term debt	8,497	8,549
Other liabilities	1,897	2,275
Deferred income taxes	1,975	1,655
Commitments and contingencies		
Redeemable non-controlling interests	116	—
Stockholders’ equity:		
Ordinary shares, €0.04 par value, 1,275 million shares authorized, 375,696,661 and 394,512,054 shares outstanding, respectively	22	31
Additional paid-in capital	7,041	10,206
Retained earnings	6,763	15,746
Accumulated other comprehensive loss	(1,363)	(1,285)
Treasury stock, at cost, 24,513,619 and 183,928,109 ordinary shares, respectively	(2,206)	(15,749)
Total Company share of stockholders’ equity	10,257	8,949
Non-controlling interests	23	1
Total equity	10,280	8,950
Total liabilities, redeemable non-controlling interests and equity	$28,278	$26,206

See Notes to the Consolidated Financial Statements.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Cash flows from operating activities:			
Net income	$4,690	$4,877	$3,837
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization	1,241	1,174	1,064
Amortization of debt-related costs	14	15	16
Charges related to repayment of debt	—	49	—
Share-based compensation	39	55	38
Inventory valuation adjustment	—	—	29
Equity investments—			
Equity income	(289)	(321)	(367)
Distribution of earnings, net of tax	307	309	385
Deferred income taxes	260	(587)	357
Gain on sales of business and equity investments	(36)	(108)	(84)
Changes in assets and liabilities that provided (used) cash:			
Accounts receivable	433	(521)	(383)
Inventories	(141)	(237)	123
Accounts payable	(199)	165	383
Other, net	(848)	336	208
Net cash provided by operating activities	5,471	5,206	5,606
Cash flows from investing activities:			
Expenditures for property, plant and equipment	(2,105)	(1,547)	(2,243)
Acquisition of A. Schulman, net of cash acquired	(1,776)	—	—
Payments for repurchase agreements	—	(512)	(674)
Proceeds from repurchase agreements	—	381	685
Purchases of available-for-sale debt securities	(50)	(653)	(688)
Proceeds from sales and maturities of available-for-sale debt securities	423	499	674
Purchases of held-to-maturity securities	—	—	(76)
Proceeds from maturities of held-to-maturity securities	—	75	—
Purchases of equity securities	(64)	—	—
Proceeds from sales and maturities of equity securities	97	—	—
Net proceeds from sales of business and equity investments	37	155	209
Proceeds from settlement of net investment hedges	1,108	609	1,295
Payments for settlement of net investment hedges	(1,078)	(658)	(1,356)
Other, net	(151)	(105)	(127)
Net cash used in investing activities	(3,559)	(1,756)	(2,301)

See Notes to the Consolidated Financial Statements.

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LYONDELLBASELL INDUSTRIES N.V.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Year Ended December 31,		
Millions of dollars	2018	2017	2016
Cash flows from financing activities:			
Repurchases of Company ordinary shares	(1,854)	(866)	(2,938)
Dividends paid - common stock	(1,554)	(1,415)	(1,395)
Issuance of long-term debt	—	990	812
Repayment of long-term debt	(394)	(1,000)	—
Debt extinguishment costs	—	(65)	—
Payments of debt issuance costs	—	(8)	(5)
Net proceeds from (repayments of) commercial paper	810	(493)	177
Other, net	(16)	(2)	—
Net cash used in financing activities	(3,008)	(2,859)	(3,349)
Effect of exchange rate changes on cash	(31)	59	(9)
(Decrease) increase in cash and cash equivalents and restricted cash	(1,127)	650	(53)
Cash and cash equivalents and restricted cash at beginning of period	1,528	878	931
Cash and cash equivalents and restricted cash at end of period	$401	$1,528	$878
Supplemental Cash Flow Information:			
Interest paid, net of capitalized interest	$333	$333	$313
Net income taxes paid	$1,209	$1,044	$741