Law No. 9,478/1997 established a concession-based regulatory framework and granted us the exclusive right to exploit crude oil reserves in each of our producing fields under the existing concession contracts for an initial term of 27 years from the date when they were declared commercially profitable. These are known as the “Round Zero” concession contracts. This initial 27-year period for production can be extended at the request of the concessionaire and subject to approval from the ANP. Law No. 9,478/1997 also established a procedural framework for us to claim exclusive exploratory rights for a period of up to three years, later extended to five years, to areas where we could demonstrate that we had made commercial discoveries or exploration investments prior to the enactment of the Law No. 9,478/1997. In order to perfect our claim to explore and develop these areas, we had to demonstrate that we had the financial capacity to carry out these activities, either alone or through other cooperative arrangements.

Starting in 1999, all areas not already subject to concessions became available for public bidding conducted by the ANP. All the concessions that we have obtained since then were obtained through participation in public bidding rounds. In 2016, the ANP granted us an extension of the production phase of the concession agreement related to Marlim Field and Voador Field until August 2052 and an extension related to Ubarana Field until August 2034.

Taxation under Concession Regime for Oil and Gas

According to the Law No. 9,478/1997 and under our concession agreements for exploration and production activities with ANP, we are required to pay the government the following:

- Signing bonuses paid upon the execution of the concession agreement, which are based on the amount of the winning bid, subject to the minimum signing bonuses published in the relevant bidding guidelines (*edital de licitação*);
- Annual retention bonuses for the occupation or retention of areas available for exploration and production, at a rate established by the ANP in the relevant bidding guidelines based on the size, location and geological characteristics of the concession block;
- Special participation charges at a rate ranging from 0 to 40% of the net income derived from the production of fields that reach high production volumes or profitability, according to the criteria established in the applicable legislation. Net revenues are gross revenues less royalties paid, investments in exploration, operational costs and depreciation adjustments and applicable taxes. The Special Participation Tax uses as a reference international oil prices converted to reais at the current exchange rate. In 2016, we paid this tax on 18 of our fields, namely Albacora, Albacora Leste, Baleia Azul, Baleia Franca, Barracuda, Baúna, Canto do Amaro, Jubarte, Leste do Urucu, Lula, Manati, Marlim, Marlim Leste, Marlim Sul, Mexilhão, Rio Urucu, Roncador and Sapinhoá; and
- Royalties, to be established in the concession contracts at a rate ranging between 5% and 10% of gross revenues from production, based on reference prices for crude oil or natural gas established by Decree No. 2,705 and ANP regulatory acts. In establishing royalty rates in the concession contracts, the ANP also takes into account the geological risks and expected productivity levels for each concession. Most of our crude oil production is currently taxed at the maximum royalty rate.

Law No. 9,478/1997 also requires concessionaires of onshore fields to pay to the owner of the land a participation fee that varies between 0.5% and 1.0% of the sales revenues derived from the production of the field.

Production-Sharing Contract Regime for Unlicensed Pre-Salt and Potentially Strategic Areas

Discoveries of large oil and natural gas reserves in the pre-salt areas of the Campos and Santos Basins prompted a change in the legislation regarding oil and gas exploration and production activities.

In 2010, three new laws were enacted to regulate exploration and production activities in pre-salt and other potentially strategic areas not subject to existing concessions: Law No. 12,351, Law No. 12,304, and Law No. 12,276. The enacted legislation does not impact the existing pre-salt concession contracts, which cover approximately 28% of the pre-salt areas.

Law No. 12,351/2010 regulates production-sharing contracts for oil and gas exploration and production in pre-salt areas not under concession and in potentially strategic areas to be defined by the CNPE. Under the production-sharing regime, we used to be the exclusive operator of all blocks. However, Law No. 13,365/2016 recently modified Law 12,3251/2010 in order to grant us the option to be the operator of the blocks offered under public bids under the production sharing regime. It is no longer mandatory for us to be the exclusive operator of all areas. CNPE will only offer us preference to operate the blocks under production-sharing regime. As part of this regulatory change, we must announce whether we will exercise our preference right for each of the areas offered, up to thirty (30) days after the notice by the CNPE and present our justifications. After our announcement, CNPE will propose to the Office of the Presidency which areas should be operated by us. The exploration and production rights for these areas will be offered under public bids. Regardless of whether we exercise our right of preference, we will also be able to participate, at our discretion, in the bidding process to increase our interest in these areas. Nonetheless, the winning bidder will be the company that offers to the Brazilian federal government the highest percentage of “profit oil,” which is the production of a certain field after deduction of royalties and “cost oil,” which is the cost associated with oil production.

Law No. 12,734 became partially effective on November 30, 2012, and amended Law 12,351, establishing a royalty rate of 15% applicable to the gross production of oil and natural gas under future production sharing contracts.

Law No. 12,304/2010, authorized the incorporation of a new state-run non-operating company that will represent the interests of the Brazilian federal government in the production-sharing contracts and will manage the commercialization contracts related to the Brazilian federal government’s share of the “profit oil.” This new state-owned company was incorporated on August 1, 2013, named Pré-Sal Petróleo S.A.—PPSA, and will participate in operational committees, with a casting vote and veto powers, as defined in the contract, and will manage and control costs arising from production-sharing contracts. Where production-sharing contracts are concerned, PPSA will exercise its specific legal activities alongside the ANP, the independent regulatory agency that regulates and oversees oil and gas activities under all exploration and production regimes, and the CNPE, the entity that sets the guidelines to be applied to the oil and gas sector, including with respect to the new regulatory model.

Assignment Agreement* (Cessão Onerosa) *and Global Offering

Pursuant to Law No. 12,276/2010, we entered into an agreement with the Brazilian federal government on September 3, 2010 (Assignment Agreement), under which the government assigned to us the right to conduct activities for the exploration and production of oil, natural gas and other fluid hydrocarbons in specified pre-salt areas, subject to a maximum production of five bnboe. The initial contract price for our rights under the Assignment Agreement was R$74,807,616,407, which was equivalent to US$42,533,327,500 as of September 1, 2010. See Item 10. “Additional Information—Material Contracts—Assignment Agreement.”

Natural Gas Law of 2009

In March 2009, the Brazilian Congress enacted Law No. 11,909, or Gas Law, regulating activities in the gas industry, including transport, processing, storage, liquefaction, regasification and commercialization. The Gas Law created a concession regime for the construction and operation of new pipelines to transport natural gas, while maintaining an authorization regime for pipelines subject to international agreements. According to the Gas Law, after a certain exclusivity period, operators *(transportadores)* will be required to grant access to transport pipelines and maritime terminals, except LNG terminals, to third parties in order to maximize utilization of capacity.

The Gas Law authorized the ANP to regulate prices for the use of gas transport pipelines subject to the new concession regime, based on a procedure defined in the Gas Law as a "chamada pública," and to approve prices submitted by carriers (*carregadores*), according to previously established criteria, for the use of new gas transport pipelines subject to the authorization regime.

Authorizations previously issued by the ANP for natural gas transport will remain valid for 30 years from the date of publication of the Gas Law, and initial carriers (carregadores iniciais) were granted exclusivity in these pipelines for 10 years. All pipelines that our subsidiaries currently own and operate in Brazil are subject to an authorization regime. The ANP will issue regulations governing third-party access and carrier compensation if no agreement is reached between the parties.

The Gas Law also authorized certain consumers, who can purchase natural gas on the open market or obtain their own supplies of natural gas, to construct facilities and pipelines for their own use in the event local gas distributors controlled by the states, which have monopoly over local gas distribution, do not meet their distribution needs. These consumers are required to delegate the operation and maintenance of the facilities and pipelines to local gas distributors, but they are not required to sign gas supply agreements with the local gas distributors.

In December 2010, Decree No. 7,382 was enacted in order to regulate Chapter I to VI and VIII of the Gas Law as it relates to activities in the gas industry, including transportation and commercialization. Since the publication of this decree, a number of administrative regulations were enacted by the ANP and the MME in order to regulate various issues in the Gas Law and Decree No. 7,382 that needed to be further clarified. Among those is ANP Resolution No. 51/2013, which prevents a carrier from holding any equity interest in concessionaires of gas transport pipelines. Resolution No. 51/2013 applies only to the concessions granted after its publication, not affecting, therefore, the transportation of our natural gas production through pipelines operated by its subsidiaries and subject to the previous authorization regime.

Price Regulation

Until Law No. 9,478 in 1997, the Brazilian federal government had the power to regulate all aspects of the pricing of crude oil, oil products, ethanol, natural gas, electric power and other energy sources. In 2002, the government eliminated price controls for crude oil and oil products, although it retained regulation over certain natural gas sales contracts and electricity. Concurrently, the Brazilian federal government has periodically created and adjusted taxes applicable to crude oil, oil and natural gas products, which have been used as a tool to balance price stability to end consumers and also to increase its tax revenues.

Environmental Regulations

All phases of the crude oil and natural gas business present environmental risks and hazards. Our facilities in Brazil are subject to a wide range of federal, state and local laws, regulations and permit requirements relating to the protection of human health and the environment, and they fall under the regulatory authority of the *Conselho Nacional do Meio Ambiente* (National Council for the Environment, or CONAMA).

Our offshore activities are subject to the administrative authority of IBAMA, which issues operating and drilling licenses. We are required to submit reports, including safety and pollution monitoring reports to IBAMA in order to maintain our licenses.

Most of the onshore environmental, health and safety conditions are controlled either at the federal or the state level depending on the localization of our facilities, the type of activity under development and other criteria to be set forth in regulation that is still pending. However, it is also possible for these conditions to be controlled on a local basis whenever the activities generate a local impact or are established in a county conservation unit. Under Brazilian law, there is strict and joint liability for environmental damage, mechanisms for enforcement of environmental standards and licensing requirements for polluting activities.

Individuals or entities whose conduct or activities cause harm to the environment are subject to criminal and administrative sanctions. Government environmental protection agencies may also impose administrative sanctions for noncompliance with environmental laws and regulations, including:

- Fines;
- Partial or total suspension of activities;
- Requirements to fund reclamation and environmental projects;
- Forfeiture or restriction of tax incentives or benefits;
- Closing of establishments or operations; and
- Forfeiture or suspension of participation in credit lines with official credit establishments.

We are subject to a number of administrative and legal proceedings relating to environmental matters. For more information about these proceedings, see Item 8. “Financial Information—Legal Proceedings.” and Note 30 to our audited consolidated financial statements included in this annual report.

In 2016, we invested US$0.9billion in environmental projects, compared to US$1.1 billion in 2015 and US$1.4 billion in 2014. These investments continued to be primarily directed at reducing emissions and wastes from industrial processes, managing water use and effluents, remedying impacted areas, implementing new environmental technologies, upgrading our pipelines and improving our ability to respond to emergencies.

Health, Safety and Environmental Initiatives

The protection of human health and the environment is one of our primary concerns, and is essential to our success as an integrated energy company.

We have a Health, Safety and Environmental (HSE) Committee (*Comitê de Segurança, Meio Ambiente e Saúde*) composed of three members of our board of directors who are responsible for assisting our board in the following matters:

- Definition of strategic goals in relation to HSE matters;
- Establishment of global policies related to the strategic management of HSE matters within our group of companies; and
- Assessment of the conformity of our strategic plan to its global HSE policies, among others.

Our efforts to address health, safety and environmental concerns and ensure compliance with environmental regulations (which in 2016 totaled an investment of R$5.88 billion, or US$1.68 billion) involve the management of environmental costs related to production and operations, pollution control equipment and systems, projects to rehabilitate degraded areas, safety procedures and initiatives for emergency prevention and control, health and safety programs as well as:

- An HSE management system that seeks to minimize the impacts of operations and products on health, safety and the environment, reduce the use of natural resources and pollution and prevent accidents;
- ISO 14001 (environment) and OHSAS 18001 (health and safety) certification of our operating units. All the oil refined in Brazil was processed by certified units. The Frota Nacional de Petroleiros (National Fleet of Vessels) has been fully certified by the International Maritime Organization (IMO) International Management Code for Safe Operation of Ships and for Pollution Prevention (ISM Code) since December 1997;
- Regular and active engagement with the MME and IBAMA, in order to discuss environmental issues related to new oil and gas production and other transportation and logistical aspects of our operations;
- A strategic goal to reduce the intensity of greenhouse gas emissions, along with a set of performance indicators with targets to monitor progress with respect to this goal; and
- We evaluate each of our operational projects to identify risks and to ensure compliance with all of our HSE requirements and the adoption of the best HSE practices throughout a project's life cycle. In addition, we conduct more extensive environmental studies for new projects when required by applicable environmental legislation.

In 2016, our emissions decreased by 15% compared to 2015, mainly due to the reduction in thermal power generation, divestiture decisions and general lower level of operational activities. We are committed to reducing the intensity of greenhouse gas emissions from our processes and products through several initiatives, including reduction of gas flaring, energy efficiency measures and operational improvements.

Eliminating fatal accidents and achieving performance levels comparable to the best international oil and gas operators when it comes to the prevention of injuries to our employees and third parties are the two most important goals set by our safety management. Although we develop prevention programs in all of our operating units, we recorded 3 fatalities involving our own and contractors' employees in 2016 (compared to 16 in 2015). We investigate all accidents reported in order to identify their causes and then take preventive and corrective actions, which are regularly monitored once they are adopted. In cases of serious accidents, we send out company-wide alerts to enable other operating units to assess the probability of similar events occurring in their own operations.

Environmental Remediation Plans and Procedures

As part of our environmental plans, procedures and efforts, we maintain detailed response and remediation contingency plans to be implemented in the event of an oil spill or leak from our offshore operations. In order to respond to these events, Petrobras has 32 dedicated oil spill recovery vessels fully equipped for oil spill control and firefighting, 113 support boats and other vehicles, 270 additional support and recovery boats available to fight offshore oil spills and leaks, around 92 km of containment booms and 118 km of absorbent booms and around 96,000 liters of oil dispersants, among others. These resources are distributed in 12 environmental protection centers in strategic areas in which we operate throughout Brazil and in emergency response centers (distributed over 21 cities) in order to ensure rapid and coordinated response to onshore or offshore oil spills.

We have more than 500 trained workers available to respond to oil spills 24 hours a day, seven days a week, and we can mobilize additional trained workers for shoreline cleanups on short notice from a large group of trained environmental agents in the country. While these workers are located in Brazil, they are also available to respond to an offshore oil spill outside of Brazil.

Since 2012, Petrobras has been a participating member of the Oil Spill Response Limited—OSRL, an international organization that brings together over 160 corporations, including oil major, national/independent oil companies, energy related companies as well as other companies operating elsewhere in the oil supply chain. OSRL participates in the Global Response Network, an organization composed of several other companies dedicated to fighting oil spills. As a member of the OSRL, Petrobras has access to all resources available through that network, and we also subscribe to their Subsea Well Intervention Services, which provides swift international deployment of response-ready capping and containment equipment. The capping equipment is stored and maintained at bases worldwide, including Brazil. An OSRL Brazilian base opened in March 2014 and is now operational.

In 2016, we conducted 13 emergency drills of regional scope with the Brazilian navy, the civil defense, firefighters, the military police, environmental organizations and local governmental and community entities.

We set up a Zero Spill Plan, aiming at optimizing management and reducing the risk of oil spills in our operations. This plan encompasses investments to improve the management of processes and to ensure the integrity of our equipment and installations. Additionally, Petrobras has a model of communication, processing and recording of oil spills that permits the daily monitoring of these incidents, their impacts and mitigation measures.

The oil spill level in our upstream operations in 2016 was kept below 0.5 m^3 per mmbbl produced. Data for 2012 compiled by the International Association of Oil & Gas Producers indicates that the industry average was 0.76 m^3 of oil spilled per mmbbl produced. We continue to evaluate and develop initiatives to address HSE concerns and to reduce our exposure to HSE risks. In 2016, we had oil spills totaling 51.9m^3, compared to 71.6 m^3 in 2015 and 69.5 m^3 in 2014.

Insurance

Our insurance programs focus principally on the evaluation of risks and the replacement value of assets, which is customary for our industry. Under our risk management policy, risks associated with our principal assets, such as refineries, tankers and offshore production units and drilling rigs, are insured for their replacement value with third-party Brazilian insurers. Although some policies are issued in Brazil, most of our policies are reinsured abroad with reinsurers rated A- or higher by S&P's rating agency or B++ or higher by A.M. Best.

Less valuable assets, including but not limited to small auxiliary boats, certain storage facilities, and some administrative installations, are self-insured. We do not maintain coverage for business interruption, except for a minority of our international operations and a few specific assets in Brazil. We generally do not maintain coverage for our wells for all of our Brazilian operations, except when required by a joint operating agreement. Although we do not insure most of our pipelines, we have insurance against damage or loss to third parties resulting from specific incidents, such as sudden and accidental seepage and oil pollution. We also maintain coverage for risks associated with cargo, hull and machinery. All projects and installations under construction that have an estimated maximum loss above US$80 million are covered by a construction insurance policy.

We have operations in 9 countries outside Brazil and maintain varying levels of third-party liability insurance for our domestic and international operations as a result of a variety of factors, including our country risk assessments, whether we have onshore and offshore operations or legal requirements imposed by the particular country in which we operate. We maintain insurance coverage for operational third-party liability with respect to our onshore and offshore activities, including losses to third parties resulting from environmental risks such as oil spills, in Brazil up to an aggregate policy limit of US$250 million. We maintain additional protection and indemnity (P&I) marine insurance against third-party liability related to our domestic offshore operations up to an aggregate policy limit between US$50 million up to US$500 million for a period of 12 months. In the event of an explosion or similar event at one of our mobile offshore units in Brazil, these policies can provide combined third-party liability coverage of up to US$750 million.

Our domestic and international operational third-party liability policies cover claims made against us by or on behalf of individuals who are not our employees in the event of property damage, personal injury or death, subject to the policy limits set forth above. As a general rule, our service providers are required to indemnify us for a claim we pay directly to a third party as a result of a court decision holding us liable for the actions of that service provider. Our operational third-party liability policies also cover environmental damage from oil spills (including liability arising from an explosion or similar sudden and accidental event at one of our offshore units) as well as litigation and clean-up and remediation costs, but do not cover governmental fines or punitive damages.

We maintain separate “control-of-well” insurance policies at our international operations to cover liability arising from the uncontrolled eruption of oil, gas, water or drilling fluid, as well as to cover claims for environmental damage from well blow-outs and similar events as well as related clean-up costs, with aggregate policy limits up to US$509 million for a period of 12 months depending on the country. In the U.S. Gulf of Mexico, for example, we maintain third-party liability coverage up to an aggregate policy limit of US$250 million, and control-of-well liability insurance up to US$509 million. Depending on the particular circumstances, either of these policies could apply in the event of an explosion or similar event at one of our offshore units in the U.S. Gulf of Mexico.

We generally do not maintain control-of-well insurance for our domestic operations onshore and offshore Brazil, except when required by a joint operating agreement. As a result, we would bear the costs of clean-up, decontamination and any proceedings arising out of a control-of-well incident. Any sudden and accidental loss of hydrocarbon containment from our domestic operations onshore and offshore that is not attributable to a control-of-well issue would be covered by either our Protection & Indemnity (P&I) insurance, with coverage of up to US$500 million for our mobile offshore units, or our onshore-offshore liability policy, with coverage of up to US$250 million.

The premium for renewing our domestic property risk insurance policy for an 18-month period beginning November 2016 was US$43.41 million. This represented a nominal decrease of 45% over the prior 18-month period. The insured value of our assets, in the same period, decreased by 4.9% to US$173.6 billion. Beginning November 2016, we changed our risk retention for operational risks from US$25 million up to US$180 million while for engineering risks it may reach US$80 million in certain circumstances.

Additional Reserves and Production Information

During 2016, our oil and gas production in Brazil averaged 2,387.4 mboe/d, of which 90% was oil and 10% was natural gas. The Campos Basin is one of Brazil’s main and most prolific oil and gas offshore basins, with over 60 hydrocarbon fields discovered, eight large oil fields and a total area of approximately 115,000 km^2 (28.4 million acres). In 2016, the Campos Basin produced an average 1,358.5 mbbl/d of oil and 525.4 mmcf/d (13.9 mmm^3/d) of natural gas, comprising 61% of our total production from Brazil. We also carry out limited oil shale mining operations in São Mateus do Sul, in the Paraná Basin of Brazil, and convert the kerogen (solid organic matter) from these deposits into synthetic oil and gas. This operation is conducted in an integrated facility and its final products are fuel gas, LPG, shale naphtha and shale fuel oil. Our business unit does not utilize the fracking method or the hydraulic fracturing method for oil production, since they are not appropriate in the context of our operations. Also, we do not inject any water or chemicals in the soil in connection with our open pit oil shale mining operations. Our process consists of crushing, screening and subsequently heating all the shale at high temperatures (pyrolysis) and we have in place a proper segregation process for the by-products derived from such process.

On December 31, 2016, our estimated proved reserves in Brazil totaled 9.5 bnbbl of oil equivalent, including 8.1 bnbbl of crude oil, condensate and synthetic oil and 222.7 bnm^3 (8.4 tcf) of natural gas and synthetic gas. As of December 31, 2016, our domestic proved developed crude oil, condensate and synthetic oil reserves represented 52.8% of our total domestic proved crude oil, condensate and synthetic oil reserves, and our domestic proved developed natural gas and synthetic gas reserves represented 60.0% of our total domestic proved natural gas and synthetic gas reserves.

We calculate reserves based on forecasts of field production, which depend on a number of technical parameters, such as seismic interpretation, geological maps, well tests, reservoir engineering studies and economic data. All reserve estimates involve some degree of uncertainty. The uncertainty depends primarily on the amount of reliable geological and engineering data available at the time of the estimate and the interpretation of that data. Our estimates are thus made using the most reliable data and technology at the time of the estimate, in accordance with the best practices in the oil and gas industry and regulations promulgated by the SEC.

Internal Controls over Proved Reserves

The reserve estimation process begins with an initial evaluation of our assets by geophysicists, geologists and engineers. Corporate Reserves Coordinators (*Coordenadores de Reservas Corporativos*, or CRCs) safeguard the integrity and objectivity of our reserve estimates by supervising and providing technical support to Regional Reserves Coordinators (*Coordenadores de Reservas Regionais*, or CRRs) who are responsible for preparing the reserve estimates. Our CRRs and CRCs have degrees in geology, engineering and accounting and are trained internally and abroad in international reserve estimates seminars. CRCs are responsible for compliance with SEC rules and regulations, consolidating and auditing the reserve estimation process. The technical person primarily responsible for overseeing the preparation of our reserves has 28 years of experience in the field and has been with Petrobras for over 33 years. Our reserve estimates are approved by our board of executive officers, which then informs our board of directors of its approval.

D&M used our reserve estimates to conduct a reserve audit of 97% of the net proved crude oil, condensate and natural gas reserves as of December 31, 2016 from certain properties we own in Brazil. In addition, D&M used our reserve estimates to conduct a reserves audit of 100% of the net proved crude oil, condensate and natural gas reserves as of December 31, 2016 in properties we operate in the United States. The reserve estimates were prepared in accordance with the reserves definitions of Rule 4-10(a) of Regulation S-X of the SEC. For further information about our proved reserves, see “Supplementary Information on Oil and Gas Exploration and Production” beginning on page F-109. For disclosure describing the qualification of D&M’s technical person primarily responsible for overseeing our reserves audit and reserves evaluation, see Exhibit 99.1.

Changes in Proved Reserves

In 2016, we incorporated 103 million boe of proved reserves from extensions and discoveries in Brazil (Santos Basin), and we increased 131 mmboe of our proved reserves due to revisions of previous estimates, because new production development well drilling and better reservoir response in onshore and offshore post-salt fields, in Brazil and in the USA, and in the pre-salt, as result of positive answers from the reservoirs, recovery mechanisms (water injection) and operating efficiency of production systems in operation, as well as the growing drilling activities and tie-back activities, in the Santos and in the Campos Basin. We reduced 169 mmboe of our proved reserves due to sales of minerals in situ and increased 16 mmboe in our proved reserves due to purchases of minerals in situ, resulting in a net effect of a decrease of 153 mmboe in our proved reserves. The net result of these additions and dispositions, excluding production, was an increase of 81 mmboe to our proved reserves in 2016. Considering a production of 925 mmboe in 2016, our net decrease of proved reserves was 844 mmboe. This volume production does not take into account the production of EWTs in exploratory blocks in Brazil, and production in Bolivia, since the Bolivian Constitution prohibits the disclosure and registration of its reserves.

At year-end 2016 compared to year-end 2015, our proved undeveloped reserves company-wide decreased by a net total of 700.5 mmboe. Thus, we had a total of 4,441.1 mmboe of proved undeveloped reserves company-wide at December 31, 2016, compared to 5,141.6 mmboe of proved undeveloped reserves company-wide at December 31, 2015.

In Brazil, the net decrease in our proved undeveloped reserves in 2016 compared to 2015 is mostly derived from the conversion of some of our proved undeveloped reserves to proved developed reserves, mainly attributable to the start up of new production units in the Santos Basin, and to the drilling of wells in existing production fields, in the Santos and in the Campos Basins, amounting to 687 mmboe. In addition, our domestic proved undeveloped reserves decreased by 32 mmboe due to revisions of previous estimates. This decrease was partially offset by the increase due to extensions and discoveries, amounting to 103 mmboe, in the pre-salt areas of the Santos Basin.

All reserve volumes described above are “net” to the extent that they only include our proportional participation in reserve volumes and exclude reserves attributed to our partners.

In 2016, we invested a total of US$13.1 billion in development projects, of which 95 % (US$12.4 billion) was invested in Brazil, and converted a total of 747 mmboe of proved undeveloped reserves to proved developed reserves, approximately 92% (687 mmboe) of which were Brazilian reserves.

Most of our investments relate to long-term development projects, which are developed in phases due to the large volumes, and extensions involved, the deep and ultra-deepwater infrastructure and the production resources complexity. In these cases, the full development of the reserves related to these investments can exceed five years.

We had a total of 4,441.1 mmboe of proved undeveloped reserves company-wide at year-end 2016, approximately 7.4% (329.1mmboe) of which have remained undeveloped for five years or more as a result of several factors affecting development and production, including the inherent complexity of ultra-deepwater development projects, particularly in Brazil.

The majority of the 329.1 mmboe of our proved undeveloped reserves that have remained undeveloped for five years or more consist of reserves in the Santos Basin and in the Campos Basin, in which we are making investments to develop necessary infrastructure.

The following tables set forth our production of crude oil, natural gas, synthetic oil and synthetic gas by geographic area in 2016, 2015 and 2014:

Hydrocarbon Production by Geographic Area

	2016					2015					2014				
	Oil (mbbl/d) (5)	Synth. Oil (mbbl/d) (4)	Nat. Gas (mmcf/d) (1)	Synth. Gas (mmcf/d) (1)(4)	Total (mboe/d)	Oil (mbbl/d) (5)	Synth. Oil (mbbl/d) (4)	Nat. Gas (mmcf/d) (1)	Synth. Gas (mmcf/d) (1)(4)	Total (mboe/d)	Oil (mbbl/d) (5)	Synth. Oil (mbbl/d) (4)	Nat. Gas (mmcf/d) (1)	Synth. Gas (mmcf/d) (1)(4)	Total (mboe/d)
Brazil*	**2,141.7**	**2.5**	**1,458.5**	**0.6**	**2,387.4**	**2,125.5**	**2.8**	**1,542.7**	**0.9**	**2,385.5**	**2,031.5**	**2.9**	**1,499.4**	**1.0**	**2,284.4**
Lula field(2)	342.8	–	256.0	–	385.5	212.6	–	142.2	–	236.29	108.38	–	69.91	–	120.03
Búzios field(2)	8.9	–	0	–	8.9	6.5	–	0	–	6.54	0.19	–	0	–	0.19
Other	1,790.0	–	1,202.5		1,993.1	1,906.4		1,400.5		2,142.7	1,922.9		1,429.5		2,164.2
International:															
South America (outside of Brazil)	21.9	–	395.4	–	87.8	38.6	–	474.9	–	117.8	57.3	–	545.9	–	148.3
North America	33.0	–	87.6	–	47.6	30.6	–	67.2	–	41.8	27.3	–	12.8	–	29.5
Africa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total International	54.9	–	483.0	–	135.4	69.2	–	542.1	–	159.6	84.6	–	558.7	–	177.8
Total consolidated production	2,196.6	2.5	1,941.5	0.6	2,522.9	2,194.7	2.8	2,084.8	0.9	2,545.1	2,116.1	2.9	2,058.1	1.0	2,462.2
Equity and non-consolidated affiliates(2):															
South America (outside of Brazil)	1.3	–	0.3	–	1.3	3.4	–	0.9	–	3.5	4.6	–	1.6	–	4.9
Africa	23.8	–	–	–	23.8	26.6	–	–	–	26.6	26.6	–	–	–	26.6
Worldwide production	**2,221.7**	**2.5**	**1,941.9**	**0.6**	**2,548.0**	**2,224.7**	**2.8**	**2,085.7**	**0.9**	**2,575.2**	**2,147.3**	**2.9**	**2,059.7**	**1.0**	**2,493.7**

(1) Natural gas production figures are the production volumes of natural gas available for sale, excluding flared and reinjected gas and gas consumed in operations.
(2) Búzios and Lula fields are separately included as they contain more than 15% of our total proved reserves each.
(3) Equity-accounted investees.
(4) We produce synthetic oil and synthetic gas from oil shale deposits in São Mateus do Sul, in the Paraná Basin of Brazil.
(5) Oil production includes LNG and production from EWTs.

The following table sets forth our estimated net proved developed and undeveloped reserves of crude oil and natural gas by region as of December 31, 2016.

Estimated Net Proved Developed and Undeveloped Reserves

Reserves category	Reserves						
	Oil (mmbbl)	Natural gas (bncf)	Total oil and natural gas (mmboe)	Synthetic oil (mmbbl) (1)	Synthetic gas (bncf)(1)	Total synthetic oil and synthetic gas (mmboe)	Total oil and gas products (mmboe)
Proved developed:							
Brazil	4,250.1	5,034.2	5,089.2	6.8	9.2	8.3	5,097.5
International							
South America (outside of Brazil)	0.5	33.7	6.1	—	—	—	6.1
North America	79.6	83.6	93.5	—	—	—	93.5
Total International	**80.1**	**117.3**	**99.7**	**—**	**—**	**—**	**99.7**
Total consolidated proved developed reserves	4,330.2	5,151.5	5,188.8	6.8	9.2	8.3	5,197.2
Equity and non-consolidated affiliates							
South America (outside of Brazil)	—	—	—	—	—	—	—
Africa	32.5	8.6	33.9	—	—	—	33.9
Total non-consolidated proved developed reserves	32.5	8.6	33.9	—	—	—	33.9
Total proved developed reserves	4,362.7	5,160.1	5,222.7	6.8	9.2	8.3	5,231.1
Proved undeveloped:							
Brazil	3,812.9	3,359.7	4,372.8	—	—	—	4,372.8
International							
South America (outside of Brazil)	0.3	80.2	13.7	—	—	—	13.7
North America	16.8	3.6	17.4	—	—	—	17.4
Total International	17.1	83.8	31.1	—	—	—	31.1
Total consolidated proved undeveloped reserves	3,830.0	3,443.6	4,403.9	—	—	—	4,403.9
Equity and non-consolidated affiliates							
South America (outside of Brazil)	—	—	—	—	—	—	—
Africa	36.5	3.9	37.2	—	—	—	37.2
Total non-consolidated proved undeveloped reserves	36.5	3.9	37.2	—	—	—	37.2
Total proved undeveloped reserves	3,866.5	3,447.5	4,441.1	—	—	—	4,441.1
Total proved reserves (developed and undeveloped)	**8,229.2**	**8,607.6**	**9,663.8**	**6.8**	**9.2**	**8.3**	**9,672.2**

(1) Volumes of synthetic oil and synthetic gas from oil shale deposits in the Paraná Basin in Brazil have been included in our proved reserves in accordance with the SEC rules for estimating and disclosing reserve quantities.

The table below summarizes information about the changes in total proved reserves of our consolidated entities for 2016, 2015 and 2014:

Total Proved Developed and Undeveloped Reserves (consolidated entities only)(1)

	Oil (mmbbl)	Natural gas (bncf)	Total oil and natural gas (mmboe)	Synthetic oil (mmbbl)	Synthetic gas (bncf)	Total synthetic oil and synthetic gas (mmboe)	Total oil and gas products (mmboe)
Reserves quantity information for the year ended December 31, 2016							
January 1, 2016	8,687.0	10,406.8	10,421.5	6.9	9.3	8.5	10,430.0
Revisions of previous estimates	197.6	(472.6)	118.8	0.8	1.2	1.0	119.8
Improved recovery	—	0.1	0.0	—	—	—	0.0
Purchases of proved reserves	0.7	93.3	16.3	—	—	—	16.3
Extensions and discoveries	87.8	92.1	103.2	—	—	—	103.2
Production	(766.3)	(892.6)	(915.1)	(0.9)	(1.4)	(1.2)	(916.2)
Sales of proved reserves	(46.6)	(631.9)	(151.9)	—	—	—	(151.9)
December 31, 2016	8,160.3	8,595.1	9,592.8	6.8	9.2	8.3	9,601.1
Reserves quantity information for the year ended December 31, 2015							
January 1, 2015	11,037.5	12,081.0	13,051.0	7.9	10.6	9.6	13,060,7
Revisions of previous estimates	(1,990.8)	(1,178.3)	(2,187.2)	0.1	0.2	0.1	(2,187.1)
Improved recovery	1.1	27.9	5.8	—	—	—	5.8
Purchases of proved reserves	—	—	—	—	—	—	—
Extensions and discoveries	411.9	492.2	494.0	—	—	—	494.0
Production	(766.0)	(924.5)	(920.1)	(1.0)	(1.4)	(1.3)	(921.3)
Sales of proved reserves	(6.8)	(91.4)	(22.0)	–	—	—	(22.0)
December 31, 2015	8,687.0	10,406.8	10,421.5	6.9	9.3	8.5	10,430.0
Reserves quantity information for the year ended December 31, 2014							
January 1, 2014	10,947.7	12,483.2	13,028.3	8.8	11.8	10.7	13,039.0
Revisions of previous estimates	631.4	539.6	721.4	0.2	0.1	0.2	721.6
Improved recovery	0.5	10.8	2.3	—	—	—	2.3
Purchases of proved reserves	22.9	47.1	30.8	—	—	—	30.8
Extensions and discoveries	272.3	264.0	316.3	—	—	—	316.3
Production	(732.9)	(911.8)	(884.8)	(1.1)	(1.4)	(1.3)	(886.1)
Sales of proved reserves	(104.5)	(351.9)	(163.1)	—	—	—	(163.1)
December 31, 2014	11,037.5	12,081.0	13,051.0	7.9	10.6	9.6	13,060.7

(1) Natural gas production volumes used in this table are the net volumes withdrawn from our proved reserves, including flared gas consumed in operations and excluding reinjected gas. Oil production volumes used in this table are net volumes withdrawn from our proved reserves and exclude LNG and production from EWTs. As a result, the oil and natural gas production volumes in this table are different from those shown in the production table above, which shows the production volumes of natural gas available for sale.

We do not have any material acreage expiring before 2025.

The following tables show the number of gross and net productive oil and natural gas wells and total gross and net developed and undeveloped oil and natural gas acreage in which Petrobras had interests as of December 31, 2016.

Gross and Net Productive Wells and Gross and Net Developed and Undeveloped Acreage

	As of December 31, 2016							
	Oil		Natural gas		Synthetic oil		Synthetic gas	
Gross and net productive wells(1):	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Consolidated subsidiaries								
Brazil	7,738	7,718.0	198	192.4	—	—	—	—
International					—	—	—	—
South America (outside of Brazil)	2,163	1,604.0	329	242.2	—	—	—	—
North America	19	10.9	8	5.0	—	—	—	—
Total international	2,182	1,614.9	337	247.2	—	—	—	—
Total consolidated	9,920	9,332.9	535	439.6	—	—	—	—
Equity and non-consolidated affiliates:					—	—	—	—
South America (outside of Brazil)	83	23.0	8	3.0	—	—	—	—
Africa	42	7.1	0	0.0	—	—	—	—
Total gross and net productive wells	**10,045**	**9,362.9**	**543**	**442.6**	**—**	**—**	**—**	**—**

	As of December 31, 2016							
	Oil		Natural gas		Synthetic oil		Synthetic gas	
	(in acres)							
Gross and net developed acreage:	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**
Brazil	4,589,843.8	4,262,179.0	353,741.2	331,812.3	1,346.0	1,346.0	0.0	0.0
International								
South America (outside of Brazil)	2,518.6	846.2	27,868.0	9,363.6	—	—	—	—
North America	16,557.4	8,528.4	6,267.2	1,509.8	—	—	—	—
Total international	19,076.0	9,374.6	34,135.2	10,873.5	—	—	—	—
Total consolidated	4,608,919.7	4,271,553.6	387,876.4	342,685.8	1,346.0	1,346.0	0.0	0.0
Equity and non-consolidated affiliates:								
South America (outside of Brazil)	—	—	—	—	—	—	—	—
Africa	587,244.2	48,573.5	—	—	—	—	—	—
Total non-consolidated	587,244.2	48,573.5	—	—	—	—	—	—
Total gross and net developed acreage	**5,196,164.0**	**4,320,127.1**	**387,876.4**	**342,685.8**	**1,346.0**	**1,346.0**	**0.0**	**0.0**

	As of December 31, 2016							
	Oil		Natural gas		Synthetic oil		Synthetic gas	
	(in acres)							
Gross and net undeveloped acreage:	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**
Brazil	571,544.0	454,484.7	233,907.0	229,766.8	0.0	0.0	0.0	0.0
International								
South America (outside of Brazil)	1,605.0	539.3	66,356.4	22,295.8	—	—	—	—
North America	2,907.7	1,629.8	90.2	46.6	—	—	—	—
Total international	4,512.7	2,169.0	66,446.6	22,342.4	—	—	—	—
Total consolidated	576,056.7	456,653.7	300,353.6	252,109.2	0.0	0.0	0.0	0.0
Equity and non-consolidated affiliates:								
South America (outside of Brazil)	—	—	—	—	—	—	—	—
Africa	57,330.2	3,101.9	—	—	—	—	—	—
Total non-consolidated	57,330.2	3,101.9	—	—	—	—	—	—
Total gross and net undeveloped acreage	633,386.9	459,755.6	300,353.6	252,109.2	0.0	0.0	0.0	0.0

(1) A “gross” well or acre is a well or acre in which a working interest is owned, while the number of “net” wells or acres is the sum of fractional working interests in gross wells or acres.

The following table sets forth the number of net productive and dry exploratory and development wells drilled for the last three years.

Net Productive and Dry Exploratory and Development Wells

	2016	2015	2014
Net productive exploratory wells drilled:			
Consolidated subsidiaries:			
Brazil	7.7	41.1	48.3
South America (outside of Brazil)	2.2	3.7	4.7
North America	–	0.1	0.4
Africa	–	–	–
Other	–	–	–
Total consolidated subsidiaries	9.9	44.9	53.4
Equity and non-consolidated affiliates:			
South America (outside of Brazil)	–	–	–
Africa	–	–	–
Total productive exploratory wells drilled	9.9	44.9	53.4
Net dry exploratory wells drilled:			
Consolidated subsidiaries:			
Brazil	5.1	14.9	19.2
South America (outside of Brazil)	1.0	–	1.1
North America	–	0.5	–
Africa	–	–	–
Other	–	–	–
Total consolidated subsidiaries	6.1	15.4	20.3
Equity and non-consolidated affiliates:			
South America (outside of Brazil)	–	–	–
Africa	–	–	0.9
Total dry exploratory wells drilled	6.1	15.4	21.2
Total number of net exploratory wells drilled	16.0	60.2	74.6
Net productive development wells drilled:			
Consolidated subsidiaries:			
Brazil	194.4	523.5	398.0
South America (outside of Brazil)	24.5	70.9	41.8
North America	0.4	0.7	–
Africa	–	–	–
Other	–	–	–
Total consolidated subsidiaries	219.3	595.1	439.8
Equity and non-consolidated affiliates:			
South America (outside of Brazil)	0.0	0.7	0.4
Africa	1.7	0.0	0.7
Total productive development wells drilled	221.0	595.8	440.9
Net dry development wells drilled:			
Consolidated subsidiaries:			
Brazil	1.0	3.0	12.7
South America (outside of Brazil)	–	0.5	–
North America	–	–	–
Africa	–	–	–
Other	–	–	–
Total consolidated subsidiaries	1.0	3.5	12.7
Equity and non-consolidated affiliates:			
South America (outside of Brazil)	–	–	–
Africa	–	–	0.1
Total dry development wells drilled	1.0	3.5	12.8
Total number of net development wells drilled	**222.0**	**599.3**	**453.6**

The following table summarizes the number of wells in the process of being drilled as of December 31, 2016. For more information about our ongoing exploration and production activities in Brazil, see "—Exploration and Production—Activities in Brazil." Our present exploration and production activities outside of Brazil are described in "—Exploration and Production—Activities Abroad." Also, see Note 15 to our audited consolidated financial statements for further information about our capitalized exploration costs and the unaudited supplementary information on oil and gas exploration and production contained in our audited consolidated financial statements.

Number of Wells Being Drilled as of December 31, 2016

	Year-end 2016	
	Gross	Net
Wells Drilling		
Consolidated Subsidiaries:		
Brazil	9	8.1
International:		
South America (outside of Brazil)	1	1.0
North America	1	0.3
Africa	—	—
Others	—	—
Total International	2	1.3
Total consolidated	11	9.4
Equity and non-consolidated affiliates:		
South America (outside of Brazil)	—	—
Africa	1	0.2
Total wells drilling	12	9.5