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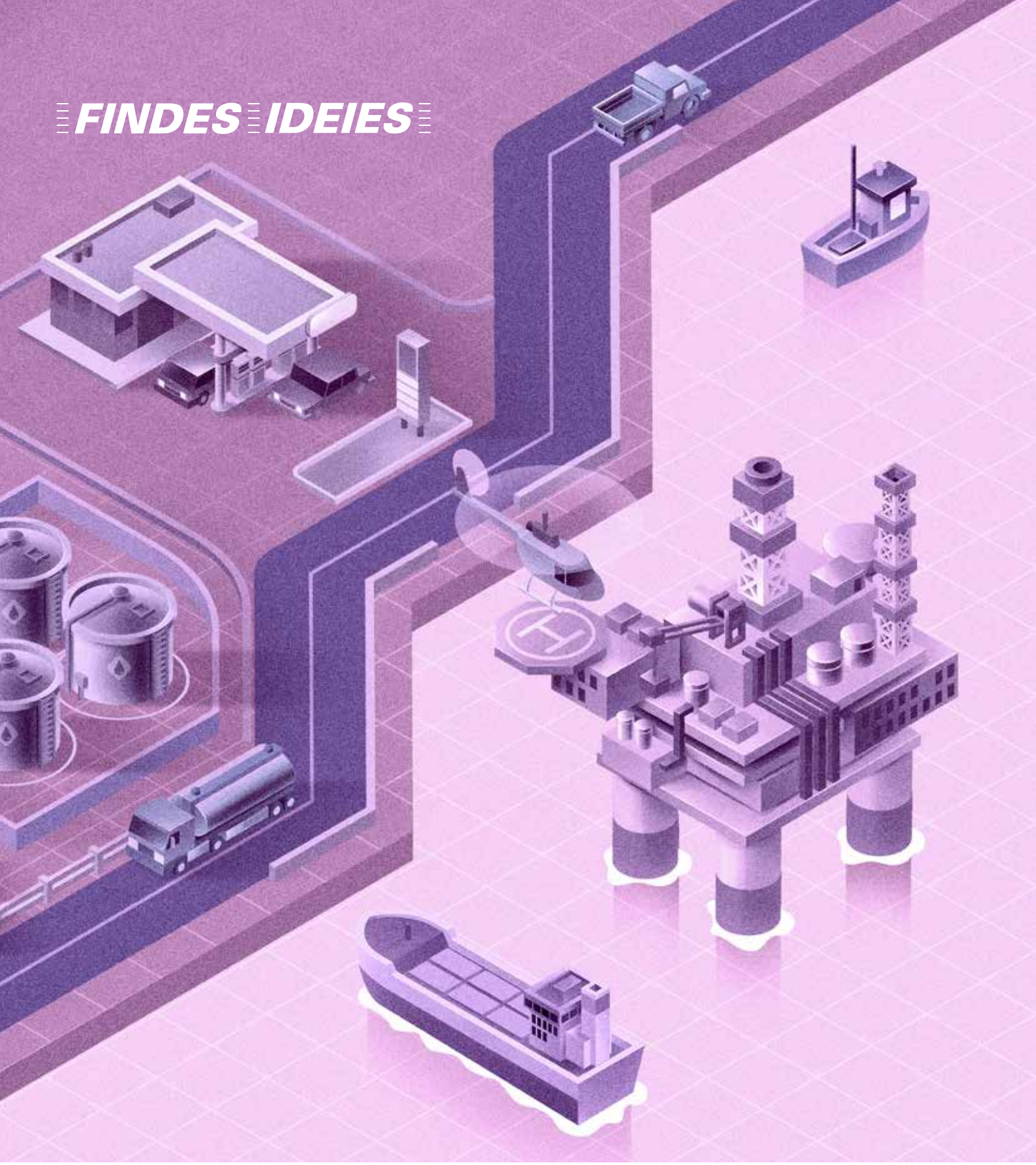

2019 ESPÍRITO SANTO OIL INDUSTRY YEARBOOK

Federation of Industries of the State of Espírito Santo – Findes
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FOREWORDS

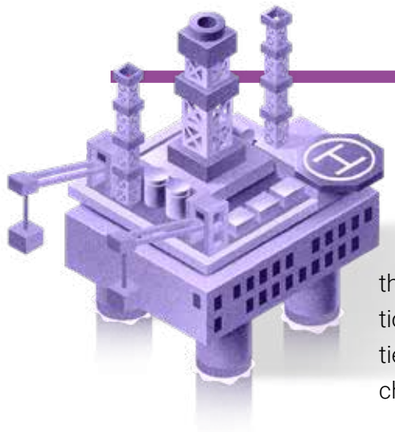
The state of Espírito Santo (ES) lives a unique moment, in a nutshell, the state has a window of opportunity to pave a new cycle of economic growth. To a great extent, the window appears as the state, for the past 15 years, has distinguished for a responsible and quality-oriented public management. Several indicators state the evolution and the improvement in the quality of life of the Espírito Santo resident. On the health front, for instance, ES has the country's lowest infant mortality rate and ranks second in life expectancy. On the human capital (education) aspect, ES has achieved the best performance in secondary school IDEB in 2017. Finally, the already recognized good fiscal management in which the state is the only one to reach the highest score (A) measured by the National Treasury.

Having this socioeconomic framework of the state in mind, it is worth highlighting the numerous opportunities in the private sector, more specifically in the Oil & Gas (O&G) extraction sector. In Espírito Santo, O&G extraction accounts for 34% of the industrial transformation value (ITV), which makes it the leading industrial sector. If in 2006 the state's oil production accounted for 4% of the national total, in 2018, this share increased to 13.0%, with 122.3 million barrels of oil. As regards the Pre-Salt oil exploration, if in 2010 the production was 22.6 thousand barrels per day, in 2018, it increased to 178.6 thousand barrels per day.

In addition, in the same year, Espírito Santo received, from royalties and special participations, approximately R$ 2.9 billion, with R$ 1.8 billion to the state government and the remainder to municipalities.

Given the above and the relevance of the oil chain for the industry, it is necessary to draw attention, briefly, to several changes to the sector's regulatory framework, as well as the strategic realignments by Petrobras that leverage the wealth creation opportunities in Espírito Santo.

In this context, the 3rd Espírito Santo Oil Industry Yearbook (2019) presents and deepens the analysis of



this industry with data and information and it highlights the opportunities open for the entire production chain of the sector.

The first chapter deals with the global oil industry, highlighting reserve levels, production, consumption, and refining capacity. Chapter 2 exposes the oil industry in Espírito Santo, presenting variables such as reserves and production, divided in onshore and offshore activity. The impacts of the oil activity, with emphasis on government participation, are addressed in Chapter 3. Chapter 4 describes the incentive mechanism towards the production of knowledge and new technologies for the sector, by way of a research, development, and innovation (RD&I) clause. Finally, Chapter 5 points out the new opportunities in oil exploration and production for Espírito Santo.

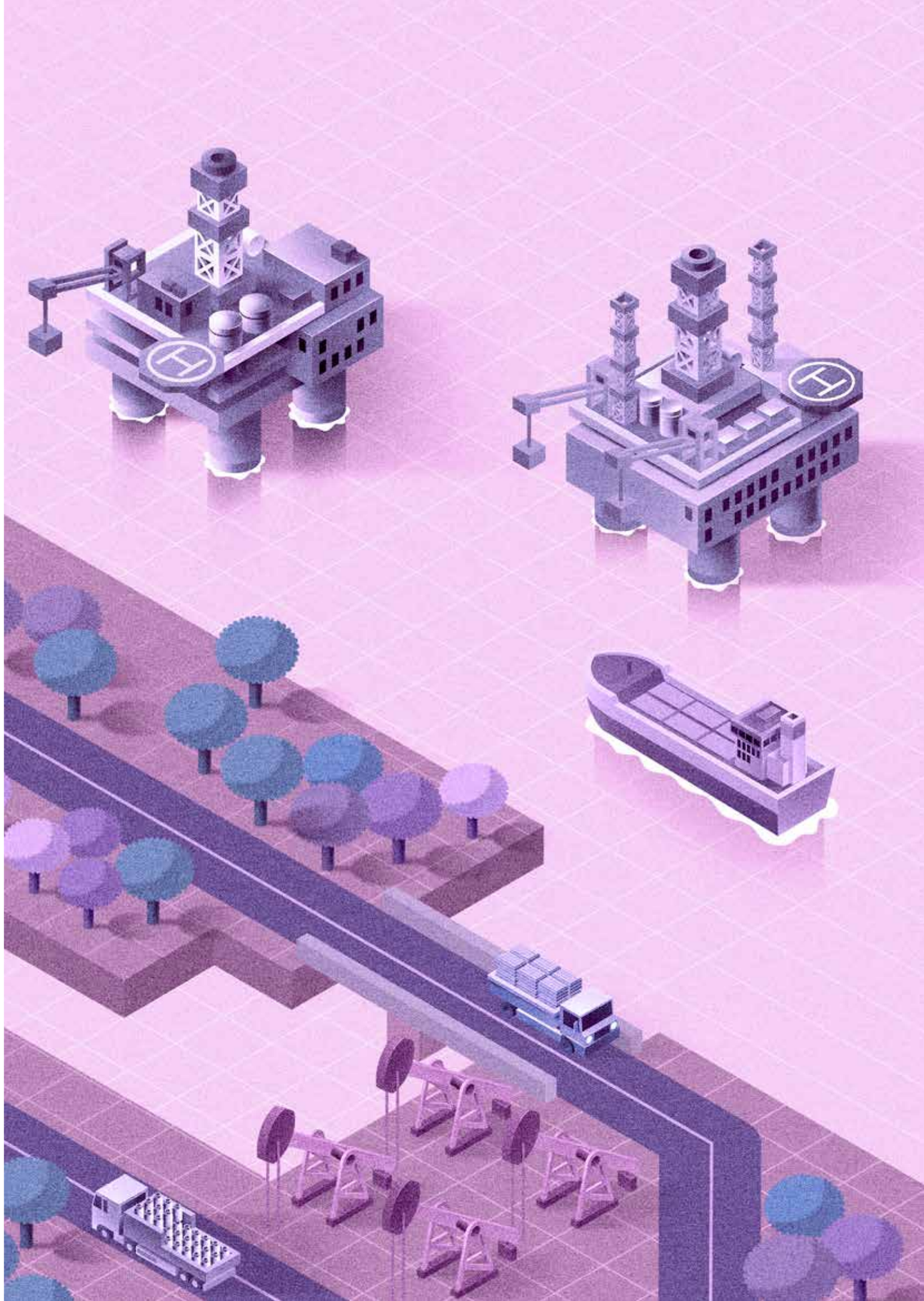
Considering the Federation of Industries of the State of Espírito Santo (Findes) participates actively of the governance model of the Espírito Santo Oil and Gas Forum and also proposes policies for the strategic development of the industry (Industry 2035), project led by the Educational and Industrial Development Institute of Espírito Santo (Ideies), an entity linked to Findes, **this document, upon providing an accurate diagnosis of the state's oil industry, provided the necessary subsidies to formulate a strategic plan for the sector. In this context, the Oil and Gas Strategic Route was built, along with key actors and stakeholders, with the intention of making Espírito Santo recognized globally in the Oil and Natural Gas sector.**

In short, the 3rd Espírito Santo Oil Industry Annual Report (2019) presents a relevant analysis of the main themes that guide the oil industry in the state. This is done from information disclosed by the National Agency for Petroleum, Natural Gas and Biofuels (ANP), by the Ministry of Economy (ME), by the BP Statistical Review of Word (BP) and by the Annual Energy Outlook (EIA). The complete document can be accessed on the Ideies page, at **www.portaldaindustria-es.com.br.**

Marcelo Barbosa Saintive

EXECTUTIVE DIRECTOR

SUMMARY



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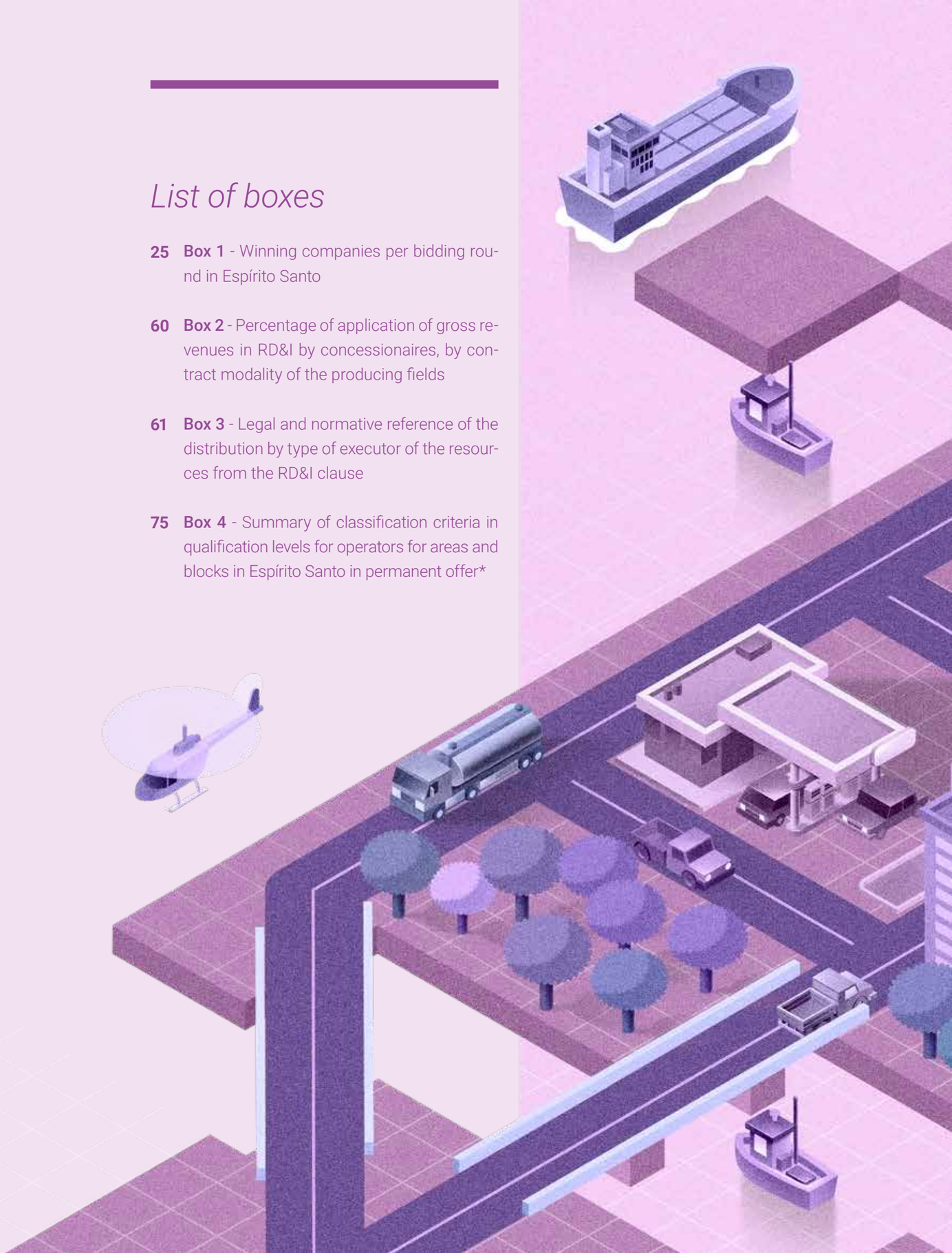


Chapter 1

INTERNATIONAL OVERVIEW

The viability of oil exploration and production projects depends on the sustained growth of the world economy. The growth of the economy demands raw materials and energy, supplied largely by oil. Other factors, such as the price of the resource and the relationship between supply and demand, also explains oil production increase and decrease. Recently, the debate about changing the global energy matrix also began to influence expectations for the production of the input.

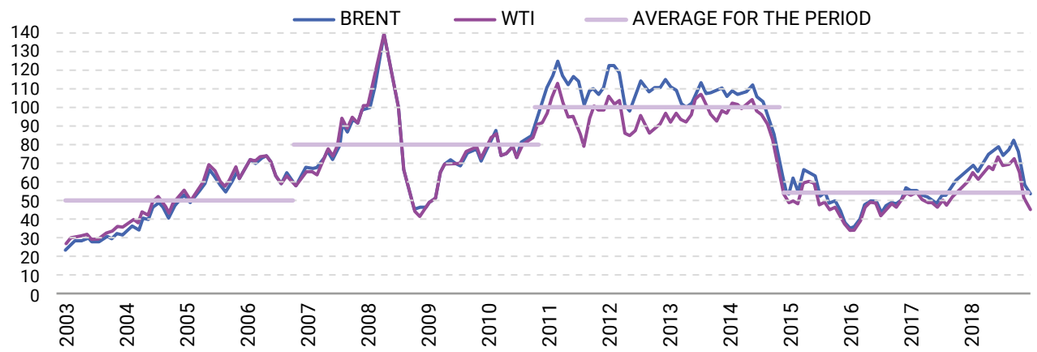
1.1 International prices

The price of a barrel of oil is determined according to the supply and demand among producing and consuming countries. The prices at levels below or above the long-term balance can increase or decrease the level of economic growth in different regions of the planet. For producing countries, a higher price for the resource can mean increased revenue from exports. In contrast, for consuming countries, it can mean production infeasibility given the high cost of the raw material and energy.

Between 2015 and 2018, the average price for a barrel of oil[1] was US$ 54.70, below the average of the previous two periods (chart 1). **After reaching its peak for the last four years, the price of oil decreased in the second half of 2018, justified mainly by the uncertainties regarding global demand and geopolitical issues.** In relation to expectations, the International Monetary Fund (IMF) hopes that for the next five years, the price of a barrel of oil will reach an annual average of US$ 57.20.

[1] International prices follow the reference from two markets. West Texas Intermediate (WTI) is the oil traded on the New York Stock Exchange and it refers to the product produced in the Gulf of Mexico. Brent, on the other hand, traded on the London Stock Exchange, refers to the production in the North Sea and the Middle East. The main difference between the two prices refers to the sulfur content present. WTI is the price of the lighter oil, whereas Brent is heavier for concentrating a greater content of sulfur.

Chart 1 - Price of a barrel of oil (US$ per barrel)



Source: Investing.com. Elaboration: Ideies/Findes

In general, the influence of a greater oil supply in the world scenario, arising from the exploration and production of unconventional oil[2] in the United States, changed the price of the input. **In 2008, 23.4% of the world supply was directed to cover the American demand and in 2019 this comparison fell to 13.7%.** Besides reducing the demand for the hydrocarbon, the country began to export the surplus from the production of unconventional oil.

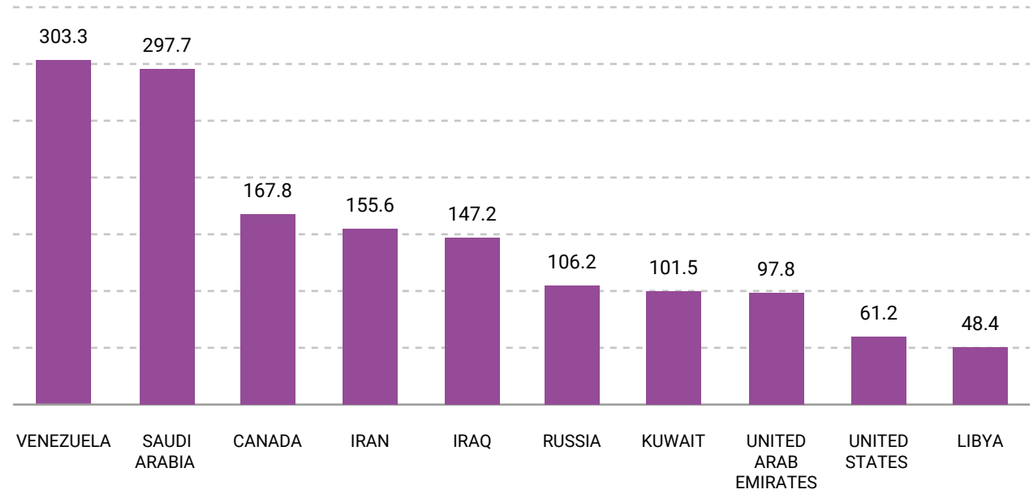
American exports climbed from US$ 1.8 billion in 2009 to US$48.3 billion in 2018, mainly to Canada, South Korea, and China. This increased input supply has contributed to the average drop in price. Furthermore, political issues brought about major fluctuations in the oil price in 2018, as economic sanctions to producing countries and restrictions on the production of the input imposed by countries that make up the Organization of the Petroleum Exporting Countries (OPEC)[3].

1.2 Global supply and demand

In 2018, world reserves were 1.7 trillion barrels of oil. There was an increase of 2 billion barrels, compared with the previous year. The division among the regions in the world was: Middle East (48.3%), South and Central America (18.8%), North America (13.7%), Commonwealth of Independent States[4] (8.4%), Africa (7.2%), Asia (7.2%), and Europe (0.8%).

Venezuela and Saudi Arabia are the two countries with the largest resource allocation, both with 303.3 and 297.7 billion barrels of oil, respectively (chart 2). Brazil is the 15th country with the largest reserve in the world, with 13.4 billion barrels of oil.

Chart 2 - Proven reserves of oil per producing country (billions of barrels) - 2018



Source: BP Statistical Review of World Energy. Elaboration: Ideies / Findes

In 2018, world oil production was 94.7 million barrels per day. There was an increase of 2.2 million barrels compared with the previous year. The division among the regions in the world was: Middle East (33.5%), North America (23.8%), Commonwealth of Independent States (15.3%), Africa (8.6%), Asia (8.1%), South and Central America (6.9%), and Europe (3.9%).

The main producing countries were the United States and Saudi Arabia with 16.2% and 13.0%, respectively (chart 3). As seen, the United States increased its production of unconventional oil, which has ensured a greater supply of the North American input consumption and an increase in world oil supply.

OPEC production fell by 0.8% in 2018, reaching the production of 39.3 million oil barrels. In contrast, the production by non-OPEC countries increased 4.8%, reaching the production of 55.4 million barrels of oil. The increased production was derived mainly from the United States, Canada, and Russia.

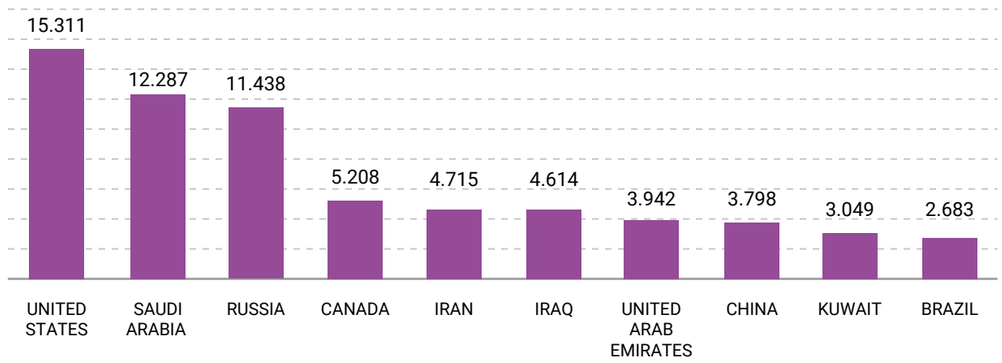
In 2018, world oil consumption amounted to 99.9 million barrels of oil per day. There was an increase of 1.4 billion barrels, compared with the previous year. The division among the regions in the world was: Asia (35.9%), North America (24.8%), Europe (15.3%), Middle East (9.2%), South and Central America (6.8%), Commonwealth of Independent States (4.1%), and Africa (4.0%).

[2] The production of unconventional oil consists in the implementation of technologies that allow the exploitation of hydrocarbon reserves of difficult access and that need to go through a specific chemical process to be used as an oil substitute. The example of this production is shale gas in the United States.

[3] Member countries: Saudi Arabia, Iran, Iraq, Kuwait, Venezuela, Angola, Algeria, Libya, Nigeria, Ecuador, the United Arab Emirates, and Qatar.

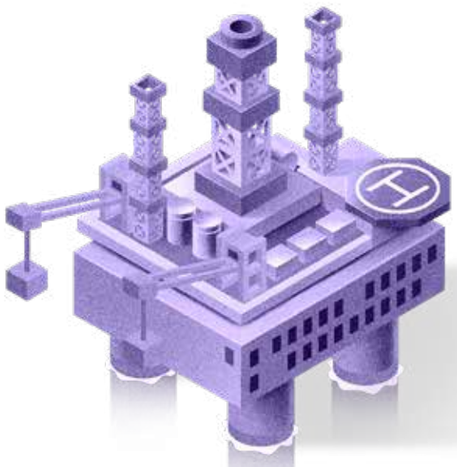
[4] Member countries: Armenia, Azerbaijan, Belarus, Kazakhstan,, Moldova, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

Chart 3 - Oil production per producing country (thousand barrels/day) - 2018



Source: BP Statistical Review of World Energy. Elaboration: Ideies / Findes

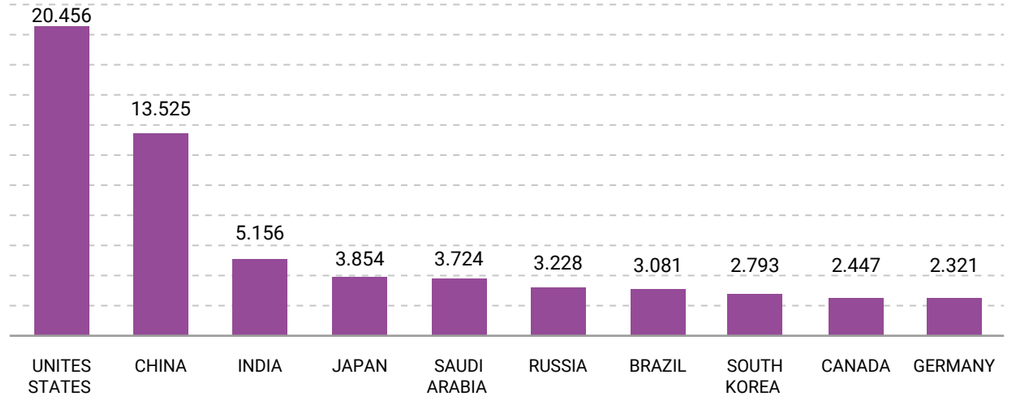
The main consuming countries were the United States (20.5%), China (13.5%), and India (5.2%), (chart 4). Consumption of countries belonging to OECD (Organization for Economic Cooperation and Development) was 47.5 million barrels of oil, lower than registered by non-OECD countries, of 52.4 million barrels. **Since 2011, countries belonging to OECD have consumed less oil than non--OECD countries.**



The global installed refining capacity was 100 million barrels per day, in 2018. There was an increase of 1.4 billion barrels per day, compared with the previous year. The division among the regions in the world was: Asia (34.7%), North America (22.3%), Europe (15.7%), Middle East (9.7%), Commonwealth of Independent States (8.2%), South and Central America (6.0%), and Africa (3.4%). The main countries with installed refining capacity were the United States (18.8%), China (15.6%), and Russia (6.6%).

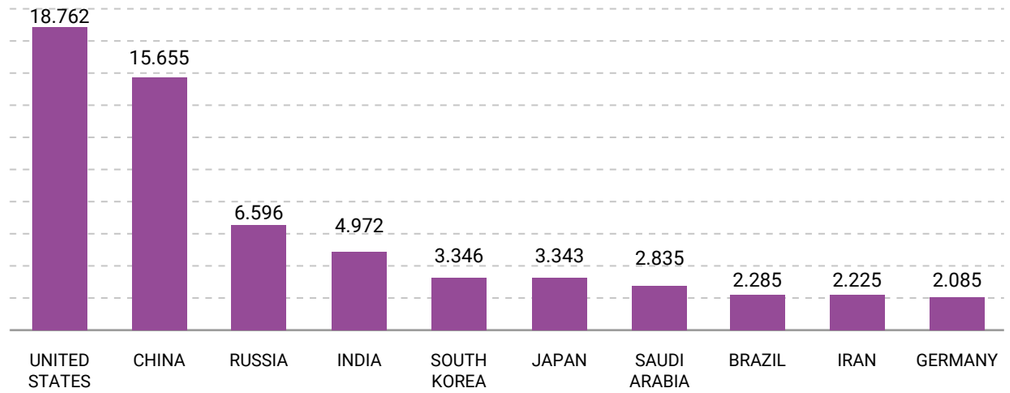
Oil refining was 83.0 million barrels per day. There was an increase of 1.0 million barrels of refined oil. The division among the regions in the world was: Asia (35.9%), North America (23.2%), Europe (15.4%), Middle East (10.2%), Commonwealth of Independent States (8.3%), South and Central America (4.6%), and Africa (2.5%). The main countries that refine oil the most were the United States (20.4%), China (15.0%), and Russia (7.0%).

Chart 4 - Oil consumption per country (thousand barrels/day) - 2018



Source: BP Statistical Review of World Energy. Elaboration: Ideies/Findes.

Chart 5 - Oil refining per country (thousand barrels/day) - 2018



Source: BP Statistical Review of World Energy. Elaboration: Ideies/Findes.

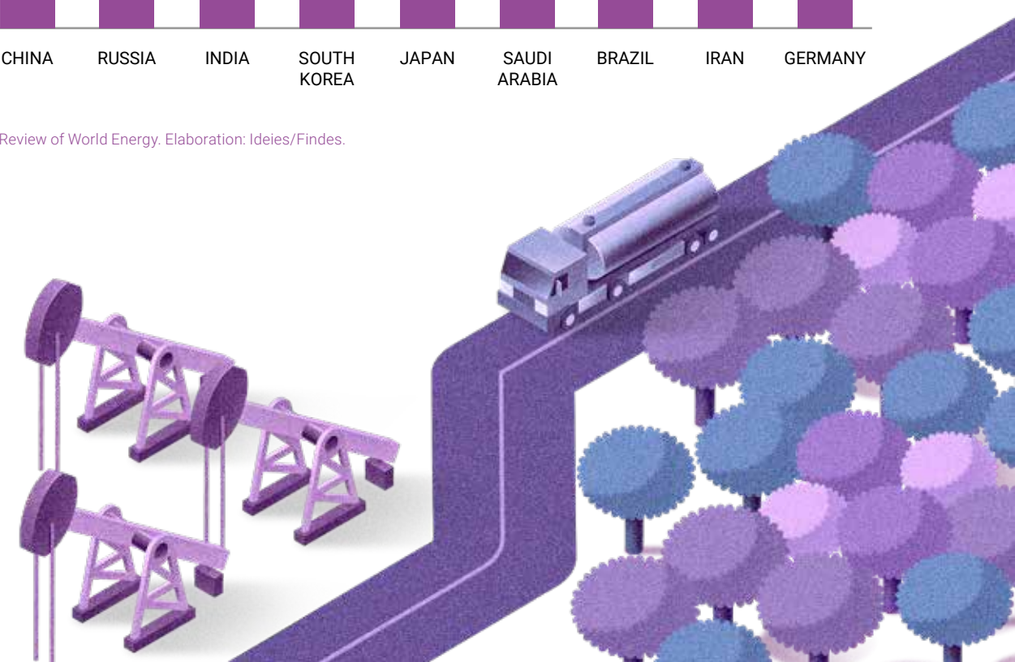
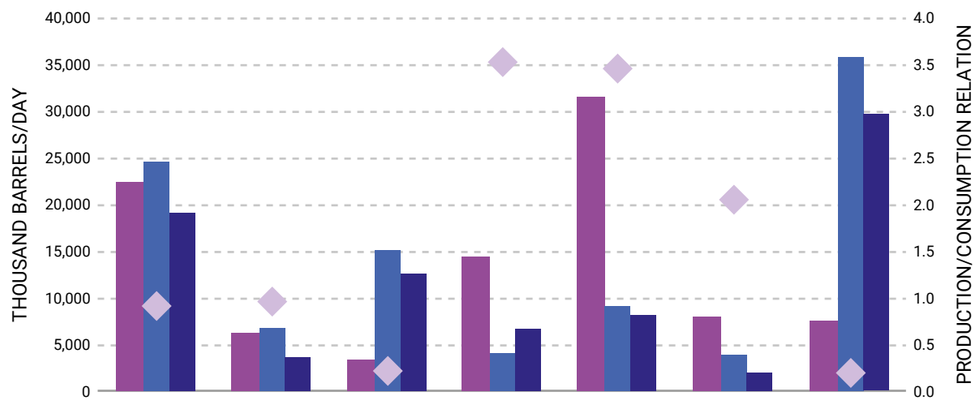


Chart 6 summarizes the worldwide distribution of oil production, consumption, and refining in 2018. **In summary, production is concentrated in the Middle East and the United States. Refining and consumption centered in Asia and North America.**

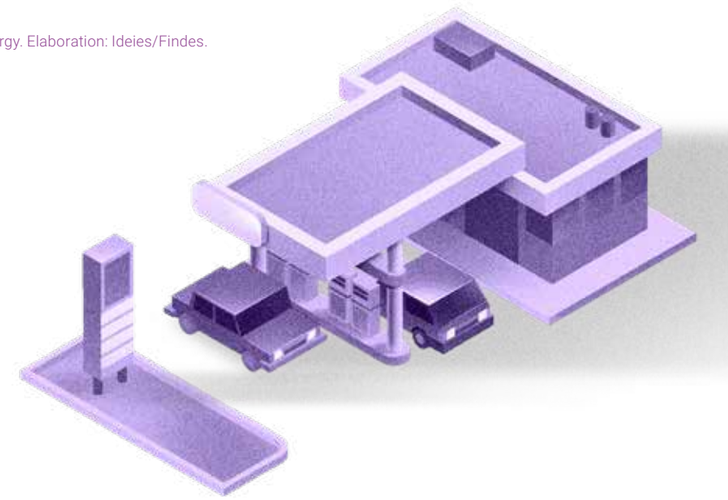
The ration between production and consumption shows how a region produces in relation to its consumption. When the indicator is greater than 1, it means that the region produces more oil than it consumes. Conversely, when the indicator is lower than 1, it means that the region produces less oil than it consumes. The Middle East (3.5 points) and the Commonwealth of Independent States (3.5) are the regions with the highest production and consumption relation, whereas Europe (0.2) and Asia (0.2) are the regions with the lowest relation.

Chart 6 - Oil production, consumption, and refining among world regions - 2018



	NORTH AMERICA	SOUTH AND CENTRAL AMERICA	EUROPE	COMMONWEALTH OF INDEPENDENT STATES (CIS)	MIDDLE EAST	AFRICA	ASIA
PRODUCTION	22,587	6,537	3,523	14,483	31,762	8,193	7,633
CONSUMPTION	24,714	6,795	15,276	4,099	9,136	3,959	35,863
REFINEMENT	19,227	3,813	12,786	6,905	8,431	2,039	29,751
PRODUCTION/CONSUMPTION	0.9	1.0	0.2	3.5	3.5	2.1	0.2

Source: BP Statistical Review of World Energy. Elaboration: Ideies/Findes.



Global energy matrix change

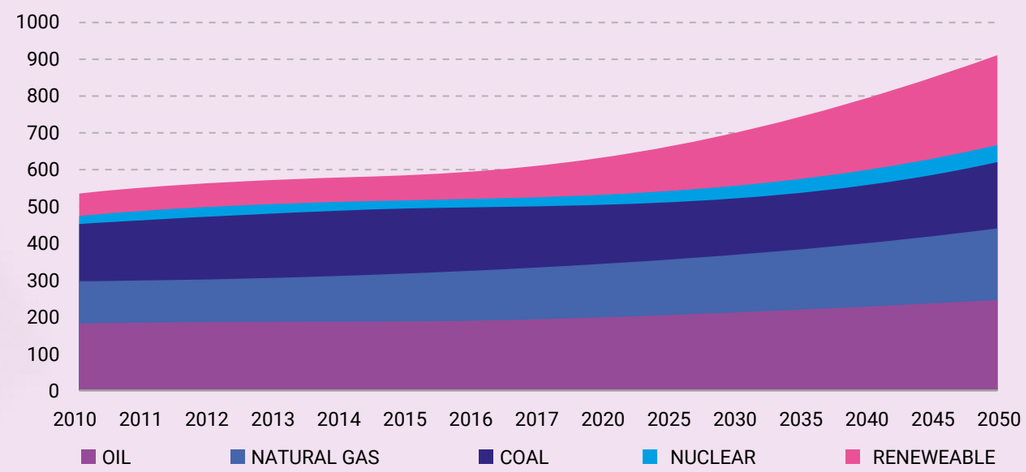
The US Energy Information Administration (EIA), North American energy agency, anticipates that energy consumption will grow by 1.2% in annual average between 2020 and 2050. **The demand for energy will be 910 quadrillion BTUs (British Thermal Unit), in 2050, with greater consumption by the industry and the transport sector.** Energy consumption will be leveraged by developing economies, especially China and India. The demand from OECD countries will grow at an annual average of 0.5%, between 2020 and 2050. In the same period, energy consumption by non-OECD countries will grow at an average rate of 1.6%.

Despite the projected increase in energy consumption, the distribution between generating sources will change. The projection is for oil to change from the current 32.0% of energy force (203.3 quadrillions BTUs) to 26.6% (242.5 quadrillions BTUs) in 2050. However, oil will continue with slightly over ¼ of the global energy matrix share.

Coal, responsible for 22.1% of energy generation in 2020 (157 quadrillions BTUs) will not extend its share as in recent years. Projection is that in 2050, the use of coal for energy will be responsible for 19.7% (179 quadrillions BTUs).

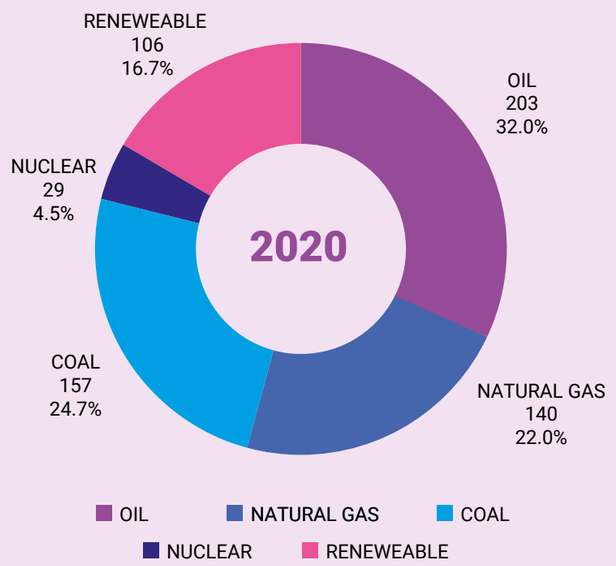
Renewable energy sources will gain greater notoriety, passing from the current 21.7% (153 quadrillions BTUs) to 27.7% (252 quadrillions BTUs) in 2050. The estimate is that variations in global energy consumption will be met, in their majority, by renewable sources. The reasons for the transition originate from economic and political changes that favor the drop in the cost of renewable energy generation. Charts 7 and 8 show that evolution.

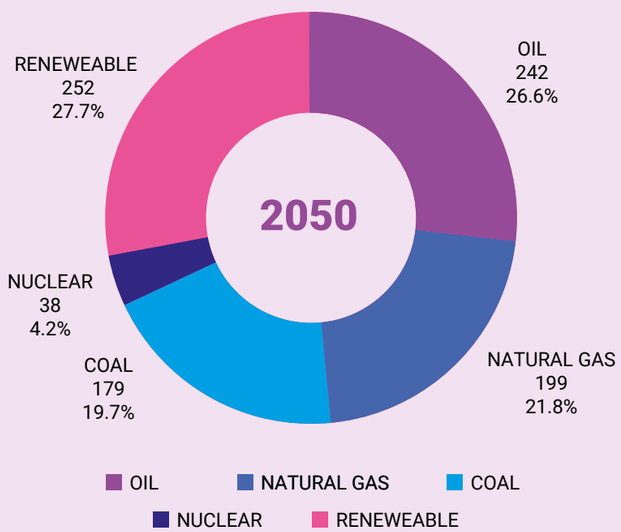
Chart 7 - Estimate of global energy consumption by source (quadrillion BTUs)



Source: Annual Energy Outlook 2019 – EIA. Elaboration: Ideies/Findes.

Chart 8 - Estimate of global energy production by source (quadrillion BTUs) and by share (%)





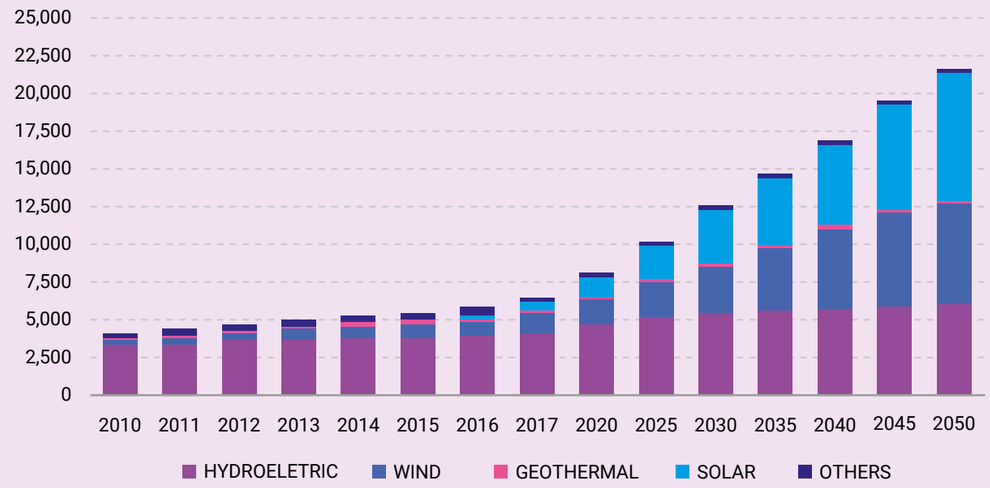
Source: Annual Energy Outlook 2019 – EIA. Elaboration: Ideies/Findes

Solar energy is the renewable source with greater growth potential, according to EIA. Between 2020 and 2050, the average annual growth will be 6.4%, reaching 8.3 trillion kWh in 2050. The greatest potential will come from India which will increase its generation in 12.2% in the period's annual average, reaching 16.1% of the global solar energy production in 2050. The estimate for Brazil is an average annual growth of 8.7%, reaching 25.8 billion kWh in 2050.

Wind energy will be the second renewable source of greater prominence in the coming years. Currently, this source produces 1.7 trillion kWh. The estimate is for an average annual rate of 4.6%, reaching a generation of 6.7 trillion kWh in 2050. China will continue to be the leading wind energy generator, reaching a share of 33.8% in 2050. However, the projection is for India to surpass the North American generation, becoming the world's second largest wind energy generator, with a 21.1% global share in 2050.

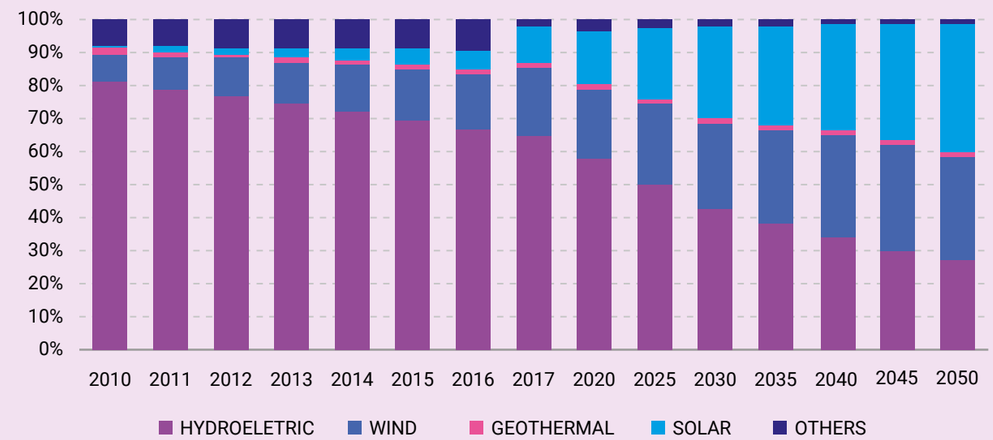
With less prominence, hydroelectric power generation will grow at an average annual rate of 0.8% between 2020 and 2050, reaching 6.0 trillion kWh. Despite the maintenance of this power generation, its share in the total produced from renewable energies will decrease (chart 10).

Chart 9 - Estimate of global energy generation by renewable source (billion kWh)

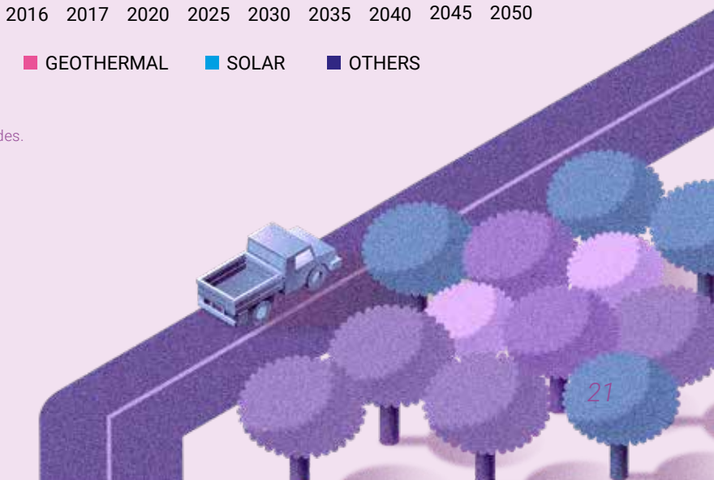


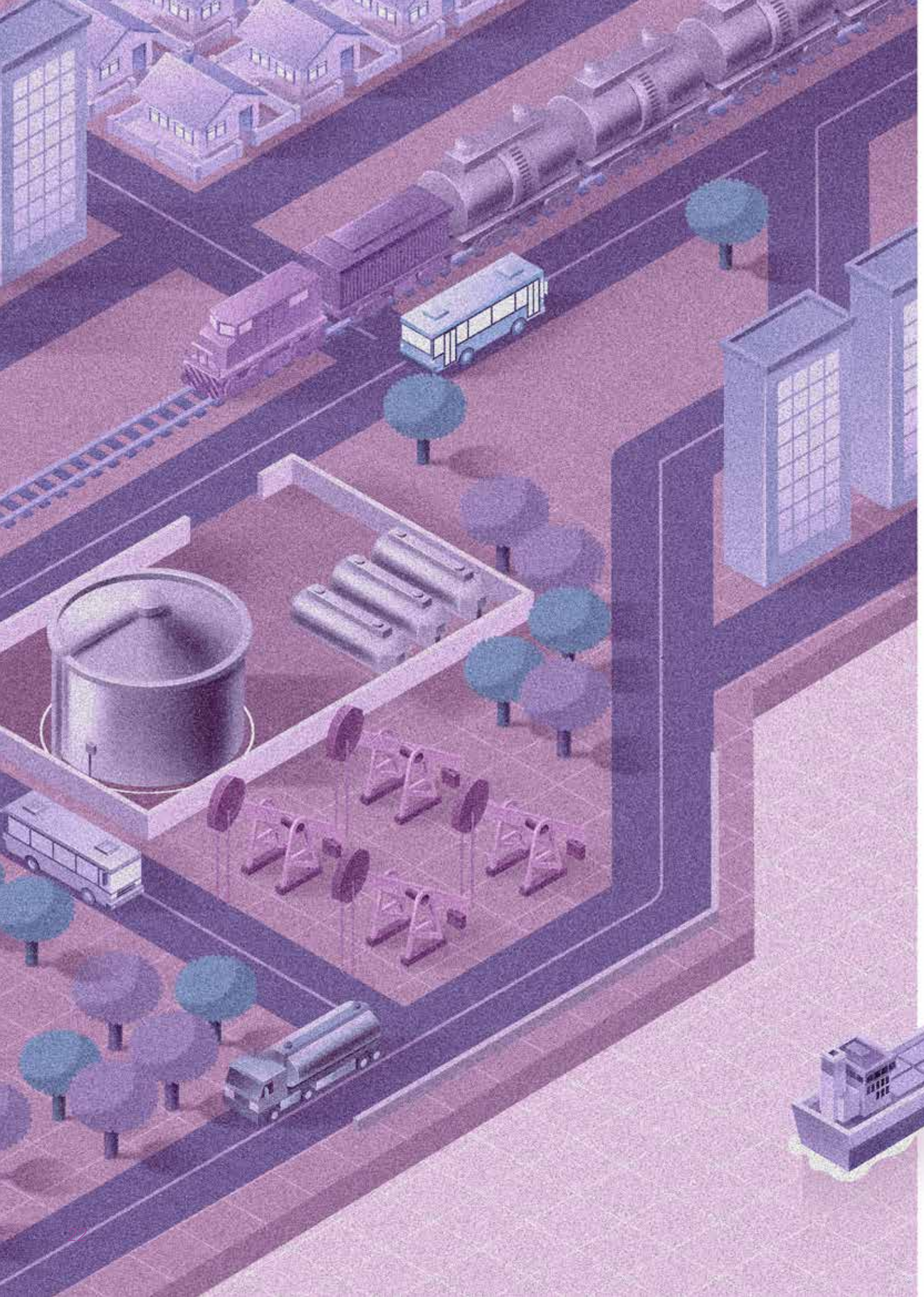
Source: Annual Energy Outlook 2019 – EIA. Elaboration: Ideies/Findes.

Chart 10 - Estimate of global energy consumption among renewable sources (%)



Source: Annual Energy Outlook 2019 – EIA. Elaboration: Ideies/Findes.





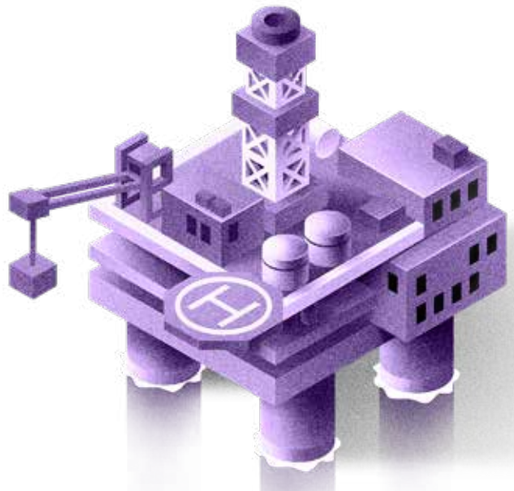
Chapter 2

OIL EXPLORATION AND PRODUCTION IN ESPÍRITO SANTO

The beginning of oil exploration and production activities passes through important phases that precede the production process. The Federal Governmente of Brazil holds the monopoly on the research and prospection of deposits of oil and natural gas and other fluid hydrocarbons, granting exploration and production rights to third parties through bidding rounds, coordinated by the National Agency for Petroleum, Natural Gas and Biofuels (ANP).

ANP determines the geological data to establish which blocks should be offered in bidding processes. After the completion of the bidding process and the signing of contracts, the operating company starts the exploration phase of the area and if hydrocarbons are found, it has to inform ANP[5]. In case oil production is economically viable, the company must issue the declaration of commerciality[6], compatible with the area's development plan for the production.

ANP rounds conducted so far have led to the following oil exploration and production structure in the State of Espírito Santo: 68 fields in the production phase in two sedimentary basins, with 52 onshore and 7 offshore fields in the Espírito Santo basin and 9 offshore fields in the boundary with the Campos basin. In addition to these fields, 21 blocks in the offshore portion and 12 in the onshore portion are in the exploration phase. Furthermore, 10 oil companies operate in the state with fields in the production phase, with 4 foreign companies (Shell, ONGC, QPI, and Central Resources) and 6 domestic companies (Petrosynergy, OPEnergia, Vipetro, IPI, Imetame, and Petrobras). Petrobras holds the concession of the fields with greater productivity in the State[7].



[5] By the declaration of hydrocarbons, analyzed in topic 2.2.

[6] This will be analyzed in topic 2.2.

[7] According to production data from ANP.

2.1 History of the rounds in the State of Espírito Santo

Since 1999, 16 rounds of exploratory blocks and 4 of mature blocks were conducted under the concession scheme, and 5 of the pre-salt, under the shared production scheme.

For Espírito Santo, the 1st Round of Block Bidding was extremely successful, mainly in the Campos basin, since 100% of the blocks were acquired. In the same round, the Espírito Santo basin received only off-shore offers and 50% of the blocks were acquired.

Table 1 - Percentage of blocks offered and acquired in Espírito Santo (unit and %)

Round	Blocks Offered per Basin				Blocks Acquired					
	Year	Campos	ES	Total	Campos	Campos Share (%)	ES	ES Share (%)	Total	Total Share (%)
Round 1	1999	3	4	7	(%)	100	2	50	5	71
Round 3	2001	2	9	11	1	50	7	78	8	73
Round 4	2002	2	7	9	2	100	3	43	5	56
Round 5	2003	12	57	69	6	50	4	7	10	14
Round 6	2004	6	69	75	4	67	19	28	23	31
Round 7	2005	8	60	68	0	-	23	38	23	34
Round 9	2007	0	16	16	0	-	14	88	14	88
Round 11	2013	0	12	12	0	-	12	100	12	100
Round 13	2015	0	7	7	0	-	0	-	0	-
Round 14	2017	5	26	31	3	60	10	38	13	42

Source: ANP Elaboration: Ideies / Findes

From the 10 bidding rounds in which Espírito Santo participated, the Campos basin received offers in 7 rounds and only in the 7th round none of the 8 blocks offered was acquired. In the other six, the utilization was at least 50%.

The Espírito Santo basin showed utilization of 88% and 100% in rounds 9 and 11, respectively. However, in rounds 5, 6, 7 and 14, block participation was below 50%.

Five times more blocks were offered in the Espírito Santo basin in comparison with the Campos basin. However, the average attractiveness of the Campos Basin is 62% and that of the Espírito Santo basin is 37%.

In the 14th Bidding Round, last one offering areas in Espírito Santo, ten blocks located in the Espírito Santo Basin were acquired by local companies, namely Bertek, Imetame, and Vipetro, and by three international companies: Brazil ExxonMobil, CNOOC Petroleum (China) and Repsol Exploración (Spain).

On that occasion, the State had 31 blocks (26 in the Espírito Santo basin and 5 in the Campos basin), being 19 on-shore and 12 offshore in the auction. In this round, in the off-shore part of the Espírito Santo basin, two of the four blocks auctioned were acquired and eight onshore blocks. And the Campos basin had three blocks acquired.[8]

In the 15th (2017) and 16th (2018) rounds, the last rounds conducted by ANP, there were no offers made on blocks in Espírito Santo.

Box 1 - Winning companies per bidding round in Espírito Santo

Round	National	International
1	Petrobras	YPF, Agip and Texaco
3	Petrobras	Esso, Unocal, Enterprise, Phillips, ElPaso, Wintershall and Kerr-McGee
4	Petrobras	BHP Billiton Limited, Shell Brasil Ltda, Partex Oil na Gas Corporation and NewField Exploration Company
5	Petrobras	-
6	Petrobras	Shell, EnCana, Kerr-McGee Corp, Synergy, Devon, SK Corporation and Repsol Sinopec
7	Petrobras, Silver Marlin and **Vitória Ambiental**	Hess, Repsol YPF, Petrogal, Shell, Central Resources and Synergy and StatoilHydro
9	OGX, Petrobras, **Vitória Ambiental** and Petro Rio	Perenco, Ongc, Canacol and SHB
11	Petrobras, Queiroz Galvão and Cowan Petróleo and Gás	Statoil Brasil O&G, Total E&P of Brasil
14	Petrobras, **Bertek Ltda, Imetame** and **Vipetro**	ExxonMobilBrasil, CNOOCPetroleum and RepsolExploración

Note: Emphasis for Espírito Santo companies.

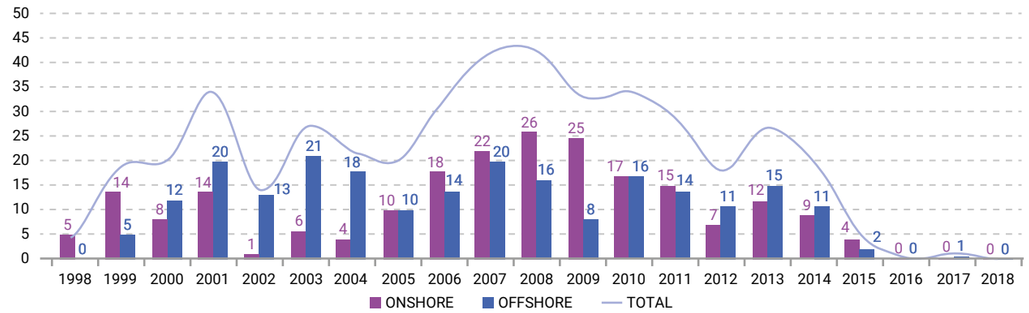
Source: ANP Elaboration: Ideies / Findes

[8] In this round, ten off-shore blocks in the Campos Basin were offered, from which five were located in the coast of the state of Rio de Janeiro, four in the coast of Espírito Santo, and one partially located in each state.

2.2 Declarations of hydrocarbon traces and marketability

The declarations of hydrocarbon traces in Espírito Santo slowed down over time. Between 2006 and 2009, an average of 37 annual declarations were issued, dropping to 22 declarations between 2010-2015. In 2016, there was no declaration, in 2017, there was only one offshore[9] declaration registered and, in 2018, there was no record of hydrocarbon discoveries.

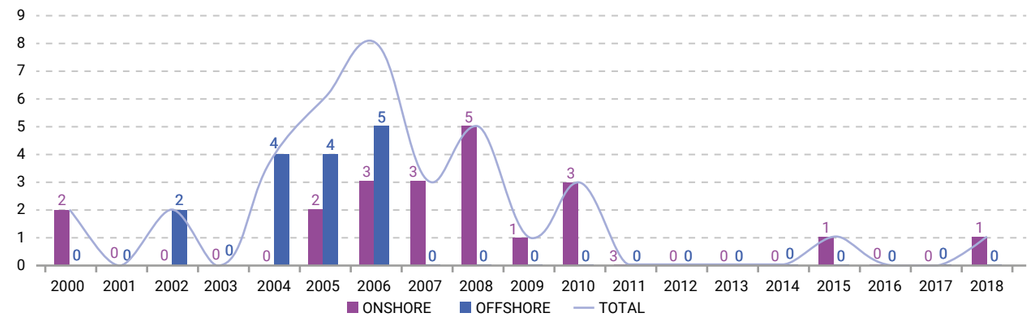
Chart 11 - Declarations of hydrocarbon traces in Espírito Santo (units)



Source: ANP Elaboration: Ideies/Findes

After the notification of hydrocarbon traces, it is verified whether there is commercial viability for the production of deposits. If affirmative, the operating company must issue the declaration of commerciality with ANP. **In Espírito Santo, the declarations of commerciality decreased at the intervals of analysis: from 2006 to 2009 were issued, on average, 3 declarations per year, and in the subsequent period (2010-2013), this average dropped to 1, being reduced to virtually zero in the period between 2014 and 2018.** In this last year, there was a single onshore record in the Cancã Leste field in the Espírito Santo basin.

Chart 12 - Declarations of commerciality in Espírito Santo (units)



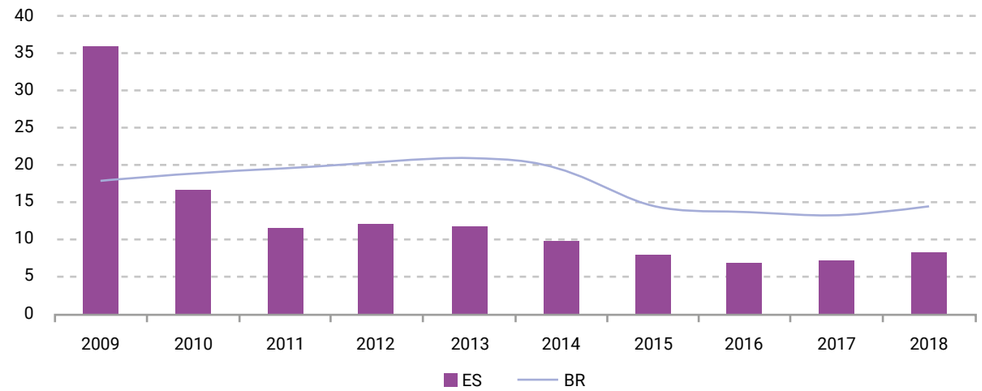
Source: ANP Elaboration: Ideies/Findes

In addition to the low issuance of declarations of hydrocarbon and commerciality, the reduction in the exploratory effort in the state can also be measured by way of the ratio between the reserves and the production of oil & natural gas (R/P)[10]. This ratio establishes the time (in years) that production will be sustained, given the volume of reserves. The higher the index, the greater the time available for oil production.

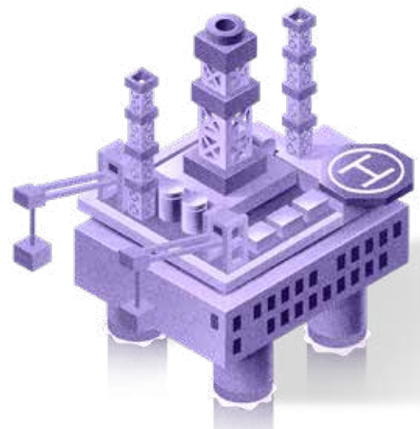
In 2009, the year of the discovery of the pre-salt reserves, production guarantee reached 36 years for Espírito Santo. As for the following period, this ratio decreased by 52.9%, reaching 8 years in 2018 (chart 13). For Brazil, this ratio corresponded to 14 years, in 2018. These results are explained, in part, by the non-performance of ANP rounds between 2008 and 2013[11].

The maintenance of the oil production capacity depends on investments into geological researches in exploration and development to assess new oil reserves.

Chart 13 - Reserves-production ratio (R/P) of Brazil and Espírito Santo (in years)



Source: ANP Elaboration: Ideies/Findes



[9] At Golfinho field in the Campos Basin.

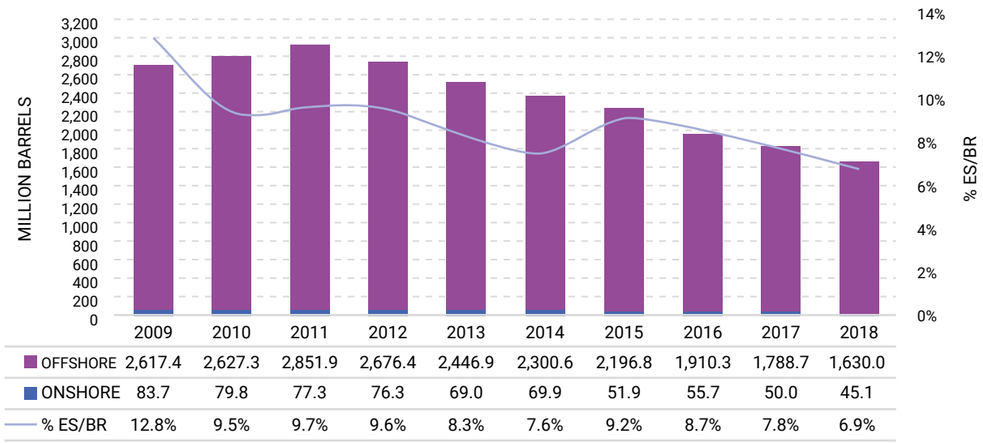
[10] The Indicator (Reserves/Production) is used by the Ministry of Mines and Energy to monitor the effectiveness of the implementation of the policy from Resolution CNPE No. 17, of 6/08/2017.

[11] This fact has been flagged since the first edition of the annual report.

2.3 Oil Reserves

In 2018, oil reserves in Espírito Santo reached 1.7 billion barrels of oil, 8.9% less than registered in 2017 (chart 14). In contrast, national reserves increased by 3.1% in the same period, reaching 24.3 billion barrels of oil. Despite the drop, **the State is the second largest holder of reserves among federative units (6.9% of national reserves),** second only to Rio de Janeiro (83% of national reserves), chart 15.

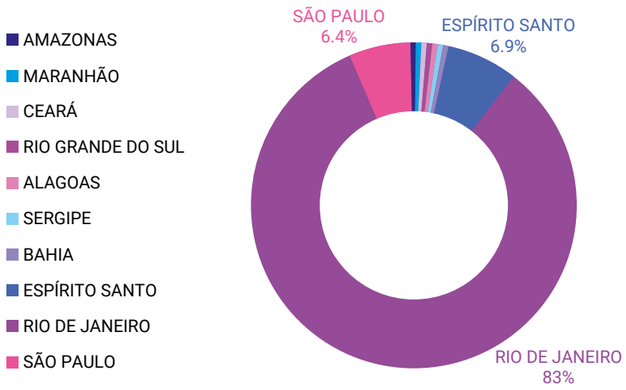
Chart 14 - Total oil reserves in Espírito Santo (million barrels) and share (%)



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
OFFSHORE	2,617.4	2,627.3	2,851.9	2,676.4	2,446.9	2,300.6	2,196.8	1,910.3	1,788.7	1,630.0
ONSHORE	83.7	79.8	77.3	76.3	69.0	69.9	51.9	55.7	50.0	45.1
% ES/BR	12.8%	9.5%	9.7%	9.6%	8.3%	7.6%	9.2%	8.7%	7.8%	6.9%

Source: ANP Elaboration: Ideies/Findes

Chart 15 - Distribution of total oil reserves by Federative Unit (%) - 2018



Source: ANP Elaboration: Ideies/Findes

Note: Reserves in 12/31

The last registered oil reserve increase in Espírito Santo was in 2011, when the State registered 2.9 billion barrels of oil, 74.9% higher than the current level of reserves. **This result is explained by the drop in well drilling activities and also by the increased attractiveness by part of oil companies towards the pre-salt areas of the Campos and Santos basins.** Between 2011 and 2017, the average annual decline of drilling activities in Espírito Santo was 39.4%.

In regard to the onshore and offshore division, the offshore oil reserves represent 97.3% of the state's total and the onshore reserves represent 2.7% of the total. For Brazil, 97.1% of reserves are concentrated offshore and 2.9% onshore. Between 2009 and 2018, the offshore reserves in Espírito Santo fell 4.6% p.a. and the onshore reserves fell 6.0% p.a. In the Brazilian case, the offshore reserves increased 1.8% p.a and the onshore reserves fell 7.2% p.a.

While Brazilian offshore reserves are concentrated in Rio de Janeiro (85.5%), Espírito Santo (6.9%), and São Paulo (6.6%), onshore reserves are concentrated among Northeast states: Sergipe (33.1%), Bahia (29.5%), Rio Grande do Norte (23.1%), and the Northern portion of Espírito Santo (6.4%).

Table 2 - Total oil reserves in Espírito Santo (million barrels)

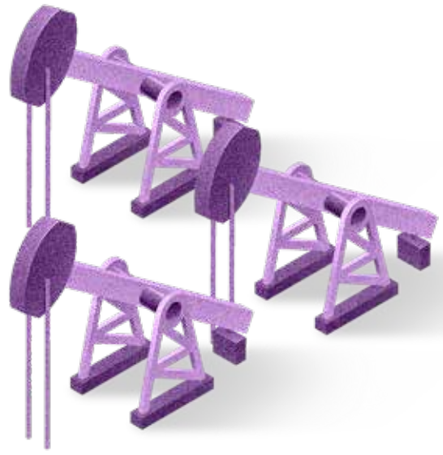
Espírito Santo	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Onshore	84	80	77	76	69	70	52	56	50	45
Offshore	2,617	2,627	2,852	2,676	2,447	2,301	2,197	1,910	1,789	1,630
Total	2,701	2,707	2,929	2,753	2,516	2,371	2,249	1,966	1,839	1,675

Source: ANP Elaboration: Ideies/Findes

Two wells were drilled in Espírito Santo in 2017, both offshore, wherein 1 was an unproven oil producer and the other a commercial producer of oil and natural gas , both in the Golfinho field, in the Espírito Santo basin. **The last onshore drilling in the State was in 2016, when 2 wells were drilled at Fazenda São Rafael, both abandoned permanently.**

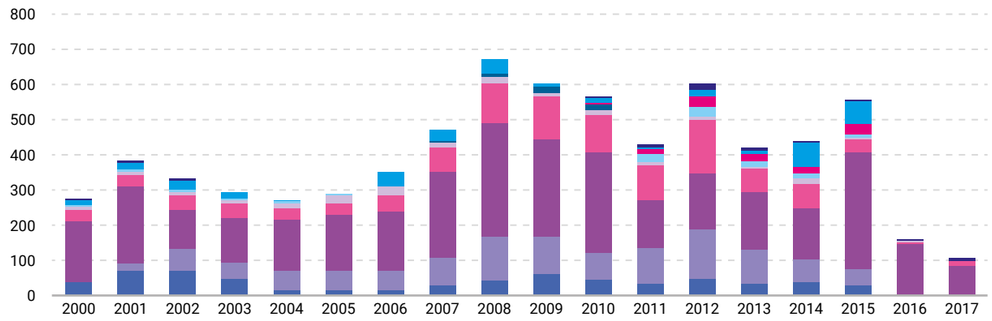
Between 2011 and 2017, drilling activities in Brazil registered an average annual drop of 29.6%. There was a decrease in drilled wells, 27.7% p.a. and 33.4% p.a., onshore and offshore, respectively. In 2017, 149 wells were drilled, 86.6% by Petrobras. Out of these, 111 onshore (90 wells in Rio Grande do Norte) and 38 offshore (35 wells in Rio de Janeiro), chart 16 and 17.

In Rio Grande do Norte, all wells drilled in 2017 are operated by Petrobras and 82.2% are in production. In Rio de Janeiro, from the 35 wells drilled, 34.3% of them were classified as commercial oil producers, most of them operated by Petrobras. **In general, well-drilling activities in Brazil are the responsibility of Petrobras and are concentrated in areas with higher success rates, such as, Rio Grande do Norte for onshore and Rio de Janeiro for offshore.**



[12] Definitions regarding well classification can be found in the glossary.

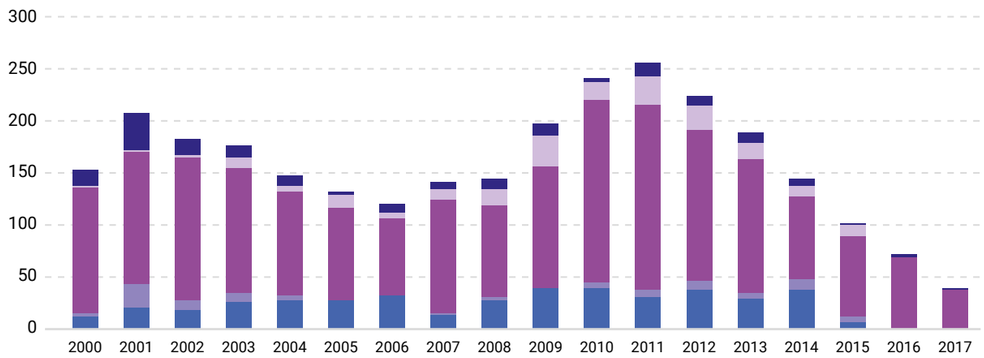
Chart 16 - Wells drilled onshore per Federative Unit (in units)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OTHERS	1	4	1	0	0	0	0	0	0	0	3	10	18	11	1	2	0	0
CE	12	19	30	19	6	0	45	34	44	9	14	0	0	0	74	61	0	0
MG	0	0	0	0	0	0	0	0	0	0	2	6	18	10	0	0	0	0
MA	0	0	0	0	0	0	0	0	0	0	2	12	28	17	16	31	6	8
AM	3	6	4	3	4	4	0	3	8	17	15	26	30	18	14	6	1	1
AL	10	10	10	9	15	27	23	15	17	12	17	9	7	4	14	8	3	0
BA	34	32	42	44	35	30	46	69	114	122	107	96	155	67	69	37	7	12
RN	172	218	110	127	142	158	168	243	321	272	283	138	156	161	147	331	145	90
SE	2	20	58	45	57	58	55	81	123	109	79	101	141	98	63	47	0	0
ES	39	74	76	50	17	17	18	31	47	63	45	36	51	38	42	30	2	0

Source: ANP Elaboration: Ideies/Findes

Chart 17 - Offshore wells drilled by Federative Unit (in units)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
OTHERS	16	35	15	11	10	3	8	7	11	12	3	14	8	10	7	2	0	0
SP	1	3	1	11	6	12	5	10	16	30	18	28	25	15	10	11	3	1
RJ	121	127	138	120	100	89	74	108	88	116	175	177	144	129	80	77	69	35
SE	4	22	10	9	4	1	1	2	2	0	5	7	10	6	10	5	0	0
ES	11	21	18	26	28	27	32	14	28	40	40	31	37	29	38	7	0	2

Source: ANP Elaboration: Ideies/Findes

2.4 Production

In 2018, oil production in Espírito Santo reached 122.3 million barrels of oil, 11.2% lower than in the previous year. National production had a drop of 1.3% in the same period, reaching 944.1 million barrels of oil. Despite the drop, Espírito Santo continues being the second largest oil producer among federative units (13.0% of the national production), second only to Rio de Janeiro (70.2%).

2.4.1 Offshore Production

Offshore production in Espírito Santo reached 118.7 million barrels of oil in 2018, 11.3% lower than in the previous year. The national offshore production registered a drop of 0.8% in 2018. Espírito Santo occupied the second position between federative units in offshore production, with 13.1%. Rio de Janeiro produced 662.8 million barrels of oil, which corresponds to 73.4% of the national production (chart 18).

According to the scale from the American Petroleum Institute, the API[13] degree of the oil produced in the Espírito Santo offshore fields was 32.1 in 2018. **The Camarupim and Camarupim Norte fields (API 57.5), both in the Espírito Santo basin, concentrate the production of one of Brazil's lightest oils.** There are also the Abalone and Argonauta fields that feature an API of 17 and 18 respectively, considered as heavy oil. The assessment regarding the API degree is important to measure the hydrocarbon value in the international market.

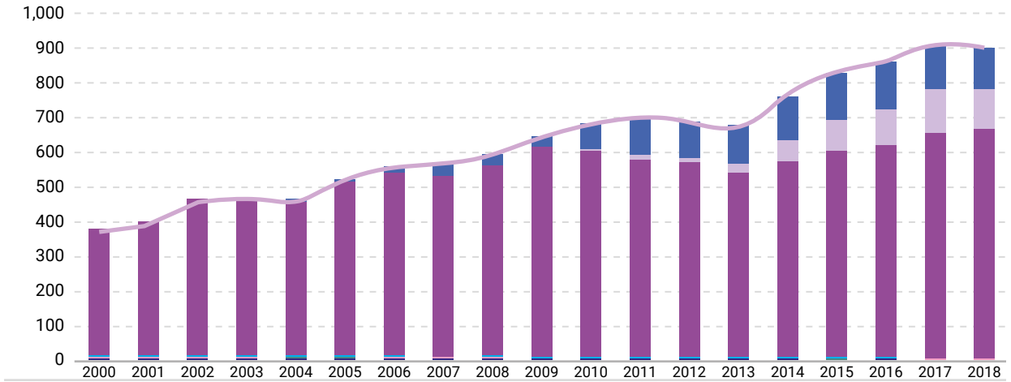
Among the fields in offshore production, the Jubarte field stands out, located in the Campos basin. In December 2018, the production of the field reached 188.2 thou bbl/day, 58.7% of the Espírito Santo's offshore production (chart 19). The field has 36 wells in production and 19 injector wells[14], interconnected in three platforms of the Floating Production Storage and Offloading (FPSO) type: P-57, P-58 and Espírito Santo FPSO. On these platforms, the oil is treated and temporarily stored in the tanks of vessels and transferred to relieving ships.

In the Espírito Santo Basin, the highlight was for the Golfinho field, which reached the production of 15.9 thou bbl/day in December (chart 19), 4.9% of Espírito Santo's offshore production. The area has 7 producing wells and no injector well, interconnected to the Cidade de Vitória PFSO. The oil produced is drained by relieving vessels. The field also produces natural gas, which is drained via a pipeline connecting the platform to the Cacimbas Treatment Unit (UTGC), in the northern part of the State.

[13] The API degree is a scale, created by the American Petroleum Institute (API). The degree measures the density of liquids derived from oil. The denser the oil, the lower its API degree and lower its value in the international market.

[14] Injector well is drilled for the destination of fluids from the production of hydrocarbon. These wells help to optimize the recovery of oil and natural gas from the producing field.

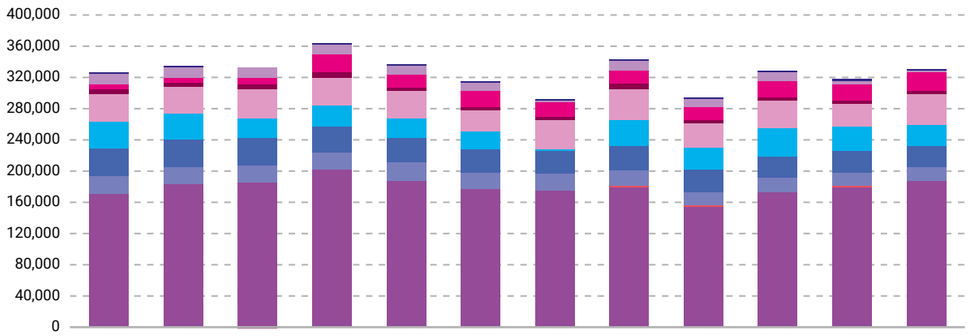
Chart 18 - Offshore production per Federative Unit (in thousand barrels)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ES	0.1	0.1	1.1	6.6	4.4	5.9	16.8	36.2	37.1	31.4	75.2	110.7	107.7	108.0	128.7	136.6	139.5	133.9	118.7
SP	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.3	0.3	5.3	14.0	10.9	25.3	59.2	90.0	102.6	120.0	116.5
RJ	358.8	380.5	438.3	446.2	443.2	501.8	529.6	520.9	547.3	605.2	594.8	568.6	561.5	532.0	563.2	596.9	614.7	650.9	662.8
SE	4.6	3.9	3.3	2.7	2.5	2.3	2.3	2.7	4.8	3.5	3.1	3.6	3.2	3.6	4.8	3.0	2.7	1.9	1.8
RN	4.4	3.8	3.8	3.9	4.3	4.2	3.7	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.3	2.1	1.9
PR	1.6	1.0	0.3	1.8	2.8	2.6	1.7	1.4	1.0	-	-	-	-	-	-	-	-	-	-
CE	4.0	4.7	4.2	4.4	4.2	3.8	3.2	3.1	2.8	2.5	2.3	2.1	1.9	2.6	2.2	1.9	1.9	1.6	1.6
BA	-	-	-	-	-	-	-	0.1	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.2	0.3	0.2	0.2
AL	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
TOTAL	374.3	394.7	451.9	466.3	462.1	521.3	558.0	568.1	596.9	646.4	684.0	702.0	688.4	674.8	761.4	831.3	864.0	910.5	903.5

Source: ANP Elaboration: Ideies/Findes

Chart 19 - Monthly production of offshore fields in Espírito Santo (bbl/day) - 2018



	JAN/18	FEB/18	MAR/18	APR/18	MAY/18	JUN/18	JUL/18	AUG/18	SEP/18	OCT/18	NOV/18	DEC/18
PIRAMBU	878.8	731.1	-	428.4	979.8	197.3	767.2	456.8	381.4	801.1	560.1	731.1
OSTRA	12,674.2	11,854.1	12,876.0	13,001.9	11,102.8	9,373.3	1,699.4	11,497.7	10,408.9	10,897.0	3,617.9	2,261.8
CACHALOTE	6,074.7	7,485.8	8,545.3	23,642.3	15,300.4	20,597.2	18,962.8	18,052.9	17,212.9	21,208.5	20,975.9	21,909.0
CANGOÁ	54.1	56.2	-	17.6	5.9	7.0	6.3	20.2	70.1	49.5	22.9	54.1
BALEIA ANÃ	6,965.0	5,616.2	6,082.6	5,816.1	5,762.2	4,916.2	5,023.3	5,408.1	5,226.9	4,713.9	4,937.1	4,944.2
BALEIA FRANCA	35,869.0	34,283.7	38,051.0	36,429.9	35,008.5	28,266.1	38,043.1	40,344.3	30,695.7	36,444.0	30,554.4	39,034.9
ARGONAUTA	33,268.8	33,099.3	26,434.6	27,843.7	24,974.9	22,079.3	627.1	33,889.0	27,769.7	34,580.5	29,894.2	28,219.2
BALEIA AZUL	34,553.2	34,821.4	33,912.5	32,634.7	31,701.9	29,282.1	30,913.6	31,498.8	28,726.5	28,332.5	27,986.0	26,667.3
CANAPU	8.9	53.5	47.6	43.2	38.4	36.1	41.7	47.8	45.6	44.1	44.1	8.1
GOLFINHO	23,768.5	22,418.1	21,566.9	21,564.4	23,052.1	21,684.2	20,769.5	19,398.5	17,903.3	17,123.1	17,605.6	15,983.8
PEROÁ	375.3	289.6	0.0	81.6	316.2	264.3	292.8	279.9	305.2	245.1	204.0	292.9
JUBARTE	170,788.9	182,453.7	185,896.3	201,892.0	187,121.0	176,296.0	174,243.6	180,151.6	154,945.2	173,651.4	180,167.4	188,276.5

Source: ANP Elaboration: Ideies/Findes

Table 3 - Offshore fields in production and under concession in Espírito Santo

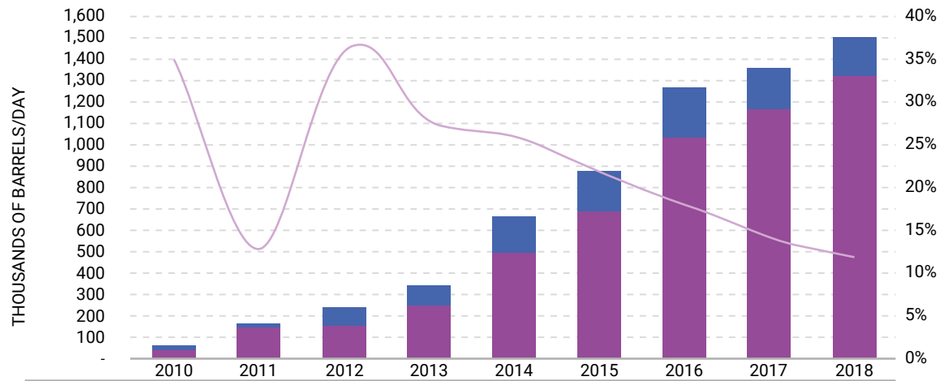
Basin	Field	Operator	%	Partner 1	%	Partner 2	%
Campos	Abalone	Shell Brasil	50%	ONGC Campos	27%	QPI Brasil Petróleo	23%
Campos	Argonauta	Shell Brasil	50%	ONGC Campos	27%	QPI Brasil Petróleo	23%
Campos	Baleia Anã	Petrobras	100%				
Campos	Baleia Azul	Petrobras	100%				
Campos	Baleia Franca	Petrobras	100%				
Campos	Cachalote	Petrobras	100%				
Campos	Jubarte	Petrobras	100%				
Campos	Ostra	Shell Brasil	50%	ONGC Campos	27%	QPI Brasil Petróleo	23%
Campos	Pirambu	Petrobras	100%				
Espírito Santo	Cação[1]	Petrobras	100%				
Espírito Santo	Camarupim	Petrobras	100%				
Espírito Santo	Camarupim Norte	Petrobras	65%	OP Energia	35%		
Espírito Santo	Canapu	Petrobras	100%				
Espírito Santo	Cangoá	Petrobras	100%				
Espírito Santo	Golfinho	Petrobras	100%				
Espírito Santo	Peroá	Petrobras	100%				

Source: ANP Elaboration: Ideies/Findes
Reference[1]: Field in process of return

The Pre-Salt in Espírito Santo[15] produced 178.6 thousand bbl/day in 2018, a reduction of 8.5% in relation to the previous year. In contrast, the domestic production of Pre-Salt increased by 10.6%, reaching 1.5 million bbl/day. This is the second consecutive year that the production of Pre-Salt in Espírito Santo registered a drop. From 2016 to 2017, production dropped 14.6% (chart 20).

The average API degree of oil in the Pre-Salt fields is 26.9, considered a medium oil in relation to its density. In the Espírito Santo part of the polygon, the average API degree is 27.1. The Baleia Azul and Pirambu fields have the lightest oil, both with an API degree of 29.7.

Chart 20 - Pre-Salt production in Brazil and in Espírito Santo (million barrels/day) and share (%)



	2010	2011	2012	2013	2014	2015	2016	2017	2018
PRE-SALT ES	22,642	21,537	87,987	96,072	172,901	190,359	228,917	195,438	178,572
PRE-SALT BR	65,199	167,500	242,700	346,100	667,027	874,973	1,262,436	1,356,205	1,500,658
% ES/BR	34.7%	12.9%	36.3%	27.8%	25.9%	21.8%	18.1%	14.4%	11.9%

Source: ANP Elaboration: Ideies/Findes

[15] Pre-salt polygon area bordering Espírito Santo.

The new development plan for Parque das Baleias

With the end of the monopoly exerted by Petrobras in 1997, it was agreed that other companies could perform oil exploration and production activities, by Law No. 9,478/1997 (Petroleum Act). Thus, round 0 ratified Petrobras's rights in concession contracts of the fields that were in production in the date the law came into effect. Block B-060, located in the Campos Basin, to the South of Espírito Santo, was an example of contracts ratified at the time.

In 2002, block B-060 received the first commercial discovery of oil, in the Cachalote field. Between 2003 and 2006, new reservoirs were discovered in the Baleia Franca, Baleia Azul, Baleia Aña, Pirambú, Caxaréu, and Mangangá fields. These fields became known as Parque das Baleias (Whales Park) and all of them are in the production stage[16].

In 2007, oil reserves were identified in the Pre-Salt layer at Parque das Baleias. ANP, through Board Resolution No. 596 and 597, requested a review of the development plan at Jubarte, in order for the integration of the fields to be contemplated, including oil and Pre-Salt.

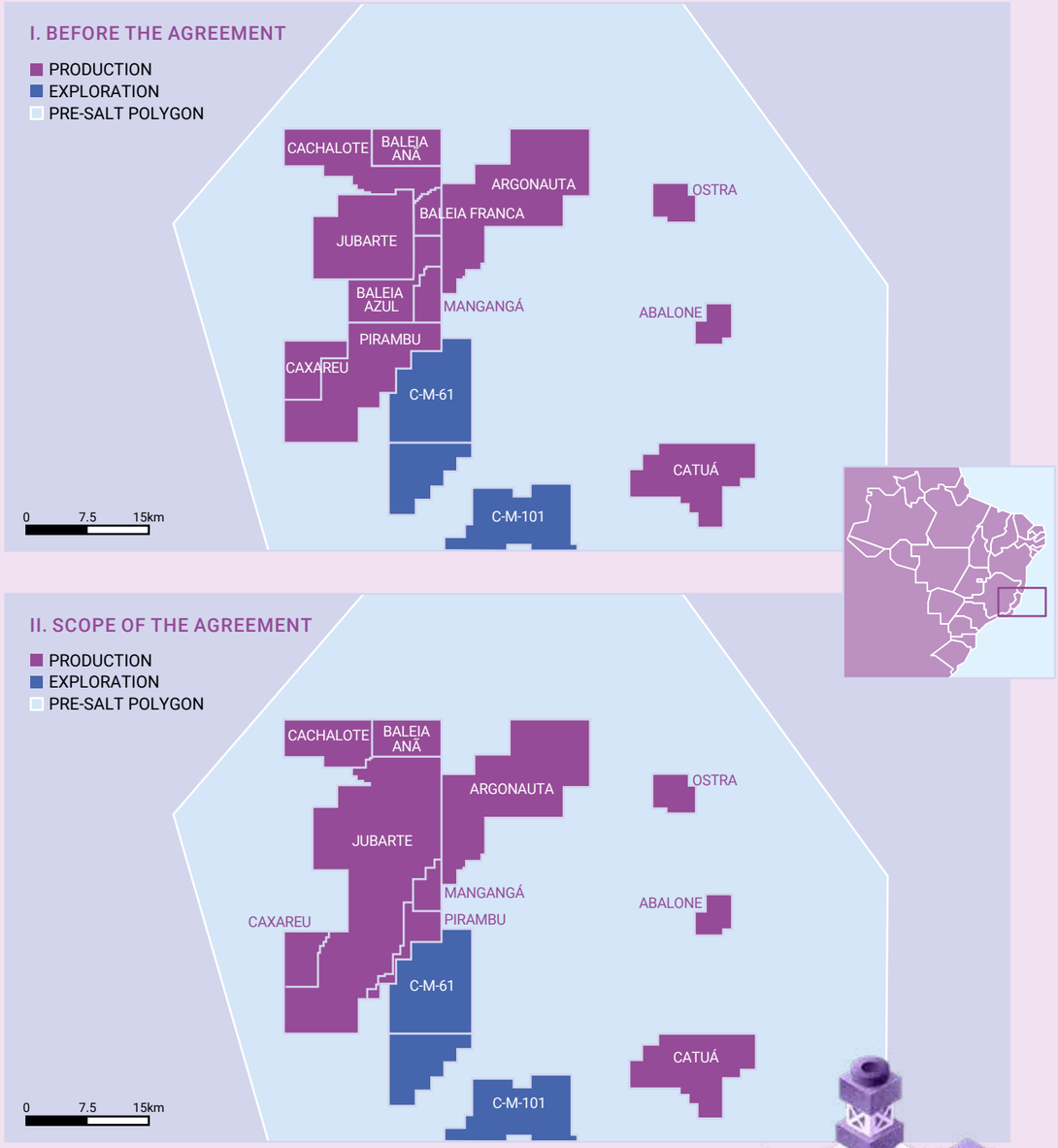
In 2013, Espírito Santo State government requested ANP to consider only one reservoir for the calculation of royalties and special participation. The request from the state government intended to obtain the proper Special Participation meant for the state. The Agency, through Board Resolution No. 69 determined the union of the fields with the formation of a single reservoir.

In response, Petrobras challenged the decision, resorting to arbitration. After successive attempts to reach an agreement, in 2018, Petrobras and ANP agreed to suspend the procedure and intensified efforts towards an agreement. Finally, the agreement considered a single reservoir, called new Campo de Jubarte, including areas between Jubarte, Baleia Azul, Baleia Franca, parts of Cachalote, Mangangá and Pirambu (Figure 1).

Beyond this decision, the agreement enabled **the approval of a new Development Plan for the New Campo de Jubarte** with an extension for another 27 years for the production phase. In addition, there will be the inclusion of a new FPSO integrated to Parque das Baleias with natural gas discharge through the construction of a flexible duct, connecting the South Espírito Santo pipeline to the North-South Espírito Santo pipeline which, in turn, connects to the Cacimbas natural gas treatment unit. Also, the New Campo de Jubarte began to generate special participation, as provided for in the request from the government of the State of Espírito Santo.

The agreement will provide greater opportunities for Espírito Santo due to three points: (i) higher revenues from the exploration and production of oil and natural gas; (ii) the expansion of investments in the natural gas discharging infrastructure; (iii) by the increased demand for products from the chain of oil and natural gas suppliers.

Figure 1 - Location of Parque das Baleias - Campos Basin, Espírito Santo



Source: ANP Elaboration: Ideies/Findes

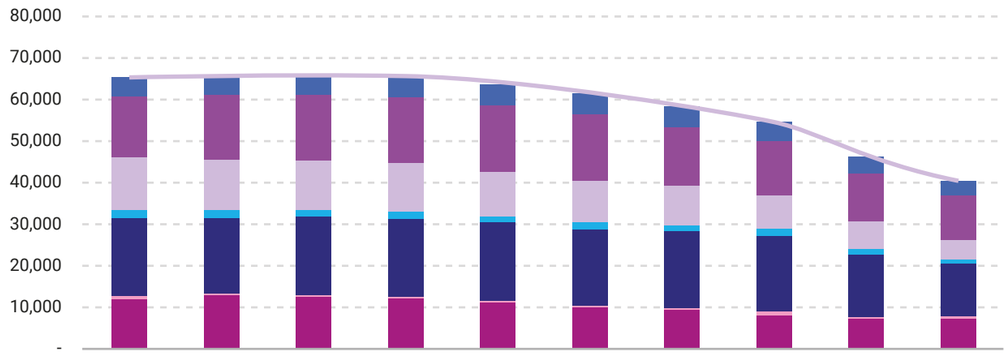
[16] Except Caxaréu (in development) and Mangangá (in the process of being returned to ANP).

2.4.2 Onshore Production

Onshore production in Espírito Santo reached 3.5 million barrels of oil in 2018, 7.9% lower than in the previous year. The national onshore production also registered a drop of 12.3% in 2018. Espírito Santo occupied the fifth position among federative units in onshore production, with 8.8% of the national production. Rio Grande do Norte produced 12.8 million barrels of oil, 31.6% of the country's production (chart 21).

According to the American Petroleum Institute scale, the API degree of Espírito Santo's onshore fields ranged between 13 to 19, considered an oil with a heavy density. Brazil's lightest onshore oil comes from the fields located in the Parnaíba Basin (Gavião Branco, Gavião Vermelho, Gavião Caboclo and Gavião Real fields), in Maranhão, whereby the average API of these fields is 54.0.

Chart 21 - Onshore production per Federative Unit (in thousand barrels)



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ES	4,587	4,801	5,179	5,435	5,350	5,235	5,066	4,690	3,891	3,588
BA	14,642	15,550	15,776	15,712	15,777	15,632	14,190	12,994	11,631	10,586
SE	12,583	12,020	11,745	11,547	10,627	10,133	9,171	8,187	6,572	4,853
AL	2,246	2,030	1,896	1,647	1,310	1,519	1,556	1,499	1,139	929
RN	18,295	17,868	18,595	18,966	19,116	18,347	18,247	18,176	15,205	12,830
CE	761	674	567	457	413	446	533	567	448	384
MA	-	-	-	-	29	43	4	14	13	15
AM	12,351	13,029	12,683	12,283	11,270	10,222	9,601	8,561	7,482	7,462
BRAZIL	65,464	65,973	66,441	66,046	63,893	61,577	58,368	54,688	46,381	40,648

Source: ANP Elaboration: Ideies/Findes

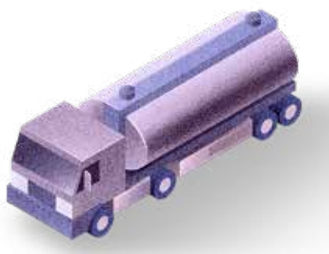
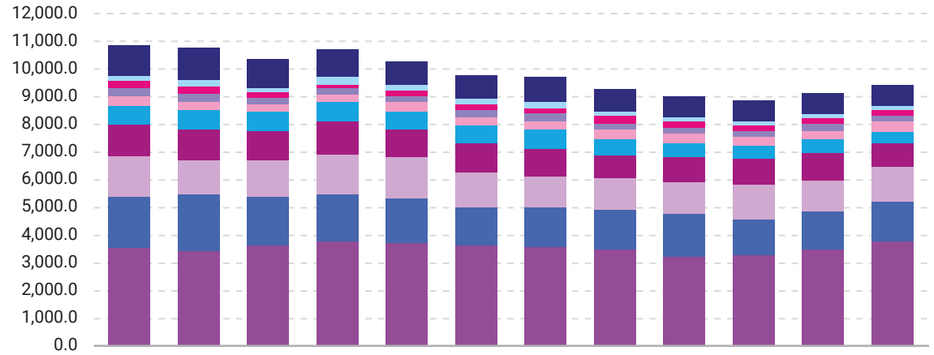


Chart 22 - Monthly production of onshore fields in Espírito Santo (bbl/day) - 2018

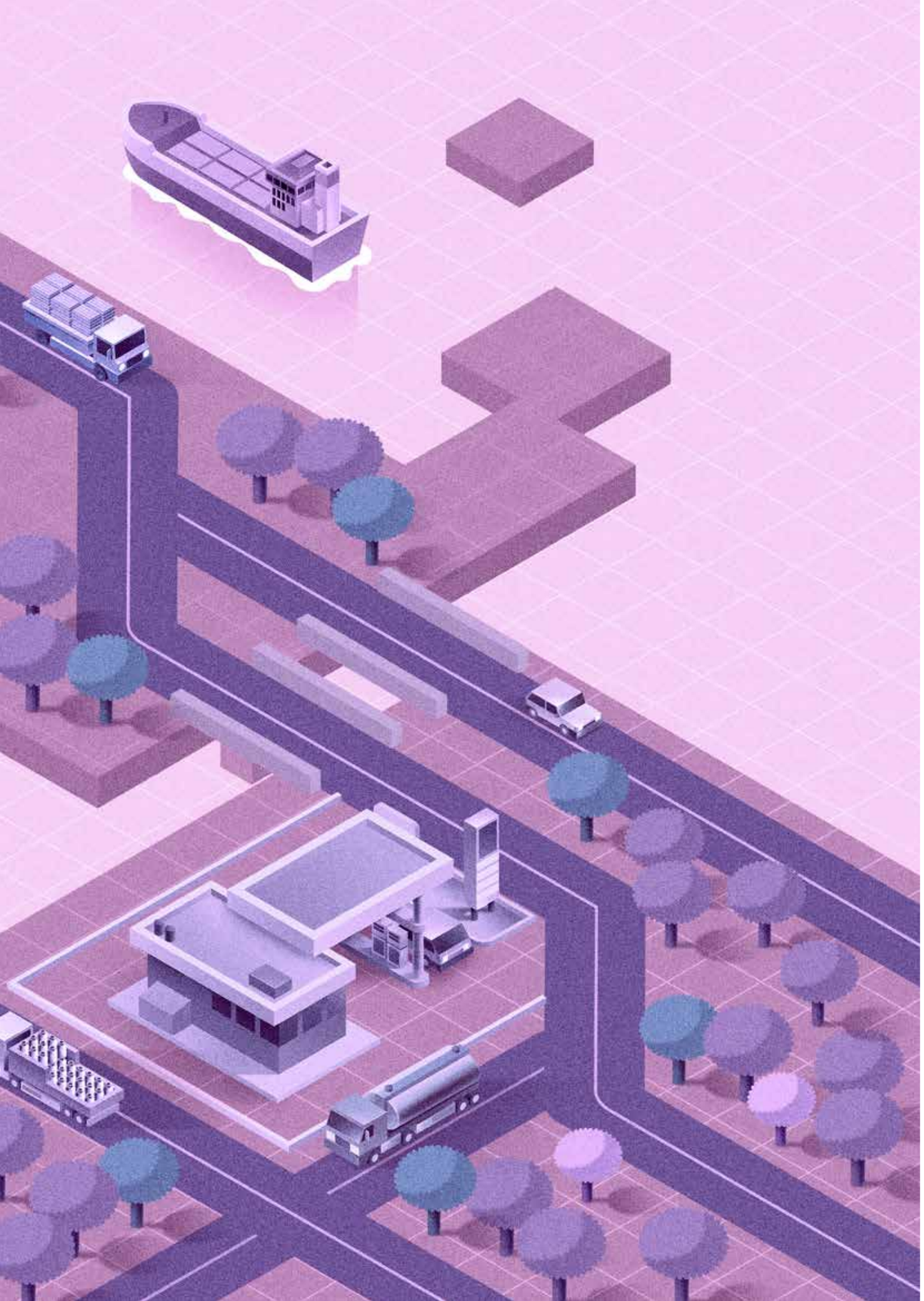


	JAN/18	FEB/18	MAR/18	APR/18	MAY/18	JUN/18	JUL/18	AUG/18	SEP/18	OCT/18	NOV/18	DEC/18
OTHERS	1,109.0	1,241.2	1,001.5	999,1	848,8	815,2	931,4	875,2	792,0	781,0	769,6	752,9
RIO PRETO OESTE	178.4	192.6	163.9	221.2	232.8	242.7	234.5	173.5	167.1	151.9	121.4	139.2
SÃO MATEUS	239.3	232.4	190.0	172.5	194.0	188.2	163.3	227.6	156.0	157.1	233.4	218.8
LAGOA PARDA	319.7	301.8	279.5	229.4	218.7	299.0	273.8	249.6	244.5	205.8	282.5	233.2
FAZENDA SÃO JORGE	342.8	320.3	276.7	256.7	325.6	290.9	326.7	311.5	348.4	307.4	301.0	324.7
FAZENDA SANTA LUZIA	656.9	647.7	641.3	691.3	665.6	655.9	649.5	601.1	477.0	513.7	470.5	437.3
FAZENDA SÃO RAFAEL	1,133.2	1,141.3	1,118.0	1,195.7	987,6	1,056.2	1,000.8	838.6	904.3	901.9	947.7	869.8
INHAMBU	1,523.7	1,247.4	1,238.7	1,455.5	1,478.3	1,235.9	1,152.2	1,151.4	1,156.0	1,299.2	1,188.9	1,220.8
CANCÃ	1,828.9	2,039.2	1,795.4	1,694.2	1,597.2	1,320.3	1,387.6	1,384.1	1,524.1	1,235.8	1,285.5	1,452.3
FAZENDA ALEGRE	3,466.8	3,391.7	3,598.3	3,739.7	3,719.4	3,654.4	3,574.5	3,481.3	3,237.1	3,272.4	3,507.3	3,759.7

Source: ANP Elaboration: Ideies/Findes

Among the fields in onshore production, the Fazenda Alegre field stands out, located in the city of São Mateus, in Northern Espírito Santo. The area, in operation since 1996, reached the production of 3.7 thousand bbl/day in 2018, representing 40.0% of what is produced through onshore in Espírito Santo (chart 22). The field has 54 producing and 13 injector wells, interconnected by four satellite stations which carry the oil to the Fazenda Alegre Station (EFAL). The oil is processed and transported by pipeline to the Terminal Norte Capixaba (TNC), following to the refining market. In 2018, the field was 6th in production in Brazil, behind only to the Carmópolis (SE), Rio Urucu (AM), Estreito (RN), Leste Urucu (AM) and Canto do Amaro (RN) fields.

In addition to this, the Cancã field, located in the city of Linhares, reached the production of 1.4 thou bbl/day in December 2018, representing 15.4% of Espírito Santo's onshore production (chart 22). The area has 29 injector wells, interconnected to the Cancã Collecting Station (ECNC). Subsequently, the oil is transported by trailer to the Fazenda Alegre Station (EFAL) and, after processing, it is transported by pipeline to the Terminal Norte Capixaba (TNC).



Chapter 3

GOVERNMENT PARTICIPATIONS AND ECONOMIC REFLEXES

Demands from the oil and natural gas industry create around them a significant specialized market for performing its activity. This, in turn, leads to the increase in the number of jobs, of supplying companies, as well as the payment of financial compensations and taxes related to the production and marketing of oil and natural gas. These positive spillovers increase local income and can be used to boost regional socioeconomic development.

The objective of this chapter is to analyze part of these economic reflexes of the oil and gas industry in Espírito Santo, which are: 1) payment of financial compensations called government participations; 2) labor market in the O&G chain; 3) exports and imports from this chain.

3.1. Government Participations

In Brazil, oil and gas reserves are the property of the Federal Government (Article 20 of the Federal Constitution). The development and exploration of these hydrocarbons are granted to winning companies of bidding rounds conducted by ANP. As a counterpart of the prospection activity, these companies need to financially compensate the Federal Government, the states and the municipalities for exploring a national heritage.

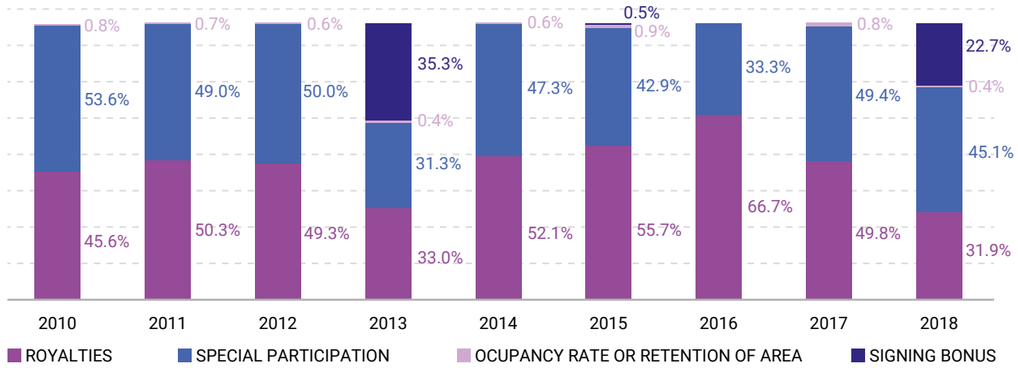
The rules that govern payments, distributions and the supervision of government participation permeates the history of the emergence and evolution of the country's oil and gas sector. Its legislation is constantly reviewed and updated, seeking the modernization of institutional relations in the O&G sector. Although positive, these constant changes, when not scheduled, generate an environment of uncertainty and insecurity for the investor.

In 2018, the Brazilian activity of oil and natural gas exploration generated R$ 65.76 billion in government participation, amounts distributed among the Federal Government, the states, the municipalities, and landowners. From these, 31.9% in royalties, 45.1% in special participations, 0.4% of area occupation or retention[17] and 22.7% in signing bonus[18].

[17] It is the payment made by concessionaires to landowners in exchange for the occupation or retention of the land area granted during the exploration and production phases.

[18] The signing bonus is a government participation paid by the winner of the bidding process to obtain the concession for the exploration and production of oil and natural gas. This amount cannot be lower than the minimum amount set in the invitation to bid. Part of this resource is intended only to the Federal Government and part to ANP.

Chart 23 - Government Participations of Brazil by modality (%)



Source: ANP Elaboration: Ideies/Findes.

Among these government participations, only the obligations of royalties and special participation (PE, in Portuguese) are intended to the states and municipalities. **In 2018, Espírito Santo (state and municipalities) received R$ 2.9 billion in government participation, with 53.4% of royalties and 46.6% in PE. This amount corresponded to 4.2% of the total received by all federative units of the country.**

3.1.1 Royalties

Royalties are financial compensations paid by all fields that produce oil and natural gas for the exploration[19] of this finite resource. Among government participations, royalties are the payments of greater national visibility. As criterion defined by law, its incidence rate may vary between 5% and 10%, being distributed among the Federal Government, states and municipalities.

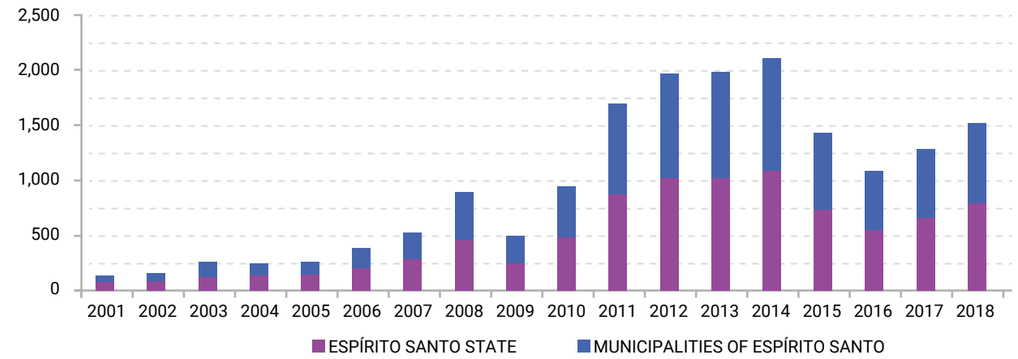
In 2018, the state of Espírito Santo grossed R$ 757.8 million in royalties generated by oil and gas extraction and production activities, and the municipalities raised R$ 790.7 million. These aggregate amounts reach R$1.5 billion, an increase in 18.6% to the grossed in 2017.

From 2001 to 2018, the amount of royalties in Espírito Santo increased considerably, mainly due to the start of the exploration in the Pre-Salt polygon. During this period, the total of these obligations paid to state government and municipalities increased, on average, 16.0% per year, a result above the national average (7.1% p.a.).

In the context of collection only for the state sphere, in 17 years, revenues from royalties in Espírito Santo increased 15.2% p.a., jumping from R$ 68.5 million in 2001 to R$ 757.8 million in 2018, in real values. Collections in Espírito Santo municipalities increased more intensely, at a rate of 16.9% p.a., going from R$55.3 million to R$790.7 million in this same comparison basis, also in real values.

Therefore, in this period, the participation of revenues from royalties in Espírito Santo over the total collected by Brazil increased in 5.5 percentage points (p.p.), going from 1.9% in 2001 to 7.4% in 2018.

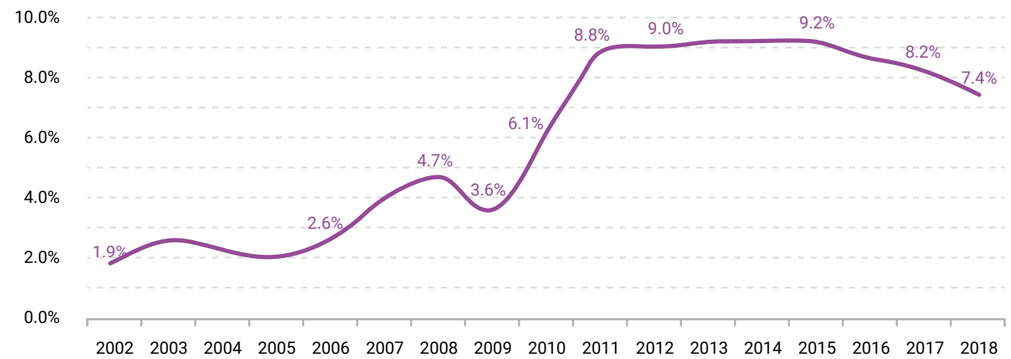
Chart 24 - Revenue from royalties in Espírito Santo (R$ million) *



(*) Values deflated by IPCA (accumulated from Jan-Dec 2018).
Source: ANP Elaboration: Ideies/Findes.

It is worth noting that from 2010 to 2014 were the peak years in revenues from royalties in Espírito Santo (chart 24). Between these years, the state registered an absolute growth of 22.3% of revenues from royalties. This moment is explained by the positive confluence of the three factors that determine the values of royalties to be paid by operators: (i) the significant growth in the production of these hydrocarbons, provided by advances in Pre-Salt exploration; (ii) increase in the price of the barrel of oil; (iii) and, from 2012, the increase in the price of the US dollar[20].

Chart 25 - Participation of revenues from royalties in Espírito Santo on the total of Brazil (%)



Source: ANP Elaboration: Ideies/Findes.

[19] According to Pinto Júnior et. al. (2016), its payment is associated to the concepts of: (i) compensation for future generations due to the exhaustion of currently existing resources; and (ii) compensatory mechanisms of the possible negative impacts from the production of oil and natural gas. It is worth mentioning that royalties are a financial compensation which is also paid by other activities of exploration of natural resources owned by the Federal Government, like, mining.

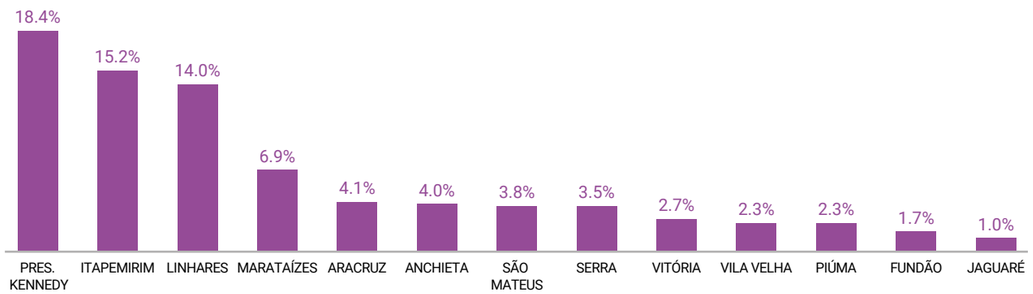
[20] For information on the price of the barrel of oil and production volume, see chapters 1 and 2, respectively. In relation to the exchange rate (US$ - average annual sale), it increased from R$ 1.67 in 2011 to R$1.96 in 2012; R$2.16 in 2013; and R$ 2.35 in 2014.

Between 2014 and 2018, this scenario became less favorable. There was a reduction in the collection of royalties in the state of Espírito Santo of 28.0% and 27.8% in the municipalities. The explanation for this drop is the lower production of oil and gas in Espírito Santo and the fall in the price of the barrel. In contrast, the increase in the Brazilian exchange rate positively offset this decline in the amounts paid in royalties. In 2016, 2017 and 2018 price of a barrel of oil started to climb, but it did not reach the same level observed in 2010 to 2014.

In 2018, offshore fields in Espírito Santo generated R$ 4.85 billion in royalties. The largest amounts paid were in the Roncador[21] (R$ 1.7 billion) and Jubarte (R$ 1.6 billion) fields, both in the Campos Basin within the Pre-Salt polygon. This year, the obligations from onshore fields in Espírito Santo totaled R$ 59.0 million (table 6), in which the largest financial compensations were paid by the Fazenda Alegre (R$ 22.0 million), Inhambu (R$ 10.2 million) and Cancã (R$ 7.0 million) fields. These royalties were divided among the Federal Government, the state and the municipalities.

In 2018, as also observed in 2017, Espírito Santo municipalities that received the most royalties were Presidente Kennedy (R$ 162.8 million), Itapemirim (R$134.1 million), Linhares (R$ 132.8 million) and Marataízes (R$61.3 million). Together they concentrated 54.6% of the total municipal revenues. This high participation is explained by the fact that they are municipalities that border fields that have a high production of oil and natural gas, and for having facilities to service the offshore activity.

Chart 26 - Municipalities with the largest revenues from royalties in Espírito Santo (% of the total collected by the State) - 2018

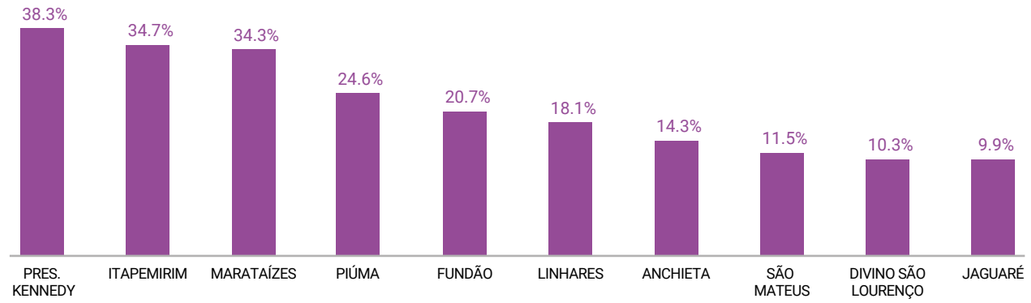


Source: ANP Elaboration: Ideies/Findes.

Espírito Santo municipalities that registered in 2018 the largest share from royalties in their total revenue were Presidente Kennedy (38.3%), Itapemirim (34.7%) and Marataízes (34.3%). Except in the case of Linhares, once again, the municipalities with the largest revenues from this government participation were exactly those that have more than one-third of their revenues consisting of royalties.

Espírito Santo State government approved, in 2006, State Law No. 8,306 which created the Fund for the Reduction of Regional Inequalities - FRDR, in Portuguese, intending to transfer to municipalities 30.0% of financial compensation resources from the royalties received for the exploration of oil and natural gas transferred to the State. In 2018, the government transferred R$141.8 million, 32.6% higher than in the previous year[22].

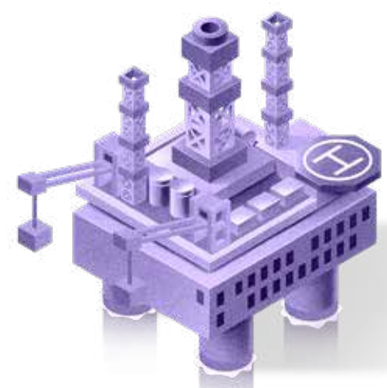
Chart 27 - Municipalities with the largest revenues from royalties in Espírito Santo (% of the total collected by the State) - 2018



Source: AEQUUS CONSULTORIA; ANP. Elaboration: Ideies/Findes.

The application of the FRDR´s resources are limited, as provided for in legislation (Art.3 of Law State No. 8,306), including the limitation in applying resources in current expenses of municipalities. As already addressed in previous versions of this annual report, state executive power has softened this article to allow municipalities receiving this transfer to use it to cover current expenditures[23].

At the end of 2019, after the determination from the Federal Supreme Court (STF, in portuguese) for the state government to distribute 25% of O&G resources[24], Espírito Santo Legislative Assembly approved the extinction of the Regional Inequalities Fund beginning in 2020.



[21] The Roncador field also borders the state of Rio de Janeiro, therefore, its royalties are also intended for the Rio de Janeiro state government and its municipalities.

[22] Source: Aequus Consultoria (2019).

[23] The justification provided is that, with the economic crisis that hit the country, Espírito Santo municipalities are struggling to pay for their daily expenses. For 2019 and 2020, State Law No. 10,988/2019 allows municipalities to use up to 50% of the FRDR to pay for current expenses.

[24] By decision of the Federal Supreme Court (STF, in Portuguese) on 08 October 2019, it was established the obligation of oil producing states to transfer 25% of their revenues from royalties to all municipalities in their territories. This decision directly impacts how royalties from the Fund for the Reduction of Regional Inequalities are distributed. With this decision, the state of Espírito Santo is obliged to distribute, using the same criteria for the distribution of revenues from ICMS (Municipalities Participation Index - IPM, in Portuguese), 25% of their revenues from royalties to all municipalities. Before this decision, 30% of resources from FRDR were intended only for municipalities that in the previous financial year: (i) had not received revenues from royalties exceeding 2% of the total amount transferred directly to state municipalities; (ii) and did not have the participation index in the ICMS share higher than 10%. Therefore, this decision by part of the STF will significantly impact the revenues of those municipalities who were previously covered by FRDR and will benefit those who did not receive the transfer of these compensatory revenues by the State.

Composition of royalty calculation

In Brazil, as we have already pointed out, oil and gas reservoir are the property of the Federal Government, and the extraction and production of these hydrocarbons are granted to companies through auctions carried out by ANP. When concessionaires begin their production, they need to pay a monthly financial compensation to the National Treasury Secretary (STN, in Portuguese) for using resources belonging to the nation. These compensations are called royalties. Every month, ANP calculates the value of obligations to be paid by each producing field in the country.

The royalties are levied on the value of production of each producing field, which is determined by the volume of oil and/or natural gas produced and by their respective reference prices:

$$Production\ value_y = (Q\ oil_y \times P\ oil_y) + (Q\ gas_y \times P\ gas_y)$$

wherein,

- ***y*** = oil and/or natural gas producing field;
- ***Q oil*** = volume of the monthly production of oil (in m³);
- ***Q gas*** = volume of the monthly production of natural gas (m³)[25];
- ***P oil*** = reference price of oil which is determined by the monthly average price of Brent-type oil (US$/bbl)[26]. The value is different for each field, since it incorporates the oil quality differential from each field. This price is calculated and provided by ANP in R$/m³.
- ***P gas*** = reference price of natural gas[27]. It is calculated by the sum of the products from volumetric fractions of natural gas by the corresponding prices. Its value is made available monthly by ANP in R$/m³.

To arrive at the value of royalties to be paid by concessionaires per field, one must multiply the value of production of each field by its respective rate provided for in a contract, which may vary from 5% to 10%:

$$Royalties_y = Aliquot_y \times Production\ value_y$$

For example, in October 2018, production at the Jubarte field was of 901,189.796 m³ of oil and 141,882,716.12 m³ of natural gas. Reference prices for this field were, respectively, R$ 1,714.56 and R$ 0.94. Therefore, the value of production was:

$$Production\ value_{jubarte} = (901{,}189.796 \times 1{,}714.56) + (141{,}882{,}716.12 \times 0.94)$$

$$Production\ value_{jubarte} = 1{,}545{,}146{,}139.49 + 132{,}748{,}306.86$$

$$Production\ value_{jubarte} = R\$\ 1{,}677{,}894{,}446.34$$

The rate of royalties for this field is 10%. Then, the total amount of royalties paid was:

$$Royalties_{jubarte} = 0.1 \times 1{,}677{,}894{,}446.34$$

$$Royalties_{jubarte} = R\$167{,}789{,}444.63$$

In other words, in October 2018, Jubarte field paid the equivalent to R$ 167.8 million in royalties. This value was credited in December 2018. ANP repeats this calculation for all producing fields in each month of the year.

Based on the monthly calculations made by ANP, the amounts of royalties collected by the Treasury Secretary for each field are transferred to the beneficiaries of these resources, which are the Federal Government, the State, and the municipalities. The distribution of royalties among the beneficiaries is made by the criteria outlined in Laws No. 9,478/1997 and No. 7,990/1989. This distribution takes into consideration criteria such as: whether the state/municipality has prospection on land or lakes/rivers; whether it is a state/municipality bordering the prospection in a continental shelf; whether the municipalities are affected by offshore loading and unloading operations of oil, natural gas and other fluid hydrocarbons.

[25] Data relative to the production of oil and natural gas per field can be found at: http://www.anp.gov.br/royalties-e-outras-participacoes/royalties or http://www.anp.gov.br/dados-abertos-anp http://www.anp.gov.br/royalties-e-outras-participacoes/royalties ou http://www.anp.gov.br/dados-abertos-anp

[26] The reference price of oil is provided by ANP at: http://www.anp.gov.br/royalties-e-outras-participacoes/preco-de-referencia-do-petroleo

[27] The reference price of oil is provided by ANP at: http://www.anp.gov.br/royalties-e-outras-participacoes/preco-de-referencia-do-gas-natural

[28] ANP has developed a tool that performs annual estimates of revenues from royalties for Brazilian states and municipalities. It is important to emphasize that due to uncertainties present in the variables that compose the calculation of royalties, the agency does not guarantee the fulfillment of its estimates. The simulator is available at http://www.anp.gov.br/royalties-e--outras-participacoes/estimativa-royalties

[29] For more details, see the following manual: http://www.anp.gov.br/images/Royalties-e-outras-participacoes/Royalties/Planilhas_dos_Calculos_dos_Meses_Anteriores/manual_para_o_calculo_dos_royalties.pdf

3.1.2 Special Participations (PE, in Portuguese)

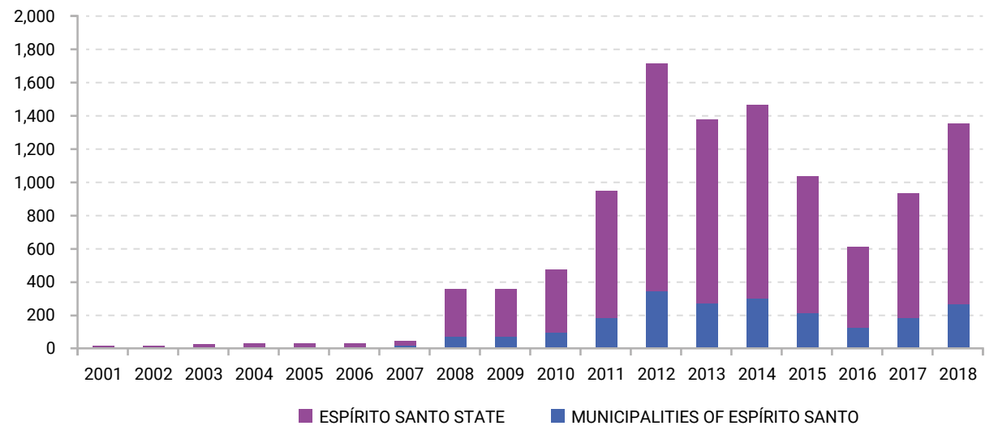
The special participation is also a financial compensation, however, in an extraordinary fashion. This obligation is paid by oil and natural gas exploration and production concessionaires, who have high volume production fields. Its regulation takes place by law No. 9,478/97 (Petroleum Act) and Decree No. 2,705/1998.

The calculation of the special participation on the production of oil and natural gas occurs applying progressive rates - which vary according to the location of the prospection, the number of production years and the quarterly production volume measured - on the net revenue of the quarterly production of each field, considered the expected deductions (royalties, investments in exploration, operational costs, depreciation, and taxes)[30].

Espírito Santo borders four fields in the Campos Basin, which generated special participations in 2018: Baleia Azul (R$ 51.7 million), Baleia Franca (R$ 87.1 million), Jubarte (R$ 2.6 billion)[31] and Roncador (R$ 1.8 billion) which generated R$ 4.5 billion. From this amount, R$ 1.37 billion, corresponding to 4.6% of the country's total PE, were destined to the State of Espírito Santo (R$ 1.1 billion) and the municipalities (R$ 270.7 million) of Marataízes, Presidente Kennedy and Itapemirim.

The amount allocated to the state increased, in real terms between 2017 and 2018, in 44.9%. The same growth percentage was registered for the municipalities.

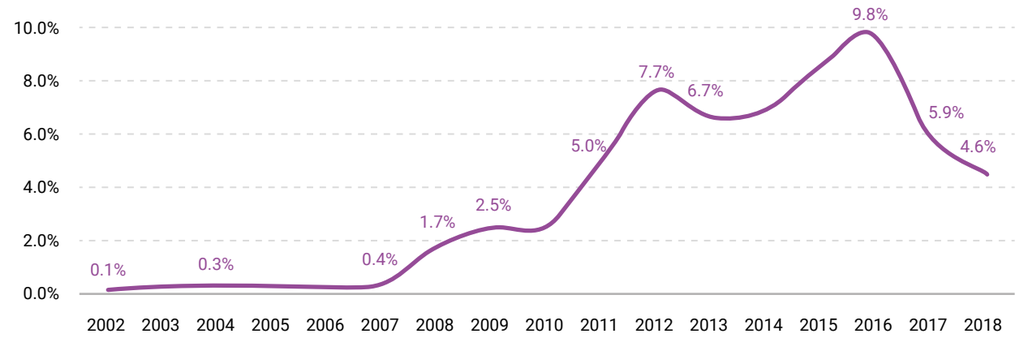
Chart 28 - Revenue from Special Participations in Espírito Santo (R$ million) *



(*) Value deflated by IPCA (accumulated from Jan – Dec – 2018)

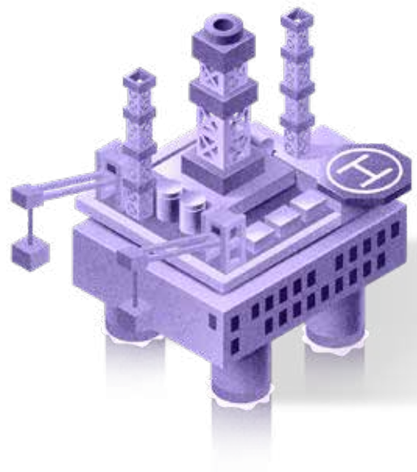
Source: ANP Elaboration: Ideies/Findes.

Chart 29 - Participation of revenues from Special Participations in Espírito Santo on the total of Brazil (%)



Source: ANP Elaboration: Ideies/Findes.

From 2002 to 2018, this financial compensation (PE) grew by 39.7% p.a., both for the State and the municipalities of Espírito Santo. This evolution is also explained by the discovery and by the entry into operation of the pre-salt polygon, being these years marked by an increase in productivity in the Baleia Azul, Baleia Franca, Jubarte and Roncador fields. **However, between 2014 to 2018, revenues from PE dropped 1.7% p.a., due to the following factors: (i) reduction of the international price of the barrel of oil; (ii) the institutional crisis at Petrobras; and (iii) lower production of oil and natural gas.**

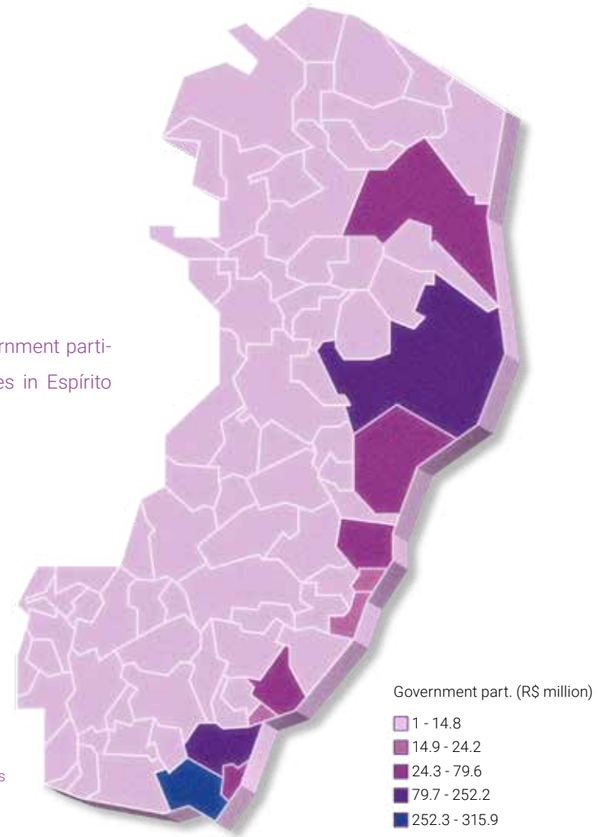


The share of revenues from special participation in Espírito Santo in the total of these revenues in the country provides a trend towards reduction beginning in 2014. Only from 2017 to 2018, this share dropped 1.3 p.p.

[30] The expenses deductible from the gross revenue (as defined by Resolution ANP 12/2014) for calculating the net revenues are not disclosed by ANP, which limits the verification of the Special Participation calculation.

[31] On 04 April 2019, the agreement between ANP and Petrobras was signed, which redefined the areas at Parque das Baleias. In this agreement, the outline of Jubarte field (called "New Jubarte field") began to be also formed by areas from the Baleia Franca, Baleia Azul, parts of Pirambu and Cachalote fields, in addition to small portions (local adjustments) of Caxaréu and Mangangá fields, all belonging to the Campos Basin. As prominently dealt with in the previous chapter, with this unification, the sum of productions from these fields, there will be an expansion in the payment of Special Participation for Espírito Santo. In addition, with the signing of this Agreement, Petrobras (concessionaire of the unified fields) assumed a receding liability of R$ 3.6 billion in PE, having paid R$ 1.5 billion upfront and the balance to be paid in 42 months. This liability and the increased PE payments (from 2019) will be distributed among the state of Espírito Santo, the municipalities bordering the new field and the Federal Government. According to the current state government, part of this revenue will be directed to the Espírito Santo Sovereign Fund (Ordinary Law No. 11,002/2019) and the State Fund for Financing Works and Strategic Infrastructure for the Development of the State of Espírito Santo (Complementary Law No. 914/2019). It is worth mentioning that these new amounts are not in this document, as this information is from 2019.

Figure 2 - Distribution of government participations among municipalities in Espírito Santo - 2018 (R$ million)



Source: ANP Elaboration: Ideies/Findes

Table 5 - Government participations generated by offshore field and bordering by municipality - 2018

Field*	Royalties (R$ million)	Special Participation (R$ million)	Total government participations (R$ million)	Municipality	average % bordering
Baleia Azul	306.24	51.74	357.99	Itapemirim-ES	24.3
				Marataízes-ES	55.7
				Presidente Kennedy-ES	20.0
Baleia Franca	334.73	87.12	421.85	Itapemirim-ES	50.0
				Presidente Kennedy-ES	50.0
Jubarte	1,617.32	2,557.31	4,174.63	Itapemirim-ES	44.6
				Marataízes-ES	6.4
				Presidente Kennedy-ES	49.1
Roncador	1,741.81	1,766.11	3,507.92	Presidente Kennedy-ES	100.0
				Campos dos Goytacazes-RJ	68.2
				São Joao da Barra-RJ	31.8

Source: ANP Elaboration: Ideies/Findes.

*Offshore fileds that generate special participation.

Table 4 - Revenues from royalties and special participation in Espírito Santo (R$ million)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Government Participations	Municipalities of ES	55.4	72.4	123.9	136.1	143.3	204.1	283.4	527.1	320.4	579.5	1,080.5	1,373.1	1,306.6	1,388.9	1,572.1	682.1	851.0	1,061.4
	State of ES	68.8	83.0	154.8	133.7	143.1	219.4	307.9	731.5	525.3	851.3	1,591.5	2,342.3	2,083.2	2,229.6	917.6	1,036.8	1,388.7	1,840.6
	Total number of states and municipalities in Brazil	11,327.4	14,239.3	21,492.1	21,932.4	26,498.3	32,269.5	27,389.9	39,935.7	27,755.5	34,475.4	38,421.5	44,590.9	42,523.3	44,502.4	27,858.0	18,958.4	31,612.5	50,574.1
	% of Brazil	1.1%	1.1%	1.3%	1.2%	1.1%	1.3%	2.2%	3.2%	3.0%	4.2%	7.0%	8.3%	8.0%	8.1%	8.9%	9.1%	7.1%	5.7%
Royalties	Municipalities of ES	55.3	71.2	119.2	130.1	136.3	196.3	273.6	456.0	249.1	485.4	889.7	1,028.3	1,030.6	1,094.6	739.1	558.7	664.2	790.7
	State of ES	68.5	77.8	135.6	109.8	115.2	188.4	268.6	447.2	240.1	474.7	828.3	962.9	979.3	1,052.4	709.3	543.4	641.4	757.8
	Total number of states and municipalities in Brazil	6,481.5	7,962.1	10,058.5	10,722.6	12,485.6	15,026.4	13,987.2	19,286.4	13,466.7	15,849.1	19,464.7	22,140.4	21,804.1	23,282.9	15,732.7	12,645.2	15,876.0	20,947.3
	% of Brazil	1.9%	1.9%	2.5%	2.2%	2.0%	2.6%	3.9%	4.7%	3.6%	6.1%	8.8%	9.0%	9.2%	9.2%	9.2%	8.7%	8.2%	7.4%
Special Participation	Municipalities of ES	0.1	1.3	4.8	6.0	7.0	7.7	9.8	71.1	71.3	94.1	190.8	344.9	276.0	294.3	208.3	123.4	186.8	270.7
	State of ES	0.3	5.2	19.2	24.0	27.9	31.0	39.3	284.3	285.2	376.6	763.2	1,379.4	1,103.9	1,177.2	833.1	493.5	747.3	1,082.7
	Total number of states and municipalities in Brazil	4,845.9	6,277.2	11,433.7	11,209.8	14,012.7	17,243.1	13,402.6	20,649.3	14,288.7	18,626.3	18,956.8	22,450.6	20,719.2	21,219.5	12,125.3	6.313,2	15,736.5	29,626.8
	% of Brazil	0.0%	0.1%	0.2%	0.3%	0.2%	0.2%	0.4%	1.7%	2.5%	2.5%	5.0%	7.7%	6.7%	6.9%	8.6%	9.8%	5.9%	4.6%

Source: ANP Elaboration: Ideies/Findes.

Table 6 - Royalties generated by onshore fields in Espírito Santo - 2018

Field	Royalties (R$ million)	Distribution (%)
Fazenda Alegre	21.99	36.9%
Inhambu	10.24	17.2%
Cancã	7.01	11.8%
Fazenda São Rafael	5.09	8.5%
Fazenda Santa Luzia	3.93	6.6%
Lagoa Parda	2.16	3.6%
Fazenda São Jorge	1.28	2.1%
Rio Preto Oeste	1.17	2.0%
Lagoa Suruaca	0.94	1.6%
Fazenda Queimadas	0.86	1.4%
São Mateus	0.77	1.3%
Rio Preto	0.70	1.2%
Rio Preto Sul	0.65	1.1%
Seriema	0.37	0.6%
Jacutinga	0.37	0.6%
Lagoa Piabanha	0.33	0.6%
Córrego Dourado	0.31	0.5%
Córrego Cedro Norte	0.29	0.5%
Gaivota	0.17	0.3%
Campo Grande	0.16	0.3%
Biguá	0.12	0.2%
Fazenda Cedro Norte	0.10	0.2%
Córrego das Pedras	0.09	0.2%
Guriri	0.07	0.1%
São Mateus Leste	0.06	0.1%
Mariricu	0.05	0.1%
Tabuiaiá	0.04	0.1%
Rio Ipiranga	0.04	0.1%
Fazenda Cedro	0.04	0.1%
Rio São Mateus	0.04	0.1%
Mariricu Norte	0.03	0.1%
Lagoa Parda Norte	0.03	0.0%
Crejoá	0.02	0.0%
Cacimbas	0.01	0.0%
Lagoa Bonita	0.01	0.0%
Rio Itaúnas	0.01	0.0%
Córrego Cedro Norte Sul	0.01	0.0%
Tucano	0.01	0.0%
Total	59.60	100%

Source: ANP Elaboration: Ideies/Findes.

3.2 Labor market

The oil and gas exploration and production activity is an important source of generation of formal, qualified and high-paying jobs in Espírito Santo, both directly and indirectly. In the first case, the industry demands skilled labor due to the high technological intensity of its activities. In the second case, the industry, by demanding specialized suppliers, mainly from other industrial sectors and of high value-added services, also fosters the generation and attraction of skilled workers.

For this reason, the oil and gas production chain can be presented according to the following link breakdown: (I) exploration and production (E&P), also known as upstream, which consists of the said O&G extraction and production activities; (II) fueling industry, which consists in processing and marketing[32] O&G products, and (III) supply chain[33], in which the industrial activities are inserted, providing specific products and services for E&P activities.

In 2018, the oil and gas production chain employed 4,589 formal workers, which corresponded to 2.9% of the national oil chain. From this total number of jobs in the state, 53.1% was in the E&P link, 14.8% in the fueling industry and 32.1% was in the supply chain industry. In relation to 2017, this total number of employees in the O&G industry in the state grew by 1.1%. This result was positively influenced by the increase in the number of employees in the supplier industry (11.8%). In this same year, both the E&P link (-3.1%) and the fueling industry (-3.8%) reduced their numbers of formal jobs.

Table 7 - Number of employees in the oil and gas chain in Espírito Santo

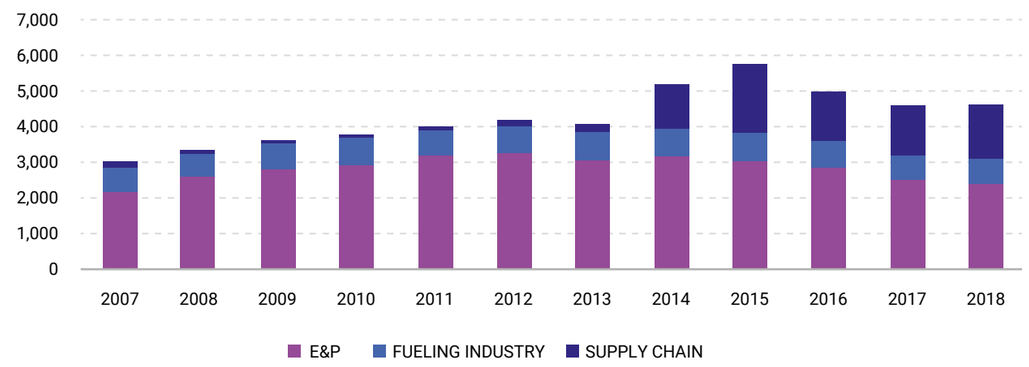
Chain link	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
E&P	2,278	2,636	2,818	2,914	3,192	3,251	3,087	3,207	3,071	2,883	2,518	2,439
Fueling industry	596	641	739	817	747	785	788	749	759	714	704	677
Supplier chain	112	44	27	41	72	122	197	1,232	1,928	1,362	1,318	1,473
Total	2,986	3,321	3,584	3,772	4,011	4,158	4,072	5,188	5,758	4,959	4,540	4,589
% of total jobs in the ES industry	1.9%	2.0%	2.1%	2.0%	2.1%	2.1%	2.1%	2.7%	3.2%	3.1%	2.9%	2.9%
% ES in Brazil - Total	2.0%	2.0%	2.0%	2.0%	2.0%	1.9%	1.8%	2.3%	2.8%	2.7%	2.8%	2.9%

Source: Ministry of Economy Elaboration: Ideies/Findes.

From 2007 to 2018, the number of formal jobs in the oil chain in Espírito Santo increased, on average, at 8.2% p.a. In this period, the number of jobs grew by 5.0% p.a. in the E&P chain and 3.3% in the fueling chain. Also, the supply chain industry link presented a growth of 26.4% p.a. in the same period.

In large part, the expressive growth of the labor market in the third link of O&G took place due to the geographical proximity of Espírito Santo to the production area at the pre-salt polygon. Therefore, several supply companies of the industry settled in the Espírito Santo territory. Emphasis is given to the arrival of industries for the manufacture of subsea equipment and infrastructure (platforms building industry and metal structures industry) for the development of the O&G production and the development of services related to engineering, maintenance, and repairs.

Chart 30 - Number of employees in the oil and gas chain in Espírito Santo



Source: Ministry of Economy Elaboration: Ideies/Findes.

[32] In this chain, retail fuel sales were not taken into account for understanding that this activity exists in virtually all regions of the country, regardless of whether the region possesses the O&G exploration and production activity.

[33] For the state of Espírito Santo, the activities related to the construction of vessels and floating structures were considered as a supplier of E&P activities for understanding that the existence of this activity in the state is a derivation of the existence of the E&P link of the O&G sector.

In counterpart, between 2015 and 2018, the total number of jobs in the oil and natural gas industry decreased at an average rate of -7.3% p.a. It occurred due to: (i) the reduction in exploratory activity and O&G production; (ii) market repositioning by part of Petrobras[34]; (iii) and discouragement towards the realization of new investments in the O&G sector. As a result, the state has witnessed a downturn in demand on the part of the goods and services operators, which, in turn, led to a decrease of -8.6% p.a. in the number of jobs in the Espírito Santo supply chain industry of O&G (third link).

Upon analyzing the composition of the labor market in the O&G chain (table 8), it is noted that 43.6% of the total formal occupations of the industry in Espírito Santo in 2018 were in professionals from exact and physical sciences, and engineering (839); and medium-level technicians from physical and chemical sciences, engineering and alike (765). In relation to the latter, the O&G sector employed 41.1% of all people who perform this modality of activity in the state's industry[35].

This year, the occupation with the greatest number of employees in the O&G chain in Espírito Santo was the oil exploration operator (472). This sector employed 87.7% of professionals who exercise this occupation in the state's general industry. Next, there were the occupations of mechanical technician (228) and administrative assistant (211).

The ES oil chain absorbs 99.4% of chemical engineers and 90.0% of mechanical engineers throughout the state's industrial sector.

In relation to the professional profile of employees in the O&G chain, the age group in this sector remained high in 2018. Approximately 66.1% of workers in the O&G chain in Espírito Santo was in the age group of 30 to 49 years, and 14.5% between 50 to 64 years. This age concentration repeats itself at a national level (table 8).

In 2018, from the 4,589 employees in the oil sector, 50.0% had at least a complete college degree. Besides, **the chain was responsible for 15.0% of employees with complete college degree of the Espírito Santo industry, 63.4% of employees with master's degree and 48.7% of employees with a doctorate in 2018.** This high level of technical qualification is a consequence of the capital intensity and the complexity of the technologies required for performing activities in the sector.

As the oil chain employs a skilled workforce, average earnings are high. In 2018, the O&G sector in Espírito Santo had an average salary of around R$12.2 thousand, above the national average (R$10.9 thousand). These values were well above the average remuneration in the Espírito Santo industry (R$ 2.6 thousand) and the national industry (R$ 2.8 thousand). This high remuneration moves an important consumer market in the location in which it is installed.

[34] According to the oil company's 2020-2024 Strategic Plan, the company's proposal is to concentrate activities in the production of oil and gas in deep and ultra-deep waters. In the document, the company states, as a new market repositioning, the comprehensive departure from the distribution and transport of natural gas, and of businesses related to biodiesel, Liquefied Petroleum Gas (LPG), and fertilizers. The company also intends to develop researches aiming for activities in renewable energies, with emphasis on wind and solar energy.

[35] The Espírito Santo/national industry, here, encompasses the extractive, transformation, and civil construction industries.

Table 8 - Job market characteristics of the oil and gas chain in Espírito Santo - 2018

	ES	BR	% ES IN BRAZIL	% ES INDUSTRY
Main Occupations				
Oil exploration operator	472	9,377	5.0%	87.7%
Mechanical Technician	228	4,016	5.7%	21.4%
Administrative Assistant	211	6,697	3.2%	5.9%
Chemical Engineer (oil and rubber)	159	2,371	6.7%	99.4%
Industrial mechanical engineer	144	2,701	5.3%	90.0%
Welder	135	1,975	6.8%	4.9%
Instrumentation technician	131	1,966	6.7%	45.8%
Truck driver (regional and international routes)	118	8,602	1.4%	3.3%
Occupational safety technician	104	2,858	3.6%	9.0%
Steel framework erector	104	304	34.2%	12.5%
Electrical maintenance technician	101	1,856	5.4%	28.9%
Function subgroup				
Professionals from the exact and physical sciences, and engineering	839	18,474	4.5%	3.9%
Medium level technicians of physical and chemical sciences, engineering and alike	765	15,166	5.0%	41.1%
Workers in the processing of metals and composites	622	10,832	5.7%	17.6%
Workers in continuous process industries and other industries	491	16,582	3.0%	6.2%
Clerks	363	16,060	2.3%	22.3%
Workers of transversal functions	354	21,366	1.7%	3.0%
Middle-level technicians in administrative sciences	246	8,521	2.9%	1.8%
Age Group				
10 to 17	49	302	16.2%	2.6%
18 to 24	266	7,902	3.4%	1.3%
25 to 29	556	16,720	3.3%	2.3%
30 to 39	1,974	60,364	3.3%	3.7%
40 to 49	1,059	38,108	2.8%	3.1%
50 to 64	666	30,636	2.2%	3.0%
Above 65	19	1,655	1.1%	1.1%
Education				
Illiterate	0	93	0.0%	0.0%
Until 5th incomplete	21	1,254	1.7%	0.4%
5th complete elementary	20	1,428	1.4%	0.4%
6th to 9th elementary	49	4,280	1.1%	0.3%
Complete elementary school	119	7,162	1.7%	0.7%
Incomplete secondary school	205	4,954	4.1%	1.3%
Complete high school	1,761	64,312	2.7%	2.2%
Incomplete higher education	119	6,691	1.8%	2.8%
Complete higher education	2,108	61,136	3.4%	15.0%
Master's Degree	168	3,688	4.6%	63.4%
Doctorate	19	689	2.8%	48.7%
Value of average remuneration of the O&G chain	R$ 12,138.87	R$ 10,938.53	-	-
Value of average remuneration (R$) of the industrial sector	R$ 2,639.38	R$ 2,785.78	-	-

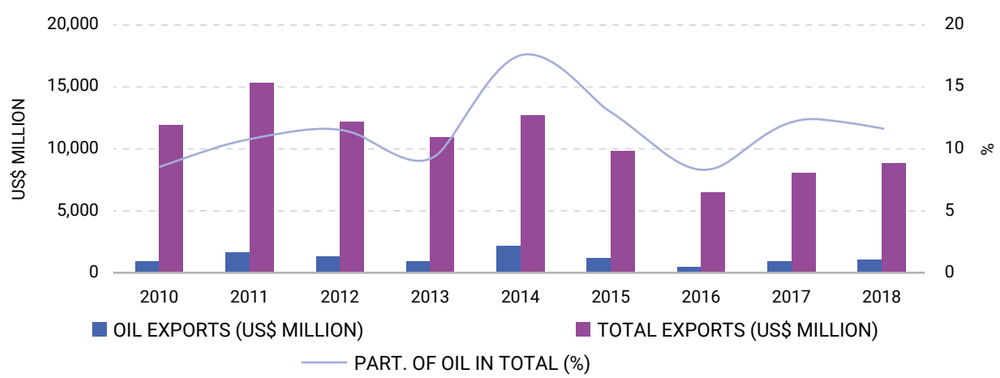
Source: Ministry of Economy Elaboration: Ideies/Findes.

3.3 External Sector

The oil industry's production can be consumed internally within the country or sold to other nations by way of foreign trade. These exports range from crude oil, coke and oil derivatives, petrochemical products, as well as products classified as "REPETRO-elegibles"[36].

With the start of production of the Espírito Santo fields at the pre-salt polygon, exports from the Espírito Santo oil industry increased significantly. In 2010, 8.6% from the total of Espírito Santo foreign sales was derived from the oil industry, jumping to 17.5% in 2014, peak year for the extraction and production of these products in the state. From that year, with the drop in international prices for a barrel of oil and with a reduced production of oil in the state, there is a reduction in the weight of the products from this industry in the total of the Espírito Santo exporting agenda, which began to account for 11.7% of total foreign sales in Espírito Santo in 2018.

Chart 31 - Oil exports in Espírito Santo (US$ million) and participations in the total (%)



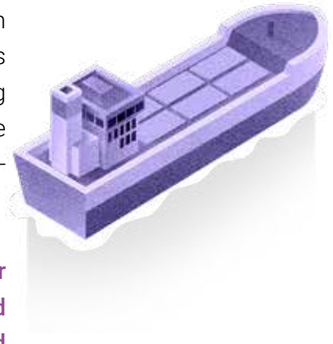
Source: Ministry of Economy Elaboration: Ideies/Findes.

From 2010 to 2018, the product that sold the most abroad was crude oil, i.e., without going through the refining process. During these years, this item concentrated, on average, 91.2% of the total value exported by the Espírito Santo O&G industry. The average participation of the state's oil exports in relation to Brazil's during the period was 4.4%.

The total value exported by the oil industry in Espírito Santo in 2018 was 1.0 billion dollars, 6.8% higher than the one grossed in the previous year. This year, the products sold abroad were: crude oil extraction (92.9%); oil derivatives (3.7%); REPETRO-elegibles products (2.9%); and petrochemical products (0.5%).

It is worth noting that there has been a significant growth of oil-derived products this year, going from US$ 0.0 in 2017 to US$ 38.5 million in 2018. A single item was responsible for this increase: fuel oil[37]. In 2017, Espírito Santo did not register significant petroleum product exports.

Between 2010-2018, crude oil exports in Espírito Santo were highly concentrated in six countries: The United States, Canada, India, Netherlands, Aruba, and China. Among these countries, the main foreign buyer was the USA, but its position was not dominant during the period. Canada occupied the first position in 2013 and the Bahamas in 2015 and 2016.



In 2018, crude oil was exported for only three countries: the United States (51.9%), India (36.2%) and China (11.8%). As seen in the first chapter, these countries are major consumers of oil and have the largest global refining capacities.

Table 9 - Oil exports in Espírito Santo (US$ million)

Period	Total oil exports		Crude oil		Oil derivatives		Petrochemical products		RETRO-elegible products	
	Total ES	%ES/BR	Total ES	% ES/BR	Total ES	% ES/BR	Total ES	% ES/BR	Total ES	% ES/BR
2010	1,020	4.4	899	3.9	0.2	0.0	1.5	0.1	119	8.2
2011	1,635	5.2	1,511	4.8	0.0	0.0	1.5	0.1	123	4.5
2012	1,397	4.4	1,322	4.2	0.0	0.0	0.4	0.0	74	2.1
2013	1,011	3.4	932	3.2	0.0	0.0	1.9	0.1	78	0.8
2014	2,223	8.3	2,001	7.4	0.0	0.0	5.6	0.2	217	5.2
2015	1,278	6.5	1,128	5.7	0.1	0.0	1.9	0.1	147	3.8
2016	535	2.8	465	2.4	0.0	0.0	2.6	0.1	68	1.3
2017	968	4.1	920	3.9	0.0	0.0	4.3	0.2	43	1.7
2018	1,034	4.4	960	4.1	38.5	2.1	5.6	0.2	30	1.1

Source: Ministry of Economy Elaboration: Ideies/Findes.

[36] REPETRO is the special tax regime applicable to the export and import of goods intended for the activities of research and exploration of oil and natural gas deposits - REPETRO, provided for in Law No. 9,478 of 6 August 1997. This regime allows, as the case may be, the application of the following custom treatments: Decree-Law No. 37 of 1966, article 93, with wording provided by Decree-Law No. 2,472 of 1988, article 3.

[37] Product obtained from the distillation of oil, which is used as a fuel for burning in furnace or boiler.

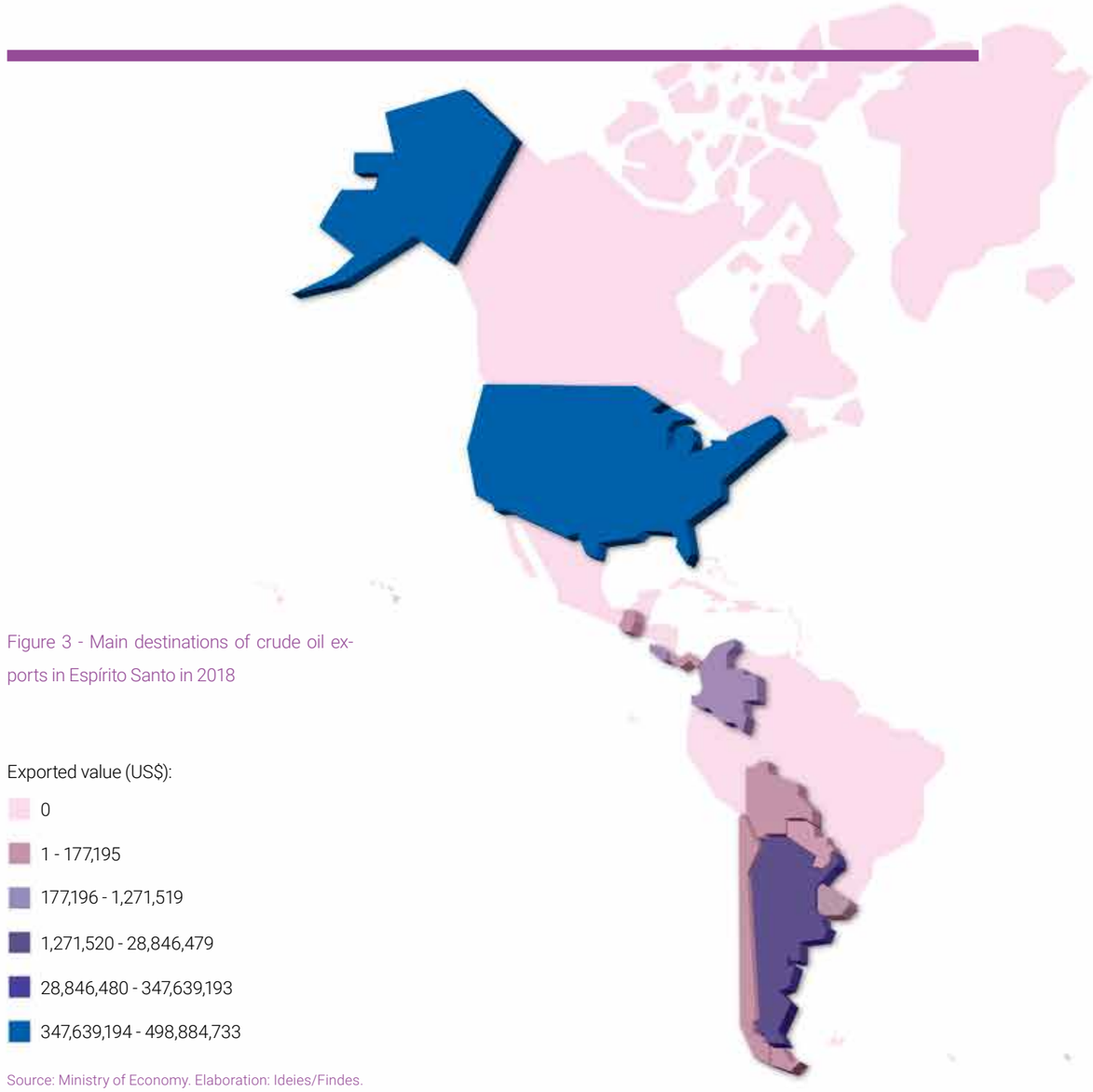


Figure 3 - Main destinations of crude oil exports in Espírito Santo in 2018

Exported value (US$):

- 0
- 1 - 177,195
- 177,196 - 1,271,519
- 1,271,520 - 28,846,479
- 28,846,480 - 347,639,193
- 347,639,194 - 498,884,733

Source: Ministry of Economy. Elaboration: Ideies/Findes.

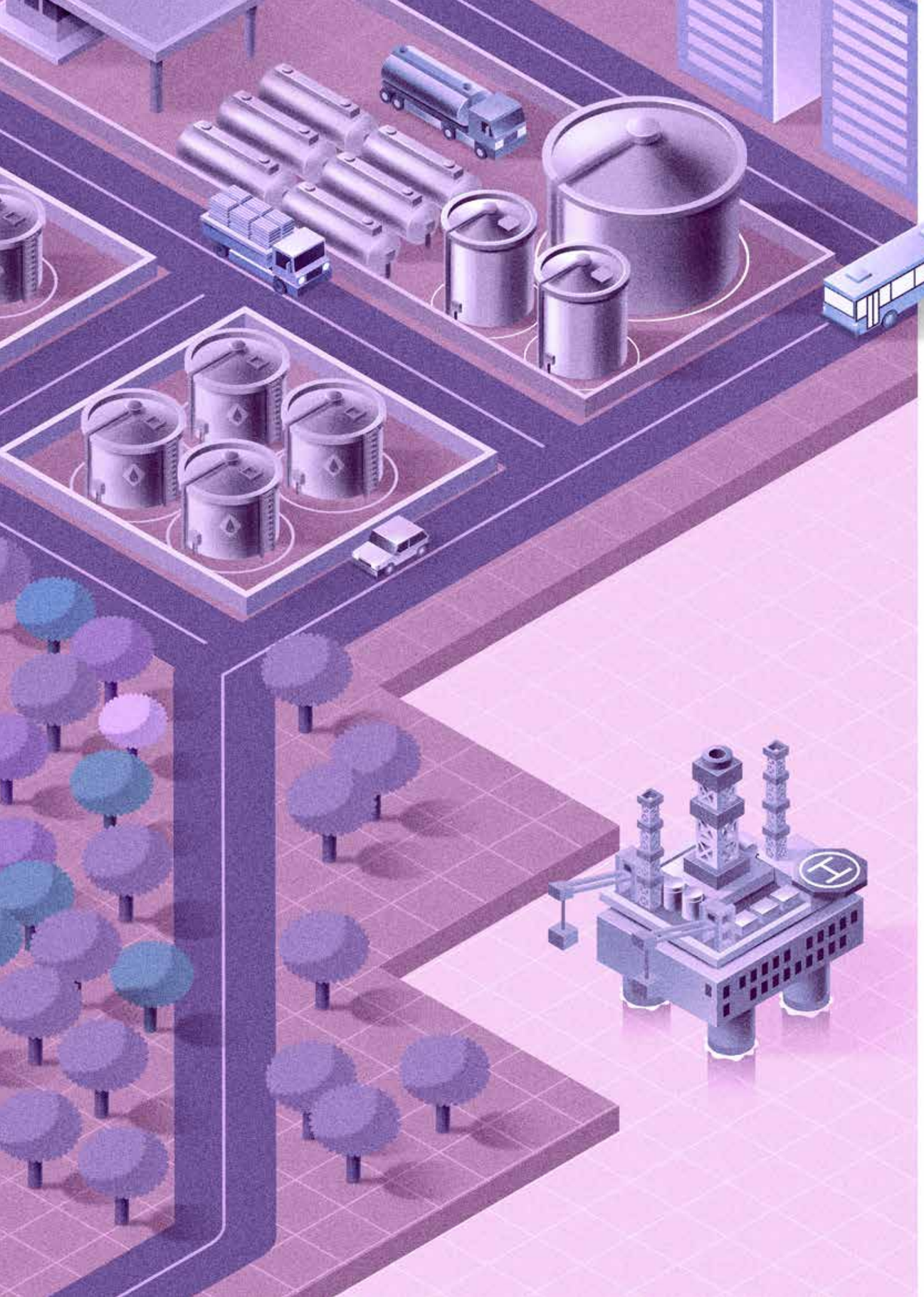
Relative to imports, Espírito Santo acquired from other countries, mainly petrochemical products and oil derivatives. Only in 2014, imports from the REPETRO-eligible were superior to petrochemical products. There was no record of foreign purchases of crude oil in this period.

The total number of products imported by the Espírito Santo oil industry amounted to US$ 178 million in 2018. From this amount, US$ 46.6 million refers to imports of oil derivatives, US$ 72.0 million to imports of petrochemical products and US$ 59.0 million to REPETRO-eligible imports.

Table 10 - Espírito Santo oil imports (US$ million)

	Total oil exports		Crude oil		Oil derivatives		Petrochemical products		REPETRO-eligible products	
Period	Total ES	%ES/BR	Total ES	% ES/BR	Total ES	% ES/BR	Total ES	% ES/BR	Total ES	% ES/BR
2010	231	0.8	-	-	46.3	0.4	119	2.9	66	2.8
2011	244	0.6	-	-	17.1	0.1	157	3.0	70	2.6
2012	290	0.7	-	-	34.6	0.2	163	3.3	92	3.2
2013	265	0.6	-	-	37.8	0.2	119	2.1	107	3.1
2014	315	0.7	-	-	35.5	0.2	107	1.9	173	4.8
2015	228	0.9	-	-	67.0	0.7	111	2.5	50	1.3
2016	132	0.8	-	-	33.8	0.4	69	1.9	29	1.1
2017	157	0.7	-	-	81.1	0.6	42	1.1	34	2.0
2018	178	0.5	-	-	46.3	0.3	72	1.8	59	0.5

Source: Ministry of Economy Elaboration: Ideies/Findes.



Chapter 4

RESEARCH, DEVELOPMENT AND INNOVATION

Innovation is one of the most important elements for a company to be competitive. Currently, a large part of innovations arises from the production of research and knowledge. As in other sectors, the development of technological solutions is key to maintain the production capacity and competitiveness of the oil and natural gas (O&G) sector.

In Brazil, there is an important encouragement mechanism for the production of knowledge and new technologies for this sector: the research, development, and innovation (RD&I) clause, present in Law No. 9,478 of 8/06/1997 and regulated by ANP Resolution No. 50/2015.

4.1 Regulation

The RD&I clause, signed in the oil and natural gas exploration and production contracts, provides for the application of a percentage from the gross revenue from production in research, development, and innovation projects and programs by oil companies.

The financing of these projects, via clause, started in 1998, year after the creation of the Oil Law (Law No. 9,478/97), but it was only regulated in 2005 by ANP Resolution No. 33/2005 and by the respective ANP Technical Regulation (No. 05/2005).

In November 2015, this regulation was replaced by Resolution No. 50/2015 and the respective ANP Technical Regulation No. 3/2015, which took effect in the following year[38].

From this latest resolution, suppliers of O&G goods and services and technology-based companies were able to use the resources from the clause. In addition, standards, definitions, and procedures were established for the three models of oil and gas exploration and production contracts existing in the country.

[38] Data on the resources of ANP's RD&I Clause undergo constant revisions and changes in the way the agency makes them available (www.anp.gov.br). From 2018, ANP began disclosing only the total quantity of projects/programs regulated by RT No. 05/2005, without the amounts spent. There is only information on values for projects regulated by RT No. 05/2015 and that require authorization from ANP. For all other projects, this information is not available. As not all projects and programs from 2017 were regulated by the current resolution, it was decided to disclose in this annual report data related only to 2018 due to their greater consistency.

The percentage to be applied varies according to the specific conditions of each modality of contract: 1.0% in the case of concession and production sharing and 0.5% in the case of onerous transfer. The values generated are invested in RD&I projects that can be carried out by the oil company itself, by Brazilian companies or by accredited institutions from all over the country [39].

Box 2 - Percentage of application of gross revenues in RD&I by concessionaires, by contract modality of the producing fields

		Value of RD&I obligations by the concessionaires
Contractual Regime	Concession	1.0% of the monthly gross revenue from each field that generates special participations (high productivity)
	Production Sharing	1.0% of the total annual gross revenue of each field
	Onerous Transfer	0.5% of the total annual gross revenue of each field

Source: ANP Elaboration: Ideies/Findes.

The gross revenue from the 18 fields, explored by way of the concession regime and that collected special participations, totaled approximately R$ 197 billion in 2018, generating R$ 1.9 billion in mandatory qualified expenditures on research and development. From these fields, 4 are from Espírito Santo (Baleia Azul, Baleia Franca, Jubarte and Roncador[40]), totaling together a gross revenue of approximately R$ 39 billion, hence, they generated R$ 399 million in qualified resources for RD&I.

Recently, ANP approved the revision of ANP Technical Regulation No. 3/2015. The changes extend the possibilities for actions by research institutions, encourages the execution of projects in partnership with universities and companies, and enables the performance of new models of projects and programs[41].

The participation of other companies in RD&I projects was already allowed, but the regulation provided a series of obstacles, hindering the participation of suppliers and small businesses. This took place as the oil company needed to prove that the company to take part in a project was a technology-based Brazilian company, a concept drawn up by the Funding Authority for Studies and Projects (FINEP) and had a series of requirements to conform to[42].

This concept used to cause legal uncertainties in oil companies since they faced difficulties in classifying companies as technology based for project hiring. To provide more security to the application of the clause's resources, ANP revoked this concept, allowing the participation of any Brazilian company which is developing technology by way of research and development programs.

Part of the obligatory resources committed by an oil company continues, necessarily, having to be invested in projects with universities and research centers. The oil company may decide where to invest the other part. However, with the change, research centers and universities may work together with suppliers and startups in developing projects guided by oil companies. This change will open the possibility of creating an innovative environment, which is more dynamic, productive and with a diversity of players, fulfilling the demands from the sector more comprehensively.

With the existing regulation, few modalities of expenditures with projects and programs need the authorization from ANP for their spending[43]. Most of these projects or programs remained without the need for prior authorization, sufficing for the executors to be accountable for the resource used at the end of the project or program.

Box 3 - Legal and normative reference of the distribution by type of executor of the resources from the RD&I clause

Concession contracts until the 10th round	Concession contract from the 11th to the 13th round and production sharing	Concession contract from the 14th round and production sharing	Onerous transfer contracts
Application of at least 50% of resources in projects and programs carried out by Accredited Institutions (AIs). From this portion, up to 30% can be directly applied in Brazilian Companies, in projects or programs carried out in partnership with the AIs and aimed at the innovation of the product, process or service.	Application of at least 50% of resources in projects or programs by AIs. In this portion, up to 30% can be applied directly in Brazilian companies, in projects or programs carried out in partnership with AIs and that aim at the innovation of the product, process or service.	Application of 30% to 40% of resources in universities or national research and development institutes accredited by ANP.	Application of 100% of resources in projects and programs carried out by AIs. From this portion, up to 30% can be applied directly in Brazilian companies, in projects or programs carried out in partnership with AIs and that aim at the innovation of the product, process or service.
The remainder of the resource, up to 50%, should be destined for any of the allowed executors: Oil company (OC), Brazilian Company (BC) or Accredited Institution (AI).	Application of at least 10% of resources in projects or programs carried out by Brazilian Companies.	Application of 30% to 40% of resources in research, development, and innovation activities that aim at resulting in products or processes with technological innovation with Brazilian Companies.	
	The remainder, up to 40%, can be applied in a project or program carried out in the facilities of the Oil Company itself or affiliates (as long as located in Brazil), or contracted by the Brazilian Companies or AIs.	The remainder can be applied in research, development and innovation activities performed in facilities of the Concessionaire itself or its affiliates (located in Brazil) or in Brazilian Companies, or universities or research and development institutes accredited by ANP.	

Source: ANP Elaboration: Ideies/Findes.

[39] Oil company corresponds to a signatory company of concession, onerous transfer, or production sharing contracts signed for the oil and natural gas exploration and production activity. Research institutions correspond to universities or research and development institutions accredited at ANP. Finally, Brazilian companies are economic organizations, duly registered with the Commercial Register or Civil Registry of Legal Entities.

[40] Roncador borders Espírito Santo and Rio de Janeiro.

[41] The changes are included in Resolution No. 799 of 2 September 2019, which is available at http://www.anp.gov.br/images/Pesquisa_Desenvolvimento/Investimentos_PDI/Regulamentacao_tecnica/resolucao-799-2019.pdf.

[42] To understand the requirements, see ANP RT No. 3/2015, item 1.7.

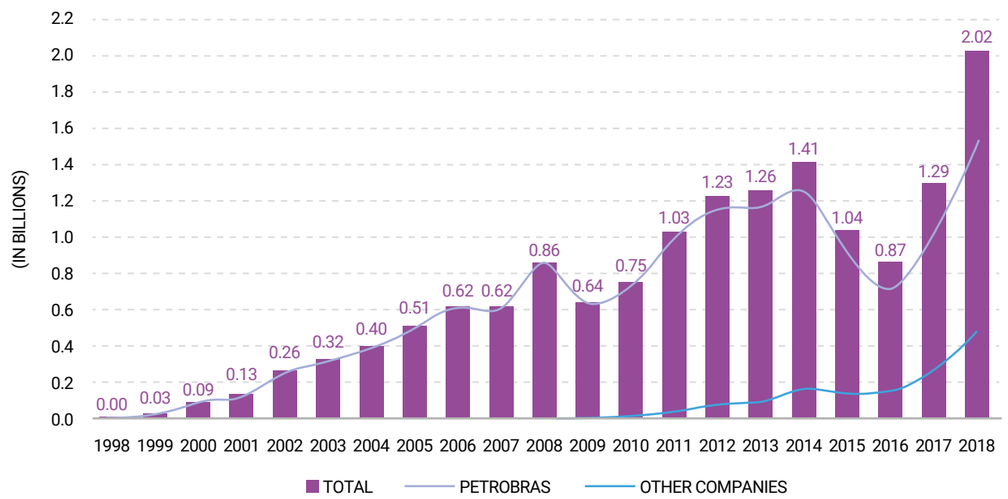
[43] The categories of projects and programs in the RT No. 03/2015 that must be submitted for authorization are: (a) technological program for the development and technical qualification of suppliers; (b) specific project for laboratory infrastructure improvement; (c) project for the study of new frontier sedimentary basins involving data acquisition activities; (d) specific project of basic industrial technology; (e) specific program of human resources training; (f) specific project of non-routine basic engineering; (i) specific project of support to laboratory RD&I installations.

4.2 Projects and Programs Developed with the resource from the RD&I Clause

Between 1998 and 2018, the RD&I clause generated in Brazil approximately R$15.3 billion in volume of obligations, wherein Petrobras is responsible for 90.4% of this amount and the other companies 9.6%.

In 2018, the value generated by the clause was R$ 2.02 billion, an increase of 56.1% in comparison with the immediately preceding year (2017). The relative participation of Petrobras against other oil companies was 76.0% in 2018. Despite this still concentrated result, there has been increased participation by other companies since 2016. This year, these companies accounted for 0.8% of the total value of obligations generated, now representing 23.9% in 2018.

Chart 32 - Values generated by the RD&I clause in Brazil (R$ billion)

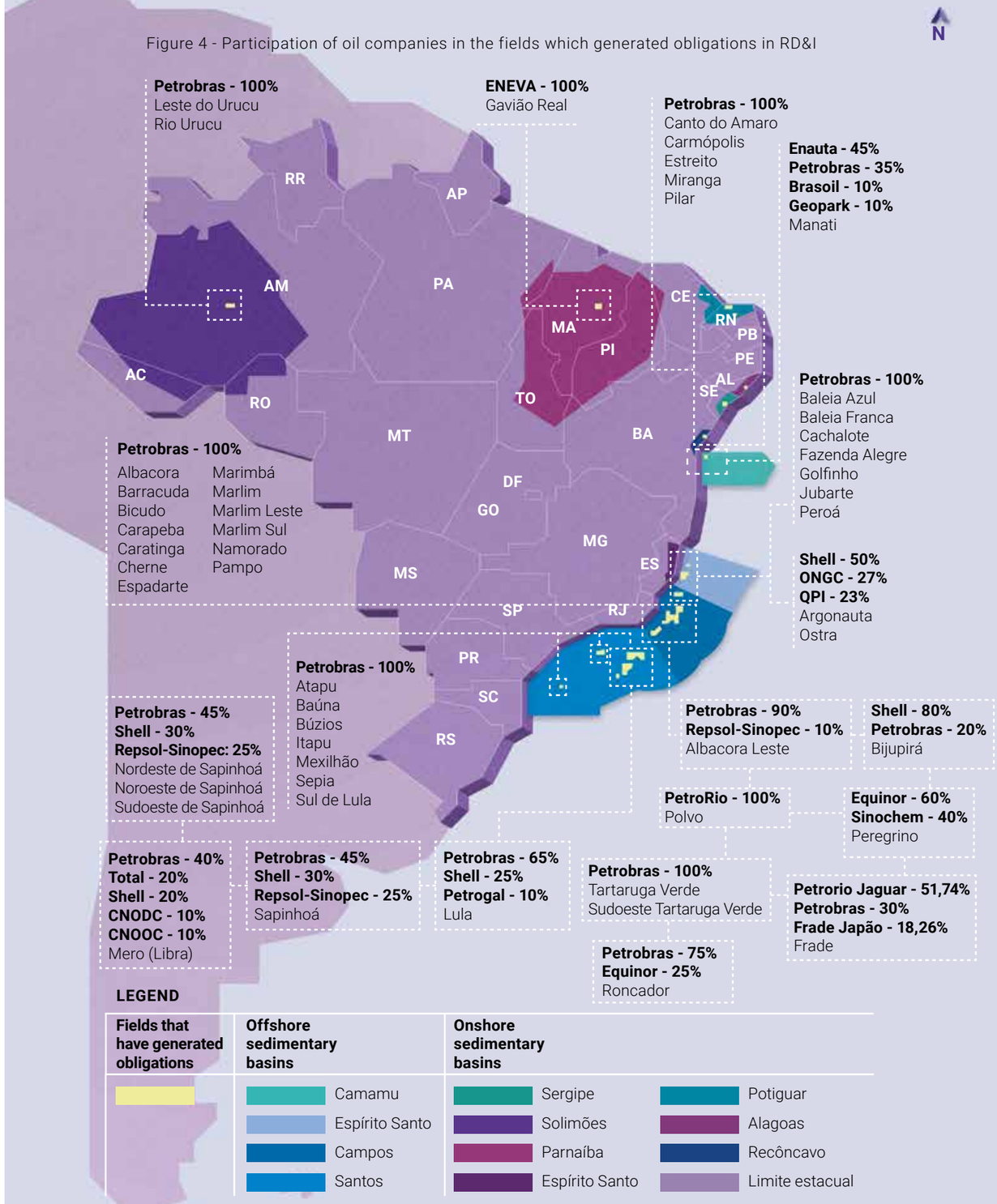


Source: ANP Elaboration: Ideies/Findes.

According to data provided by ANP[44], between 1998 and 2018, 10,874 projects were developed in Brazil financed with resources from the obligations generated by the clause. The peak in the number of projects occurred in 2005 (1,047 projects), the year before to the beginning of the validity of RT No. 05/2005. **Upon comparing 2018 (598) with 2017, the number of projects increased by only 1.35%, but it is the largest number of projects since 2006 (946).**

[44] The list of projects submitted by oil companies which were financed with resources from the RD&I clause in Brazil can be accessed at: http://www.anp.gov.br/pesquisa-desenvolvimento-e-inovacao/investimentos-em-p-d-i/projetos-de-pd-i. The number of projects mentioned refers to those that required and did not require authorization from ANP.

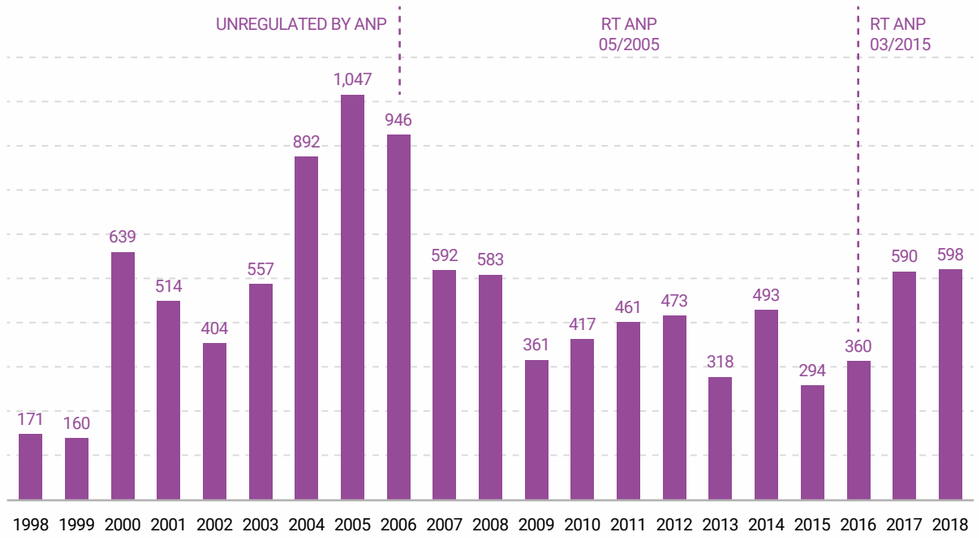
Figure 4 - Participation of oil companies in the fields which generated obligations in RD&I



Source: ANP Elaboration: Ideies/Findes.

Note: Information up to the third quarter of 2019.

Chart 33 - Number of projects started that received resources from the RD&I clause in Brazil



Source: ANP Elaboration: Ideies/Findes.

From the total of projects developed in Brazil (10,824) using resources from the RD&I clause, 1,655 projects needed ANP authorization due to it is specificities, according to technical regulation n° 03/2015. It is worth pointing out that, as a general rule, the majority of projects do not require prior analysis by part of the agency before being contracted by the oil company, as provided for in the technical regulations[46]. From this total, 87.6% were performed by Petrobras.

These projects authorized by ANP totaled an approved expenditure of R$ 5.7 billion in the period from 2005 to 06/2019. Oil companies with the higher authorized values were Petrobras and Shell, with 90.2% and 6.0% of the total value, respectively.

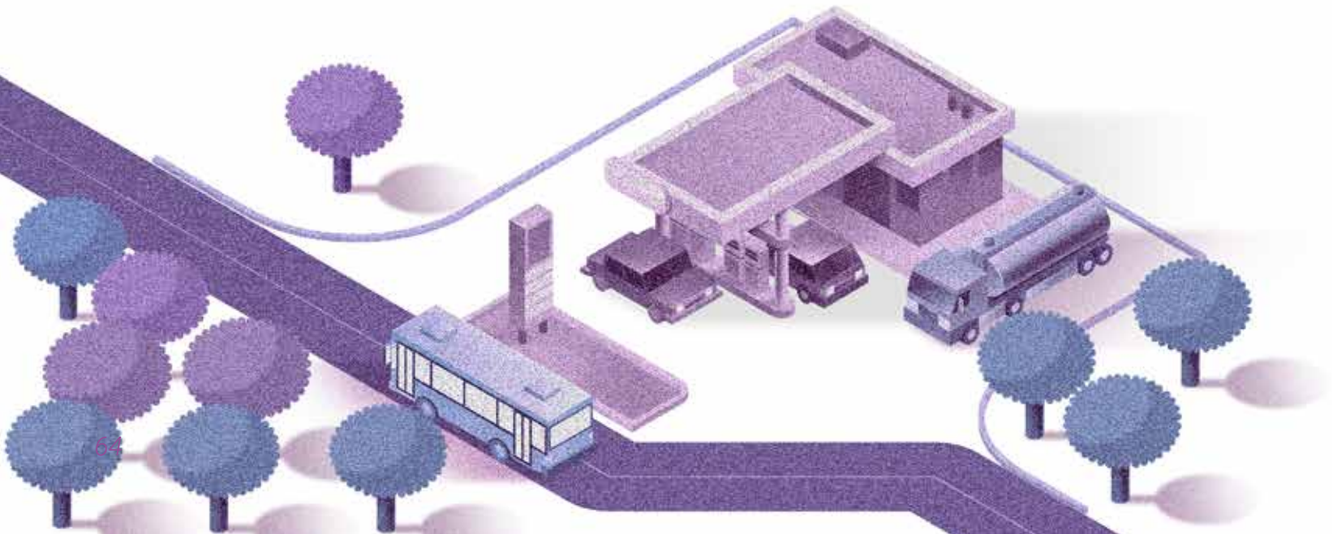
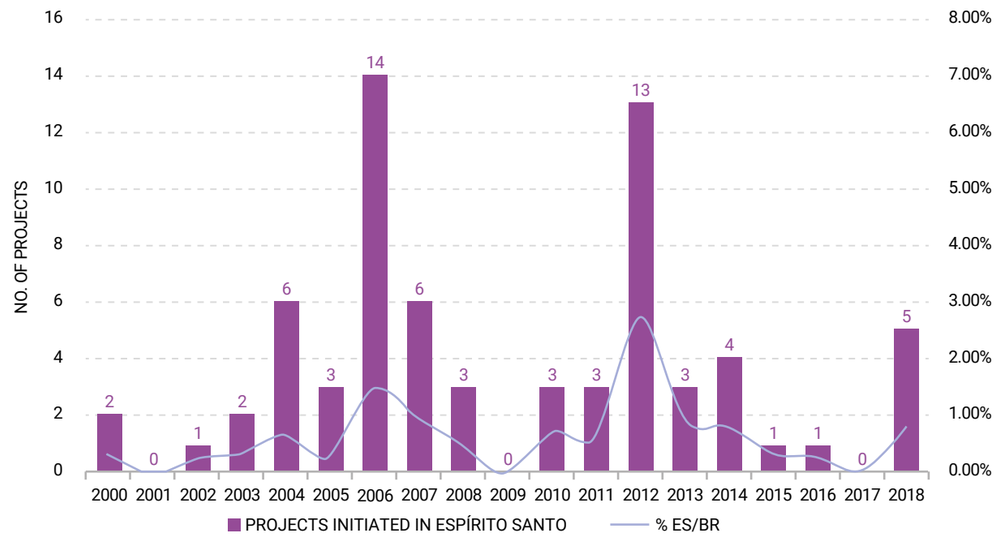


Chart 34 - Number of projects started that received resources from the RD&I clause in Espírito Santo



Source: ANP Elaboration: Ideies/Findes.

From 2000 to 2018, a total of 70 projects were started in Espírito Santo, developed with resources from the RD&I clause.

From the four oil companies[47] that generate RD&I obligations for having producing fields bordering the state, only Petrobras (69) and Queiroz Galvão (1) had projects developed with this resource.

The greatest number of projects was started in 2006 (14) and 2012 (13), however, the number for 2018 (5) is the largest of the past six years and higher than 2017, when no project was carried out, as it occurred in 2001 and 2009.

In 2018, the number of projects developed by the state represented only 0.84% of Brazil's total.

In Espírito Santo, as well as in Brazil, only a portion (13 out of 70) of the projects financed with resources from the clause needed authorization. A great part of these projects was intended for the creation and the adequacy of laboratory infrastructure and the acquisition of equipment needed for research.

[45] Number related to the total of projects and research, development and innovation programs released by ANP to receive resources from the RD&I clause. The fact that these projects/programs were approved does not guarantee their performance.

[46] ANP disclosed a consolidated table with project information and their respective values, authorized between November 2005 and 30 June 2019.

[47] Petrobras; Shell; ONGC E QPI.

Table 11 - Investments in RD&I authorized by ANP in Brazil by leading concessionaires

Oil Company	No. of authorized projects	%	Authorized values (R$ millions) *	%
PETROBRAS	1,450	87.6%	5,210.75	90.2%
SHELL	71	4.3%	349.01	6.0%
QUEIROZ GALVÃO	32	1.9%	9.62	0.2%
EQUINOR	23	1.4%	49.30	0.9%
PETROGAL	24	1.5%	73.75	1.3%
SINOCHEM	13	0.8%	19.87	0.3%
REPSOL	17	1.0%	45.76	0.8%
CHEVRON	9	0.5%	6.37	0.1%
GEOPARK	3	0.2%	0.67	0.0%
BP	2	0.1%	2.32	0.0%
ONGC	2	0.1%	0.50	0.0%
PARNAÍBA GÁS NATURAL	2	0.1%	5.57	0.1%
BRASOIL	2	0.1%	0.24	0.0%
QPI	2	0.1%	0.19	0.0%
FRADE JAPÃO	1	0.1%	3.16	0.1%
RIO DAS CONTAS	1	0.1%	0.11	0.0%
TOTAL S/A	1	0.1%	0.09	0.0%
TOTAL	1,655	100.0%	5,777.27	100.0%

Authorized projects (from November 2005 until June 2019)

* Accumulated from Jan/2005 to Jun/2019

Source: ANP Elaboration: Ideies/Findes.

4.3 Executors of projects and programs financed by the RD&I clause

The research and development projects carried out with resources from the clause may be executed by the oil company, by research institutions and by Brazilian companies. In the case of the last two, the studies developed aim at fulfilling specific demands from oil extraction and production companies. Normally, the interconnection between the demanding party and the candidates for project implementation is done by way of institutional articulation, being chosen the institution/company that the oil company deems to be better suited to develop the job.

4.3.1 Registered institutions

In Brazil, in 2018, there were 140 research institutions registered with ANP for the execution of projects using resources from the RD&I clause. These institutions divide themselves into a total of 843 research units (RU). These accredited institutions cover a total of 3,688 lines of research, distributed in seven thematic areas, dedicated towards the sector's scientific and technological development (Table 12). The state with more institutions registered was Rio de Janeiro (31), followed by São Paulo (22).

Until 2018, in Espírito Santo, only the Federal University of Espírito Santo (UFES), the Federal Institute of Espírito Santo (IFES) and East Central College (UCL) carried out projects using resources from the RD&I clause, with UFES being responsible for 97.1% of the total number of projects carried out in the state.

In 2018, Espírito Santo developed 5 projects using resources from the RD&I clause, totaling R$ 11.4 million[48], all performed by UFES research units. From these projects, two were related to the production theme, one with well engineering, one related to safety and the environment and one about advanced oil recovery. This year, only two research institutions were registered at ANP: UFES with 14 research units registered and UCL with 1.

Table 12 - Number of Lines of Research per area - until 2018

Area	Line of Research	Share (%)
Cross-cutting Themes	1,288	34.9%
Exploration and Production of Oil and Natural Gas	1,157	31.4%
Biofuel	533	14.5%
Supply	318	8.6%
Other Energy Sources	184	5.0%
Natural Gas	139	3.8%
Sector Regulation	69	1.9%
Total	3,688	100.0%

Source: ANP Elaboration: Ideies/Findes.

This small number of research units explains, to some extent, the only 70 projects/programs developed within the state, with three possible reasons in particular: (i) reduced number of professors, fellows and laboratories present in these RUs; (ii) the complexity and duration of projects and programs; (iii) obligations of teachers in other academic activities. These points, together, reveal why the state's RUs have limited momentum to receive investments from the RD&I clause.

[48] No project from 2018 needed ANP's authorization. These values were intended to be carried out during the entire period of the project. And each project has a different duration, ranging from 24 to 42 months.

An option to increase the number of projects with resources from this clause is, therefore, to increase the number of registered research units registered. According to data from the CNPQ Census (2017), there were 37 lines of research in Espírito Santo linked directly to the activity of extraction and production of oil, natural gas and biofuels that were still not registered to ANP. As long as they fulfilled the other requirements from ANP Resolution No. 47/2012 and the respective ANP Technical Regulation No. 7/2012[49], these lines of research could be transformed into research units registered in the agency.

Table 13 - Espírito Santo institutions that received resources from the RD&I clause - 1998 to 2018

	UFES	IFES**	UCL	Total ES
No. of research units registered at ANP*	14	0	1	15
No. of projects that received resources from the RD&I clause without the need for ANP authorization	55	1	1	57
No. of projects that required ANP authorization	13	0	0	13

* Two research units do not appear in this list: Research Group on Oil/Natural Gas Engineering, Energy and Environment (GPEPEM-UFES), registered in January 2019 and the Research on Environment, from the Vila Velha University (UVV), registered in March 2019.

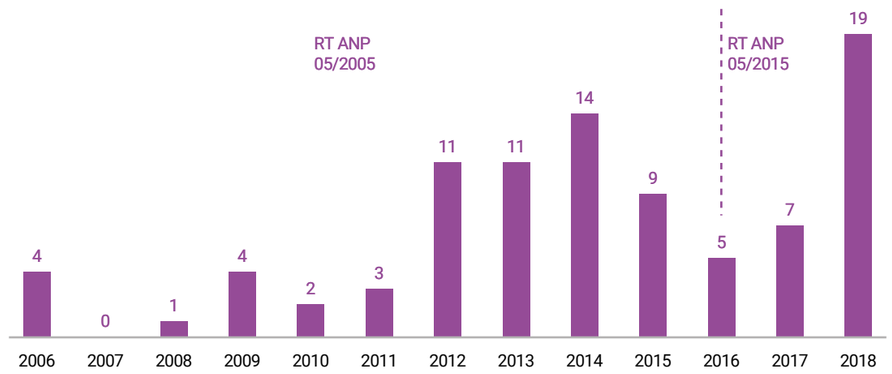
** IFES, until the date of this publication, was not accredited by ANP.

Source: ANP Elaboration: Ideies/Findes

4.3.2 Brazilian Companies

Brazilian companies developed 90 RD&I projects using resources from the clause from 2006 to 2018, where only seven required ANP's authorization, i.e., they fell into the project and program categories that should be submitted for authorization. These companies may be the sole executors of the project, they may subcontract a research institution or even be subcontracted by the oil company.

Chart 35 - Projects developed by Brazilian companies using resources from the RD&I clause



Source: ANP Elaboration: Ideies/Findes

Note: To prepare this information, oil companies were excluded.

Companies from Espírito Santo still have not developed research, development, and innovation projects with these resources, however, the state holds the potential to do so. In the Espírito Santo Oil and Gas Forum (FCP&G, in Portuguese), with executive coordination by the Federation of Industries of the State of Espírito Santo (Findes), there are 18 companies which are responsible for developing 30 unique projects[50] that fall into the requirements needed to receive resources from the clause. These projects are being carried out by individual companies or through consortia among different companies, promoting the complementarity of skills towards the development of new products, in the resolution of problems and contributing to innovation efficiency.

FCP&G has been working to disseminate projects developed by the participating companies, to enable them to access the resources from the RD&I clause. The maintenance of the production and competitiveness capacity of the oil and gas sector permeates through the development of new technologies. Using resources from the clause will make it possible to foster greater opportunities for promoting technological development and innovation within the state.

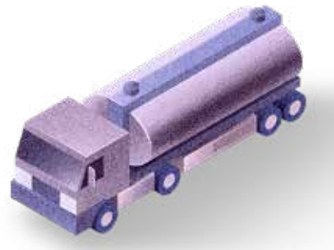
Considering new rules ANP rules of reducing bureaucracy in using mandatory research and development resources is expected that startups and suppliers from the oil industry will have greater access with less bureaucracy to the resources from the clause.

[49] ANP Technical Regulation No. 7/2012 approved by ANP Resolution No. 47/2012 and improved in 8 march 2019 by ANP Resolution No. 775/2019, establishes rules, conditions and technical requirements for the accreditation of research institutions able to participate in projects financed with resources provided for in RD&I Clauses. Access at: http://legislacao.anp.gov.br/?path=legislacao-anp/resol-anp/2019/fevereiro&item=ranp-775-2019

[50] Projects in the testing, starting, development phase, or completed. See the complete listing attached.

Chapter 5

OPPORTUNITIES FOR ESPÍRITO SANTO



With the advancement in processes related to energy transition for the next decades, the structure of energy generating sources will change, with greater involvement by part of renewable sources. Oil may lose share, but will still continue contributing with slightly over 1/4 of the world demand for energy[51]. On the national scene, plans for investments in oil and natural gas by the main actors of the sector are concentrated in seizing this window of opportunity.

ANP, concerned in providing the sector with a competitive environment, is promoting some measures to attract and diversify the actors involved, providing greater predictability to agents. For Espírito Santo, new opportunities in exploration and production are concentrated in the calendar of rounds of areas located in ultra-deep waters and of the permanent offer. In addition to these, there is the inclusion of exploration areas that Petrobras is letting go, either due to the new repositioning of the company's market[52] or even due to the areas returned to ANP for lack of investments by part of the company[53].

5.1 Next bidding rounds of ANP blocks

In August 2018, the National Council for Energy Policy (CNPE, in Portuguese) published guidelines[54] for the multiannual planning of bidding blocks for the exploration and production of oil and natural gas in the 2020 - 2021 biennium. The Council defined criteria for performing the seventeenth and eighteenth bidding rounds of blocks for the exploration and production of oil and natural gas. The seventeenth round was authorized[55] and the areas were defined for which ANP will promote the auction.

[51] According to projects from the Energy Information Administration, presented in Chapter 1.

[52] See note 51

[53] ANP Board Resolution 0254/2019.

[54] According to CNPE resolution No. 10 of 2018

[55] According to CNPE resolution No. 24 of 2019

Figure 5 - Schedule of rounds authorized and announced by ANP for Espírito Santo

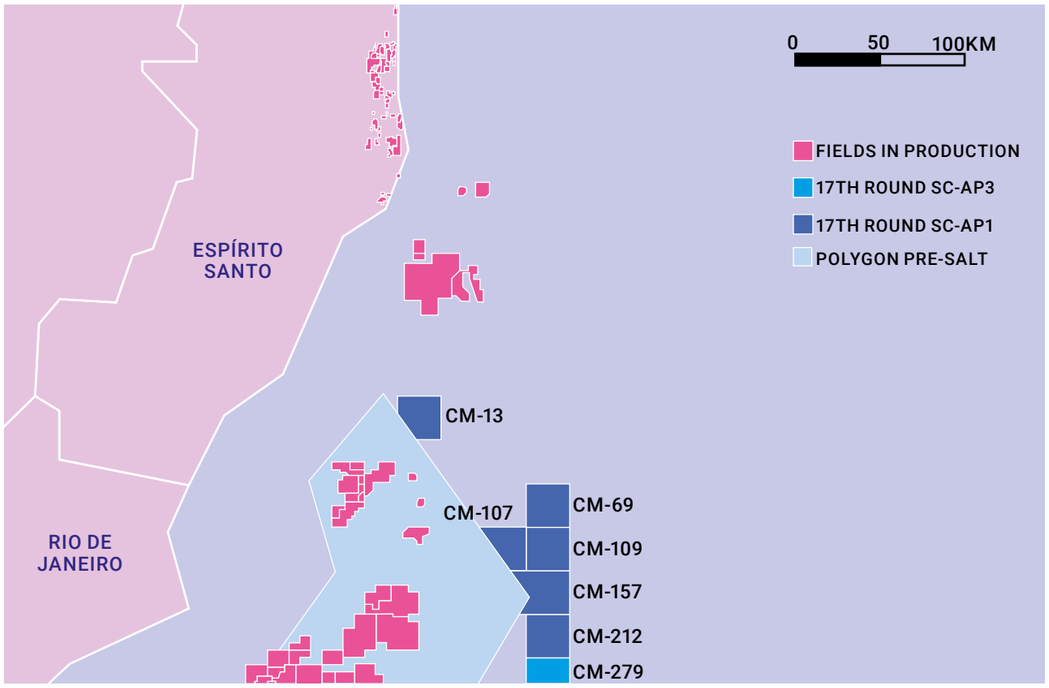
AUTHORIZED	ANNOUNCED
2020	**2021**
17TH BIDDING ROUND	**18TH BIDDING ROUND**
CAMPOS BASIN	ESPÍRITO SANTO BASIN
SC-AP1 E SC-AP3	SES-VT. SES-AUP2 E SES-AUP3

Source: ANP Elaboration: Ideies/Findes

In this round, 128 blocks will be offered in the basins/sectors: Pará-Maranhão (SPAMA-AUP1 sector), Potiguar (SPOT-AP2 and SPOT-AUP2 sectors), Pelotas (SP-AP1, SP-AR1 and SP--AUP1 sectors), Campos (SC-AUP2, SC-AP3 and SC-AP1 sectors) and Santos (SS-AUP5, SS--AP4 and SS-AUP4 sectors). The assets total an area of 64.1 thousand km².

Bordering Espírito Santo, there are 6 blocks from the SC-AP1 sector and 1 block from the SC-AP3 sector (Figure 6). The area is exploratory and thus, with no record of drilling activity. Only block C-M-13 was drilled in 2003 and classified as dry with traces of oil, but that did not justify production for the oil company at the time. The bordering Espírito Santo municipalities are Anchieta, Piúma, Itapemirim, Marataízes, Presidente Kennedy, Vila Velha and Guarapari.

Figure 6 - Areas being offered in ANP's 17th round - Espírito Santo



Source: ANP | Elaboration: Ideies/Findes

ANP is also authorized to perform the 18th round, in the modality of concession, in 2021. For this round, blocks from Ceará Basins should be selected (SCE-AP1, SCE-AP2 and SCE-AP3 sectors) and from Pelotas (SP-AR2, SP-AR3, SP-AP2, SP-AUP2 and SP-AUP7 sectors) and ultra-deep waters from the Espírito Santo Pre-Salt Basin SES-AUP2, SES-AUP3 and SES-VT sectors).

It has to be emphasized that **the maintenance of the bidding rounds' calendar in Brazil is key for attracting investments in the oil and natural gas sector**, increasing its potential and ensuring greater predictability to agents representing the sector, to society and municipal, state and federal governments.

5.2 Permanent Offer

Following CNPE resolutions No. 17/2017 and 8/2018, ANP keeps authorized to bid by a permanent offer, the fields returned or undergoing the process of return, as well as exploratory blocks offered in previous bids that were not acquired or returned to the agency. Some areas with marginal accumulations[56] located in mature basins were also included. Being excluded from this offer are the blocks located in the Pre-Salt Polygon and other areas considered strategic.

Permanent offer[57] is a bidding process comprising several distinct steps of the Rounds coordinated by ANP (figure 7). In this offer modality, bidders registered with ANP may express interest at any time to operate in any one of the blocks or areas offered by the agency. To do so, all that is required is a declaration of interest accompanied by the assurance of the offer for the desired block or area.

After the approval of at least one declaration of interest and respective documentation, the Special Bidding Commission (CEL, in Portuguese) of the permanent offer discloses the schedule for the offer presentation cycle. The winner of the bidding is the company or the consortium that i) obtains the highest score in signing bonus and the minimum exploratory program in exploratory blocks; and (ii) the largest signing bonus in areas of marginal accumulations. Subsequently, the winning bidder is qualified, the object is awarded and the bidding is approved. Finally, the signing of the contract ensures the company the concession of the area.

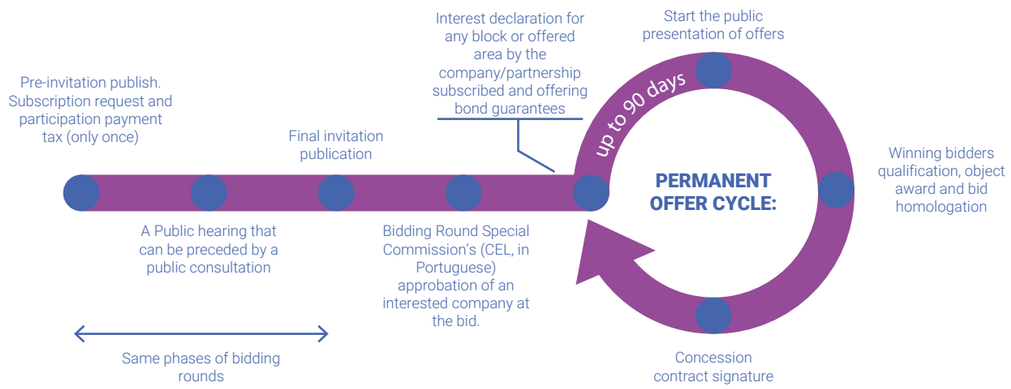
[56] Area with the discovery of oil and/or natural gas in which there was no production or it was interrupted by a lack of economic interest.

[57] The objective of the National Council for Energy Policy with this permanent offer is: (i) to expand Brazilian oil and natural gas reserves and production; ii) increase knowledge of sedimentary basins; (iii) to decentralize the exploratory investment in the country; (iv) to establish national and foreign companies in Brazil; and (v) to provide opportunities to small and medium-sized enterprises (CNPE Resolutions No. 17/2017 and No. 8/2018).

This described process is repeated, starting a new cycle every time there is the declaration of interest and declaration of guarantees of the remaining blocks and areas in the permanent offer.

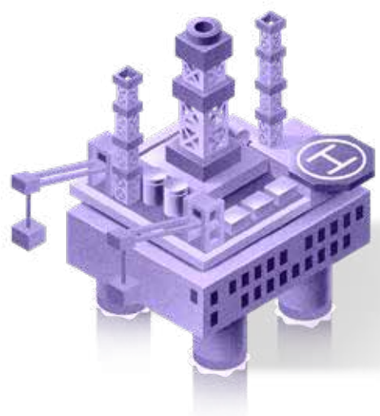
This type of offer has some aspects that are simpler than other ANP bids. Among them, we can mention: i) single registration, i.e., the registration is performed only once, regardless of the number of offer cycles in which the company/consortium wishes to participate, ii) single participation fee with a reduced value; iii) the acquisition of the technical data package is optional; iv) reduction of the financial guarantee for the Minimum Exploratory Program; v) reduced signing bonus for mature basins (maximum value set by the agency was R$ 60 thousand in the first invitation to bid; vi) local onshore content (50% in the exploration and 50% during production).

Figure 7 - Steps of the Permanent Offer



Elaboration: Ideies/Findes.

The areas with marginal accumulations and exploratory blocks in Espírito Santo enable the participation of companies of a wide range of sizes (product lifecycle management - PLM[58]), technical and legal qualifications in the E&P activity[59] (see highlight 4). Therefore, the permanent offer opens space for the deconcentration of the country's E&P sector, which will allow the expansion and diversification of the activity, both in the country and in Espírito Santo.



Box 4 - Summary of classification criteria in qualification levels for operators for areas and blocks in Espírito Santo in permanent offer*

Campos Basin Exploratory Blocks	Espírito Santo Basin Exploratory Blocks	Areas with Marginal Accumulations
The company must have at least: A R$ 68 million PLM, hold experience in the E&P activity and evidence of tax and labor conformity. These qualifications classify it as "operator B", qualified to operate in blocks located in shallow waters, onshore and in areas of marginal accumulations.	The company must have at least: A R$ 5.5 million PLM, hold experience in the E&P activity and evidence of tax and labor conformity. These qualifications classify it as "operator C", qualified to operate in blocks located onshore (not remote) and in areas with marginal accumulations.	The company must have at least: A R$700 thousand PLM, have an E&P professional with at least two years of experience (technical qualification) and evidence of tax and labor conformity. These qualifications classify it as "operator D", qualified only to operate in areas with marginal accumulations.

(*) The technical qualification of operators C and B are by score. For more details, see section 8 and pages 64 and 65 in the permanent offer invitation do bid (http://rodadas.anp.gov.br/pt/oferta-permanente/edital-e-modelos-dos-contratos-de-concessao)

Note: Non-operating companies (participation by consortium) need to have 25% of the PLM required from the operator for each criterion, provide a summary of their main activity and send evidence of tax and labor conformity.

Source: ANP Elaboration: Ideies/Findes

In ANP's first permanent offer invitation to bid, released in 2019, the following was made available in the state of Espírito Santo: 2 sectors with 31 onshore exploratory blocks in the Espírito Santo Basin; 1 sector (in the ES and RJ border) with 2 offshore (shallow waters) blocks in the Campos Basin; 2 onshore sectors with 4 areas of marginal accumulations in the Espírito Santo Basin. The complete list of these areas and blocks is at the end of the section.

Table 14 - Number of sectors, blocks and areas of Permanent Offer made available for Espírito Santo

	Basin	State	Sectors (qty)	Block or Areas (qty)	Environment
Exploratory Blocks	Espírito Santo	ES	2	19	Onshore
	Campos	ES and RJ	1	2	Offshore (shallow waters)
Areas with Marginal Accumulations	Espírito Santo	ES	2	4	Onshore

Source: ANP Elaboration: Ideies/Findes

On 10 September 2019, ANP held the 1st cycle of Permanent Offer. In Espírito Santo, 3 areas with marginal accumulations received declarations of interest. Another area of marginal accumulation remains in offer as well as the state's exploratory blocks.

[58] Documentation consisting of financial statements (balance sheet, profit and loss statements, etc.) and the opinion of independent auditor attesting the financial capacity of the bidder in acquiring the offered area or block.

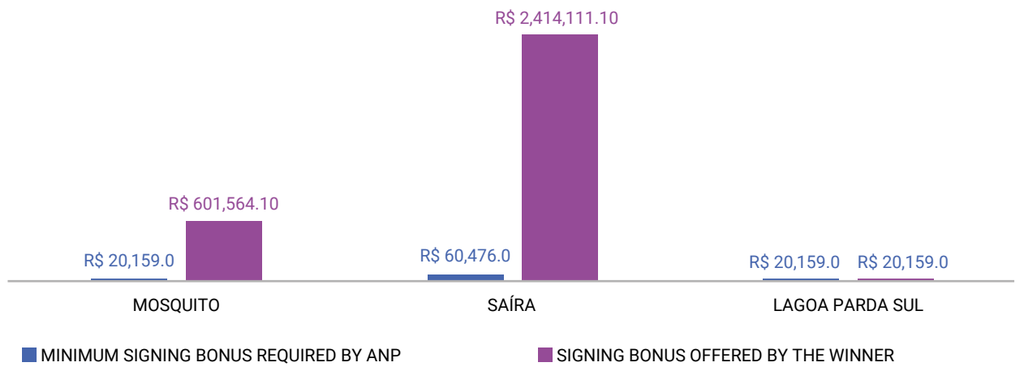
[59] For more details, see page 65 of ANP's permanent offer's invitation to bid: http://rodadas.anp.gov.br/arquivos/Oferta_Permanente/Edital/edital-op.pdf

[60] Only blocks C-M-58 and C-M-99 from the SC-AR2 sector that border the states of Espírito Santo and Rio de Janeiro were considered.

Winners from this cycle were the consortium composed by Petromais Global Exploração e Produção Ltda. (50%) and Eagle Exploração de Óleo e Gás Ltda. (50%) which acquired the areas of Mosquito e Saíra from the municipality of São Mateus; and the operator Imetame Energia Ltda. acquired the area of Lagoa Parda Sul in Linhares. Altogether, these winners will have to perform a minimum investment of R$ 4.2 million over three years for well rehabilitation.

The total bonus offered for these acquired areas in the permanent offer in the state was of R$ 3.03 million. Among the areas, the biggest bonus offered was R$ 2.41 million, paid by the Saíra area.

Chart 36 - Signing bonus of marginal accumulation areas with declarations of interest in the 1st Cycle of Permanent Offer - Espírito Santo



Source: ANP Elaboration: Ideies/Findes

5.2.1 Authorized areas for permanent offer - brief characterization

In the Espírito Santo basin, 2 exploratory sectors and 4 marginal accumulation fields were offered.

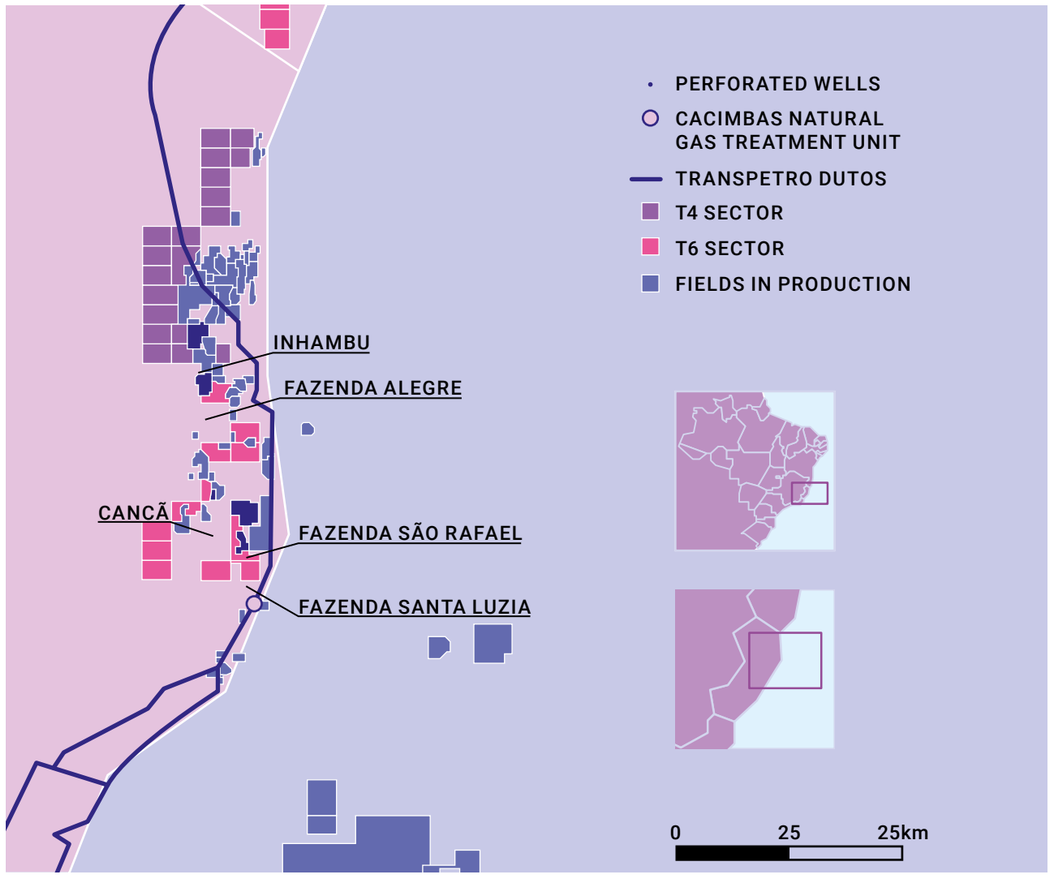
Concerning the offer in Espírito Santo, the main characteristic is the proximity of the exploratory blocks to the already known reservoirs of the Espírito Santo and Campos basins. Also, these are areas that have few drilled wells.

Sector T4 (figure 8), located in the municipalities of Conceição da Barra and São Mateus, to the North of Espírito Santo, have 20 exploratory areas, wherein half of them have drilled wells. Altogether there are 18 drilled wells, which, according to the category[61], can be grouped as follows: 8 special wells (44.4%), where there is no clear reason for drilling, and 10 pioneer wells (55.%), whose first perforations have the purpose of seeking an oil and/or natural gas reservoir.

The situation of the wells can be classified according to the current state of the well. Thus, sector T4 can be classified as follows: 7 dry wells and no traces of oil (38.8%), 4 dry wells with traces of oil (22.2%), 3 abandoned wells for other reasons (16.7%), 2 wells of mineral research (11.1%), 1 well for water disposal (5.6%) and 1 subcommercial oil producing well (5.6%). The latter is located in the ES-T-291 area.

Sector T6, located in the municipalities of Jaguará, São Mateus and Linhares, also to the North of Espírito Santo, has 12 permanent offer blocks. The sector has 40 drilled wells with exploratory characteristics. The situation of these wells can be classified as follows: 19 dry wells and no traces of oil (47.5%); 8 dry wells with traces of oil (20.0%); 3 unproven oil producers (7.5%); 1 well commercial producer of oil and natural gas[62] (2.5%) and the remainder are dry and abandoned wells (22.5%).

Figure 8 - Permanent Offer - Sector 4 and Sector 6, Espírito Santo Onshore Basin

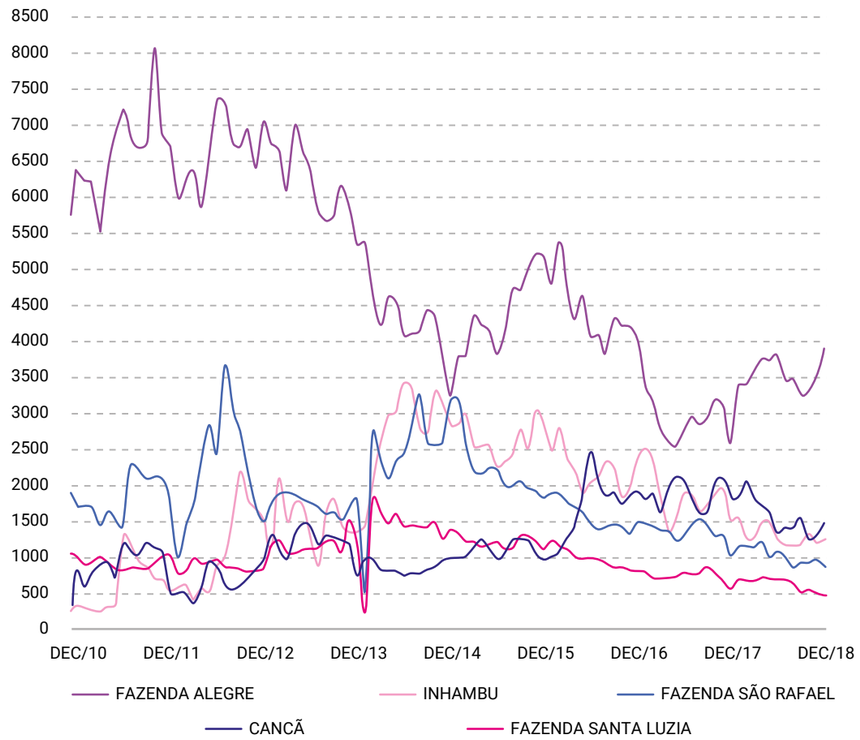


Source: ANP Elaboration: Ideies/Findes

[61] Established according to its intended operation, according to ANP Resolution No. 699/2017.

[62] Located in sector S-T-496

Chart 37 - Oil Production (bbl/day)



Source: ANP Elaboration: Ideies/Findes

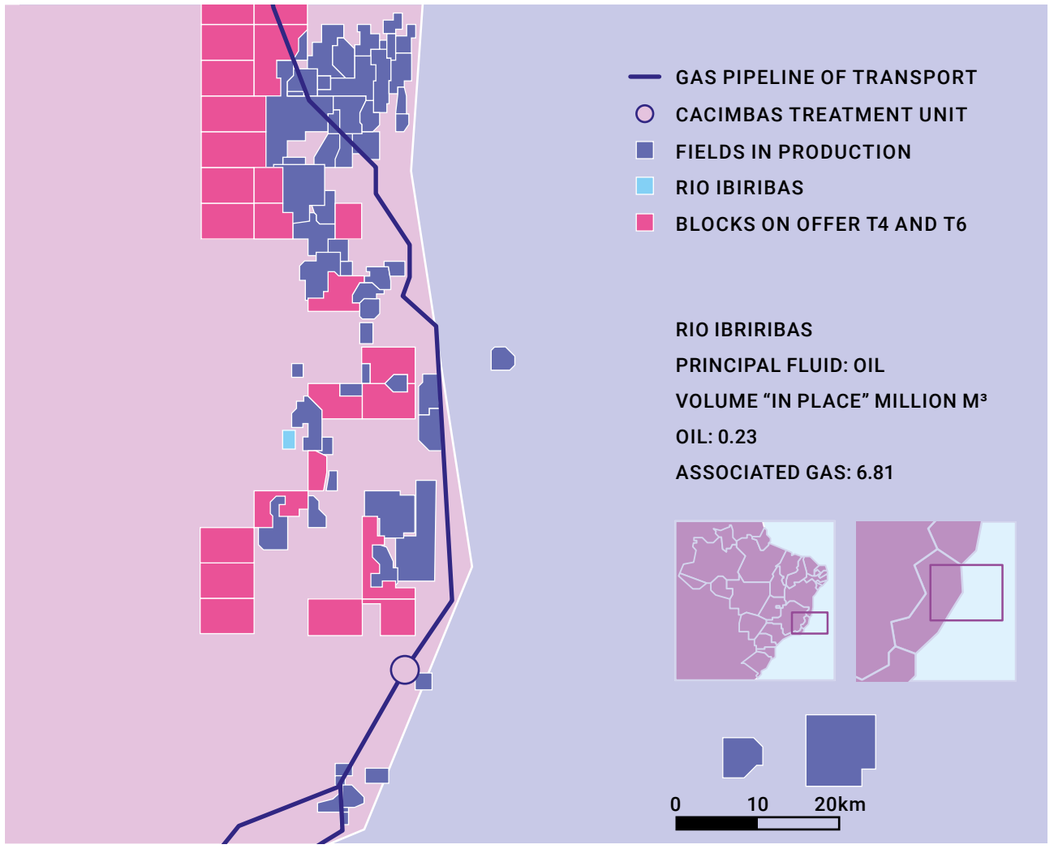
In addition, the result from the dry wells does not make block marketability conclusive. **Despite the limited drilling activity, sectors T4 and T6 are close to fields with known reservoirs and undergoing production process (figure 9 and chart 37).** These are areas that require further studies and exploration activities to assess their potential. Blocks T4 and T6 are close to the Fazenda Alegre, Inhambu and Cancã fields, classified among Brazil's 20 largest onshore producing fields.

Fazenda Alegre field, for example, has 39.4 million cubic meters (Mm³) of oil and 655 million cubic meters (Mm³) of associated natural gas. Inhambu, on the other hand, has a reservoir with 15.9 million cubic meters (Mm³) of oil and 159.3 million cubic meters (Mm³) of associated gas. Cancã field has a reservoir of 6.7 million cubic meters (Mm³) of oil and 164.9 million] cubic meters (Mm³) of associated gas[63].

In addition to these, sector T-6 is located close to the Santa Luzia, São Rafael and Rio Ipiranga fields[64]. The Santa Luzia and São Rafael fields, respectively, operated by Petrobras, stand out for having, respectively, 228.1 million and 127.1 million cubic meters (Mm³) of non-associated natural gas. In addition, these reservoirs are located next to the Cacimbas natural gas treatment unit (Figure 9).

Still on the onshore part, the Rio Ibiribas marginal field, located in the city of Linhares, is in the offer (Figure 9). The area, conducted by Petrobras, had its drilling activity started and completed in the 1980s, with 3 wells drilled. The classification of these wells was: dry with traces of oil, oil new field wildcat and subcommercial oil producer.

Figure 9 - Permanent offer - Rio Ibiribas marginal field



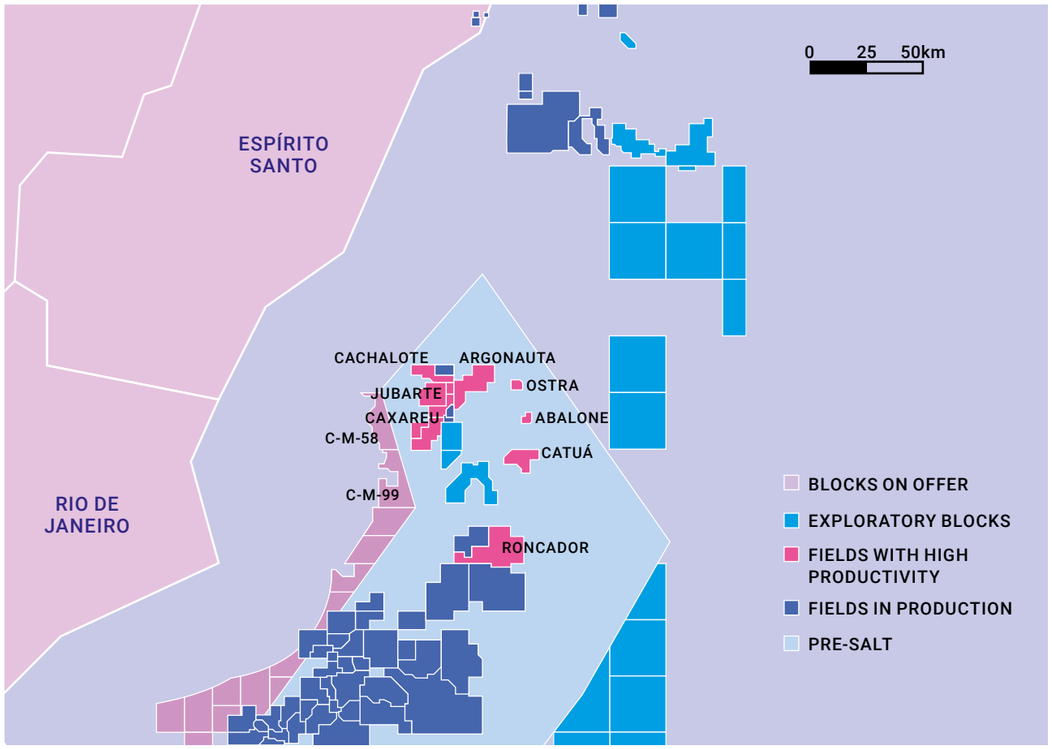
Source: ANP Elaboration: Ideies/Findes

In the offshore part, the permanent offer has two blocks at sector SC--AR2, located at the margins of the Pre-Salt polygon at the Campos Basin, bordering Espírito Santo (Figure 10). Block C-M-58, in shallow waters, was acquired in the 5th Round by Petrobras and returned in 2008. Block C-M-99, in deep and ultra-deep waters, was offered in the 6th Round and it was not acquired (Figure 10).

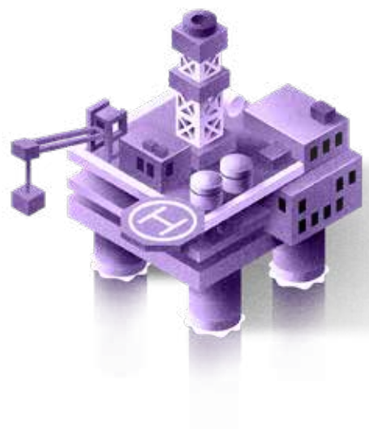
[63] The values refer to estimates performed for 2016.

[64] This field was returned to ANP and it will be addressed in section 5.3.

Figure 10 - Permanent Offer - Sector SC-AR2, Campos Basin



Source: ANP Elaboration: Ideies/Findes



These areas had no drilling activities in the past, so there is a higher exploratory risk due to the lack of exploratory data. However, in defining a distance of 30 km from the center of each block, a mapping of the drilling activity around these areas was included.

For block C-M-58, 112 drilled neighboring wells were mapped. From this total, 52 wells (46.4%) were permanently abandoned; 23 wells (20.5%) are producing[65]; and 11 wells (9.8%) are injectors; the remaining wells were closed, abandoned or not classified. It is noteworthy to state that no well was returned or wasted, the latter refers to a well that is closed and all equipment referring to the drilling activities are removed.

For block C-M-99, 24 neighboring wells within a 30 km radius from the center of the area were mapped. From the total, no well is in production and 21 wells (87.5%) were permanently abandoned[66], 1 well was temporarily abandoned without monitoring (4.1%), 1 well was abandoned due to exploratory logistics[67] (4.1%) and 1 well has not been rated by the oil company (4.1%). Still within the radius, there is the well that, in 2006, an oil reservoir was found in the Caxareu field, located in the Pre-Salt polygon.

The mapping revealed that the drilling of these wells, the majority in the Pre-Salt polygon, feature high success rates, 57.1% for block C-M-58 and 20.8% for block C-M-99. The mean success rate for drilling in offshore wells in all of Brazil, between 2014 and 2017, was 33.5%. The success rate includes wells that were drilled and classified as an injector, new field wildcat, unproven oil producer and/or natural gas producer.

5.2.2 Areas in study and public consultation for Permanent Offer - brief characterization

CNPE and ANP are studying 1,139 blocks from 20 onshore and offshore sedimentary basins, between exploratory and mature areas for inclusion in the permanent offer. Espírito Santo has 3 offshore sectors under analysis, all of them in the Espírito Santo Basin (Figure 11). The areas are located in the surroundings of exploratory fields already under concession, both held in Rounds 6, 11 and 14[68].

Sector SES-AP1 has 16 exploratory blocks and 23 wells drilled by Petrobras and Perenco Brasil from 1998 to 2014. **The sector borders the Golfinho field[69], which, in 2018, accounted for 6.2% of the oil production and 10.3% of natural gas, in monthly average, of Espírito Santo's production.** From the total 23 wells drilled, 14 wells were within a 70 km radius of the Golfinho field, and among these, 5 wells were mapped as unproven oil and/or natural gas producers (35.7%).

Sector SES-AP2 has 7 exploratory blocks and 7 drilled wells, all permanently abandoned. **The drilling activity has a low success rate since that from the total number of wells, 5 were classified as dry.**

Sector SES-AUP 3, in turn, did not register any drilling activity.

In November 2019, ANP published in the Brazilian Federal Register a notice of public consultation and public hearing No. 25/2019, with the objective of informing and including exploratory blocks and area with marginal accumulation in the Permanent Offer, in addition to obtaining subsidies for the elaboration of the call for bids and the concession contracts for the exploration and production of oil and natural gas in these areas. **For Espírito Santo, 4 blocks in sectors SES-AP1 and SES-AP2 were inserted in the public consultation, both scheduled to take place in February 2020.**

[65] All operated by Petrobras.

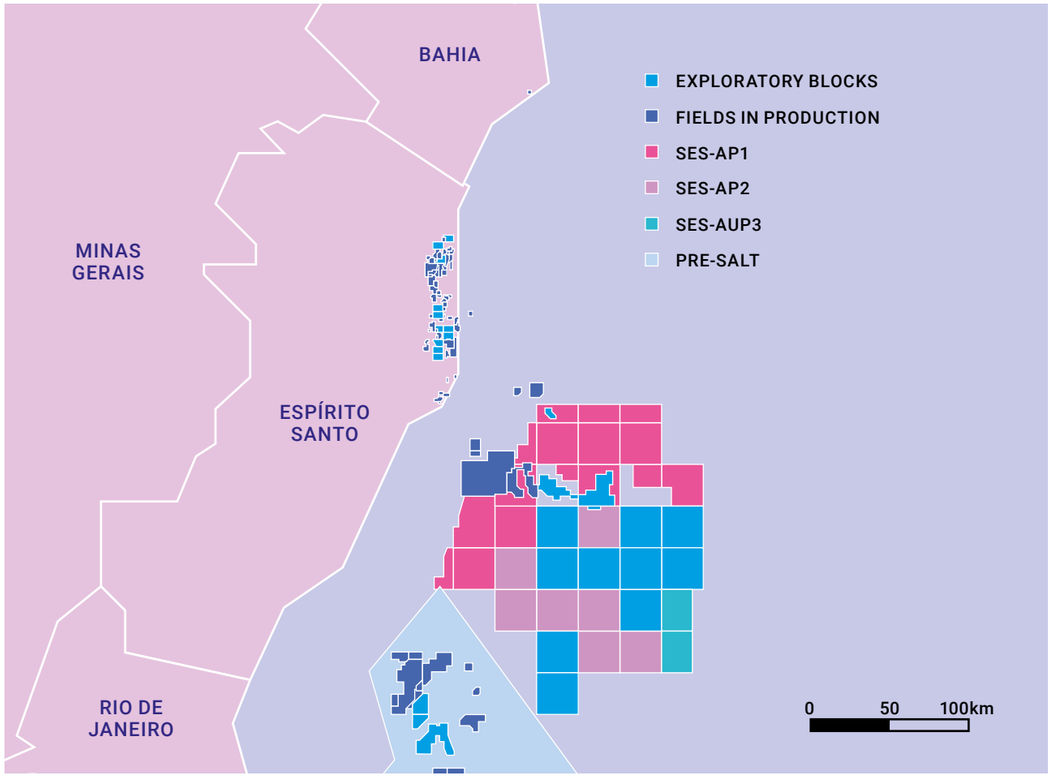
[66] Due to the characteristic of dry wells, without hydrocarbon traces.

[67] It was abandoned even being reclassified as a subcommercial producer of natural gas.

[68] See the history of rounds in chapter 2.

[69] Oil from the Golfinho field is classified as "light" (API higher than 30). In addition, the field has a reservoir of natural gas, non-associated to oil.

Figure 11 - Areas under study for Permanent Offer



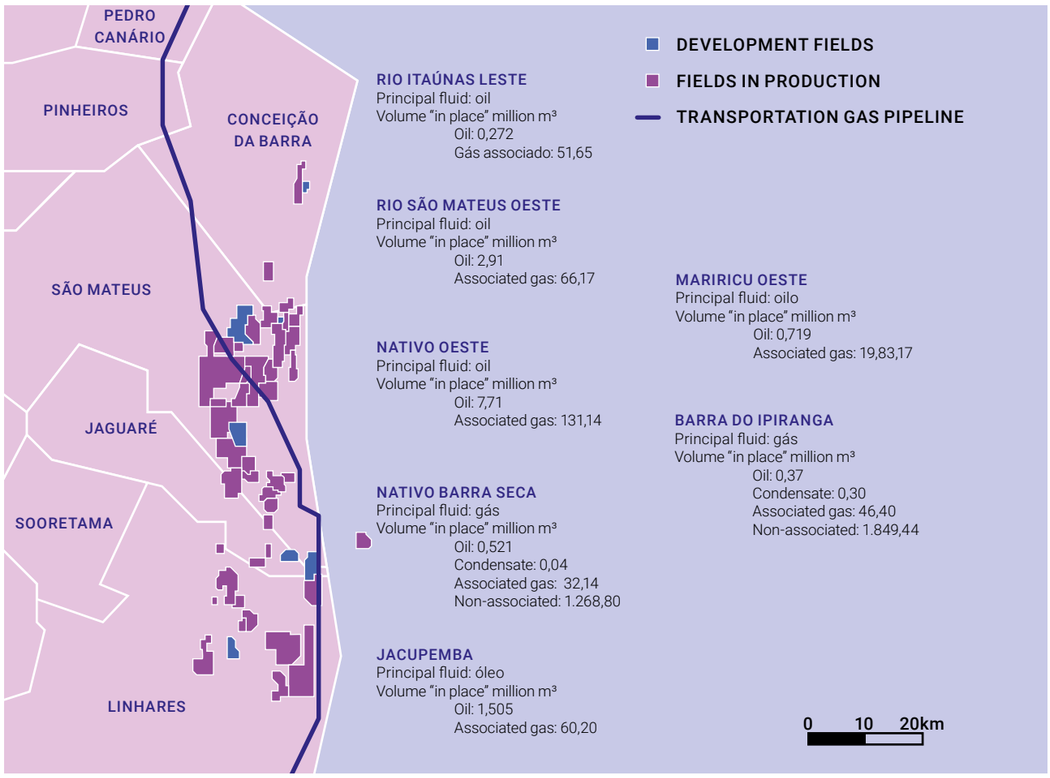
Source: ANP Elaboration: Ideies/Findes

5.3 Areas returned to ANP

In 2019, ANP's joint board of Directors determined, through Board of Directors Resolution No. 0254/2019, the extinction of the concession process for 8 Petrobras fields, wherein 7 are located in the Espírito Santo Basin. The recovery of these areas by the agency took place because Petrobras neither reinstated production, which was stopped for more than six months nor transferred the rights of these fields within the period determined by the ANP notification (twelve months). Until the date of this version of the Annual Report, no new bidding process had been opened for these fields.

It is noteworthy that, with the technological evolution and accumulation of knowledge, the technical, economic and financial viability of offshore fields became more feasible and with lower production costs. In light of this, large-sized oil companies reviewed their business plans and focused their activities on offshore areas at the expense of onshore areas. However, onshore fields have the potential for small and medium-sized companies, due to the production scale.

Figure 12 - Fields returned by Petrobras



Fonte: ANP. Elaboração: Ideies/Findes

Barra do Ipiranga field, located in São Mateus, has a volume of 1.8 billion cubic meters (Mm³) of non-associated gas, and 40.4 million cubic meters (Mm³) of associated gas, estimated in 2015[70]. The area reached its peak in early 2000, with a daily production of 250 thousand cubic meters (Mm³/day) of non-associated gas. Even during its decline phase, it produced, in April 2013, 104 thousand cubic meters (Mm³/day) of the input. The last production in the field was in 2015. The first drilling operation in the area was in 1986 and the field currently has 21 drilled wells and only 1 was declared with no traces of oil and/or natural gas. The area also has 1 well of deeper natural gas deposits, which was abandoned by the previous concessionaire.

The Jacupemba field, located in the municipality of Linhares, was acquired in Round 6, in 2004. The area, still little explored, has a volume of 60.2 thousand cubic meters (Mm³) of associated gas and 10.2 million cubic meters (Mm³) of non-associated gas, estimated for 2015. There was production in April and May 2015, regarding 11.7 barrels of oil. The three wells that were drilled are unproven oil producers, wherein 1 of them was declared a commercial oil producer.

[70] Field reserves have been estimated according to the oil in place methodology, using the volumetric method. The volume is continuously reviewed, due to the production and in the light of new geological information. The definitions were obtained from the oil dictionary.

The Mariricu Oeste area, located in São Mateus, has 2 drilled wells, both with traces of oil. The volume of the field corresponds to 19.8 thousand cubic meters (Mm³) of associated gas and 719 thousand cubic meters (Mm³) of oil, estimated for 2015. The field's accumulated gas production until 2015 was 0.3 thousand cubic meters of gas. The area reached the highest peaks of activity in 2012 and 2015, when it reached the production of 40.6 barrels of oil/day and 17.5 barrels of oil/day, respectively. Despite the largest associated gas reserve, production is concentrated in the oil from the reservoir, estimated in 0.71 thousand cubic meters of oil (Mm³). It is noteworthy that the gas produced was ventilated in the tanks, having no use.

The Nativo Oeste field, located in São Mateus, has 9 drilled wells, two permanently abandoned. The volume of the field was estimated, in 2015, in 131.1 thousand cubic meters (Mm³) of associated gas and 7.7 thousand cubic meters (Mm³) of oil. Gas production until 2015, accumulated in 0.4 thousand cubic meters, also used the in-tank ventilation process, with no economic exploitation. The last production in the area was in 2017, with 1.2 barrels of oil/day and 0.8 cubic meters of non-associated gas.

The Rio Barra Seca field, located in the city of São Mateus, has a volume of 1.3 million cubic meters (Mm³) of non-associated gas and 32.1 million cubic meters (Mm³) of associated gas, estimated for 2015. The reservoir has already reached production over 500 thousand cubic meters/day (Mm³/day) of non-associated gas, in 2005. For comparison purposes, currently, the Miranga field, in the Recôncavo Basin (Bahia) produces 530 thousand cubic meters (Mm³/day) of gas and sits among the ten onshore fields with the largest production of gas in Brazil. The Barra Seca field discharged the gas to Lagoa Suruaca station, currently deactivated. The field has been without production since 2012.

The Rio Itaúnas Leste area, located in the municipality of Conceição da Barra, has two drilled wells, both drilled in the 1990s. Only 1 well has a reservoir containing oil and gas. The area's volume is 51.6 million cubic meters (Mm³) of associated gas and 272 thousand cubic meters (Mm³) of oil, estimated for 2015. Peak production was at the end of the 1990s, reaching the production of 12 thousand cubic meters (Mm³/day) of associated gas and 30 barrels of oil/day. The field has been without production since 2009.

The Rio São Mateus Oeste field, located in São Mateus, has 9 wells that were drilled between the 1980s and the 2000s. The area's volume is 66.1 million cubic meters (Mm³) of associated gas and 2.9 million cubic meters (Mm³) of oil, estimated for 2015. Production, which began in 2008, peaked at 25 barrels of oil/day in 2009, however, it has not produced since 2016.

According to ANP, all seven fields will be offered in the Permanent Offer, but still not scheduled to take place.

5.4 Other opportunities for E&P in Espírito Santo

5.4.1 New market repositioning of Petrobras

In 2018, Petrobras started the process of selling a set of onshore and offshore areas as part of the company's new market repositioning. **In 2019, the company was offered participation in three onshore fields in Espírito Santo: Lagoa Parda, Cricaré and Peroá[71].** In addition to the sale of the onshore poles, the company announced the sale of equity interest in two blocks of the offshore part of the same basin.

In Lagoa Parda, in the city of Linhares, Petrobras has offered the Lagoa Parda, Lagoa Parda Norte and Lagoa Piabinha areas. These concessions share the same discharging and production treatment facilities. In October 2019, Petrobras announced the sale of these three fields to Imetame Energia Ltda. for US$ 9.37 million[72].

In the Cricaré pole, located in São Mateus, Jaguaré, Linhares and Conceição da Barra, Petrobras announced the sales of all its participations in the 27 onshore fields. These areas also share the same discharging and production treatment facilities. For this offer, the buying company/consortium may sign oil and natural gas purchase and sale contracts with Petrobras. Among the requirements to be qualified as a potential concessionaire is to be or have the minimum qualification of an ANP's "C" operator in onshore fields abroad.

Finally, the Peroá pole adds the sale of the participation in the offshore fields of Peroá and Cangoá, in shallow waters of the Espírito Santo Basin. The production system from these areas counts with six wells connected to the PPER-1 unmanned platform. In addition, one of the wells is connected to the pipeline that connects to the Cacimbas Gas Treatment Unit (UTGC). Also being offered in the package, there is a drilled exploratory well (concession BM-ES-21) in the Malombe field. Being an ANP's "A" operator is among the requirements to be a potential concessionaire.

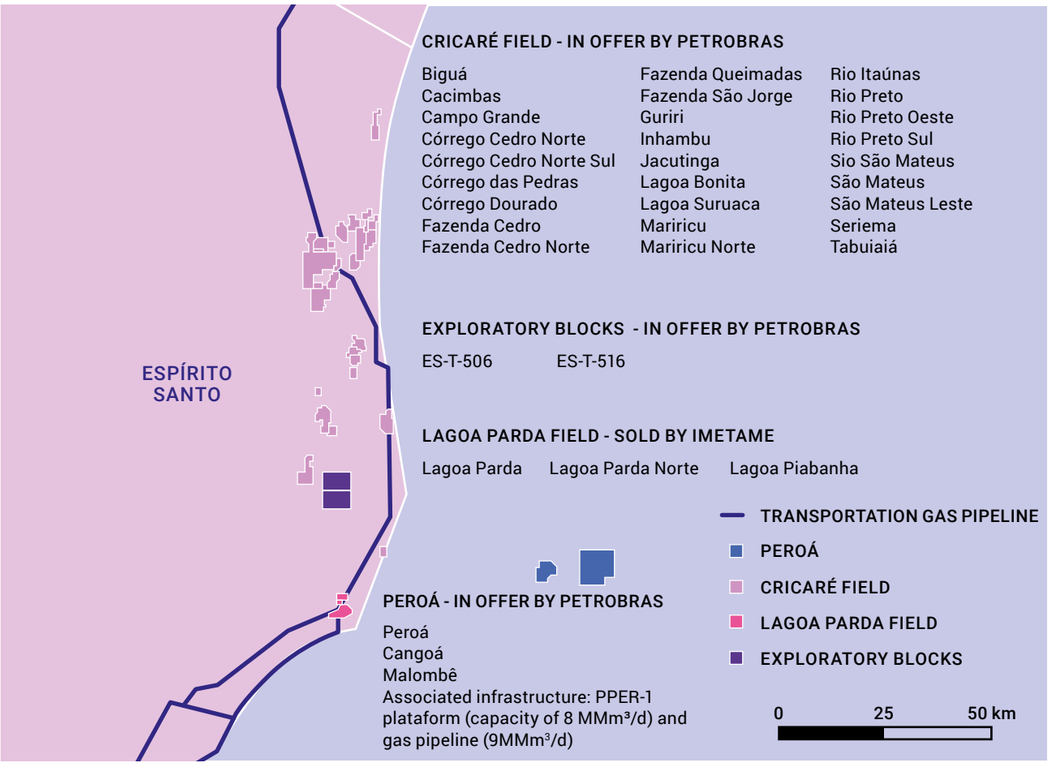
On the onshore part, Petrobras announced the sale of its participation in 50% of the ES-T-506 and ES-T-516 exploratory blocks located in the Espírito Santo Basin[73]. The remaining participation is operated by COWAN. These blocks were acquired in ANP's 11th Round of Bidding and they are currently in the First Exploratory Period (PEM, in Portuguese). The offers will be carried out by block and the consortium may exercise the right of preference on them. To participate in the process, the transferee must have a PLM of R$ 1.4 million to be qualified as a non-operator.

[71] For more details, see the teaser released by Petrobras in 08 Oct 2018: https://www.investidorpetrobras.com.br/pt/resultados-e-comunicados/teasers/2018

[72] Imetame also acquired the Lagoa Parda Sul field, during the first cycle of Permanent Offer. With this result, the company consolidates itself as a major player in the Espírito Santo basin.

[73] For more details, see the teaser released by Petrobras in 12/04/2019: https://www.investidorpetrobras.com.br/ptb/16082/Teaser-Bacia-Espirito-Santo-Portugues.pdf

Figure 13 - Other Opportunities for Espírito Santo



Source: ANP Elaboration: Ideies/Findes

5.4.2 Opportunities generated by the decommissioning of installations

The decommissioning of installations corresponds to the set of associated activities: (i) the definite interruption of activities in the installation; ii) the permanent abandonment and wasting of wells; iii) installation removal; iv) the proper disposal of materials, waste and rejects; and iv) the environmental recovery of the area.

This process takes place when areas are returned to ANP due to a lack of economic viability in E&P, due to the end of the concession contract or motivated by revitalization projects of oil and gas fields. In the latter case, the units are deactivated for others to replace them, increasing the field's recovery factor. From 2015 to 2018, ANP approved 26 Installation Deactivation Programs (PDI, in Portuguese)[74] in Brazil[75].

In 2019, the agency announced that 5 offshore PDIs had been approved: three fixed platforms in the Cação field in the Espírito Santo Basin; FPSO Brazil in the Roncador field in the Campos Basin (boundary between the states of Rio de Janeiro and Espírito Santo); FPSO Marlim Sul in the Campos Basin (Rio de Janeiro state). The Installation Deactivation Programs of another 6 offshore production units was undergoing analysis.

Table 15 - Offshore Installation Deactivation Programs - 2019

Production Unit	Type	Field	Basin	Status
FPSO Brasil	FPSO	Roncador	Campos	Approved
FPSO Marlim Sul	FPSO	Marlim Sul	Campos	Approved
PCA-01 PCA-02 PCA-03	Fixed Platform Fixed Platform Fixed Platform	Cação	Espírito Santo	Aprovado Aprovado Aprovado
P-07	Semi-submersible Platform	Bicudo	Campos	Undergoing Analysis
P-12	Semi-submersible Platform	Linguado	Campos	Undergoing Analysis
P-15	Semi-submersible Platform	Piraúna	Campos	Undergoing Analysis
P-33	FPSO	Marlim	Campos	Undergoing Analysis
FPSO Cidade do Rio de Janeiro	FPSO	Espadarte	Campos	Undergoing Analysis
FPSO Piranema Spirit	FPSO	Piranema	Sergipe	Undergoing Analysis

Source: ANP Elaboration: Ideies/Findes.

In December 2019, Petrobras announced that the estimated costs of its ongoing decommissioning projects[76] will total US$ 6 billion until 2024.

For 2020, the company projects that it will have an expense of US$ 0.5 billion to deactivate seven offshore production units, three of them located in Espírito Santo (Cação 1, 2 and 3). These Espírito Santo installations have not produced since 2016 and the invitation to bid for the removal of the platform was carried out by the company in 2019.

Another decommissioning project planned by Petrobras for Espírito Santo is the one for the FPSO Capixaba platform of the Jubarte field in 2022. To do so, the company will have an estimated cost of US$ 1.1 billion. The intent of this project is to replace this production unit by another of greater capacity, which will increase the productivity of Parque das Baleias.

Therefore, there is a range of opportunities for Espírito Santo companies to participate in the final stage of the oil and natural gas chain, both in Espírito Santo and in other Brazilian states.

[74] To the date of this publication, the Resolution proposal that deals with the decommissioning of exploration and production installations is undergoing consultation and public hearings (No. 24/2019) at ANP. For more information, access: http://www.anp.gov.br/consultas-audiencias-publicas/concluidas/5470-consulta-e-audiencia-publicas-n-24-2019

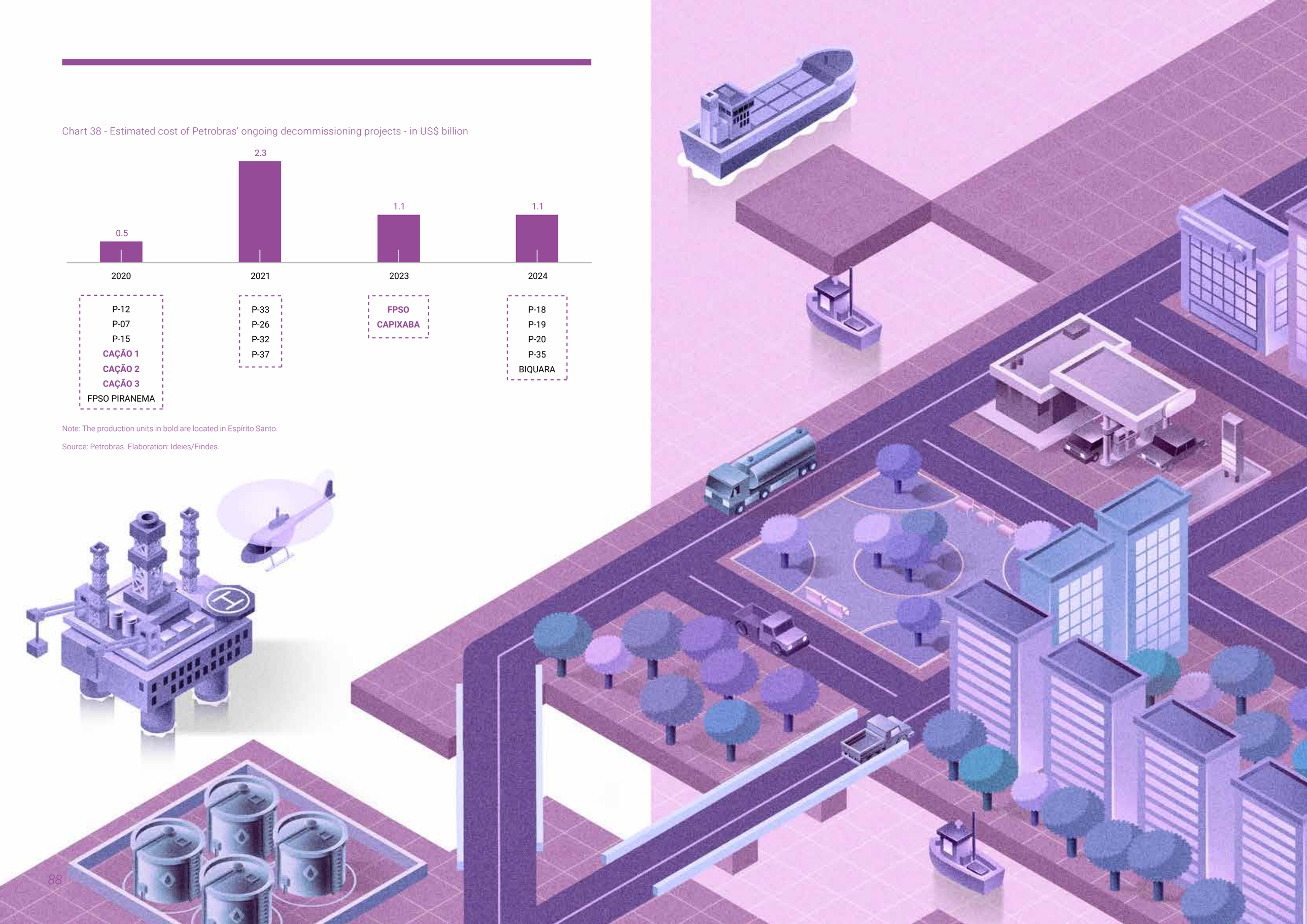
[75] At the end of the production phase or in the event of termination of the concession contract, the operator needs to deliver to ANP the Installation Deactivation Program (PDI, in Portuguese). From this document, the agency assesses the aspects related to the recovery of reservoir resources, so that the decommissioning does not take place prematurely, the alternatives for removing the installations and whether the activities will take place according to current regulations and using the industry's best practices (minimization of risks).

[76] It involves the removal of platforms and pipelines and the stagnation of offshore wells.

Chart 38 - Estimated cost of Petrobras' ongoing decommissioning projects - in US$ billion

Note: The production units in bold are located in Espírito Santo.

Source: Petrobras. Elaboration: Ideies/Findes.



GLOSSARY

A

Adjacent pioneer exploratory well: well that aims at testing the occurrence of oil or natural gas in an area adjacent to a discovery.

Area return notification: written communication on the return of areas, done by the Concessionaire to ANP, in the circumstances provided for in Contract, containing the list of Reversible Goods in the portion to be returned and the delimitation of the polygon of the areas to be retained.

B

Barrel of oil equivalent (BOE): barrel of oil equivalent (1,000 m³ of gas ≈ 6.28981 bbl) - a measure that adds the production volumes of oil and gas.

Barrel of oil per day (bod): unit used to reference the daily production of barrels of oil.

Bidding rounds: action organized by ANP, aiming at the auction among companies and/or consortia interested in acquiring exploratory areas in concessions or sharing.

Brent: oil extracted in the North Sea and traded on the London stock exchange, wherein its price is the international reference for the price of oil.

BTU: Abbreviation of British Thermal Unit. English unit of measurement of thermal energy, equivalent to 1.055056 x 10^3 J. A BTU is defined as the amount of energy required to raise the temperature of one pound of water from 39ºF to 40ºF.

C

Closed well: completed well that has already entered into production or injection operation, but finds itself closed, awaiting normalization of surface conditions, additional studies for decision making, or probe intervention for reassessment, recompletion, restoration, abandonment, among others.

Coke: Fuel derived from the agglomeration of coal, consisting of mineral matter and carbon, fused together. It is a solid and cohesive residue remaining from the destructive distillation of coal, oil or other carbonaceous residues and containing, mainly, carbon.

Concession: delegation of an economic activity by public authorities, usually through a competitive process, to an economic agent that demonstrates capacity to perform it, at its own risk and for a fixed period. In Brazil, the concession administrative agreement is drawn up by ANP, granting companies the performance of exploration and production activities of oil and natural gas in Brazilian territory.

Concessionaire: company incorporated under Brazilian laws, with headquarters and administration in Brazil, with which ANP enters into an oil and natural gas exploration and production concession contract in a sedimentary basin located in national territory.

D

Declaration of Commerciality: written notification from the concessionaire to ANP declaring a deposit a commercial discovery in the concession area.

Decommissioning: a set of legal and technical actions, and engineering procedures applied in an integrated manner to a Pipeline, aiming to ensure that its deactivation fulfills conditions related to safety, environment preservation, reliability, and traceability of information and documents.

Declaration of hydrocarbon traces: concession contracts establish the terms and work programs for exploration and production activities. According to these contracts, the concessionaire is obliged to communicate ANP any discovery of hydrocarbons or other mineral resources within the concession area in up to 72 hours after the occurrence.

Deep waters: oceanic waters located at any distance from the coast with a seabed depth between 300-1,500 meters.

Development Plan: it is the development and production planning instrument, covering the entire life cycle of the oil field. It describes the activities and the investments that will be made, so that all other short and medium-term plans must be consistent with them.

E

Exploration phase: aims at discovering and evaluating oil and/or natural gas deposits. Exploratory activities involve the acquisition of seismic, gravimetric, magnetomechanical, geochemical, well drilling and evaluation data, among others, having to obligatorily contemplate the fulfillment of the Minimum Exploration Program (PEM, in Portuguese) agreed with ANP.

Exploratory Block: geographically delimited areas relating to a sedimentary basin, where oil and natural gas exploration activities take place.

Exploratory well for deeper prospecting: well that aims at testing the occurrence of deeper accumulations or favorable geological conditions in a particular area.

Exploratory well for shallower prospecting: well that aims at testing the occurrence of shallower accumulations or favorable geological conditions in a particular area.

Extension exploratory well: well that aims at delimiting the accumulation of oil or natural gas and/or investigating contact between fluids, communication between regions of a reservoir, and properties that allow it to be characterized.

F

Financial compensation: value due to states, municipalities and the Federal Government for the use of natural resources, since these entities are affected by the exploration and production activity.

G

Government Participations: payments to be made by the oil and natural gas exploration and production concessionaires, in accordance with the terms of articles 45 to 51 of Law No. 9,478 of 1997, and Decree No. 2,705, of 1998.

H

Hydrocarbon: chemical compound consisting only of carbon and hydrogen atoms. Oil and natural gas are examples of hydrocarbons.

I

In accordance do REPETRO: these are assets of a special customs regime of export and import, which are intended for research and prospection activities of oil and natural gas deposits, with suspension of payment of customs taxes.

Injection exploratory well: well that aims at the injection of fluids into the reservoir with the objective of improving hydrocarbon recovery.

Injecting well: well operating as a fluid injector to improve hydrocarbon recovery from the reservoir.

Injecting well for storage: well operating as a fluid injector for natural gas storage.

M

Marginal fields: inactive areas in which there was no oil and/or natural gas production or production was interrupted by lack of economic interest.

Mature fields: oil fields whose production is already in decline.

Mature Basin: Sedimentary basin of oil whose production is already in decline.

Minimum Exploratory Program (PEM, in Portuguese): exploratory activities to be mandatorily fulfilled by the concessionaire during the exploration phase, defined by ANP according to the evaluation criteria of the areas to be explored.

N

National Agency of Petroleum, Natural Gas and Biofuels (ANP): Market-regulating agency for oil, natural gas, and biofuels in Brazil, except the control of natural gas distribution, whose sphere belongs to the state.

O

Oil derivates: products resulting from oil refining.

Offshore: marine environment and land-sea transition zone or area located in the sea.

Onshore: terrestrial environment or area located on land.

Oil fields: producing area of oil or natural gas, from a continuous reservoir or more than one reservoir, at variable depths, covering facilities and equipment intended towards production. (source: Law No. 9,478 of 8/06/1997).

Oil production chain: set of production chain activities, from the extraction of crude oil to the last phase of the sector's added value, divided into four branches: exploration, refining, petrochemical industry and processing industry.

Oil consumption: activity consisting of the use of crude oil for the manufacture of oil by-products.

Onerous transfer: transfer model of an exploratory area to Petrobras - bilateral negotiation, upon the payment of a certain amount, which was regulated by Law No. 12,276 of 30 June 2010, limiting exploration to a maximum of 5 billion BOE.

Oil: all and any liquid hydrocarbon in its natural state, following the example of crude and condensate oil, which has its exploration and production regulated by Law. No. 9,478 of 8/06/1997.

Oil Production: set of coordinated actions for the extraction of oil or natural gas from a deposit and the preparation for its handling, under the terms defined in section XVI of Article 6 of Law No. 9,478 of 1997, or even the volume of oil or natural gas extracted during production, as it shows the text in each case.

Oil refining: activity developed by an industrial unit that uses, as raw material, the oil from the extraction and production unit of a field which, through processes that include heating, fractionation, pressure, vacuum and reheating in the presence of catalysts, generates oil derivatives from the lighter (refinery gas, LPG, naphtha) to the heavier (bunker fuel oil), in addition to solid fractions, such as coke and asphalt residue.

Oil well: drilling on land surface used to produce oil and/or natural gas.

P

Payment for area occupation or retention: amount paid by the concessionaires to landowners of the area where oil and natural gas exploration and production activities are carried out. This payment is made in two ways: (i) annually, by means of unit values in Brazilian Reais per square kilometer of concession area established in the invitation to bid and in the contract, being applicable, in succession, to the exploration, development, and production phases. The determination of this value is made by ANP taking into account the geological characteristics and the location of the sedimentary basin; (ii) monthly, by multiplying the equivalent to 1% of the field's total oil and natural gas production, during the calculation month, by their respective reference prices.

Permanent offer: Continuous offer of returned fields (or in the process of return) and of exploratory blocks offered in previous bids and not acquired or returned to the agency (Article 4 of CNPE Resolution No. 17 of 6/08/2017).

Permanently abandoned well: well where there is no interest for future reentry and operations for the establishment of permanent barrier integrated sets were carried out.

Pioneer exploratory well: well that aims at testing the occurrence of oil or natural gas in one or more objectives of a not yet drilled geological prospectus.

Pre-Salt: underground region formed by a vertical prism of indeterminate depth, with a polygonal surface defined by the geographical coordinates of its vertices established in Annex of Law No. 12,351/2010, as well as other regions that may be subsequently delimited in an act from the Executive Branch, according to the evolution of geological knowledge.

Producing well: well operating as a hydrocarbon producer.

Production exploratory well: well that aims at draining one or more deposits from a field.

Production phase: when discovered oil and/or natural gas accumulations with proven commercial viability give rise to a producing field, being developed and put into production to supply the market.

Production Sharing: oil and natural gas exploration and production model, which provides for not only the payment of royalties, but also the physical division of hydrocarbon production, discounting the costs incurred in exploration and production activities. It is currently regulated by Law No. 12,351 of 12/22/2010.

Production Units (Exploration and Production): set of installations destined to promote the separation, treatment, storage and discharge of fluids produced and handled in an oil and natural gas field.Prospection: set of coordinated operations for the extraction of oil or natural gas from a deposit and preparing for its handling.

Prospection: set of coordinated operations for the extraction of oil or natural gas from a deposit and preparing for its handling.

Proven reserves: Amount of Oil or Natural Gas that the analysis of geoscience and engineering data indicates, with reasonable certainty, that the well is economically viable, whose investments are commercially recoverable.

R

Returned fields: area returned to ANP by means of the Area Return Notification. The return of the field implies in the interruption of all exploration activities in the returned portion, except for those activities related to facility deactivation and environmental recovery.

Royalties: financial compensation due to the Federal Government, states and municipalities, by the oil and natural gas exploration and production concessionaires, which is paid monthly according to the production volume of the month in a particular field, from the beginning of production.

S

Sedimentary basin: depression on the Earth's crust where sedimentary rocks accumulate, which may contain oil or gas, either associated or non-associated.

Shale: crystalline metamorphic rock featuring a laminar structure, rich in micaceous material.

Shallow waters: oceanic waters located at any distance from the coast with a seabed depth between 0-300 meters.

Signing Bonus: feature offered by the winning bidder in the proposal to obtain the oil or natural gas exploration concession, wherein its value cannot be less than the minimum value set in the invitation to bid. Part of this resource is destined to the Federal Government and part to ANP.

Special Participation: it is the extraordinary financial compensation due to the Federal Government, States and Municipalities, according to ANP Resolution No. 12/2014, by the oil and natural gas exploration and production concessionaires, in the cases of large production volumes or high profitability.

Special well: Well that aims at the specific objectives that do not fall within the previously defined purposes.

Storage well: well that aims at allowing natural gas storage operations, including the injection, withdrawal and monitoring.

Stratigraphic exploratory well: well that aims at understanding the stratigraphic column and obtaining other surface geological information in a basin or little explored region.

Subprime: term given to the financial crisis stated on 24 July 2007, when subprime credits from American banks were granted to people unable to pay for them. This cycle of loans generated a "real estate bubble" that upon bursting struck stock exchanges and bankrupted several banks.

T

Temporarily abandoned well with monitoring: well where there is interest for future reentry and operations for the establishment of barrier integrated sets, which must be periodically monitored and/or checked, were carried out.

Temporarily abandoned well without monitoring: well where there is interest for future reentry and operations for the establishment of non-monitored and/or checked barrier integrated sets were carried out.

U

Ultra-deep waters: oceanic waters located at any distance from the coast with a seabed depth greater than 1,500 meters.

Upstream: segment of the oil industry which comprises activities related to the exploration, development, production and transportation of oil to the refineries.

W

Wasted well: permanently abandoned well in which there was the removal of all equipment related to the wellhead assembly and the cut of the surface coating at the bottom of the pre-wellhead.

Well in observation: well instrumented for monitoring pressures in a hydrocarbon-producing reservoir or for natural gas storage.

Well operating for disposal: well operating for the disposal of fluids produced by other wells or for the disposal of different effluents generated in exploration and production activities, in zones that are not producing at that moment.

Well producing and injecting: well operating simultaneously producing hydrocarbons and injecting fluids (at different intervals).

Well removing stored natural gas: well operating for the removal of natural gas from a storage reservoir.

WTI (West Texas Intermediate): oil extracted from the Permiano Basin in Western Texas and Eastern New Mexico, traded in the New York Stock Exchange. Its serves as international reference for the price of oil.

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ANNEXES

Box 1 - Projects financed with resources from the P,D&I clause in Espírito Santo[77] - 2000-2018

Executing Accredited Institution	Project Title	Oil Company	Start Date	End Date	ANP Authorization
UFES	Technical, environmental and economic feasibility for the application of oil sand on local roads and on concrete artifacts.	Petrobras	11/23/2000	5/22/2002	-
UFES	Plasma for oil refining and natural gas processing - ctpetro 2000	Petrobras	11/23/2000	12/25/2002	-
UFES	Oceanographic characterization of the Espírito Santo Basin based on past data.	Petrobras	1/18/2002	8/15/2002	-
UFES	Plasmas for oil refining and natural gas refining.	Petrobras	9/30/2003	9/28/2005	-
UFES	Scientific studies in measuring natural gas flow through ultrasonic sensors.	Petrobras	1/05/2004	12/29/2005	-
UFES	Studies on water resources and the continuity of hydrogeological studies of aquifers from barrier formations and Rio Doce	Petrobras	12/29/2003	12/22/2005	-
UFES	Biodegradation of fluids from offshore well drilling aiming at avoiding environmental impacts.	Petrobras	6/25/2004	12/31/2005	-
UFES	Implementation of methodology for the characterization of oils.	Petrobras	11/03/2004	1/31/2005	-
UFES	Development of study for the characterization of oily waste.	Petrobras	11/29/2004	11/28/2005	-
UFES	Plasma for processing of heavy and extra heavy oils.	Petrobras	12/10/2004	12/10/2007	-
UFES	Implementation of methodologies for the characterization of heavy and extra heavy oils at the UFES Department of Chemistry	Petrobras	12/14/2004	6/14/2007	-
UFES	Effect of acid oils on polyamide 11 in DQUI-CCE-UFES flexible ducts	Petrobras	3/10/2005	3/09/2007	-
UFES	Implementation of the competence center for the exploration and production of heavy oils.	Petrobras	5/01/2005	8/31/2008	-
UFES	Distillation system to obtain the PEV - ASTM D2892 curve of oils at UFES LABPETRO and adequacy of heavy and ultra-heavy oils.	Petrobras	12/15/2005	12/15/2008	-
UFES	Hydrogeological survey of Espírito Santo.	Petrobras	2/26/2006	2/25/2008	-
UFES	Studies on water resources and water monitoring of Northern Espírito Santo.	Petrobras	4/17/2006	4/16/2010	-
UFES	Implementation and development of methodologies to determine metals and sulfur in heavy and extra heavy oils, and derivatives.	Petrobras	11/29/2006	11/27/2008	-
UFES	ADD-RPD: Intelligent system for recognizing defect patterns in motor pumps	Petrobras	12/06/2006	5/18/2011	-
UFES	Adequacy of Methodology for Obtaining PEV Curves for Heavy and Extra Heavy Oils.	Petrobras	12/18/2006	12/18/2010	-

[77] Those projects that needed authorization from ANP for their performance have information in the "ANP Authorization" column. It is noteworthy that only 14 of the projects that are included in this table actually needed the agency's authorization. Such projects fall into the topics pre-established by the legislation, which required this authorization (RT No. 05/2005).

Executing Accredited Institution	Project Title	Oil Company	Start Date	End Date	ANP Authorization
UFES	Implementation of nuclear magnetic resonance laboratory at LABPETRO - UFES	Petrobras	12/20/2006	6/20/2011	-
UFES	Plasma for pyrolysis and natural gas processing	Petrobras	12/20/2006	6/20/2010	-
UFES	Effect of acid oils on polyamide 11 in flexible ducts - Phase II	Petrobras	7/16/2007	7/09/2011	-
UFES	Numerical Simulation for Heavy Oils.	Petrobras	10/11/2007	4/02/2011	-
UFES	Development of Scientific Studies in Measuring Natural Gas Flow Through Ultrasonic Sensors	Petrobras	11/05/2007	4/30/2010	-
UFES	Development of laboratory analytical methods to support research and development projects in the area of characterization, evaluation and primary processing of heavy and extra heavy oils.	Petrobras	12/21/2007	12/18/2013	-
UFES	Development of the Quasi-Dual Formulation of the Boundary Element Method in Wave Propagation Issues: Analysis of Completeness Conditions in the Sequence of Radial Functions and Implementation of an Iterative Solution Scheme.	Petrobras	11/18/2008	5/16/2011	-
UCL	Study of Topics in the Control and Discharge of Fluids and Particulates during Well Drilling in Deep Waters.	Petrobras	2/22/2010	8/19/2014	-
UFES	Elaboration of the Executive Project for the Scope Addendum for Building the Infrastructure of the Nucleus of Studies in Flow and Measurement of Oil and Gas - NEMOG	Petrobras	6/16/2010	7/09/2013	-
UFES	Hydrogeological Survey of the State of Espírito Santo.	Petrobras	12/29/2010	12/27/2015	-
UFES	Application of numerical solution techniques in geophysical models: simulation of wave propagation through the finite volume method, application of the recursive procedure of the boundary element methods in dynamics and optimization of the representation of surfaces, potential and discrete data set through functions of radial base.	Petrobras	4/27/2011	11/21/2014	-
UFES	Recognition of Defect Patterns in Submerged Centrifugal Pumping Systems	Petrobras	12/13/2011	4/05/2015	-
UFES	Electromagnetic Modeling and Simulation in Carbonaceous Incrustation Mitigation	Petrobras	1/02/2012	9/27/2015	-
UFES	Development and Application of New Technologies in the area of Oil Chemistry related to the Exploration and Production (E&P) Segment	Petrobras	1/05/2012	12/28/2016	-
UFES	Development of a methodology for the study of hydrolysis of chlorides and the degradation of naphthenic acids in oils during the atmospheric and vacuum distillation process.	Petrobras	5/02/2012	4/21/2015	-
UFES	Socioeconomic diagnosis of fishing communities of the Espírito Santo Basin and the Northern portion of the Campos Basin.	Petrobras	8/31/2012	8/19/2017	-
UFES	Phytoremediation of heavy metals.	Petrobras	9/3/2012	8/7/2017	-
UFES	Application of alternative analytical techniques and chemometrics in developing new methods for the evaluation of oils.	Petrobras	10/31/2012	10/29/2017	-

Executing Accredited Institution	Project Title	Oil Company	Start Date	End Date	ANP Authorization
UFES	Fiber Optic Sensor for Simultaneous Temperature and Oil Level Measurement in Terrestrial Production Tanks	Petrobras	10/31/2012	8/25/2017	-
UFES	Characterization of Asphaltenes and Paraffins by High-Resolution Accurate Mass Spectrometry (FT-ICR MS)	Petrobras	10/31/2012	10/29/2017	-
UFES	Application of Broadband Powerline Communication Technology for Automation, Supervision and SISP in Onshore Oil Wells	Petrobras	10/31/2012	6/16/2017	-
UFES	Studies on the behavior of multiphase and wet gas meters: numerical simulations, laboratory and field analyses.	Petrobras	10/31/2012	11/18/2016	-
UFES	Consolidation of the NCQP - Nuclear Magnetic				
Resonance Laboratory - UFES	Petrobras	10/31/2012	10/29/2017	-	
UFES	Studies on the velocity profile behavior in the flare gas measurement section and its influence on the quality of measurements: Numerical Simulation, Experimental Studies, and Field Analyses.	Petrobras	11/13/2012	8/03/2016	-
UFES	Environmental characterization of the Espírito Santo Basin and the Northern portion of the Campos Basin (Pelagic and Physical-Chemical System of Water and Sediments) - Project AMBES	Petrobras	11/14/2012	11/12/2016	-
UFES	Assembly of Manual Distillation Unit for Determining Chloride Evolution in Brazilian Oils.	Petrobras	8/21/2013	8/20/2015	-
UFES	Analytical Methods for Oil Evaluation for the Environmental Area	Petrobras	11/4/2013	12/27/2017	-
UFES	Development of analytical techniques for the characterization and quantification of paraffins in oils, concentrating on logistics and supply activities.	Petrobras	2/03/2014	2/02/2016	-
UFES	Expansion of Learning Mechanisms in the Defect Pattern Recognition Methodology in Submerged Centrifugal Pumping Systems.	Petrobras	9/25/2014	9/23/2017	-
UFES	Evaluation of corrosion rates in oils from the Pre-Salt and mixtures	Petrobras	12/17/2014	12/15/2017	-
UFES	Diagnosis of the Root Cause of Oscillations and Disturbances in PEU	Petrobras	1/07/2015	1/05/2018	-
UFES	Building of the Infrastructure of the Nucleus of Studies in Flow and Measurement of Oil and Gas - NEMOG	Petrobras	8/30/2006	2/13/2015	229/2006
UFES	Implementation of the Chemical Competence Nucleus for Heavy and Extra Heavy Oils from the Federal University of Espírito Santo.	Petrobras	8/30/2006	2/17/2013	229/2006
153/2009					
UFES	Adaptation of the infrastructure of the UFES Technological Center Material Laboratory	Petrobras	8/30/2006	2/3/2014	229/2006
UFES	Modernization and expansion of the infrastructure at the welding laboratory at the UFES Technological Center	Petrobras	8/30/2006	1/29/2014	229/2006

Executing Accredited Institution	Project Title	Oil Company	Start Date	End Date	ANP Authorization
UFES	Assembly of a flow simulation loop at the Nucleus of Studies in Flow and Measurement of Oil and Gas - NEMOG	Petrobras	11/01/2006	5/22/2015	236/2006
UFES	Acquisition of equipment for the implementation of the Chemical Competence Nucleus for Heavy and Extra Heavy Oils of the Federal University of Espírito Santo.	Petrobras	11/01/2006	1/07/2013	236/2006
UFES	Structuring and implementation of five Chemical and Biological Oceanography laboratories focusing on deep-water environmental monitoring	Petrobras	11/24/2006	5/05/2014	262/2006 189/2013
UFES	Acquisition of equipment for implementing the Laboratory of Environmental Geochemistry (Lab GAM) at the oceanographic base in the Federal University of Espírito Santo	Petrobras	7/23/2007	7/10/2013	066/2007
UFES	Physical adequacy of the Laboratory of Computational Transport Phenomena (LFTC)	Petrobras	10/11/2007	12/3/2008	074/2007
UFES	Acquisition of equipment for the assembly of analytical and research and development support laboratories at the Nucleus of Competences in Chemistry of Heavy and Extra-Heavy Oils at UFES.	Petrobras	6/06/2008	5/30/2015	064/2008
UFES	Implementation of specific laboratories at the Nucleus of Studies in Flow and Measurement of Oil and Gas - NEMOG	Petrobras	11/24/2008	5/21/2015	080/2008
UFES	PRH 29 - Fostering the human resource capacity in Oil and Gas through support for PRH 29.	Petrobras	12/07/2011	5/06/2016	424/2011
IFES	Fostering the development of human resources through scholarships grants for technical courses of interest of the Oil, Gas, Energy, and Biofuel sector.	Petrobras	4/16/2013	3/30/2016	396/2013
UFES	Marine environmental characterization and monitoring in the Espírito Santo Basin (Chemical and Biological Oceanography).	Petrobras	12/09/2014	12/07/2017	341/2014
UFES	Institutional Program from the Federal University of Espírito Santo in Oil and Gas	Queiroz Galvão	9/27/2016	8/31/2017	-
UFES	Research Project for the Numerical and Experimental Study of Physical Methods for Incrustation Mitigation in Wells with Sand Containment	Petrobras	7/30/2018	42 months	-
UFES	Physical and Physical-Chemical Effects: Influence of salts in the oil acidity - Development of Analytical Methodology to Eliminate Interference of Salts in Determining the Total Acid Number (NAT, in Portuguese) in Oil.	Petrobras	7/30/2018	24 months	-
UFES	Numerical Simulation of the Dispersion of the Mean Concentration of Primary Pollutants in Two Oil Exploration and Production Regions	Petrobras	10/17/2018	24 months	-
UFES	Adaptation and activity of sulphate-reducing bacteria of oil reservoirs at high hydrostatic pressure	Petrobras	11/29/2018	24 months	-

Source: ANP Elaboration: Ideies/Findes

Box 2 - Projects under development by Espírito Santo companies that have not yet received resources from the P,D&I clause, but fall into RT No. 03/2015 by ANP.

Code	Project's name	Company	Status
ES-20	Polished and conventional rods for pumping units	Tecmark	Development
ES-24	Cladding tube centralizer	Tecvix	Tests
ES-28	Enable local manufacturing of Terrestrial Alternative Pumps for Oil Wells (BM)	Tecvix	Tests
ES-30	Vapor injecting tube	Tecvix	Completed
ES-36A	Torn Pipes for Oil Wells	Tecvix	Completed
ES-38B	Repair pipes through deposition of thickness using the MIG/MAG process with controlled short circuit (STT and CMT) and TIG	Endserv	Conclusion
ES-38C	Recovery of superduplex (and others) steel pipes, by the GMAW process with AC and secondary power supply	Tecvix	Conclusion
ES-41	Optimized Inspection and Cleaning Techniques in Tanks, Vessels, and Hulls	VixSystem	Tests
ES-42	Adaptation of drones for onshore well surveillance and pipeline monitoring	Vix Fly/Mogai/ Ictus	Tests
ES-43	Hydraulic Spacer for Mechanical Pumping	Qualimec	Tests
ES-44	Manufacture of Isolated Coatings for Oil Wells	HKM	Development
ES-45B	Isolated gloves	Tecvix	Development
ES-46	Approximation equipment	Metacon/Mogai	Starting
ES-50	Mobile system for inspecting pipes in wells	Tecvix	Starting
ES-51A	"IHM Mobile" App in onshore wells	2 Solve	Starting
ES-51E	"IHM Mobile" App in onshore wells	SPG (wefor)	Starting
ES-52A	Wellheads	Tecvix	Starting
ES-52B	Wellheads	BJ e Seisa	Starting
ES-52C	Wellheads	HKM	Starting
ES-53A	Oil residue collection and transfer system during tank cleaning	Metacon	Starting
ES-54A	Auxiliary access device for confined space	Metacon	Starting
ES-54B	Auxiliary access device for confined space	BJ e Seisa	Starting
ES-57	Module/device with electronics to check rod alignment and eccentricities for mechanical pumping	Borges Tecnologia	Starting
ES-P55A	Compact unit for well intervention	Tecvix	Starting
ES-P55B	Compact unit for well intervention	Borges Tecnologia	Starting
ES-P59	Extended Nipple	Tecvix	Starting
ES-P60	Roving Bat	Borges Tecnologia	Starting
ES-61	Dual completion columns for steam injection	Tecvix	Starting
ES-62	Identification systems that enables the improvement of the integrity assurance process and document control of cargo handling equipment and accessories	Vix Logística / TMA Logística / Sudpar	Starting
ES-63	Virtual reality system that simulates oil production facilities, with the objective of increasing the effectiveness and efficiency of the training programs, providing increased safety in production operations.	Inside / IFES Vitória	Starting

Source: Espírito Santo Oil and Gas Forum Elaboration: Ideies/Findes.

Table 1 - Areas with marginal accumulations in Espírito Santo made available in the permanent offer

Basin	Sector	Area with marginal accumulation	Exploratory model	Bid status	Area offered (km²)	Rehabilitation phase (years)	Payment for area occupancy or retention (R$/km²/year)²	Royalty Rates (%)	Offer Guarantee Value (R$)	Initial Work Program (PTI, in Portuguese) (R$)	PTI Financial Guarantee (R$)	Minimum Signing Bonus (R$)	Signing Bonus Offered by the Seller (R$)	Surcharge	Other Signing Bonus Offers	Number of Producer Wells	Characteristics
Espírito Santo	SES-T4	Mosquito	Madura	Petromais Global Exploração e Produção LTDA* (50%)	11,9	3	47,5	5%	1,500.0	700,000.0	210,000.0	20,159.0	601,564.1	2984%	80,777.8	3	**Original in situ volume:** 3.05 MMbbl of oil and 30 MMm³ of natural gas **Accumulated production:** 0.09 MMbbl of oil and 0.78 MMm³ of natural gas
Espírito Santo	SES-T4	Saíra	Madura	Petromais Global Exploração e Produção LTDA* (50%)	19,8	3	47,5	5%	4,200.0	2,100,000.0	630,000.0	60,476.0	2,414,111.1	3992%	-	6	**Original in situ volume:** 16.94 MMbbl of oil and 26.93 MMm³ of natural gas **Accumulated production:** 44.9 MMbbl of oil and 0.037 MMm³ of natural gas
Espírito Santo	SES-T6	Lagoa Parda Sul	Madura	Imetame Energia Ltda.* (100%)	1.7	3	47.5	5%	1,500.0	700,000.0	210,000.0	20,159.0	20,159.0	100%	-	2	**Original in situ volume:** 673 MMbbl of oil and 194 MMm³ of natural gas **Accumulated production:** 41.3 MMbbl of oil and 62.6 MMm³ of natural gas
Espírito Santo	SES-T6	Rio Ibiribas	Madura	Without expressions of interest	3.2	3	47.5	5%	1,500.0	700,000.0	210,000.00	20,159.00	-	-	-	2	**Original in situ volume:** 1.43 MMbbl of oil and 6.81 MMm³ of natural gas **Accumulated production:** 37.5 MMbbl of oil and 0.15 MMm³ of natural gas

NOTE1: The exploration phase may be extended under the concession contract provisions.

NOTE2: Amounts related to the payment for area occupation or retention, in Brazilian Reais per km² in January 2019, applicable to the exploration phase. These amounts will be paid and adjusted annually, from the date of signing of the concession contract, by the application of the IGP-DI accumulated in the 12 months preceding the date of each readjustment, as provided for in Article 28 of Decree No. 2,705/98. These amounts will be increased by 100% in case the exploration phase is extended, when applicable, and for each development stage. For the production phase, the amounts will be increased by 900%.

NOTE3: The bidders will be qualified as operators or as non-operators. Those qualified as operators will be classified in the following levels: Operator A, for operating blocks located in deep/ultra-deep waters, shallow waters and onshore; Operator B, for operating blocks located in shallow waters and onshore; Operator C, for operating only blocks located onshore, and Operator D, for operating only onshore with marginal accumulations.

(*) Operating company of the marginal accumulation area.

Source: ANP Elaboration: Ideies/Findes

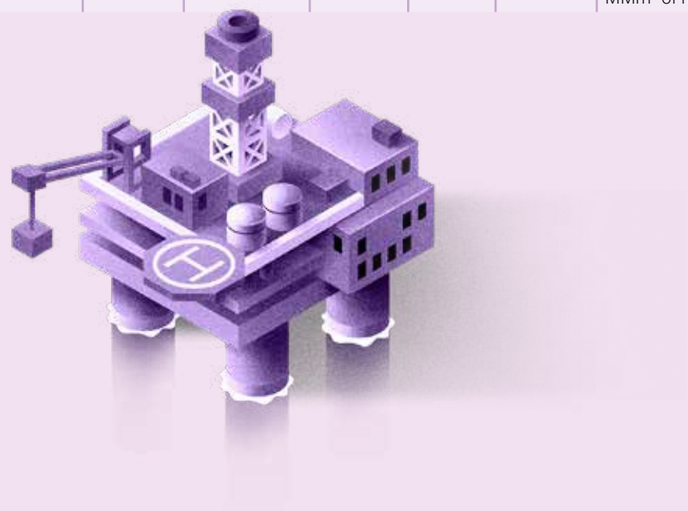

Table 2 - Exploratory Blocks in Espírito Santo made available in the permanent offer:

Basin	Sector	Sector State	Block	Status	Environment	Exploratory Model	Area (km²)	Exploration Phase (years)	Area Retantion (R$/km²/years)	Minimum qualification	Royalty Rates (%)	Offer Guarantee Value (R$)	Minimum Bonus (R$)
Espírito Santo	SES-T4	ES	ES-T-290	Available	Onshore	Madura	30.443	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-291	Available	Onshore	Madura	24.091	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-304	Available	Onshore	Madura	30.436	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-305	Available	Onshore	Madura	20.291	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-318	Available	Onshore	Madura	30.429	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-331	Available	Onshore	Madura	30.421	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-344	Available	Onshore	Madura	28.406	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-352	Available	Onshore	Madura	30.407	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-353	Available	Onshore	Madura	30.407	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-362	Available	Onshore	Madura	30.399	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-363	Available	Onshore	Madura	39.174	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-371	Available	Onshore	Madura	30.392	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-380	Available	Onshore	Madura	37.797	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-389	Available	Onshore	Madura	37.786	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-398	Available	Onshore	Madura	30.370	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-399	Available	Onshore	Madura	16.162	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-407	Available	Onshore	Madura	30.363	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-408	Available	Onshore	Madura	19.998	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T4	ES	ES-T-409	Available	Onshore	Madura	15.454	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-429	Available	Onshore	Madura	21.877	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-454	Available	Onshore	Madura	24.573	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-466	Available	Onshore	Madura	22.077	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-467	Available	Onshore	Madura	28.042	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-486A	Available	Onshore	Madura	10.450	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-495A	Available	Onshore	Madura	19.536	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-504	Available	Onshore	Madura	30.295	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-514	Available	Onshore	Madura	30.288	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-517	Available	Onshore	Madura	27.549	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-525	Available	Onshore	Madura	30.280	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-527	Available	Onshore	Madura	29.930	5	47.50	C	7.5%	4,000.00	50,000.00
Espírito Santo	SES-T6	ES	ES-T-528	Available	Onshore	Madura	20.637	5	47.50	C	7.5%	4,000.00	50,000.00
Campos	SC-AR2	ES and RJ	C-M-58	Available	Offshore (shallow waters)	High Potential	210.941	7	2,226.79	B	10.0%	241,000.00	26,264,142.90
Campos	SC-AR2	ES and RJ	C-M-99	Available	Offshore (shallow waters)	High Potential	258.214	7	2,226.79	B	10.0%	241,000.00	69,500,878.08

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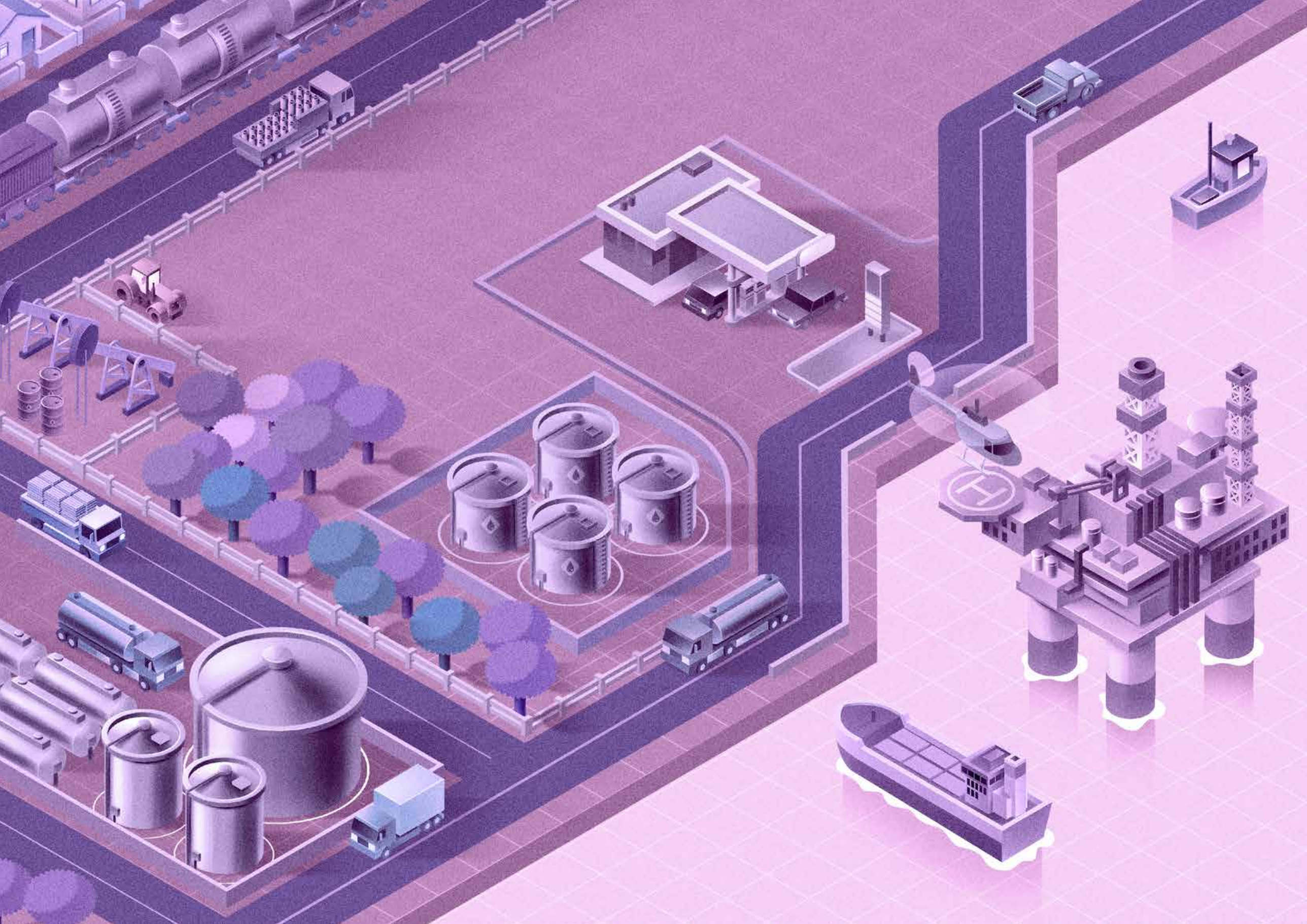
Source: ANP Elaboration: Ideies/Findes



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