Empresa de Pesquisa Energética

BRAZILIAN OIL & GAS REPORT 2018/2019

TRENDS AND RECENT DEVELOPMENTS

December 2019

Rio de Janeiro, Brazil

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Acknowledgements

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This report was based on, among others, analyses performed for the International Petroleum Industry Report (*Boletim de Conjuntura da Indústria do Petróleo*).

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List of Abbreviations

AIP – Production Individualization Agreement (Acordo Individual de Produção)
ANP – National Agency of Petroleum, Gas and Biofuels (Agência Nacional do Petróleo, Gás e Biocombustíveis)
BNDES – Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social)
boe/d – Barrels of oil equivalent per day
b/d – Barrels per day
CADE – Administrative Council for Economic Defense (Conselho Administrativo de Defesa Econômica)
CBIO – Decarbonization Credit (Crédito de Descarbonização por Biocombustíveis)
CDPQ – Caisse de Dépôt et Placement du Québec
CNODC – CNPC Exploration & Development Company
CNPE – National Energy Policy Council (Conselho Nacional de Política Energética)
E&P – Exploration and Production
EPE – Energy Research Office (Empresa de Pesquisa Energética)
FGTL – Floating Gas-to-Liquids
FLNG – Floating Liquefied Natural Gas
FNS – North-South Railway (Ferrovia Norte-Sul)
FOB – Free on board
FPSO – Floating Production Storage and Offloading Unit
Ibama – Brazilian Institute of the Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)
LPG – Liquified Petroleum Gas
LRAP – Advanced Petroleum Recovery Laboratory (Laboratório de Recuperação Avançada de Petróleo)
LUBNOR – Lubrificantes e Derivados do Nordeste Refinery
MINFRA – Ministry of Infrastructure (Ministério da Infraestrutura)
MME – Ministry of Mines and Energy (Ministério de Minas e Energia)
NTS – Nova Transportadora do Sudeste
PPSA – Pré-Sal Petróleo S.A.
PRP – Brazilian Oil Reference Price (Preço de Referência do Petróleo)
REFAP – Alberto Pasqualini Refinery
REGAP – Gabriel Passos Refinery
REMAN – Isaac Sabbá Refinery
REPAR – Presidente Getúlio Vargas Refinery
REPLAN – Paulínia Refinery
RLAM – Landulpho Alves Refinery
RNEST – Abreu e Lima Refinery
SIX – Shale Industrialization Unit (Unidade de Industrialização do Xisto)
STF – Federal Supreme Court (Superior Tribunal Federal)
TAG – Transportadora Associada de Gás
TBG – Transportadora Brasileira Gasoduto Bolívia-Brasil
TOR – Transfer-of-Rights (Cessão Onerosa)
USGC – United States Gulf Coast

Introduction

The Brazilian Oil & Gas Report is an annual publication, whose purpose is to outline the sector's trends and developments from July 2018 to June 2019. Facts that happened after June 2019, will not be focus of this report. However, some of the most important results, like for Brazilian rounds, are briefly described.

From July 2018 to June 2019, total monthly oil output had consistently failed to live up to expectations, which had been very high due to the development of the prolific Pre-salt Region. Three key factors to understand Brazil's oil production level in this period were: i) growth in Pre-salt fields output; ii) increasingly high rates of decline from mature fields; iii) postponement of new projects. Until the middle of this decade, Petrobras had focused on capital-intensive pre-salt development projects, reducing investments in existing onshore and offshore fields and postponing some new projects.

However, recent start-ups of significant fields helped Brazil reach a new record high domestic oil production. Brazil also started to target declining outputs from mature fields. The Federal Government implemented a series of measures, such as reducing local content requirements and royalties, and allowing Reserve Based Lending.

Changes in the laws and regulations of the sector, combined with the alluring conditions put up in recent auctions, leveraged investments. In addition, the possibility of becoming an operator is increasingly luring major upstream companies to the Brazilian oil and gas industry.

The country's focus has also been on promoting downstream investments. Some regulations and laws are under review to bring more competition and development into oil products and gas markets, one of the Federal Government's main objectives. Another important issue under consideration are increased penalties for those agents who continuously evade fuel taxes. In addition, according to its new guidelines, Petrobras has announced the sale of half of its refining capacity, its natural gas infrastructure and other assets. Combined with new port and railway concessions, this should provide more competition to natural gas and oil products.

This report brings an overview of Brazilian oil and gas industry and addresses both the upstream and downstream, including licensing rounds, mature fields, investments, government initiatives, and infrastructure projects.

Upstream

After six consecutive years of decline, the number of exploratory wells drilled has increased in Brazil in 2018[1]. The fall in oil prices, beginning in 2014, and regulatory changes introduced with the discovery of the Pre-salt Region contributed to this decline. From 2008 to 2016, there were only four licensing rounds, which reduced exploration significantly (ANP, 2019b).

The resurgence of oil and gas exploration in Brazil is mainly due to 48 offshore blocks awarded in the Production Sharing and Concession Bidding Rounds held between 2017 and 2018 (ANP, 2019b). Large international oil companies, such as ExxonMobil, Shell, BP, Equinor and Petrobras, were among the competitors. As a result, there are 65 environmental licensing processes for oil and gas drilling activities currently being analyzed by the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA, 2019).

Figure 1 shows the evolution of awarded areas and blocks to be auctioned off in the Santos and Campos Basins.

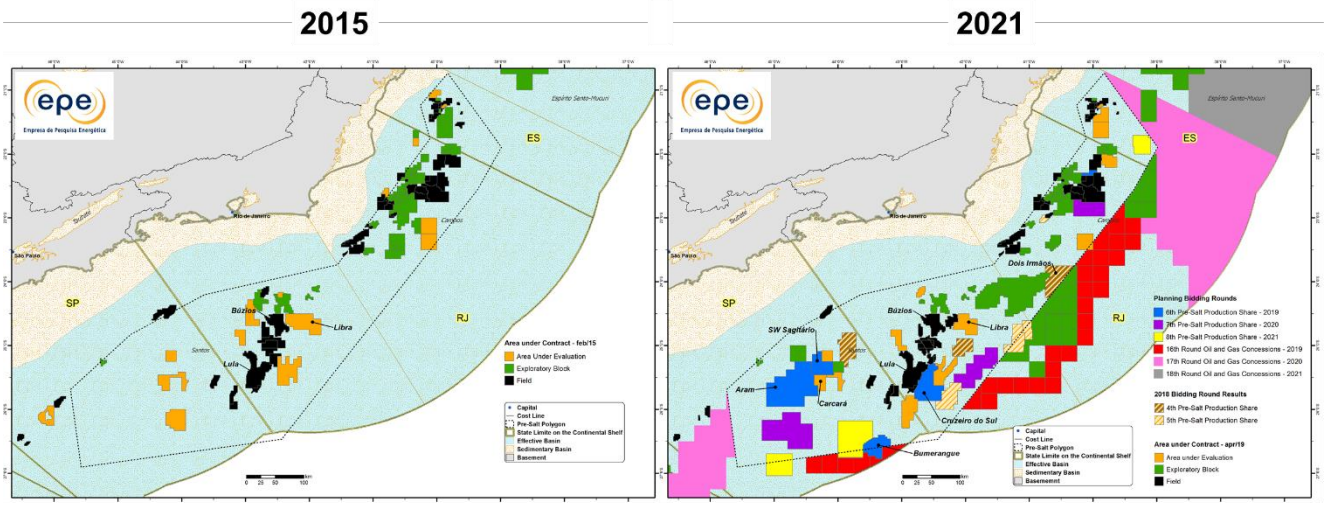

Figure 1 - Evolution of awarded areas and blocks to be auctioned off in the Santos and Campos Basins

Source: Data from ANP (2019b)

Note: The 2021 map includes the blocks in the 16th, 17th and 18th Concession Bidding Rounds and in the 6th, 7th and 8th Production Sharing Bidding Rounds.

[1] After reaching 238 in 2011, the number of exploratory wells drilled in Brazil fell continuously, reaching 26 in 2017. Brazil had a minor raise to 28 wells in 2018 (ANP, 2019a).

The recent results in exploration and domestic oil production are, in part, due to the large reservoirs and the high productivity of the pre-salt oil fields. Santos Basin's production relies on oil flow rate per well above the global oil industry's average[2]. Increased productivity requires fewer wells per production system, reducing costs. New technologies also helped to reduce development costs.

Pre-salt areas continue to attract most investments and its production already accounts for over 60% of the country's oil and gas production (ANP, 2019c). The aforementioned productivity and high drilling success rates enabled the fast rise in production. Pre-salt's annual drilling success rates in exploration between 2005 and March 2015 were 90% (PETROBRAS, 2015), showing high values when compared to the world average for wildcat drilling (38% success for wells drilled between 2007 and 2012 - NELON *et al*, 2013). Likewise, continued investments in new technologies[3] improved well construction efficiencies, which reduced drilling and completion times. The combination of these factors allowed a 40% fall in well breakeven costs from 2010 to 2017 (PETROBRAS, 2018). These factors boosted investments, even in a low oil price scenario.

The start-up of several production units were another factor responsible for the growth in pre-salt output. In the first half of this year, Petrobras started production from platforms P-67 in Lula field, as well as P-76 and P-77 in Búzios field. Each of these three Floating Production Storage and Offloading (FPSOs) units have a crude oil production capacity of 150 thousand b/d (PETROBRAS, 2019a).

Domestic oil production reached a record high of 2.73 million b/d in May 2019, as production in the Santos Basin (mostly pre-salt) offset the decline in the Campos Basin (mostly conventional post-salt), as shown in Figure 2.

[2] Nine wells of the Pre-salt Region produced over 35 thousand boe/d in June 2019, with one well in Mero field producing 60 thousand boe/d (ANP, 2019c). According to Petrobras (2014), the average productivity in the North Sea and Gulf of Mexico reaches 10 thousand to 15 thousand b/d per well.

[3] Productivity and field recovery factors tend to improve due to continued innovation, research and development. An important investment was the construction of the Advanced Petroleum Recovery Laboratory (LRAP) by Shell and Petrobras (COPPE, 2018).

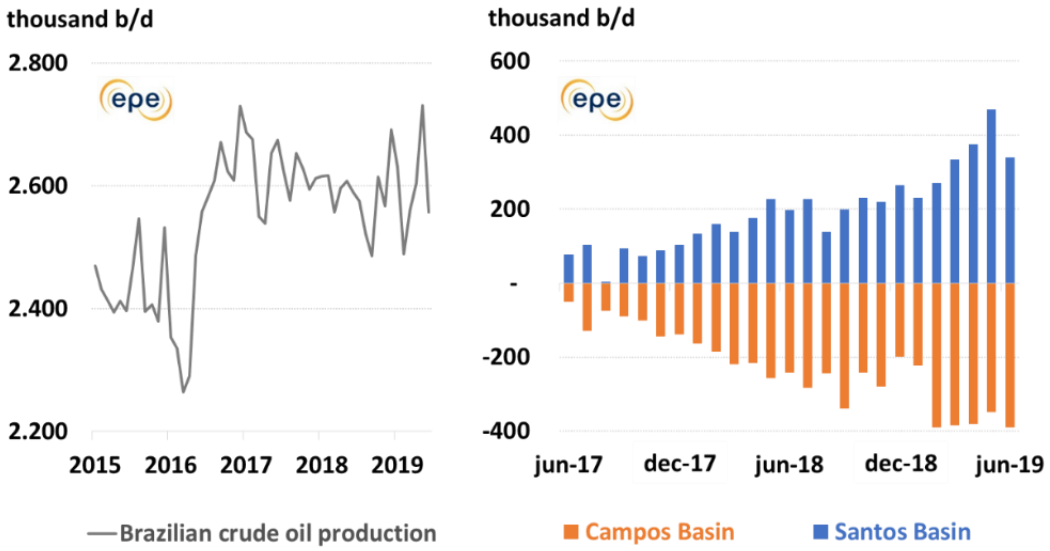

Figure 2 - National oil production and accumulated monthly change in Campos and Santos Basins oil production since May 2017

Source: Data from ANP (2019c)

Campos Basin's declining output has been dragging the country's production down, stymying its growth potential. Between May 2017 and June 2019, oil production in the Campos Basin declined by 390 thousand b/d, while increasing 340 thousand b/d in the Santos Basin (ANP, 2019c). June's production drop was mainly due to a scheduled maintenance on FPSO Cidade de Mangaratiba in the Lula field (ANP, 2019d).

The decline of mature fields' production is natural. Combined with Petrobras' option to concentrate its investments in other assets, the decline of production became more evident. In addition, Petrobras started a divestment program of mature fields (PETROBRAS, 2019a) and the expectation is that small and medium companies may achieve a better recovery rate. The average recovery rate for the Campos Basin is 24%, and Brazil's best rate is in the Recôncavo basin, with 33%. Meanwhile, the recovery rate stands at 35% globally, and comes close to 50% in Norway (ANP, 2018b).

The Federal Government has implemented a series of measures to attract specialized players, in order to revitalize activities in the onshore and shallow water fields. The National Agency of Petroleum, Natural Gas and Biofuels (ANP) has begun to require investment plans for mature fields. Assets that do not meet this requirement may have their contracts voided. In such a case, these fields can be offered to other interested parties (ANP, 2018c). Furthermore, ANP started reducing mandatory local content requirements, having lowered percentages in about 30 concession contracts. It also granted a royalty reduction from 10% to 5% on the incremental production of mature fields (ANP, 2018d). The regulator also started accepting Reserve Based Lending, which should help smaller players secure financing (ANP, 2018e). All these changes are meant to enable the increase of investments in the short term, consequently fostering exploration and production (E&P) activities in mature fields.

Petrobras' divestment program allowed other companies to enter Brazil's upstream. In the last few months, the state-owned company sold stakes in the offshore fields of Tartaruga Verde and Espadarte in the Campos Basin to Petronas, the Baúna field in the Santos Basin to Karoon, and the Pampo and Enchova clusters in the Campos Basin to Trident Energy. Petrobras also sold 34 onshore and offshore assets (Macau Cluster) in the northeastern state of Rio Grande do Norte to SPE 3R Petroleum, and the company's stake in the offshore Maromba field in the Campos Basin to BW Offshore (PETROBRAS, 2019a).

Petrobras also announced teasers for the sale of onshore fields in Recôncavo, Rio Ventura and Tucano Sul clusters in the state of Bahia, and Cricaré and Lagoa Parda clusters in the state of Espírito Santo. In addition, the state-led oil company put more offshore fields up for sale: the Garoupa Cluster, which comprises 11 producing shallow water fields in the Campos Basin, the Peroá Cluster in the state of Espírito Santo, and partial stakes in four concessions in deep water of the Sergipe-Alagoas Basin (PETROBRAS, 2019a). The divestment of Petrobras' small fields has been one of the main requests of small and medium companies that intend to invest in production in those areas. The sale of mature fields can promote investments, recovery rates growth, and increase production in the medium to long term.

Petrobras seeks the best capital return on investments, which includes the development of pre-salt projects (PETROBRAS, 2019a; 2019b). The state-owned company announced plans to invest US$ 75.7 billion between 2020 and 2024, of which 85% in E&P activities (PETROBRAS, 2019b).

Other players have also committed to investing in Brazil's E&P. Equinor announced its intention to invest US$ 15 billion by the end of the next decade, which includes two FPSOs in the Carcará field, in the Santos Basin pre-salt. The first unit with a production capacity of 220 thousand b/d is scheduled for 2024 (OFFSHORE ENERGY TODAY, 2018). Shell plans to invest US$ 2.0 billion per year in ultra-deep waters in Brazil by 2025, including an FPSO in Gato do Mato area (in the Santos Basin pre-salt, scheduled for 2023) with a capacity of 90 thousand b/d (REUTERS, 2019). ExxonMobil has announced it intends to drill at least five wells in Brazil by 2020 (EXXONMOBIL, 2019), while local companies are increasing investments on drilling exploratory wells[4].

Most of the recent petroleum and gas production increases in Brazil came from the Pre-salt Region, especially the fields of Lula (1.15 million boe/d), Sapinhoá (312 thousand boe/d) and Búzios (281 thousand boe/d) (ANP, 2019c). Lula has been in development by Petrobras and partners since 2007, and is the field that has been driving Brazil's production for the past years. Sapinhoá was discovered in 2008, and its production started ramping up in 2014.

Discovered in 2010, Búzios is the main field under the Transfer-of-Rights Agreement (TOR[5]) and is helping boost production over the past months. The entry of these production units is what drove expectations for Brazil's production up over the last few years.

Particularly since the TOR in 2010 and the Libra auction in 2013, Petrobras chose to allocate most its capital in the pre-salt's development, delaying investments in onshore and mature offshore fields.

In conjunction with crude oil, natural gas production has been growing too. Most pre-salt fields have a relatively high gas-to-oil ratio. Given the gas composition, and the fact that the expected production was higher than the current takeaway capacity in the Pre-salt region, this gas production has proven to be a challenge to operators. In addition to the considerable distance between many of the major fields and the coastline, certain fields contain considerable amounts of contaminants. The main contaminant is carbon dioxide (CO_2), and its average estimated concentration in the Santos and Campos Basins is shown in Figure 3.

[4] For example, the PetroRio's revitalization campaign in the Polvo field, in shallow waters of the Campos Basin, with an estimated investment of US$ 60 million (PETRORIO, 2019).

[5] According to Law nº 12.276/2010, the Transfer-of-Rights (TOR or *Cessão Onerosa* in Portuguese) is a regulatory system that allows Petrobras to directly contract specific exploratory areas with the Federal Government. The TOR contract helped capitalize Petrobras to develop the Pre-salt, and the contract stipulated lower royalty payments (ANP, 2016). The law granted Petrobras the right to extract up to five billion barrels of oil equivalent from un-awarded areas located in the Pre-salt Region, as detailed in the TOR Agreement signed between the Federal Government and Petrobras (CNPE, 2019).

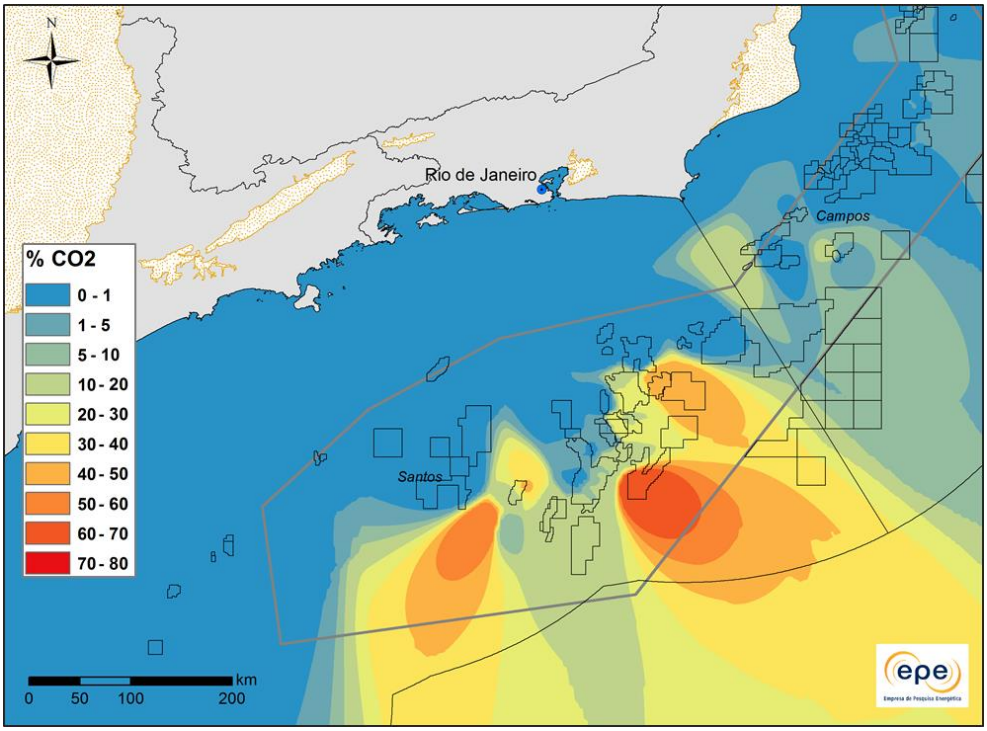

Figure 3 - CO_2 concentration in the eastern bank of Brazil's main exploration areas

Source: EPE (2019a)

The costs to remove this CO_2 and to transport the natural gas should be taken into account for the monetization of this natural gas. According to EPE (2019a), break-even costs can range from US$ 2/MMBtu to US$ 16/MMBtu considering natural gas with 0% to 30% CO_2. Considering the price of a natural gas molecule sold in Brazil in 2018, it would probably be profitable to build the infrastructure required do export and sell this gas only in fields with a CO_2 concentration of up to 20%. For other cases, alternatives of monetization should be studied, like Floating Gas-to-Liquids (FGTL), Floating Liquefied Natural Gas (FLNG), injection for advanced oil recovery, as well as other alternatives and combinations thereof.

There are other ongoing opportunities for both gas and oil production in Brazil. Following the successful exploratory block bidding rounds held in the first half of 2018, the 5th Production Sharing Bidding Round was held in September 2018. All four blocks on offer in the Santos and Campos Basins were auctioned off, as shown in Figure 4, generating R$ 6.8 billion (US$ 1.8 billion) in signing bonuses and an average profit oil of 42% (ANP, 2019b).

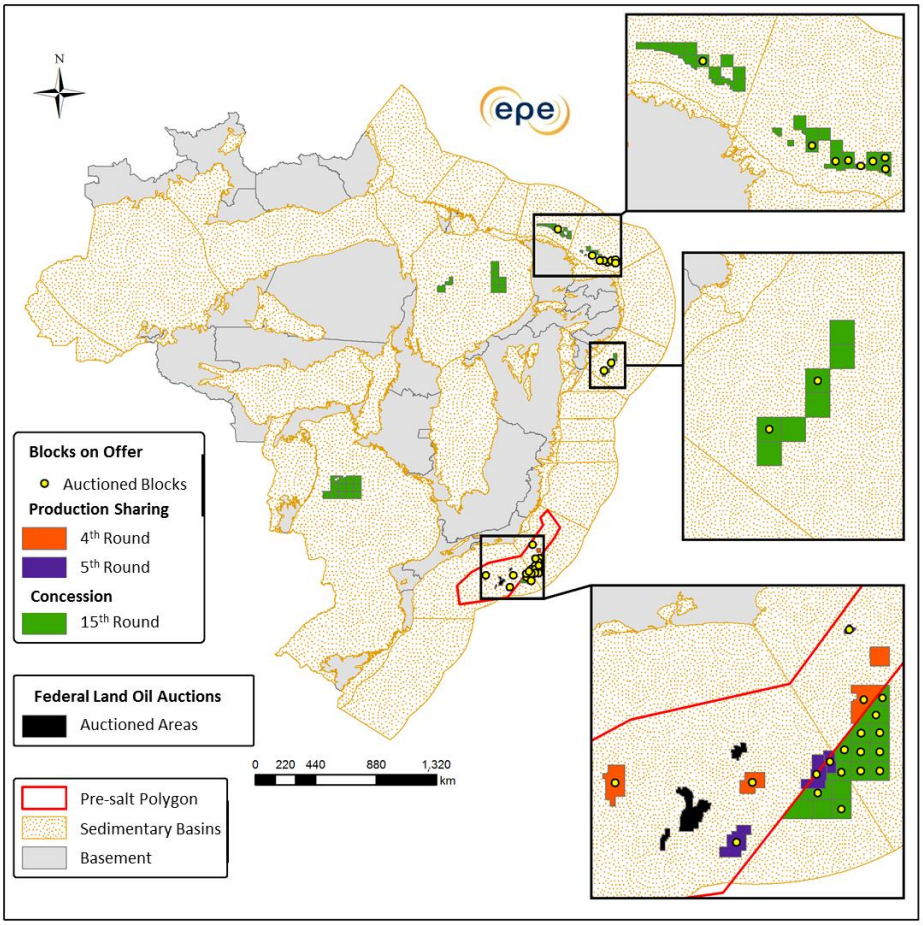

Figure 4 - Offered areas in the 4th and 5th Production Sharing Bidding Round, and the 15th Bidding Round

Source: Data from ANP (2019b)

Note: EPE (2018) analyzed the 15th Concession Bidding Round and 4th Production Sharing Bidding Round, which took place in March and June 2018, respectively.

The Brazilian oil and gas bidding round calendar has recently been updated by the National Energy Policy Council (CNPE)[6] in order to enhance the sector's predictability. In December 2018, the CNPE authorized ANP to proceed with the 16th Concession Bidding Round[7] and the 6th Production Sharing Bidding Round (in the Pre-salt Region) in 2019. Additionally, the Council authorized ANP to hold the 17th and 18th Concession Bidding Rounds in 2020 and 2021, respectively, also requesting the Agency to prospect certain areas that can possibly be included in the 7th and 8th Production Sharing Bidding Rounds (CNPE, 2018). The up to date calendar can be observed in Figure 5.

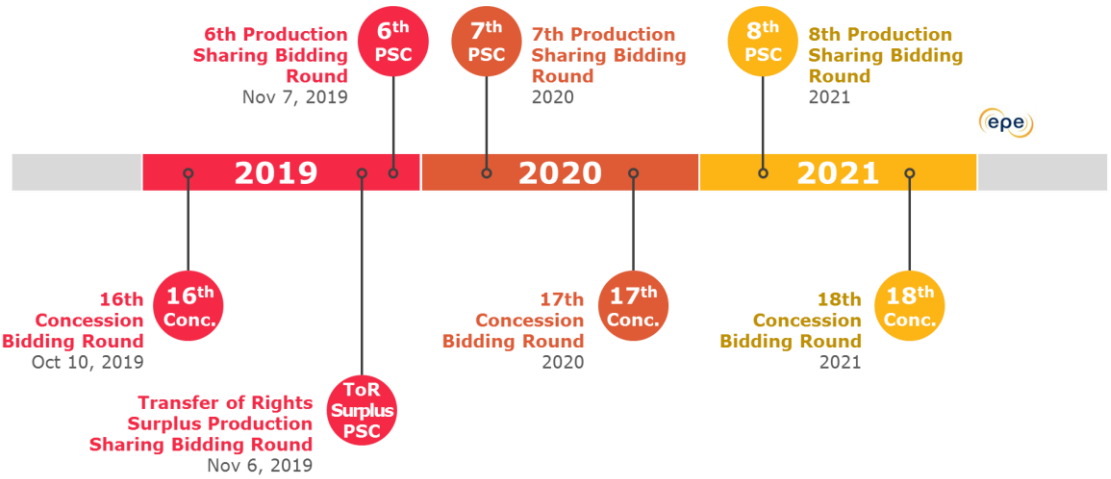

Figure 5 - Brazilian oil and gas bidding round calendar: 2019-2021

Source: Data from ANP (2019b)

In addition to adhering with the scheduled bidding rounds, CNPE reduced the local content requirements of existing contracts[8], such as for the Libra field.

In April 2019, CNPE authorized ANP to hold a Production Sharing Bidding Round for surplus volumes to those contracted under the Transfer-of-Rights (TOR) regime in areas of the Pre-salt (CNPE, 2019). The Federal Government made the TOR Surplus Auction a priority, and throughout the first half of the year managed to resolve most of the controversies.

[6] Chaired by the Minister of Mines and Energy, the CNPE is an inter-ministerial advisory board to the Brazilian President, responsible for the formulation of energy policies and guidelines. In 2017 and 2018, the CNPE approved a schedule of bidding rounds up to 2021, in order to promote more investments in the oil and gas industry, and stated its intent to hold licensing rounds regularly (CNPE, 2017; 2018).

[7] The CNPE, through Resolution nº 17/2018, authorized ANP to hold the 16th Bidding Round for exploration and production of oil and natural gas, under the concession regime (CNPE, 2018). The CNPE Resolution nº 3/2019 changed the offer of the blocks for technical reasons (CNPE, 2019). In October 2019, the 16th Bidding Round offered 36 blocks located in the offshore basins of Pernambuco-Paraíba, Jacuípe, Camamu-Almada, Campos and Santos Basins, totaling an area of 29 thousand km² (ANP, 2019e).

[8] The new percentages range from 18% to 50%, considerably lower than the previous percentages, which were bid components in the bidding rounds up to 2017 (ANP, 2018f; CNPE, 2018; EPE, 2017).

Initially, the Federal Government and Petrobras reviewed the TOR contract signed between the parties in 2010. Both parties agreed the Government will pay Petrobras US$ 9 billion to compensate for previous investments. In addition, CNPE set the guidelines for the auction and established the signing bonuses and the minimal profit oil to the country (Table 1).

Table 1 - Transfer-of-Rights Surplus Production Sharing Bidding Round parameters

Field	Signing Bonus	Profit Oil
Atapu	R$ 13.7 billion (US$ 3.4 billion)	26.23%
Búzios	R$ 68.2 billion (US$ 17.8 billion)	23.24%
Itapu	R$ 1.8 billion (US$ 0.5 billion)	18.15%
Sépia	R$ 22.9 billion (US$ 6.0 billion)	27.88%

Source: CNPE (2019)

Note: Exchange rate quote of 3.80 USD/BRL.

By the end of June 2019, the Federal Government was negotiating with Congress and State representatives to determine what part of the TOR signing bonus and of the government take will go to local and state authorities. This distribution of funds should avoid further contestation and allowed the auction to proceed at its scheduled date in November 6th, when the blocks of Búzios and Itapu were awarded, totaling US$ 18.4 billion in signing bonuses.

The 16th Bidding Round occurred on October 10th, with 12 blocks located in the Campos and Santos basins awarded. Signing bonuses added up to US$ 2.3 billion, with a minimum expected investment of US$ 394.7 million. On November 7th, ANP held the 6th Production Sharing Bidding Round. The consortium of Petrobras and CNPC Exploration & Development Company (CNODC) was awarded the Aram block, in the Santos Basin, offering almost 30% of profit oil to the country, besides a signing bonus of US$ 1.3 billion and an exploratory investment of US$ 73.2 million.

Another significant front to stimulate E&P in Brazil is the Open Acreage. The program consists of the permanent offer of relinquished fields[9]. The first cycle of the Open Acreage took place in September 2019, awarding 45 of the 287 exploration and production concessions[10] available by auction. Almost 20 companies submitted offers, including Enauta, Eneva, ExxonMobil and Murphy (ANP, 2019b).

[9] Exploration blocks offered in past bidding rounds and not auctioned off.

[10] 273 blocks and 14 marginal accumulation oil fields offered in the basins of Alagoas, Campos, Espírito Santo, Parnaíba, Potiguar, Recôncavo and Sergipe (ANP, 2019b).

Throughout the last three years, the Federal Government launched a series of initiatives in order to reduce the regulatory burden and to increase the attractiveness of the sector to foreign and domestic capital.

In the beginning of 2019, the Ministry of Mines and Energy (MME) announced its upstream priorities. The main goals were: i) to conclude the TOR Surplus Production Sharing Bidding Round; and ii) to proceed with the multi-year calendar of bidding rounds (MME, 2019a). Other relevant milestones were the approval of the Production Individualization Agreement (AIP) of Lula's[11] shared reservoir, and the agreement between Petrobras and ANP for the unification of the Parque das Baleias field[12], in the Campos Basin. The latter also includes the extension of the concession period, which will enable the implementation of a new production system from 2022 (PETROBRAS, 2019a).

Furthermore, Brazil's state-run company Pré-Sal Petróleo (PPSA[13]) successfully concluded the 2nd Federal Government Oil Auction in August 2018. PPSA auctioned off three-year's worth of oil and gas production of Mero and Sapinhoá fields to Petrobras, and one-year worth of the Lula field to Total. The crude oil was sold roughly for the Brazilian Oil Reference Price (PRP[14]). With the country's production and exports from production sharing contracts increasing, PPSA's importance in international oil marketing should increase significantly over the next decade.

[11] The shared Lula field includes the Lula Field, the Tupi South Block of the TOR contract and the non-contracted area belonging to the Federal Government. The agreement establishes each companies´ share and the rules for the joint execution of oil development and production operations and natural gas in the shared deposits (PETROBRAS, 2019a).

[12] The agreement deals with a determination of the ANP to unify the fields of Jubarte, Cachalote, Caxaréu, Baleia Franca, Baleia Anã, Baleia Azul and Pirambú.

[13] Pré-Sal Petróleo (PPSA) is responsible for: i) managing oil and gas production-sharing contracts in the Pre-salt Region; and ii) organization of the federal government's crude oil and natural gas marketing (PPSA, 2019).

[14] The Brazilian Oil Reference Price (PRP) is used as a basis for Government Take payments and has typically been calculated at a discount to Brent for the most of oil types produced in Brazil (ANP, 2019e).

Downstream

Historically, Brazilian state-run oil company Petrobras had been the guarantor of the national fuel supply and had hitherto often protected the domestic market prices by softening international fluctuations. However, in October 2016, the company started a revision of its pricing policy, effectively trying to match international and domestic prices, the so-called import parity pricing policy, and allowing monthly price changes. In June 2017, the policy was updated to allow for daily changes in diesel and gasoline prices.

Petrobras also revised its liquefied petroleum gas (LPG) pricing policy for residential use[15] in 2018. The company adopted a 12-month price average and quarterly price changes, instead of monthly price changes. The idea was to soften the international price volatility for a product used for cooking, so that the Brazilian consumer would not have to be subjected to seasonal price swings.

In the immediate aftermath of the trucker's strike that immobilized the country's logistics in May 2018, a series of measures were undertaken by the Brazilian Government. One of these was the introduction of a temporary diesel subsidy program, that payed up to R$ 0.30 per liter (around US$ 0.30 per gallon) to producers and importers of the fuel between June and December 2018. During this period, Petrobras refrained from passing international price increases to domestic prices for a few months, spacing out price increases. In addition, the Brazilian National Congress approved a provisional measure in July 2018, later turned into law, which established a minimum freight price for road transportation. The diesel subsidy ended in December 2018, but the minimum freight table continues to be valid.

In March 2019, Petrobras updated its diesel pricing policy, stating prices would be readjusted at most once every 15 days. However, last June the company changed this decision and lifted timing constraints for gasoline and diesel prices adjustments.

Figure 6 shows a comparison of gasoline and diesel prices at Brazilian refineries and in the U.S. Gulf Coast. It can be noted that, since the revision of its pricing policy, fuel prices in Brazil started following international prices more closely.

[15] CNPE recognized in 2005 that different LPG prices for residential consumers are of interest to the national energy policy (CNPE, 2005). Since then, LPG prices for residential use in Brazil have generally been lower than import parity.

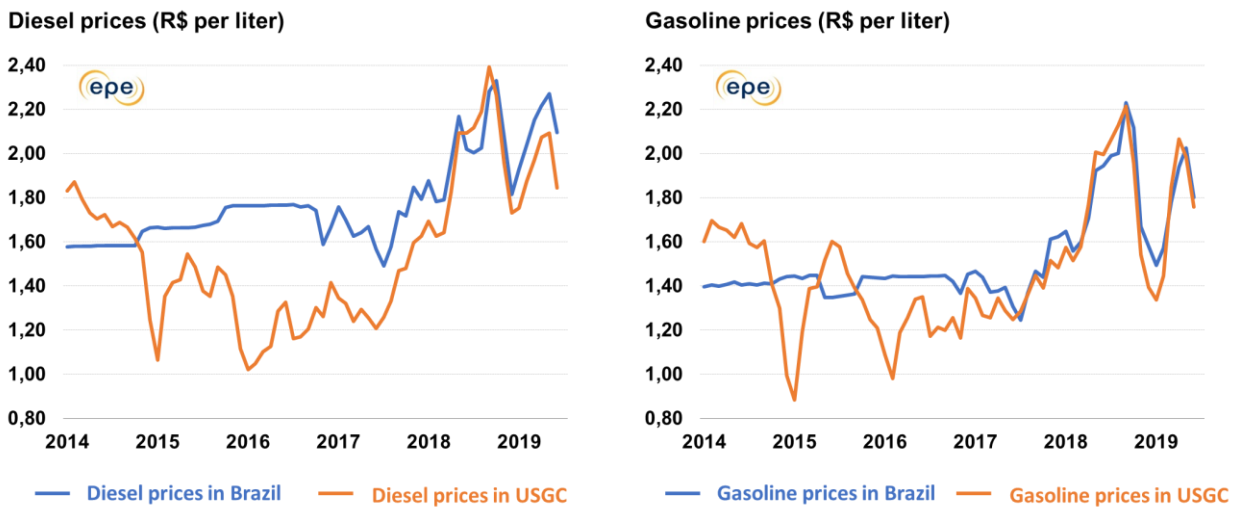

Figure 6 - Diesel and gasoline prices at Brazilian refineries and in the U.S. Gulf Coast

Source: Data from ANP (2019d) and EIA (2019)

Note: U.S. Gulf Coast prices as international references for gasoline and diesel (U.S. Gulf Coast Conventional Gasoline Regular Spot Price FOB and U.S. Gulf Coast Ultra-Low-Sulfur No. 2 Diesel Fuel Spot Price FOB).

Petrobras changed its strategy and adopted new guidelines in 2016 for its refining, transportation and logistics segments, looking to maximize margins in its value chain. Combined with the introduction of the import parity pricing policy, these changes had a significant impact on Brazilian refining and importing activities[16].

Refinery utilization rate dropped sharply in Brazil, from an average of 85% in 2008-2016 to 75% in 2017-2019. Output of diesel, Brazil's most-widely consumed refined product, declined from 900 thousand b/d in mid-2015 to 700 thousand b/d in the first half of 2019. Gasoline production decreased slightly from 460 to 430 thousand b/d over the same period. As a result, Brazilian imports of diesel and gasoline have grown strongly in recent years, as shown in Figure 7.

[16] Petrobras has a dominant position in the Brazilian downstream market, even though there is no longer a monopoly established by law. The company holds on to most of the fuel logistics infrastructure and controls 99% of the country's refining capacity.

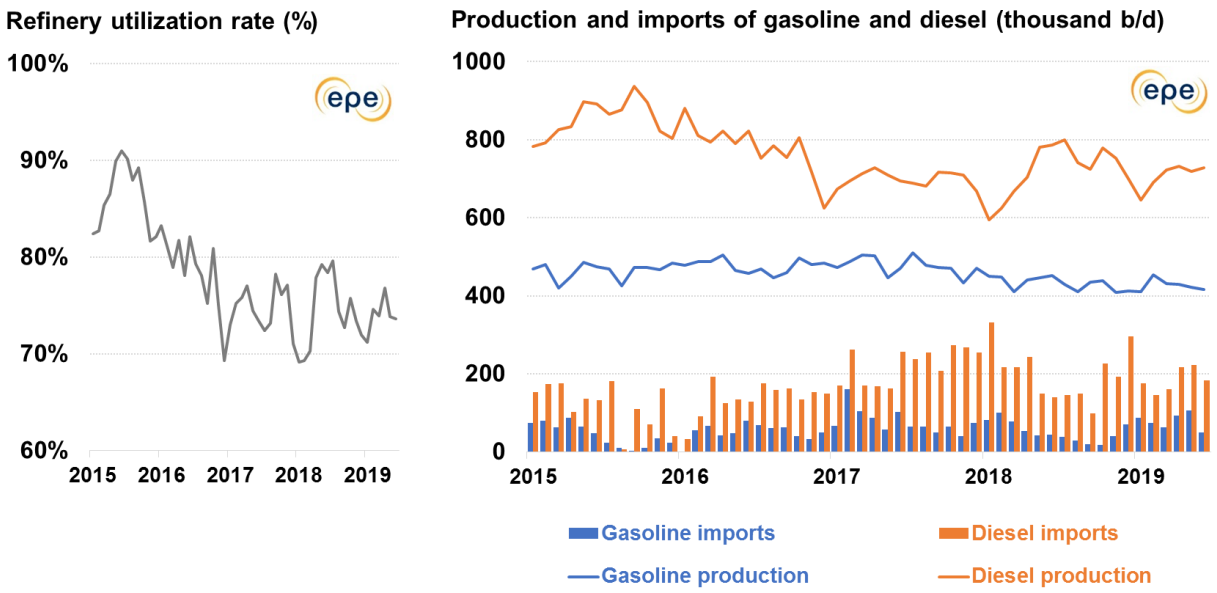

Figure 7 - Refinery utilization rate, and production and imports of gasoline and diesel in Brazil

Source: Data from ANP (2019d)

Between July 2018 and June 2019, refinery output has remained at the same average level as in 2017-2018, despite the partial shutdown of the Paulínia Refinery (REPLAN[17]) from August 2018 to January 2019. The outage was due to a fire that damaged an atmospheric distillation unit and a catalytic cracking unit (PETROBRAS, 2019a).

In accordance to its new guidelines, that reposition the company's portfolio to focus on higher-yielding assets, Petrobras has continued its downstream divestment program. From July 2018 to June 2019, the company concluded the sale of its 90% stake in natural gas pipeline operator TAG[18] to the group formed by Engie and the canadian fund Caisse de Dépôt et Placement du Québec (CDPQ) for US$ 8.6 billion, the sale of Pasadena refinery to Chevron in a US$ 467 million deal, and the sale of distribution assets in Paraguay to Copetrol Group for US$ 331 million. Petrobras also raised US$ 2.5 billion from the additional sale of its stake in fuel distribution unit BR Distribuidora, through a secondary public offering. The deal reduced Petrobras's stake in the unit to 37.5% (PETROBRAS, 2019a).

Since Petrobras started its divestments, asset sales were challenged in court. In June 2019, the Federal Supreme Court (STF) ruled that state-run companies do not need congressional approval to sell their subsidiaries. The decision allowed Petrobras to proceed with its divestment program, in accordance to its new guidelines.

[17] Replan is the largest refinery in Brazil with a refining capacity of 434,000 b/d.

[18] Transportadora Associada de Gás (TAG) operates a 4,500 km natural gas pipeline system that is predominantly located in Brazil's northeast region. It accounts for 47% of the country's gas pipeline infrastructure and 26% of total gas transportation capacity (PETROBRAS, 2019a).

In April 2019, Petrobras announced its intention to sell refining and associated logistics assets in Brazil. It includes seven refineries and one shale industrialization unit of the company's 13 refining units, with total refining capacity of 1.1 million b/d, as shown in Figure 8. This amount represents nearly half the country's refining capacity (PETROBRAS, 2019a).

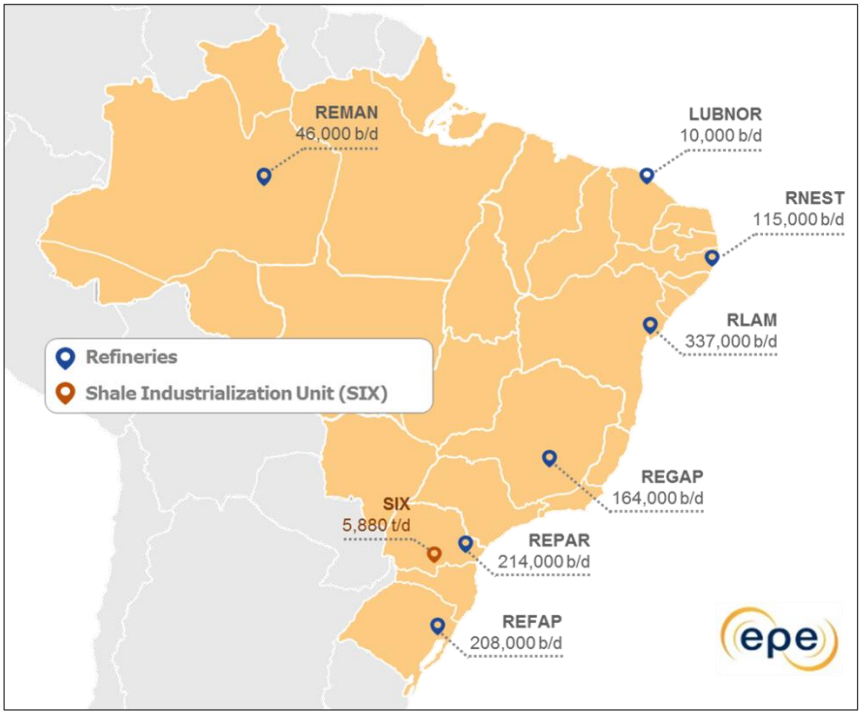

Figure 8 - Refining assets included in the Petrobras divestment program

Source: Data from Petrobras (2019a)

The first phase of the refining divestment program started in June 2019 and includes RNEST, RLAM, REPAR and REFAP refineries, as well as their corresponding logistics assets. Teasers of the second phase, comprising REGAP, REMAN and LUBNOR refineries and the SIX shale industrialization unit were also announced in September 2019 (PETROBRAS, 2019a).

In an agreement signed with antitrust regulator Cade, Petrobras committed to sell all of the refining assets disclosed by the end of 2021. The agreement establishes that some of the assets considered as potential competitors[19] cannot be acquired by the same buyer or economic group. In return, the agreement suspended the administrative investigation opened by CADE over the alleged abuse of Petrobras's dominant position in the refining segment (PETROBRAS, 2019a).

[19] Refining assets considered as potential competitors: (i) RLAM and RNEST refineries; (ii) REPAR and REFAP refineries; and (iii) REGAP and RLAM refineries (PETROBRAS, 2019a).

Petrobras's downstream divestment program is in line with the new guidelines set by the Federal Government. Aiming at increasing efficiency and stimulating competition in the fuels market, the Brazilian Ministry of Mines and Energy (MME) set out among its main goals in the first half of 2019: i) to attract investments in the refining and logistics segments; ii) to evaluate alternatives to the liquefied petroleum gas (LPG) pricing policy; and iii) to combat the adulteration and tax evasion in fuel markets (MME, 2019a). Therefore, the Federal Government created the program *Abastece Brasil*. Its aim is to promote competition, attract investments in downstream segments, end the LPG price differentiation policy, and combat fuel adulteration and tax evasion (MME, 2019b).

In the natural gas sector, the Federal Government launched the *Novo Mercado do Gás* program, aimed at lowering the domestic gas price, attracting greater investments and building a favorable environment for new investors to enter the natural gas industry. The program also aims to expand investment in gas-fired generation to make the power grid more reliable in the face of increased intermittent wind and solar generation (MME, 2019c). In addition, CNPE set guidelines for the sector, looking to open the country's natural gas market and reducing the dominant position of Petrobras[20] (CNPE, 2019).

Similarly to the fuels market, Petrobras signed an agreement with CADE to sell its remaining stakes in natural gas pipeline companies: 10% in Nova Transportadora do Sudeste (NTS), 10% in TAG, and 51% in Transportadora Brasileira Gasoduto Bolívia-Brasil (TBG) by the end of 2021. Furthermore, the company also committed to sell its stakes in gas distribution companies (PETROBRAS, 2019a).

Combined with the potential production in pre-salt areas and in Sergipe-Alagoas Basin, the new regulatory framework could boost the natural gas industry in Brazil. The Ministry of Mines and Energy expects to attract investments of US$ 8.5 billion (R$ 34 billion) in the gas infrastructure through 2032 (MME, 2019c).

Infrastructure is one of the greatest concerns policymakers and investors have about the Brazilian downstream segment. That is why recent auctions of infrastructure projects were so meaningful. In the first half of 2019, the Federal Government auctioned off 23 concessions, including port terminals, airports and a railway, raising US$ 2 billion (R$ 7.7 billion).

[20] Petrobras is responsible for 77% of Brazil's natural gas production, 100% of natural gas imports (from Bolivia by pipelines and from LNG terminals), and almost 100% of natural gas processing capacity. Besides, the state-run company has stakes in main pipeline operators, as well as in 20 of the 27 state distributors.

The auctions of fuel terminals included five brownfield areas in Belém port and one greenfield area in Vila do Conde port (in the northern state of Pará), three brownfield areas in Cabedelo port (in the northeastern state of Paraíba), and one greenfield area in Vitória port (in the southeastern state of Espírito Santo). The auction of 12 airports was divided by region in three blocks: Northeast (with airports in Recife, Maceió, João Pessoa, Aracaju, Juazeiro do Norte and Campina Grande), Midwest (with airports in Cuiabá, Sinop, Rondonópolis and Alta Floresta), and Southeast (with airports in Vitória and Macaé). In the rail sector, Brazilian logistics company Rumo won the 30-year concession to operate a 1,537 km of the southern section of the North-South Railway (FNS), connecting Porto Nacional (in Tocantins state) with Estrela D'Oeste (in São Paulo state) (MINFRA, 2019).

Apart from the government's concessions, Brazilian ethanol logistics company Logum recently announced its intention to build a 128 km long ethanol pipeline in the state of São Paulo. The Brazilian Development Bank (BNDES) and Logum signed a financing agreement worth US$ 460 million (R$ 1.8 billion) for deployment of the pipeline and storage infrastructure. After the completion of the investment, scheduled for 2021, the fuel-carrying capacity will be expanded to more than 8 billion liters of ethanol per year (BNDES, 2019). Furthermore, Logum is looking to expand its pipeline network into central Brazil to reach more ethanol plants.

Brazil is among the world's largest producers of biofuels. Domestic ethanol production hit a record-high last year, reaching 32.3 billion liters, up 17% year on year. An increase of domestic gasoline prices in 2018 (Figure 6) and a global oversupply of sugar pushed ethanol to gain competitiveness and market share in the country (EPE, 2019b).

Brazil's biodiesel production also reached record levels in 2018, rising to 5.4 billion liters, an increase of 27% compared to 2017. This growth was driven by the increase of the mandatory biodiesel blend from 8% to 10% in March 2018 (EPE, 2019b). The compulsory blending has reached 11% since September 2019, in accordance with the Federal Law 13,263/2016 (BRASIL, 2016). Additionally, the legal framework enables an increase of biodiesel in the blend up to reach 15 % in 2023 (CNPE, 2018).

Brazil's National Biofuel Policy (RenovaBio[21]), which goes into effect at the beginning of 2020, improved the outlook for biofuel production and should attract new investments in the sector. In June 2019, CNPE set a goal of reducing carbon emissions in the transportation sector by 11% until 2029 (CNPE, 2019).

[21] RenovaBio set emission reduction targets for the fuel sector. These targets will be established for each fuel distributor, taking into account their market share. In addition, the policy establishes the decarbonisation credit (CBIO), which combines the emission reduction targets and the life cycle assessment of each biofuel producer (EPE, 2019b).

Final Remarks

Brazil is increasingly consolidating itself as a major player in the oil industry. Over the past years, expectations have been high with respect to Brazil's oil production, especially due to the development of the prolific Pre-salt Region. However, total output has failed to live up to those expectations, with production increasing slightly.

Focused on capital-intensive pre-salt development projects, Brazil's main operators have reduced investments in its onshore and offshore mature fields. This helped the recovery rates to decline in those fields, especially in Campos Basin, which kept total crude oil production in check, even with the start-up of several FPSO units. In order to boost recovery rates, the Federal Government implemented a series of measures designed to incentivize incremental production in mature oil and gas fields. That situation can offer the opportunity to smaller companies in onshore and shallow water mature fields. This business model may help the recovery rates to revert part of decline in those fields.

Despite of the mature fields' declining, the 1st semester 2019 saw domestic crude oil production hitting a historical record-high in May. The approval of several final investment decisions also improved the prospects of the Brazilian oil industry. In addition, the definition of a multi-year bidding round calendar and Petrobras's divestment program enhanced the attractiveness of the Brazilian oil and gas industry and can increase the upstream opportunities in Brazil.

In the downstream segment, major changes are expected in the coming years, aiming to keep the supply guaranteed. Headed by the Ministry of Mines and Energy and including further Ministries, regulators, and other public institutions, the *Abastece Brasil* and the *Novo Mercado do Gás* programs aim to promote competition, to attract greater investments, and to build a favorable environment for new investors. The RenovaBio policy can drive Brazil's biofuel industry to greater efficiency and to new investments. Domestic growth forecasts demonstrate there will be demand and opportunities for both oil products and biofuels in the near future.

Brazil seeks to attract more investments over time in the whole oil and gas industry. In conjunction with high quality pre-salt reservoirs, technological capability, sizable market, and room for improvement in infrastructure, these changes should allow existing prospects for the country's oil and gas industry to materialize.

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