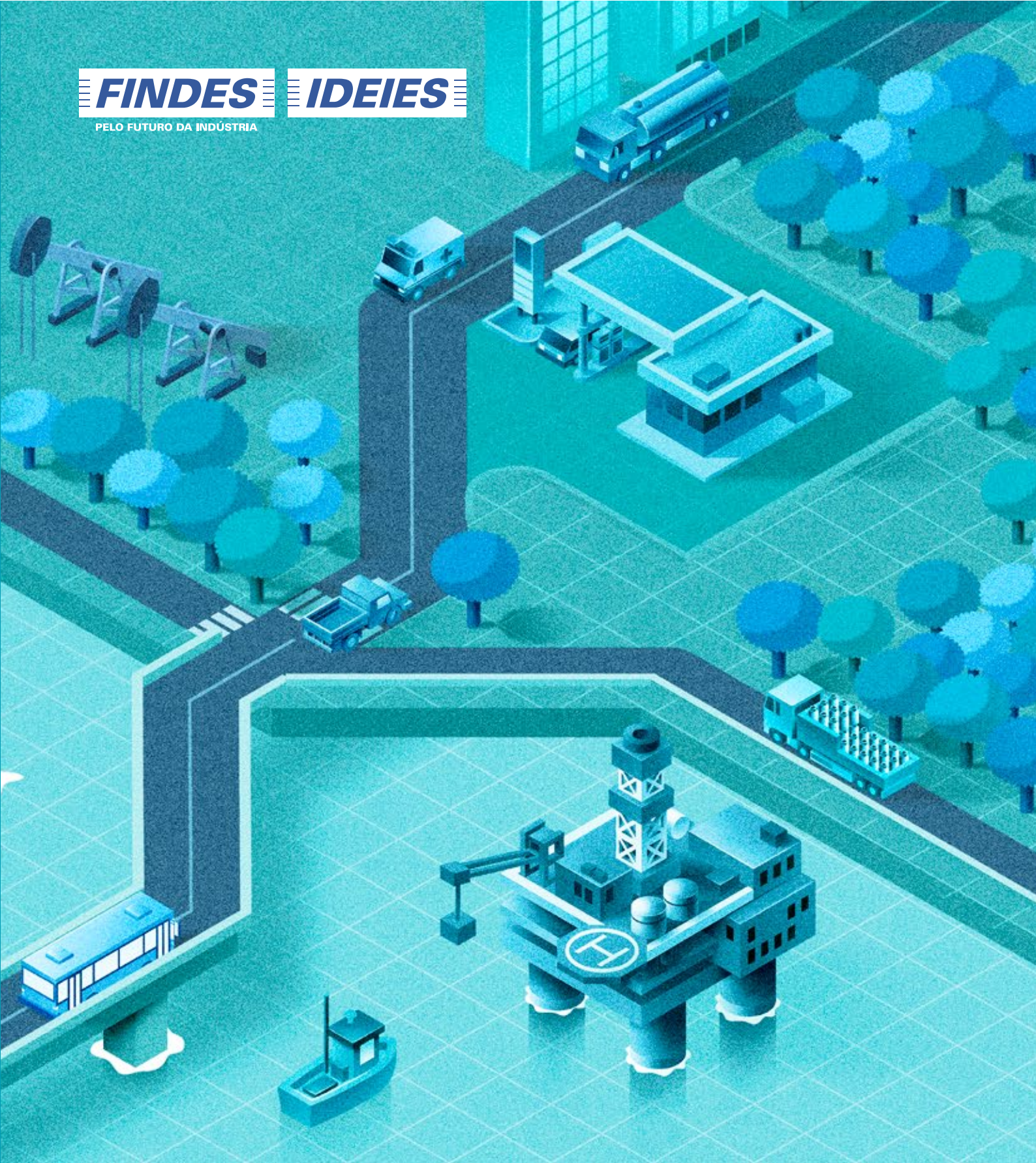


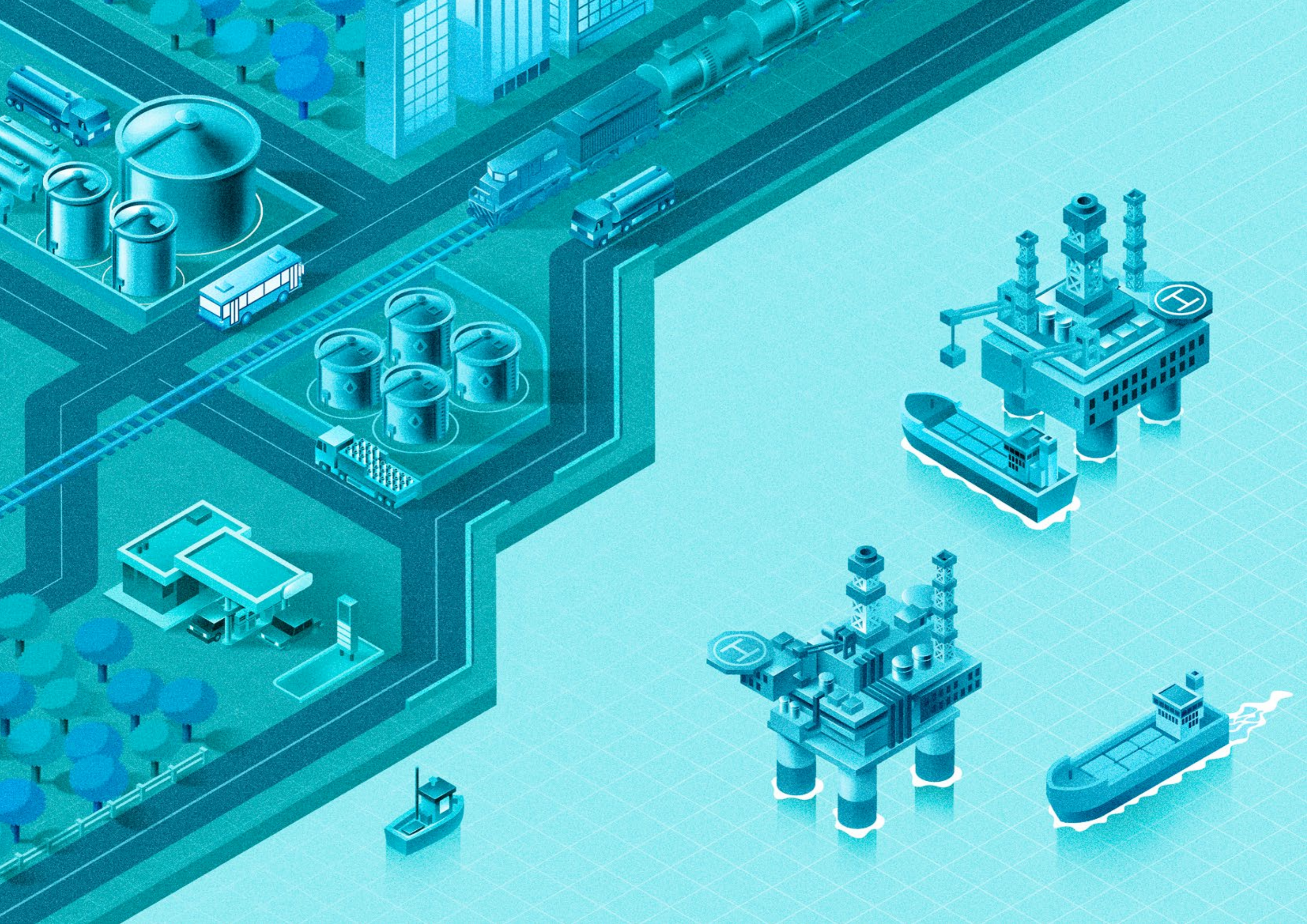
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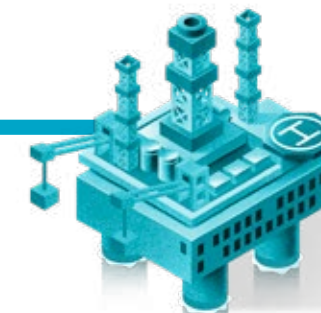
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PELO FUTURO DA INDÚSTRIA



2020 **ESPÍRITO SANTO**
OIL INDUSTRY
YEARBOOK





INTRODUCTION

If, in 2020, the fall of the oil barrel price and the fear of a lower-for-longer scenario were more likely due to the drop in demand for fuel caused by the novel coronavirus pandemic, the year 2021 begins with expectations of a more gradual rebound in commodity prices to pre-pandemic levels. The light at the end of the tunnel seems to emerge from the tightening of input supply by producing countries, overshadowing fears of a further fall in demand for fuels. The stain that seems to smear this optimistic surface was the price of the oil barrel which, in December 2020, was at levels equal to the beginning of the pandemic.

The projections of the National Agency of Oil, Natural Gas and Biofuels (ANP) seem to give strength to optimism, especially for national production. According to data from the agency, the five-year period between 2021-2025 is expected to have an average annual growth in oil production of 4.4%, higher than the previous five-year period, between 2016-2020, when the average growth in oil production was 3.4%.

There is, however, caution. The strategic plans of the main oil companies were reviewed during the novel coronavirus pandemic and are still moderate. The main characteristics are the drop in investments and the maintenance of production in priority areas, focusing on projects with greater efficiency. For Espírito Santo, the most anticipated project is the Integrado Parque das Baleias (IPB). The project was budgeted at BRL 5 billion and currently Petrobras is contracting the FPSO (Floating Production Storage and Offloading).

With Petrobras leaving areas considered less profitable for the company, the challenging role of Espírito Santo is to lead investors to these assets. In the scenario of energy transition and search of oil

companies for more efficient assets, the performance in the business environment appears to be an important advantage in the promotion of this sector in the state. On the same lines, the need for ongoing efforts to advance innovation in the sector, especially by the supply chain, should be highlighted. In the present issue, we highlight the performance of companies from Espírito Santo in bids for the development of innovative solutions focused on the oil and gas sector.

In this sense, the Espírito Santo Oil Industry Yearbook presents a relevant analysis of the main themes that guide the oil industry in the state, to provide the government and the main local actors with technical and strategic information.

The first chapter deals with the global oil industry. Chapter 2 focuses on the oil industry in Espírito Santo. The reflections of the oil activity, especially government participation, are dealt with in Chapter 3. Chapter 4 discusses the incentive mechanism for Research, Development, and Innovation. Finally, chapter 5 points out the new opportunities in oil exploration and production for Espírito Santo.

All this work was carried out to transform public data into reliable and strategic information based on data provided by ANP, the Ministry of Economy (ME), British Petroleum (BP), the International Monetary Fund (IMF), and the State of Espírito Santo's Court of Auditors (ECA-ES). The complete document can be accessed on the Ideies page at www.portaldaindustria-es.com.br

Enjoy your reading!

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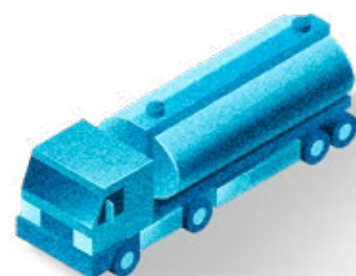
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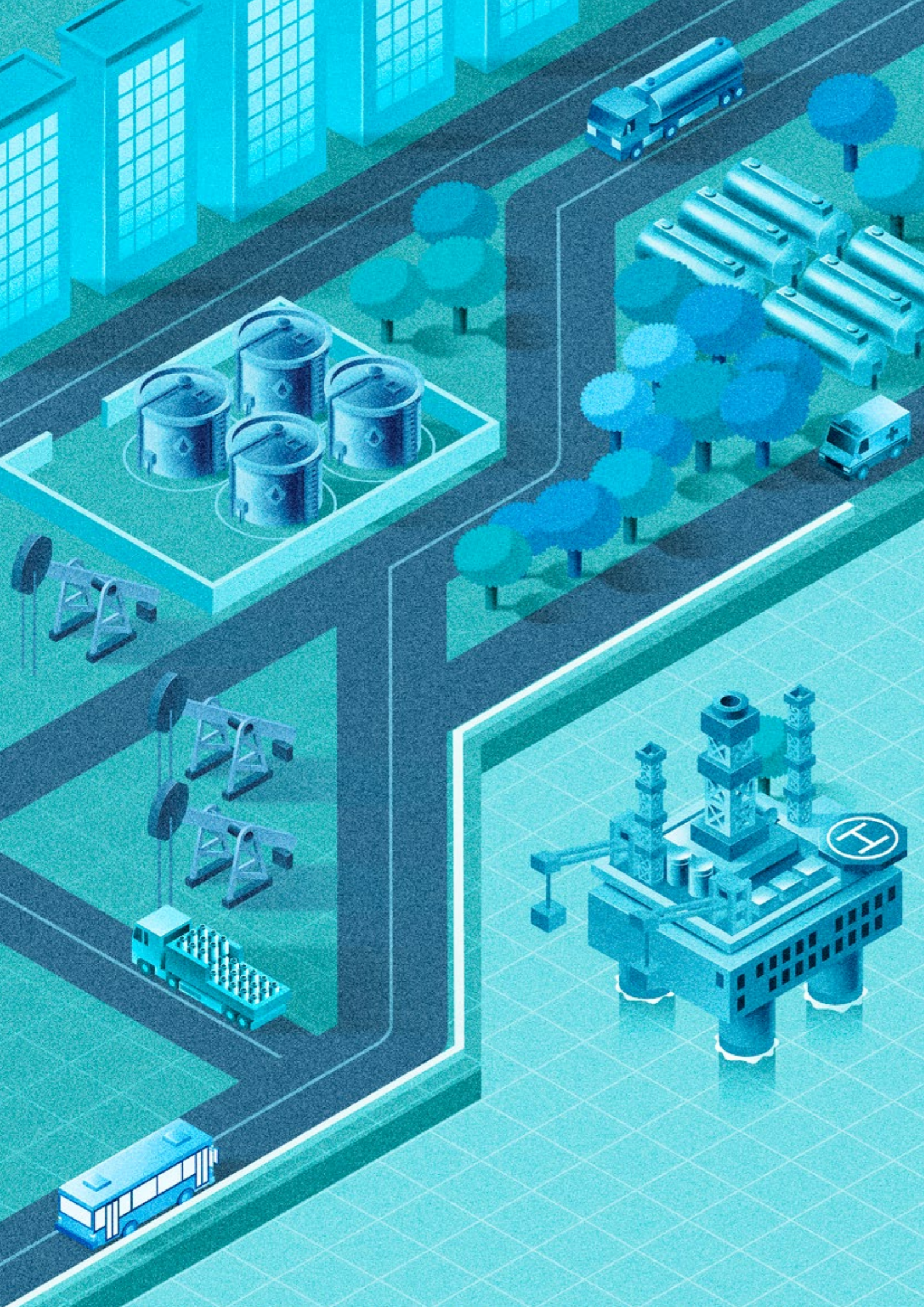
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Chapter 1

INTERNATIONAL OVERVIEW

The oil and natural gas chain has global dimensions. To understand the sector at the local level, it is important to understand how this region positions itself in the world, in terms of influence on the global input demand and supply. This mechanism will determine the international oil

prices, which will be used as a reference by all countries. In this context, this chapter presents the behavior of international prices in the last two decades and which are the main countries and regions in terms of oil reserves, supply (production), demand, and input refining.

1.1 International prices

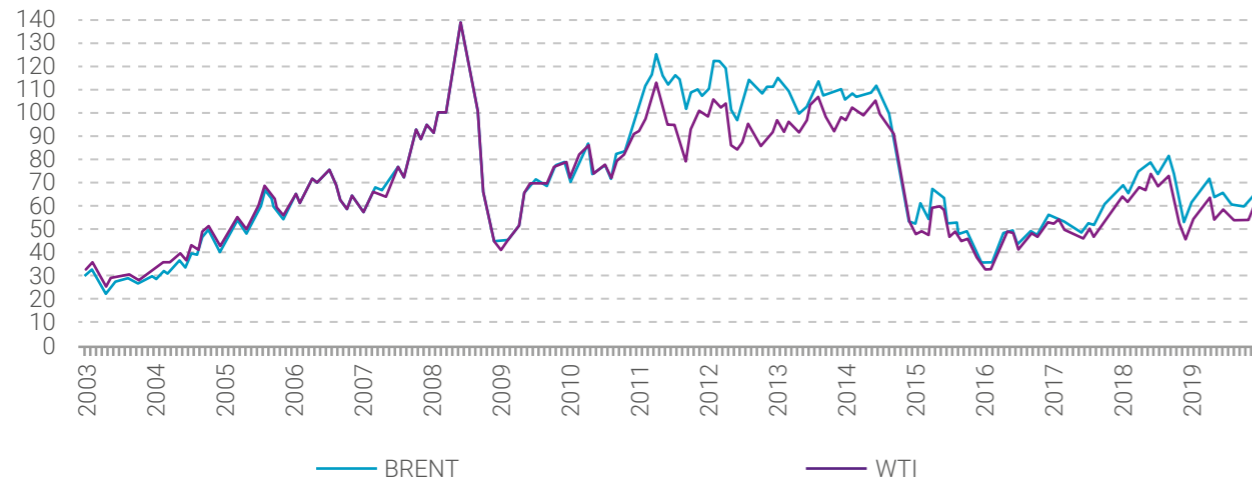
In the first half of 2019, the price of oil increased, reaching higher values than the historical average. However, in the second semester, the average price of the oil barrel was close to the historical average of the period (Chart 1), which was mainly explained by uncertainties regarding global demand and political issues. In 2019, WTI - the onshore benchmark in oil pricing in Texas, Louisiana, and North Dakota - was priced at USD 60.23 per barrel. Brent, the benchmark price for oil produced in the North Sea, was priced at USD 53.50 per barrel, also in 2019.

At the same time, it was estimated that in 2020 the world economy would decline by 4.4%, according to the projections of the International Monetary Fund (IMF). The justification lies in the economic crisis caused by the novel coronavirus pandemic. The drop in production worldwide has led to a reduction in global oil demand.

The global economic downturn led to an oil supply greater than the oil demand and, consequently, a sharp drop in the international price of oil. In January 2020, WTI was priced at USD 58.16 per oil barrel and in April it reached the lowest value registered: USD 19.33 per oil barrel. Brent started 2020 priced at USD 51.56 per oil barrel, and in June it also had its lowest price registered, at USD 19.56 per oil barrel.

The IMF expects that the price of the oil barrel will reach an annual average of USD 36.20 in 2020 and USD 37.50 in 2021. The organization also estimates that prices should increase after 2021, with an average price of USD 46.00, although 25% lower than in 2019..

Chart 1 - Oil barrel price (USD per barrel)



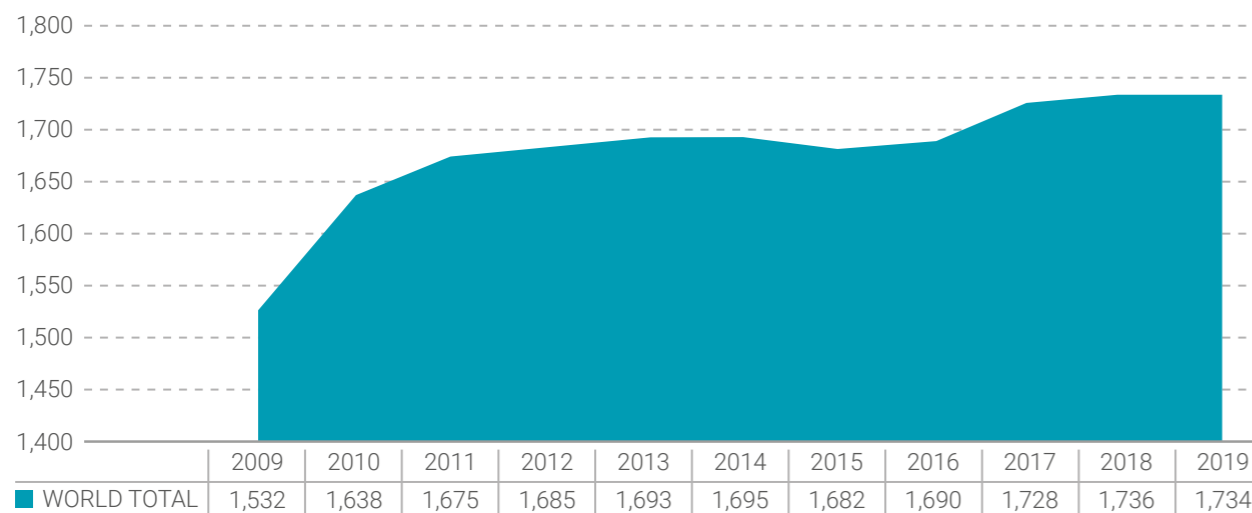
Source: Investing.com. Elaboration: Ideies/Findes

1.2 Oil Reserves

The total global oil reserves¹ in 2019 stood at 1.73 trillion oil barrels, practically stable when compared to 2018, with a slight drop of 0.1%. In absolute terms, the reduction was 2.1 billion barrels. It should be noted that this was the first negative variation

in oil reserves in the last four years. The shares of oil reserves by region were: Middle East (48.1%), South and Central America (18.7%), North America (14.1%), Commonwealth of Independent States² (8.4%), Africa (7.2%), Asia (2.6%), and Europe (0.8%).

Chart 2 - Proven oil reserves in the world (billions of barrels)

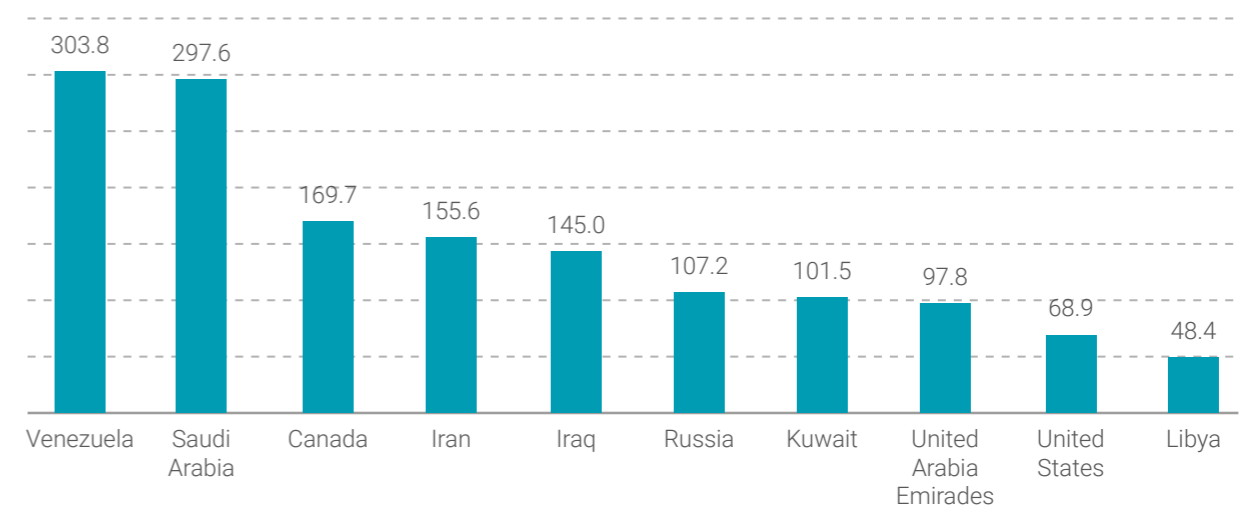


Source: BP Statistical Review of World. Elaboration: Ideies/Findes
Legend: World total

Individually, Venezuela and Saudi Arabia are the two countries with the largest volumes of reserves, with 303.8 and 297.6 billion oil barrels, respectively (Chart 3). Brazil is the 15th country in the world in terms of volume of reserves, with 12.7 billion oil barrels.

Canada was the country that had the greatest reduction in reserves in 2019 - 1.08 billion oil barrels -, followed by Brazil, with a decrease of 720 million oil barrels. India was the country that had the greatest growth in oil reserves in 2019 - 184.0 million oil barrels -, followed by Colombia, that increased its reserves by 177.8 million barrels.

Chart 3 - Proven oil reserves by producing countries (billions of barrels) - 2019



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

1.3 Production

In 2019, the global oil production was 95.2 million barrels per day, 0.1% lower than in 2018 (Chart 4). There was a production decrease of 2.1 million barrels per day, compared to the previous year, which caused the first negative variation in oil supply since 2009. The shares by region from the global oil production were: Middle East (33.5%), North America (31.9%), Commonwealth of Independent States (15.4%),

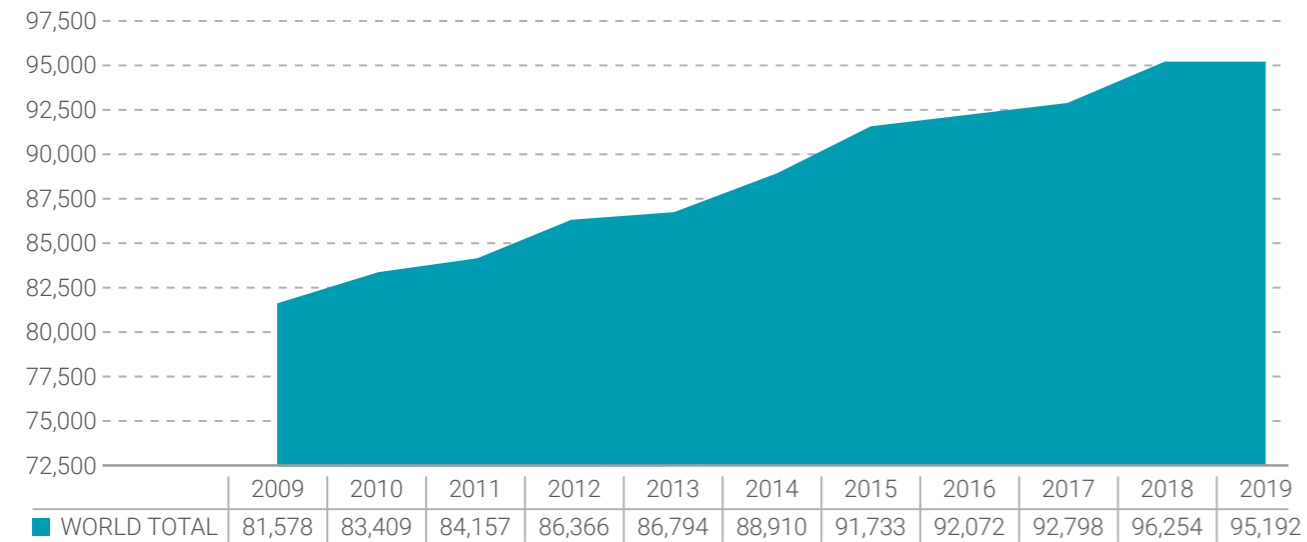
Africa (8.8%), Asia (8.0%), South and Central America (6.5%), and Europe (3.6%).

The top largest oil producers were the United States and Saudi Arabia, with 17.9% and 12.4% of shares in world oil production, respectively (Chart 5). Brazil is the 10th country with the largest oil production in the world, with 2.9 million barrels per day.

¹ The concept used was Proven Oil reserves. Proven reserves are those that can produce with a high level of guarantee.

² Member countries: Armenia, Azerbaijan, Byelorussia, Kazakhstan, Moldova, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

Chart 4 - Oil production in the world (thousand barrels/day)

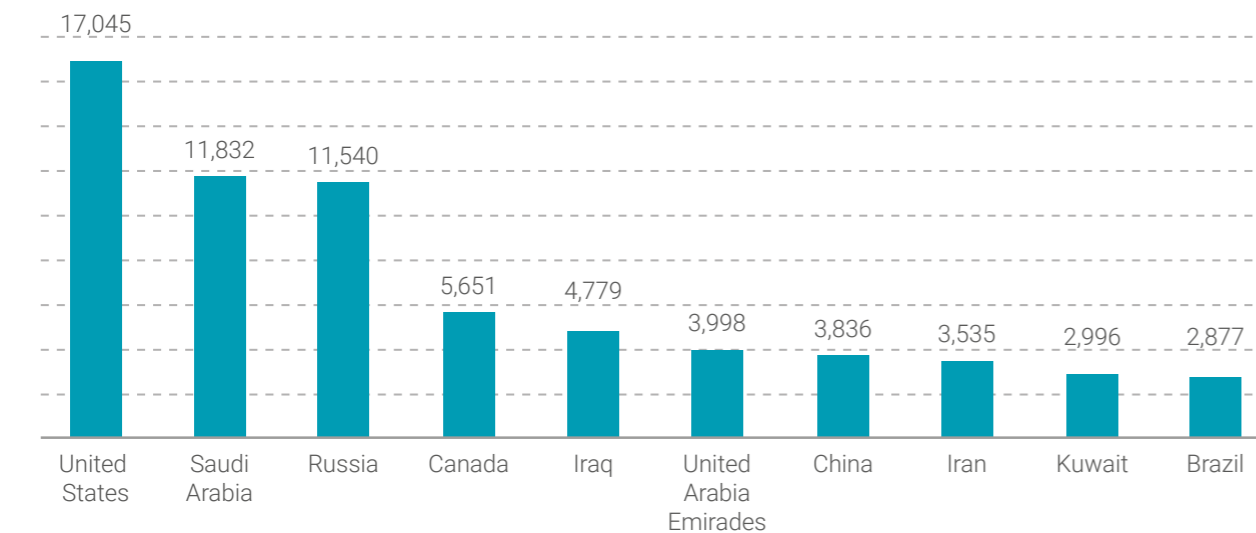


Source: BP Statistical Review of World. Elaboration: Ideies/Findes

The United States was the country that most increased its production in 2019, by 1.7 million oil barrels per day, and Iran was the one that most reduced its oil production, with a decrease of 1.3 million barrels per day. With regard to the Organization of Petroleum

Exporting Countries (OPEC), its production fell by 5.3% in 2019, reaching the production of 35.6 million oil barrels per day. On the other hand, non-OPEC production increased by 3.4%, reaching the production of 59.6 million oil barrels per day.

Chart 5 - Oil production by producing country (thousand barrels/day) – 2019



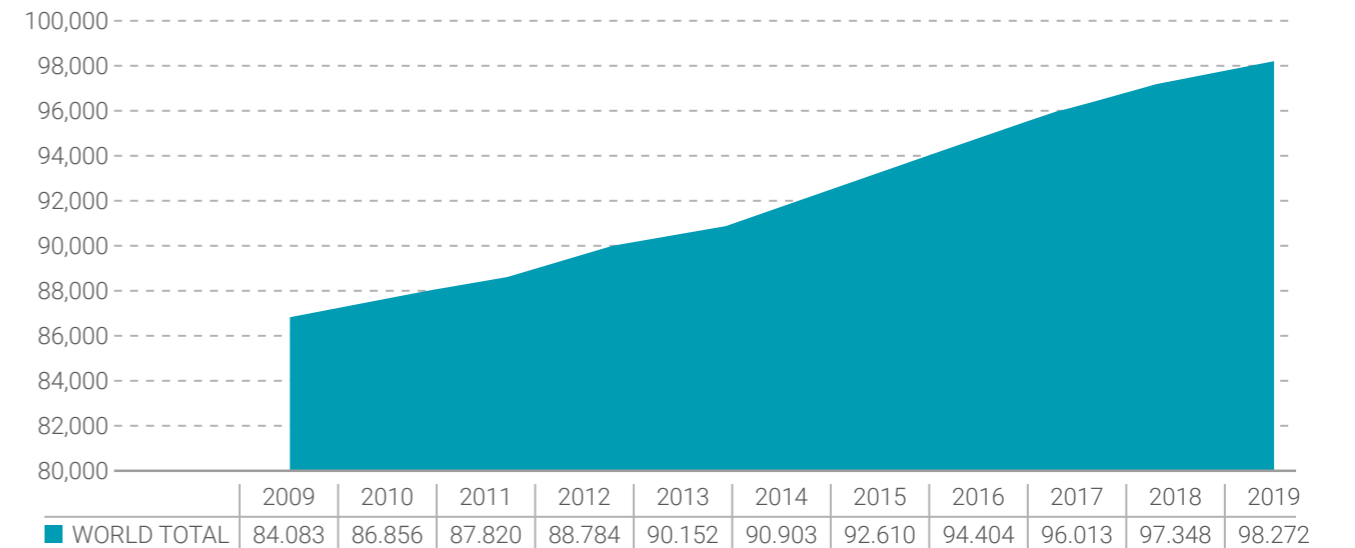
Source: BP Statistical Review of World. Elaboration: Ideies/Findes

1.4 Demand

Global oil consumption in 2019 was at 98.3 million barrels per day, 0.9% higher than in 2018 (Chart 6). There was an increase of 924.1 thousand barrels, compared to the previous year. The shares by region of worldwide oil consump-

tion were: Asia (36.8%), North America (23.9%), Europe (15.2%), Middle East (9.6%), South and Central America (6.0%), Commonwealth of Independent States (4.3%), and Africa (4.2%).

Chart 6 - Oil consumption in the world (thousand barrels/day)



Fonte: BP Statistical Review of World. Elaboração: Ideies/Findes

The main consumer countries were the United States (19.7%), China (14.3%), and India (5.4%), Chart 7. Brazil is the 9th largest oil consumer in the world, with 2.4 million barrels per day. The consumption of OECD (Organization for Economic Cooperation and Development) countries was 45.8 million oil barrels daily, less than what was registered by non-OECD countries, 52.5 million barrels daily. Since 2013, OECD countries have consumed less oil than non-OECD countries.

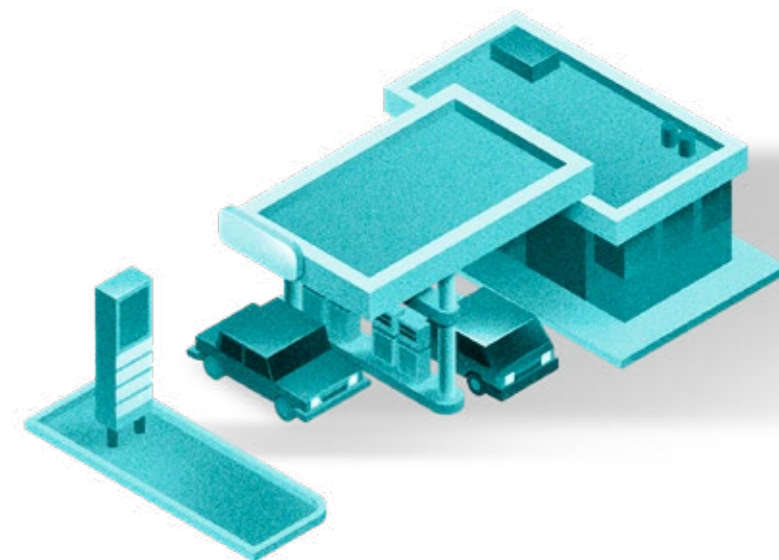
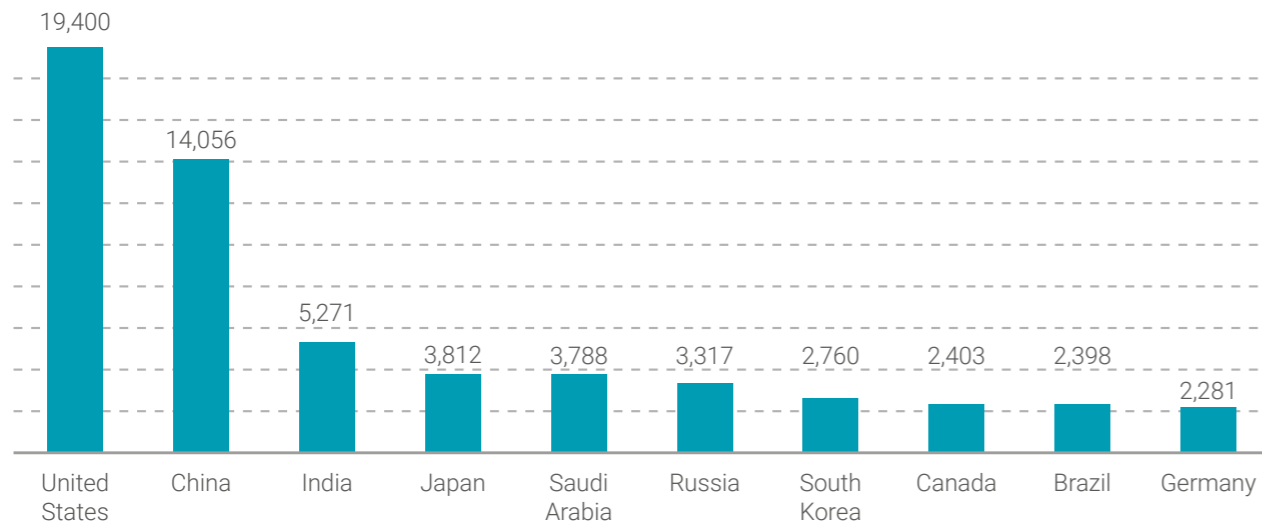


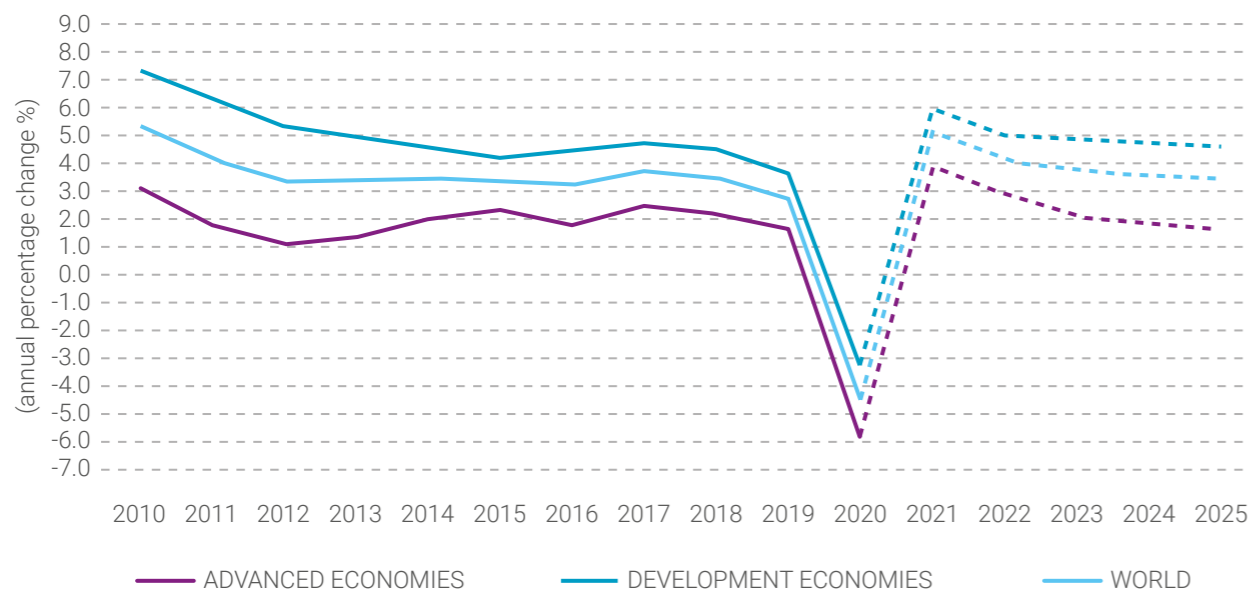
Chart 7 - Oil consumption by country (thousand barrels/day) – 2019



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

Oil consumption has a strong correlation with the growth of global production. Chart 8 shows the global GDP growth projection. According to the IMF projections, the drop in production due to the novel coronavirus health crisis will come mainly from the advanced economies (-5.8%) and, to a lesser extent, from the developing economies (-3.3%). According to the projections, developing economies are expected to have a faster rebound in 2021 (6.0%) spurred mainly by the growth of India (8.8%) and China (8.2).

Chart 8 - Real GDP growth projection (annual percentage change %)



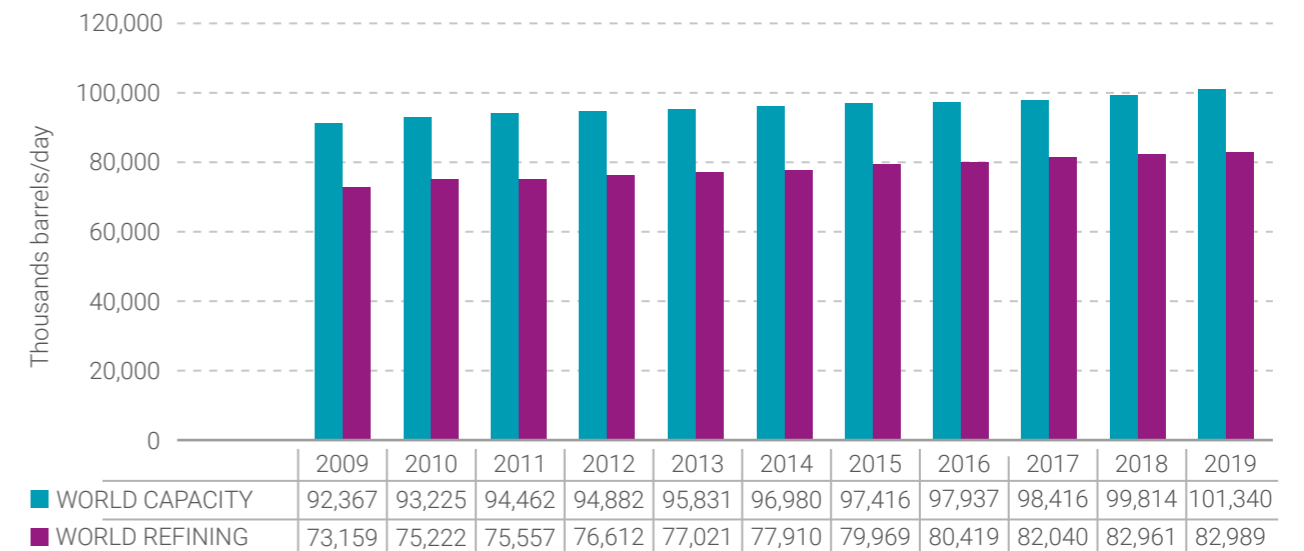
Source: International Monetary Fund (IMF). Elaboration: Ideies/Findes

1.5 Refining

The worldwide oil refining was 83.0 million barrels per day in 2019. There was an increase of 1.5 million barrels per day from the previous year. The shares by world region were: Asia (35.0%), North America (22.3%), Europe (15.4%), Middle East (9.9%), Commonwealth of Independent States (8.2%), South and Central America (5.9%), and Africa (3.2%).

The refinery throughput worldwide was 83.0 million barrels per day in 2019. There was an increase of 28 thousand barrels of refined oil in the world, 0.03% more than in the previous year (Chart 9). The shares by world region were: Asia (36.5%), North America (22.9%), Europe (15.4%), Middle East (10.3%), Commonwealth of Independent States (8.3%), South and Central America (4.2%), and Africa (2.5%).

Chart 9 - Global oil refining capacity (thousand barrels/day)

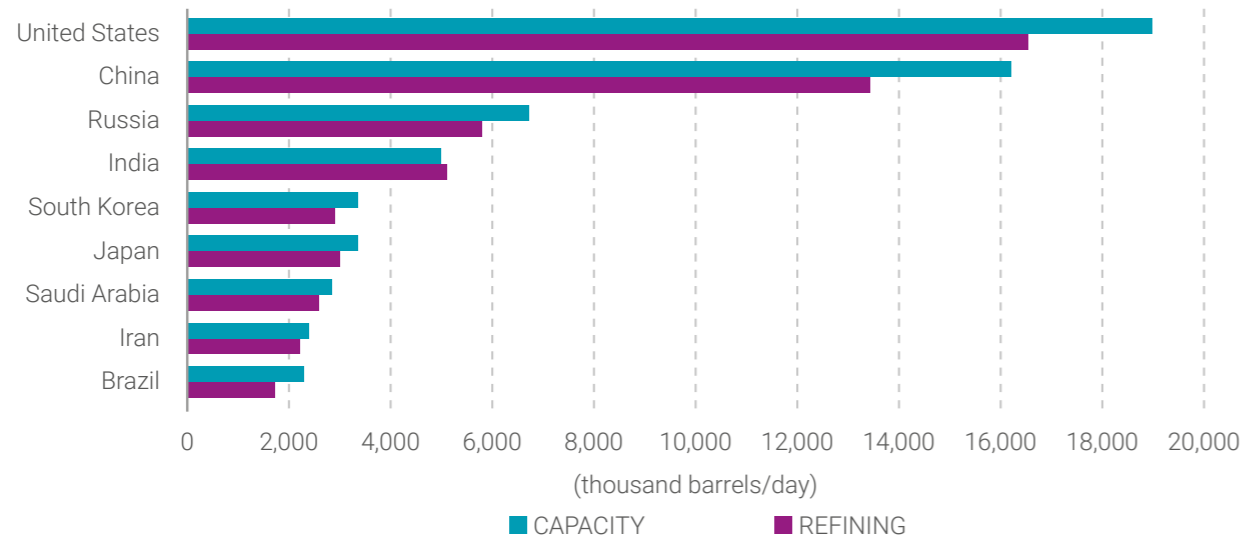


Source: BP Statistical Review of World. Elaboration: Ideies/Findes.

The countries with the largest refining capacity are: United States (18.7%), China (16.0%), and Russia (6.6%), Chart 10. Brazil is the 9th country with the largest refining capacity in the world, with 2.3 million barrels per day. The refining park of OECD countries has a capacity of 45.1 million barrels of oil daily, less than that registered by non-OECD countries, 56.2 million barrels a day. Since 2009, non-OECD countries have achieved a refining park with greater capacity than that of OECD countries.

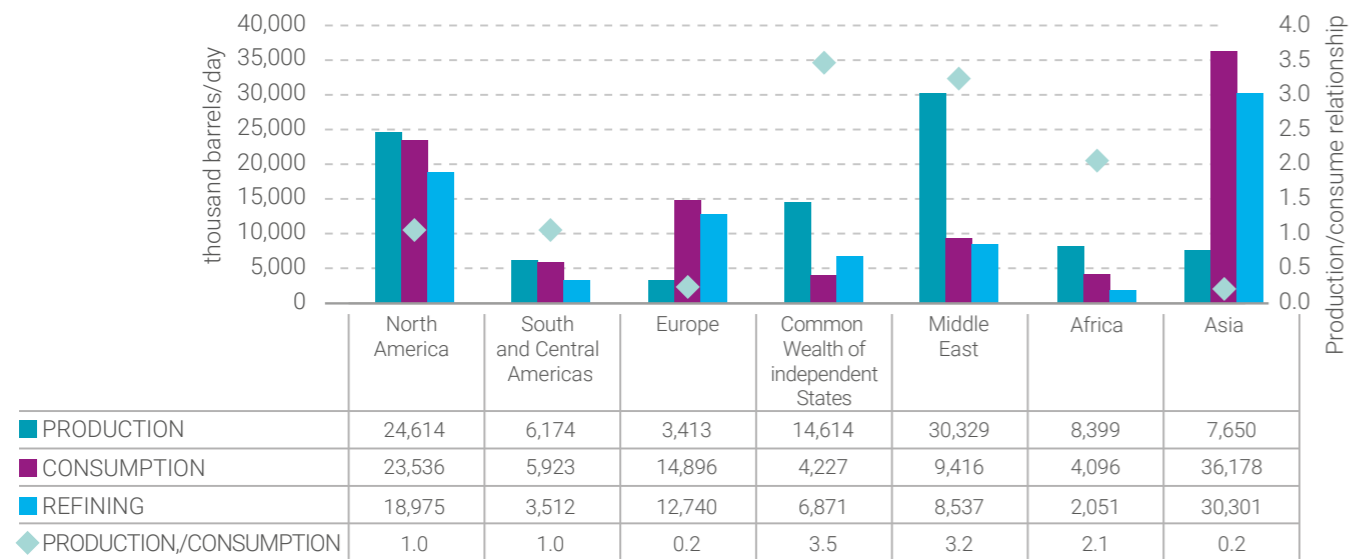
The countries that most refined oil in the world were: United States (20.0%), China (16.2%), and Russia (7.0%), Chart 10. Brazil is the 11th country with the largest oil refining capacity in the world, with 1.8 million barrels per day. The United States was the country that most reduced its oil refining in 2019, with a drop of 400 thousand barrels of unrefined oil per day. China, on the other hand, was the country that most refined oil, with an increase of 949 thousand barrels of refined oil in 2019.

Chart - 10 Oil refining capacity by country – 2019



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

Chart 11 - Regional distribution of oil production, consumption, and refining – 2019

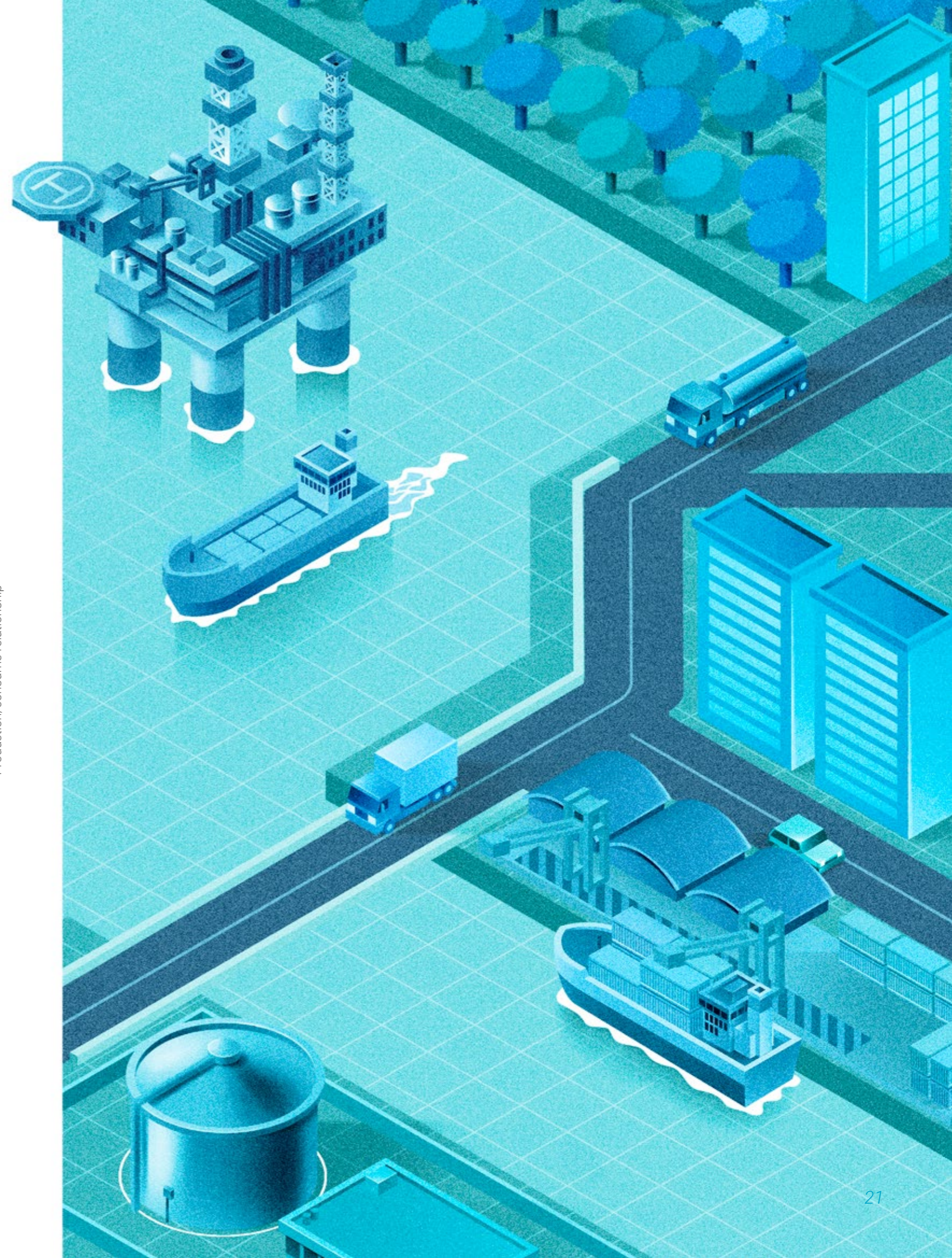


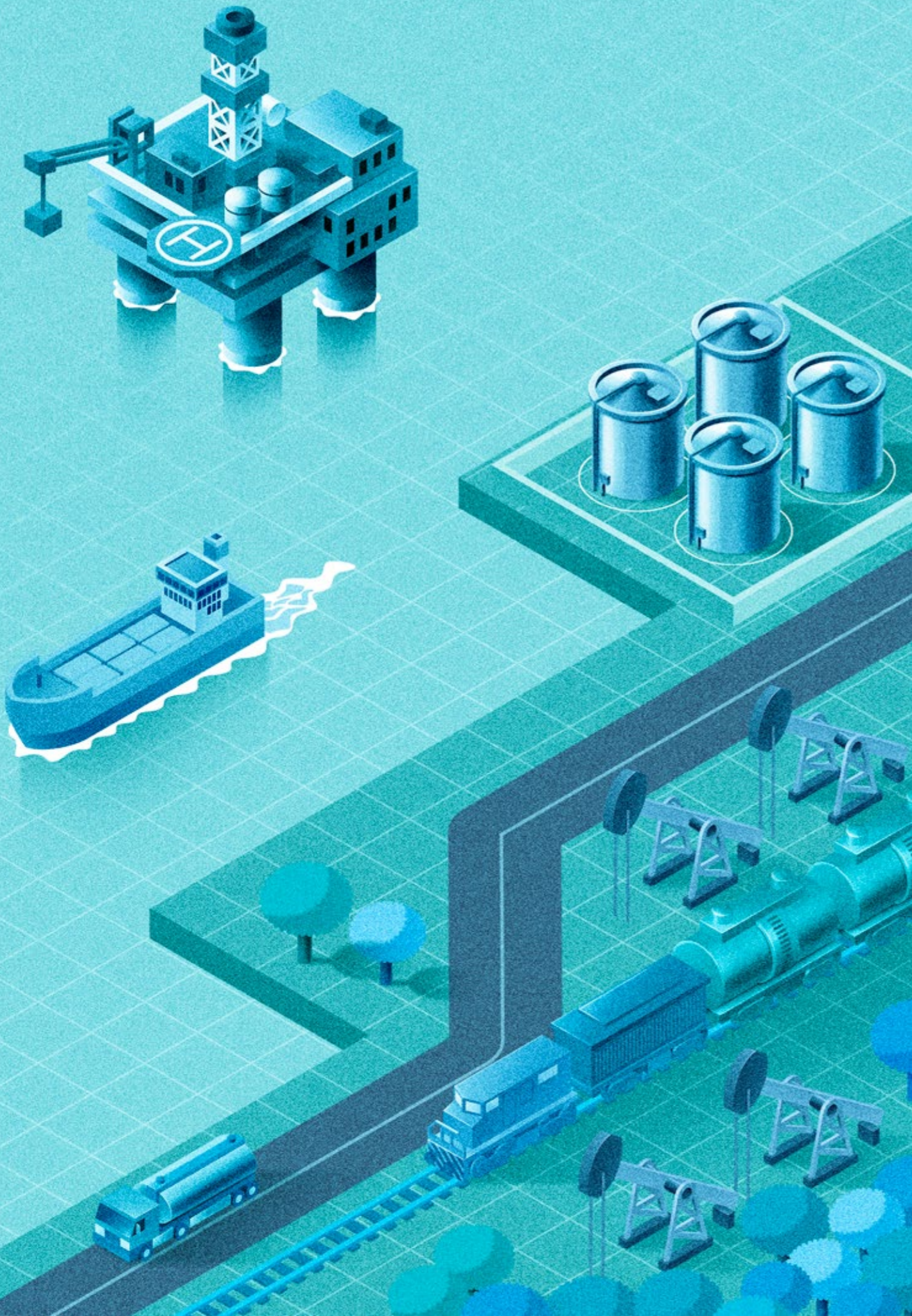
Fonte: BP Statistical Review of World. Elaboração: Ideies / Findes.

Chart 11 summarizes the global shares of oil production, consumption, and refining in 2019. In short, production is concentrated in the Middle East and the United States. Refining and consumption are concentrated in Asia and North America.

The production-consumption indicator quantifies how much a region produces in relation to its consumption. When the indicator is gre-

ater 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 Commonwealth of Independent States (3.5) and the Middle East (3.2) are the regions with the highest production-consumption ratio and Europe (0.2) and Asia (0.2) are the regions with the lowest ratio.





Chapter 2

OIL EXPLORATION AND PRODUCTION IN ESPÍRITO SANTO

The State of Espírito Santo has 67 oil-producing fields and 26 exploration blocks divided into two sedimentary basins: part of the Campos basin and the entire Espírito Santo basin. On the border with the Campos basin, the state has 7 fields in production and 5 exploration blocks. In the Espírito Santo basin there are 60 fields in production (7 offshore and 53 onshore). The Espírito Santo basin also has 21 exploration blocks (10 offshore and 11 onshore).

In total, 15 onshore producing fields are in the process of returning to ANP. There are 14 fiel-

ds returned by Petrobras and 1 field returned by Petrosinergy. In addition, two fields have marginal accumulations: Crejoá, operated by Central Resources and the Rio Ipiranga field, operated by Imetame and IPI. In the state of Espírito Santo, there are 10 oil companies with producing fields. Four of them are foreign companies (Shell Brasil, ONGC, QPI Brasil, and Central Resources) and six are national companies (Petrosynergy, OPEnergia, Vipetro, IPI, and Petrobras). Petrobras has the concession of the fields with higher productivity in the State.

2.1 Drilling Activity

Oil companies are subject to exploration and production contracts for a certain area that was auctioned. The exploration aims at discovering oil and/or natural gas deposits, as well as evaluating the commercial feasibility to begin the production phase at the field. It is in the exploration phase that the oil company needs to carry out the Minimum Exploratory Program (PEM), agreed to in the contract. At this stage, the seismic, gravimetric, magnetometric, and geochemical data acquisition, and the well drilling are performed. The monitoring of well drilling is an important indica-

tor for the oil industry, since it is an indication of the activity preceding production.

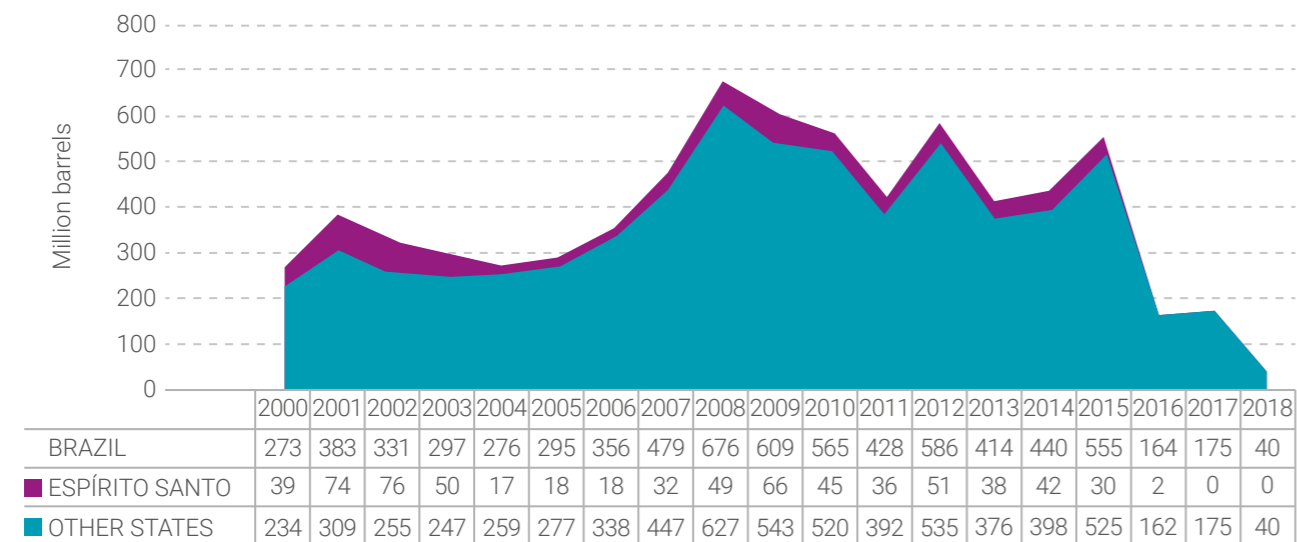
Between 2000 and 2018, 10,277 wells were drilled throughout Brazil, 71.4% onshore and 28.6% offshore. In Espírito Santo, 1,116 wells were drilled, 61.2% onshore and 38.8% offshore. Data analysis revealed that the expansion and retraction of the onshore and offshore drilling activities occurred in different periods. The rise of onshore drilling happened between 2000 and 2009, while offshore drilling happened between 2007 and 2010.

Concerning the onshore activity, 7,342 wells were drilled between 2000 and 2018 throughout Brazil. From this total, 47.2% are producing and 17.2% have been closed³. Between 2000 and 2009, 3,975 wells were drilled throughout Brazil, an average annual growth of 8.4%. In the period between 2010 and 2015, the drilling numbers remained stable, with an average annual drop of 0.3%. Between 2016 and 2018, this activity had an average annual

drop of 37.5%. Brazilian onshore drilling activity lost momentum after 2015 (chart 12).

In Espírito Santo, 683 wells were drilled onshore between 2000 and 2018. From this total, 33.2% are producing and 17.0% were permanently abandoned⁴. The last record of onshore drilling in the state was in 2016, when two wells were drilled by Petrobras in the Fazenda São Rafael field, located in Linhares. Currently, these wells are abandoned.

Chart 12 - Wells drilled onshore – Brazil, Espírito Santo, and other states (units)



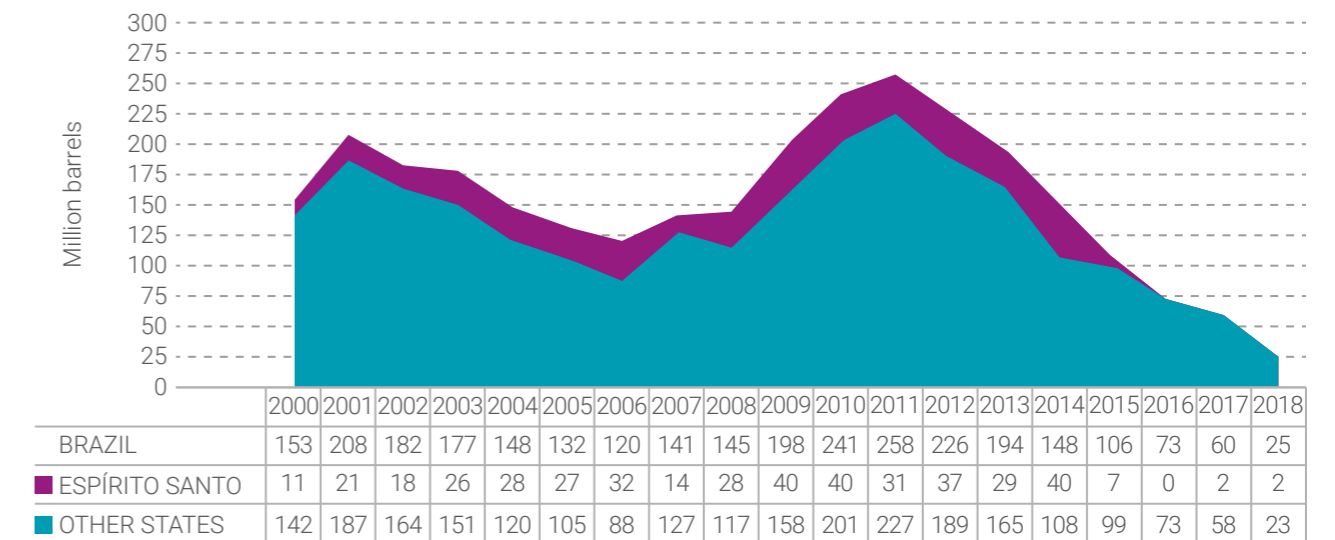
Source: ANP
Elaboration: Ideies/Findes

In the offshore activity, 2,935 wells were drilled between 2000 and 2018 throughout Brazil. From this total, 49.5% were permanently abandoned and 14.3% are producing⁵. Between 2000 and 2006, 1,120 wells were drilled throughout Brazil, with an average decrease of 3.0% per year. In the period between 2007 and 2011, drilling grew 12.8% on an annual average. However, between 2011 and 2018, this activity had an average annual drop of 27.0%. The

Brazilian drilling activity in offshore operations lost momentum after 2011 (Chart 13).

In Espírito Santo, 433 offshore wells were drilled between 2000 and 2018. From this total, 67.4% have been permanently abandoned and 14.1% are producing⁶. The last offshore drilling documented in the state happened in 2018, when two wells were drilled by Petrobras, one in block C-M-596 and one in the Jubarte field, both abandoned today.

Chart 13 - Wells drilled offshore – Brazil, Espírito Santo, and other states (units)



Source: ANP
Elaboration: Ideies/Findes

2.2 Declarations of hydrocarbon traces

Declarations of hydrocarbon are issued by the oil company when there are traces of hydrocarbons or any other natural resources in the explored area. The analysis of the declarations can be used as an indication for the exploration activity and future pro-

duction in a given region. In Espírito Santo, the declarations of hydrocarbon traces slowed down with time. For example, in a recent period, between 2016 and 2020, the number of declarations per year ranged between 0 and 3. (Chart 14).

³ The remaining onshore wells in Brazil are classified as: temporarily abandoned with monitoring (10.7%), permanently abandoned (5.7%), surface abandoned, i.e., permanent abandonment which includes removal of the wellhead and site restoration (4.7%), injecting (4.6%), abandoned waiting for permanent abandonment/site restoration (3.1%), temporarily abandoned without monitoring (2.5%), under intervention (1.3%), returned (1.2%) and others (1.7%).

⁴ The remaining onshore wells in Espírito Santo are classified as: closed (13.3%), temporarily abandoned with monitoring (8.8%), returned (7.8%), temporarily abandoned without monitoring (6.3%), abandoned awaiting permanent abandonment/surface abandonment (4.8%), surface abandoned (3.5%), operating for disposal (2.0%), under intervention (1.2%) and others (2.0%).

⁵ The remaining offshore wells in Brazil are classified as: closed (9.0%), temporarily abandoned without monitoring (6.9%), injecting (6.5%), abandoned due to exploration logistics (4.0%), abandoned waiting for permanent abandonment/seabed abandonment (1.6%), seabed abandoned, i.e., abandonment including the removal of the wellhead and site restoration (1.6%), temporarily abandoned with monitoring (1.3%) and others (3.4%).

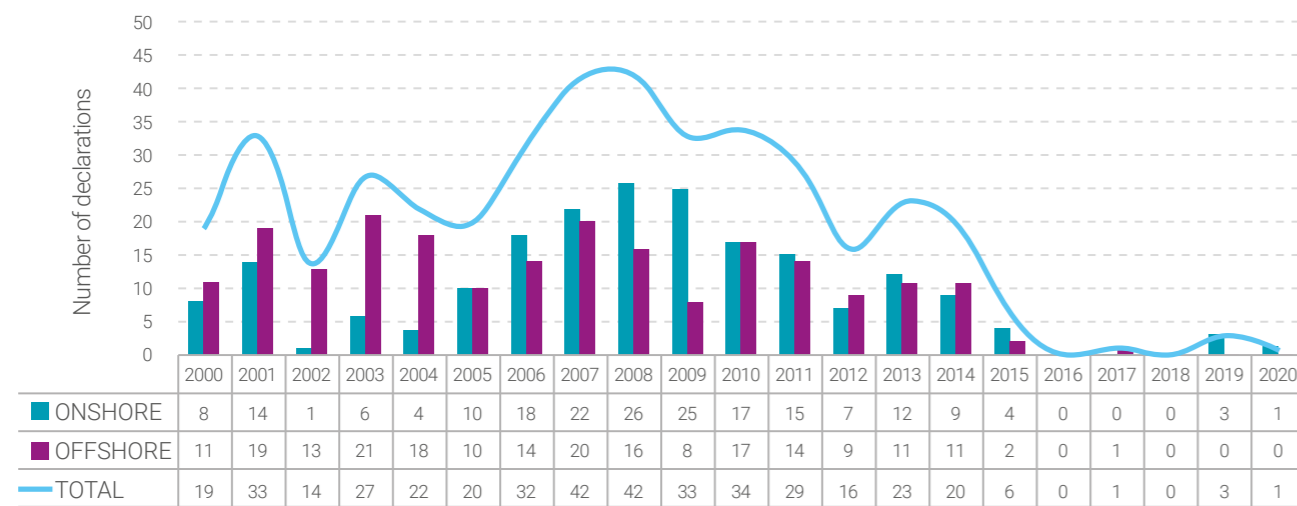
⁶ The remaining offshore wells in Espírito Santo are classified as: closed (5.5%), injecting (4.8%), temporarily abandoned without monitoring (4.2%), abandoned due to exploration logistics (1.2%), abandoned waiting for permanent abandonment/seabed abandonment (1.2%) and others (1.6%).

Between 2000 and 2008, a total of 251 declarations of hydrocarbon were issued, from which 43.4% were onshore and 56.6% were offshore. In the period between 2009 and 2015, a total of 161 declarations were issued, 55.3% onshore and 44.7% offshore. In the most recent phase of the oil industry, which covers the years 2017 to 2020, a total of 5 declarations of hydrocarbons were issued, from which 4 were onshore and only 1 offshore. Onshore, the declara-

tions of hydrocarbons were issued for the fields in block ES-T-476 (3 declarations) and ES-T-487 (1 declaration). Offshore, there was 1 declaration for the Golfinho field.

Regarding the fluids found, during the period between 2000 and 2020, 69.6% were oil, 9.1% natural gas, 16.7% oil blended with gas and 4.6% unidentified.

Chart 14 - Quantity of declarations of hydrocarbon traces in Espírito Santo



Source: ANP
Elaboration: Ideies/Findes

2.3 Declarations of Commerciality

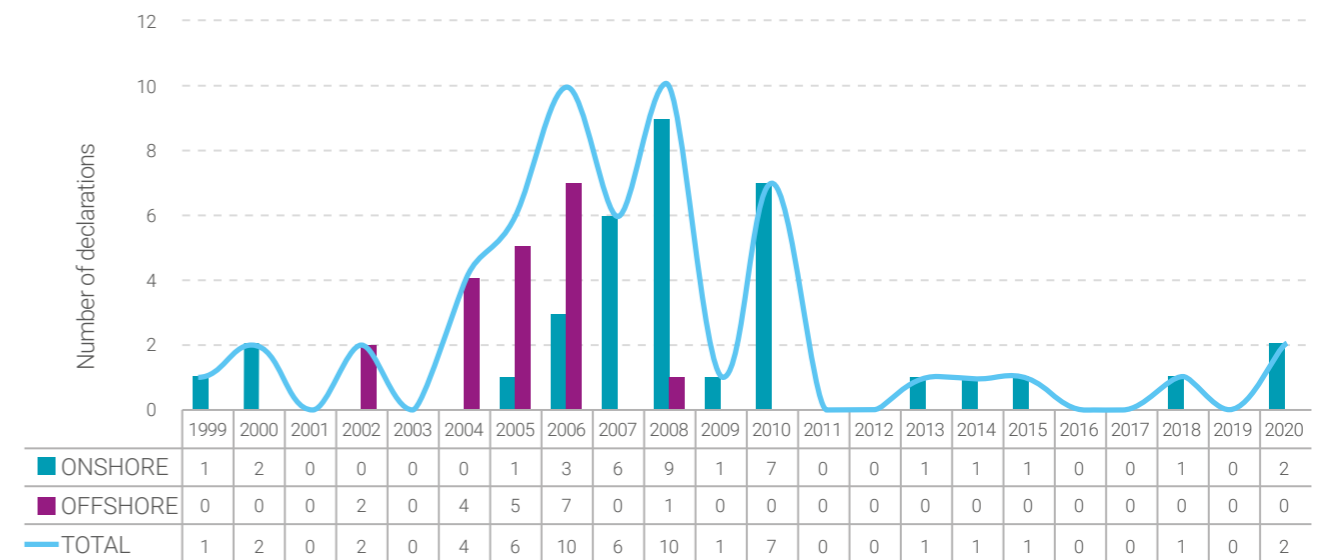
After the notification of hydrocarbon traces, it is verified whether the production of the deposits is commercially feasible. If it is feasible, the operating company must submit a declaration of commerciality to ANP. Between 2000 and 2010, the state registered a total of 48 declarations of commerciality, 39.6% offshore and 22.9% onshore. In the period between 2011 and 2020, Espírito Santo documented 6 new declarations of commerciality, all onshore (Chart 15).

The onshore highlight was the commercial feasibility of areas with marginal accumulations. The ES-T-486 block in the Cancã field issued a declaration of commerciality in 2018. The field is operated by Petrobras and is currently included in the company's divestment plan, in the non-binding phase. The proposal is that other small and medium-sized companies may operate in areas that are currently not profitable for Petrobras.

In addition, in 2020 the GB_AM4 block in the Garça Branca field and the RM_AM4 block in the Rio Mariricu field informed commercial feasibility. The Garça Branca field is operated by Petromais Exploração e Produção, a company that bought the field at the ANP's 4th round of marginal accumulations in 2017. The Rio Ma-

riricu field is operated by Ubuntu Engenharia and was also bought in the 4th round of marginal areas. The two companies are examples of how opening the onshore market for small and medium-sized enterprises can diversify onshore production in Espírito Santo.

Chart 15 - Quantity of declarations of commerciality in Espírito Santo



Source: ANP
Elaboration: Ideies/Findes

2.4 Oil reserves

In 2019, the Brazilian oil reserves reached 21.8 billion oil barrels⁷, 10.3% lower than what was registered for 2018 (Chart 16). In 2019, Espírito Santo reached a total reserve of 1.4 billion oil barrels, 16.8% lower than what was ascertain-

ned in the previous year. Despite the drop, the state is the second largest oil-reserve holder among the federative units (6.4%), only behind Rio de Janeiro (85.7%).

⁷ The concept used was Total Oil Reserves. The total oil reserves are classified by the sum of proven, probable, and possible reserves.

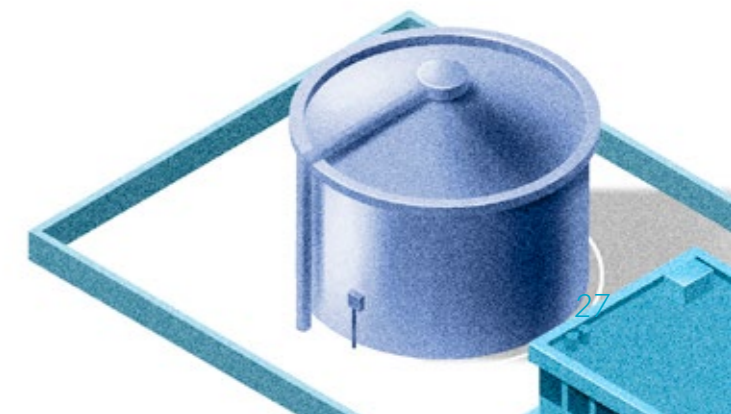
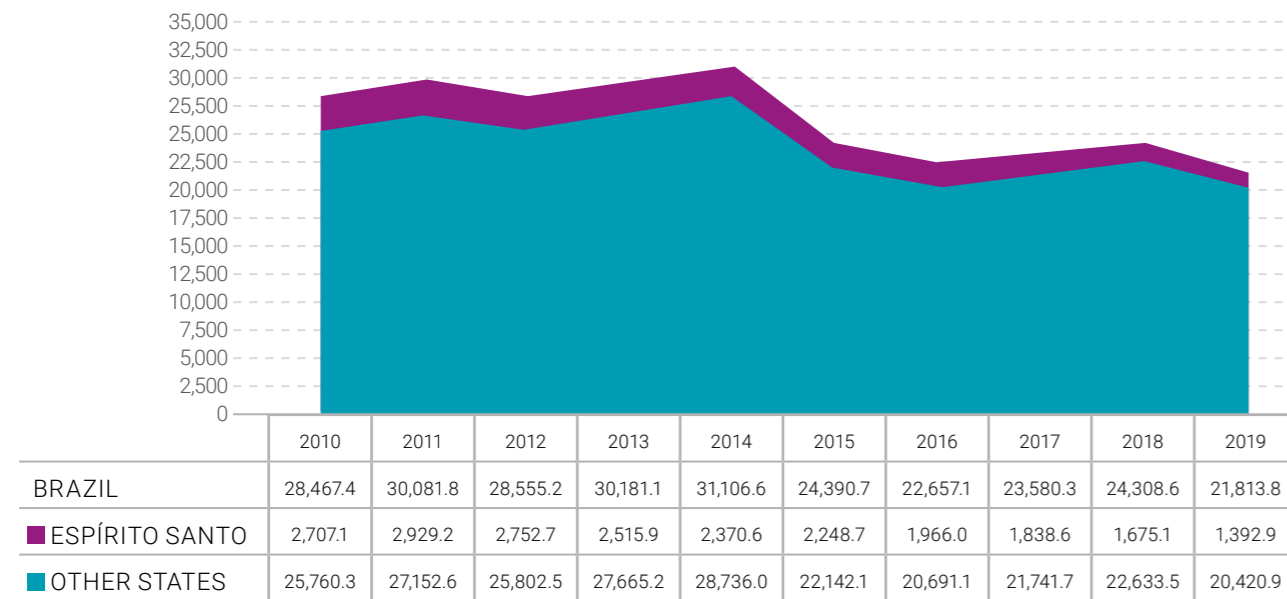


Chart 16 - Total oil reserves in Brazil (million barrels)

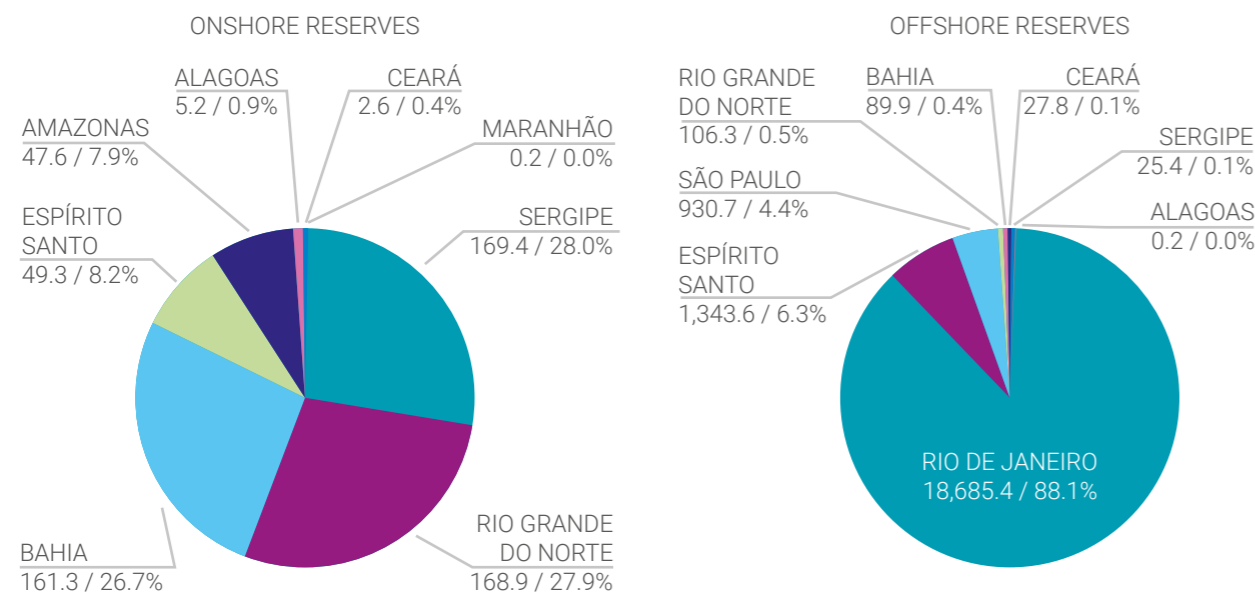


Source: ANP
Elaboration: Ideies/Findes

Concerning the onshore/offshore shares, 604.5 million oil barrels are onshore (2.8%) and 21.2 billion oil barrels are offshore (97.2%). Regarding regional distribution, 90.8% of the entire onshore reserve is concentrated in four Brazilian states:

Sergipe (28.0%), Rio Grande do Norte (27.9%), Bahia (26.7%), and Espírito Santo (8.2%). As to the offshore share, 98.8% of the reserves are located in three Brazilian states: Rio de Janeiro (88.1%), Espírito Santo (6.3%), and São Paulo (4.4%).

Chart 17 - Distribution of oil reserves by federative unit (%) – 2019



Source: ANP
Elaboration: Ideies/Findes

The last year to see an increase in the oil reserves in Espírito Santo was 2011, when the state registered 2.9 billion oil barrels, 47.6% higher than the current reserve level. The cur-

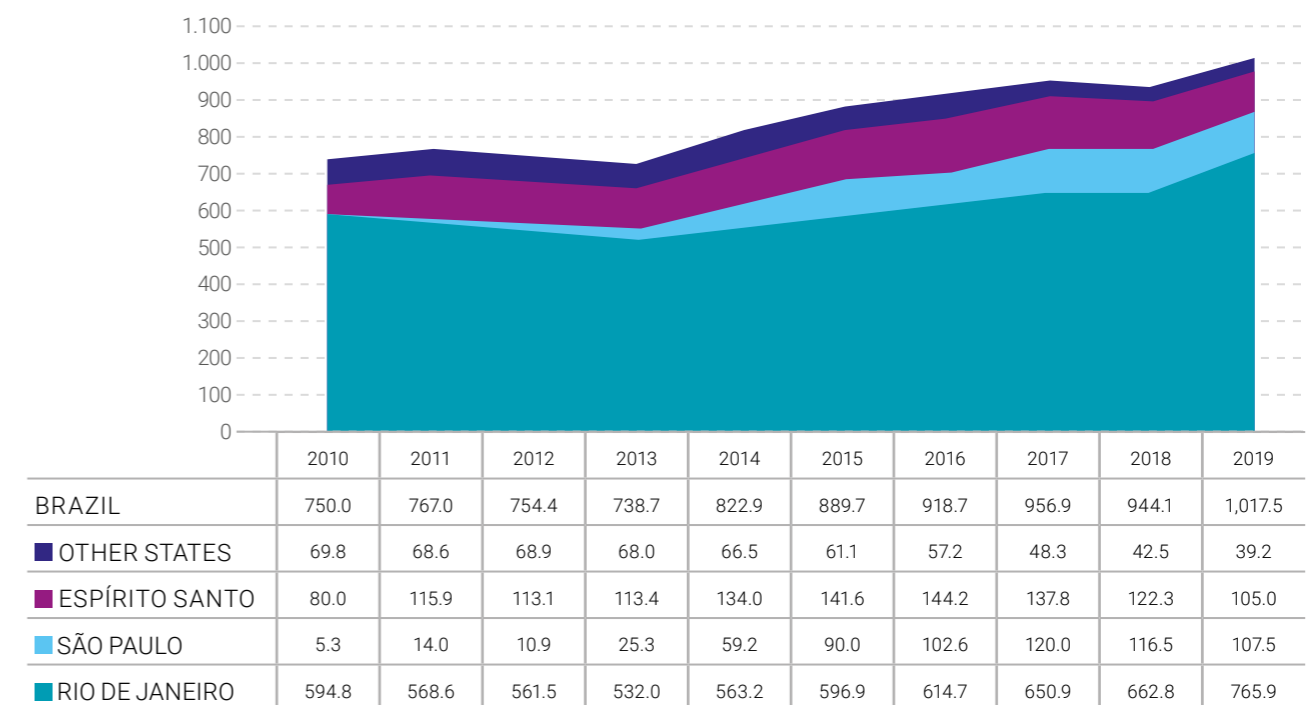
rent result can be explained by the drop in the exploration activity in the state due to the higher attractiveness of the pre-salt areas of the Campos and Santos basins.

2.5 Oil Production

In 2019, the oil production in Brazil reached 1.0 billion oil barrels, 7.8% higher than what was registered for 2016 (Chart 14). National production increased by an annual average of 3.1% between the years 2010 and 2019. In Espírito Santo, the production reached 105.0 million oil barrels in 2019, registering a 14.2% drop compared to the previous year, the largest drop in production in 10 years. With the

reduction, the state had a 10.3% participation in national production and, consequently, ceased to be ranked second in oil production. The state of São Paulo took over as the second largest oil producer, with 107.5 million barrels⁸ (10.6% of national production), only behind Rio de Janeiro, which produced 765.9 million oil barrels (75.3% of the national production) (Chart 18).

Chart 18 - Total oil production (millions of barrels)



Source: ANP
Elaboration: Ideies/Findes

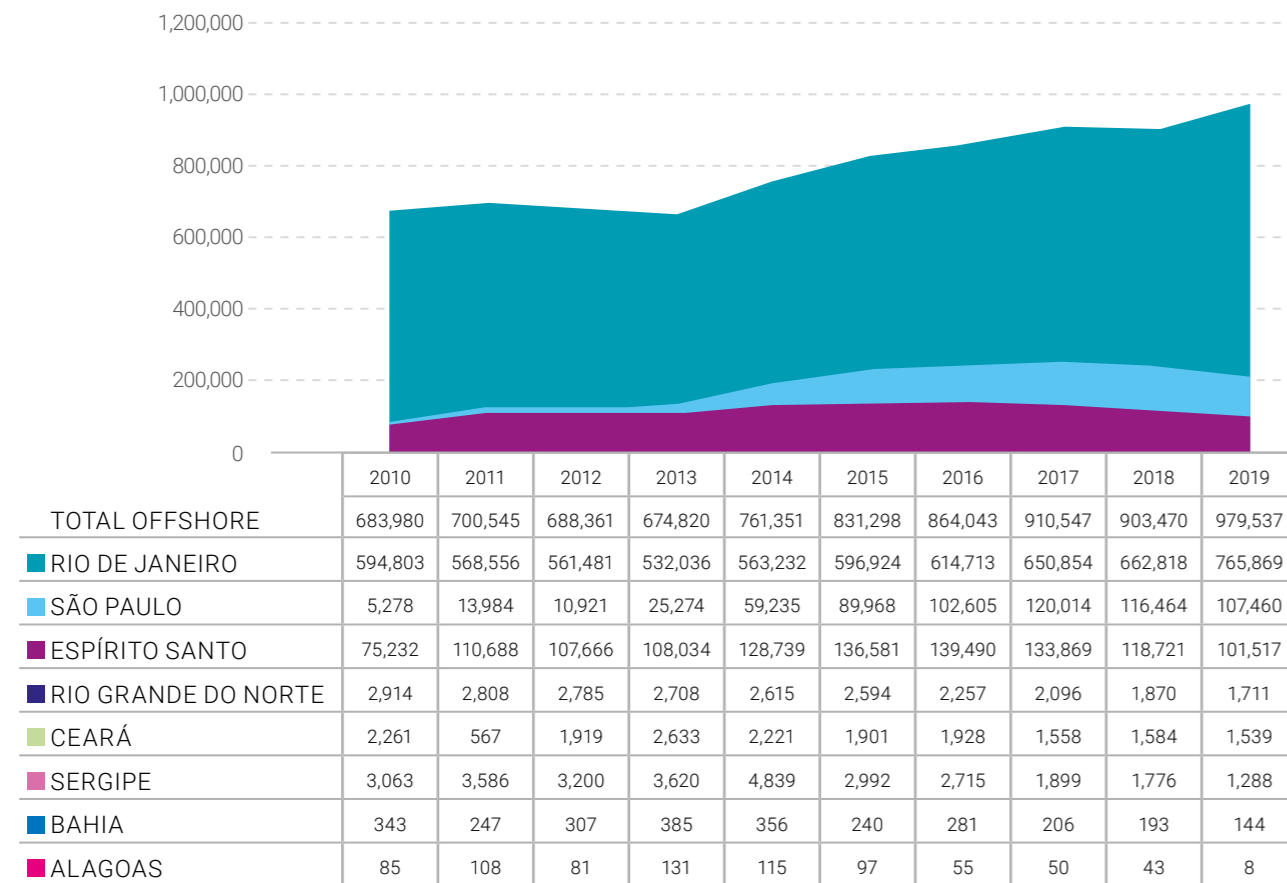
⁸ In Sao Paulo, the Sapinhoá field was responsible for the current production level of the Santos Basin.

2.5.1 Offshore production

With regard to the oil production at sea, Brazil produced 979.5 million oil barrels in 2019, 8.4% higher than the production level of the previous year. Offshore production increased by an annual average of 3.7% between 2010 and 2019. Rio de Janeiro produced

765.9 million oil barrels (78.2%), followed by São Paulo which produced 107.5 million barrels (11.0%), and Espírito Santo, with a total of 101.5 million barrels (10.4%). Chart 19 shows the evolution of offshore production in these states.

Chart 19 - Offshore oil production (thousands of barrels)



Source: ANP
Elaboration: Ideies/Findes

According to the Dynamic Dashboard of Oil and Natural Gas by ANP, the offshore share of the Espírito Santo basin produced an average of 9.8 bbl/day in 2019, 52.5% lower than the level of production in the same period of the previous year. The drop in production was due to the Golfinho field, which had its production reduced by 52.8% in 2019 (Chart 20). The Golfinho field had an average production of 50.2 thousand oil barrels in

2010, but today it is not considered so attractive by the concessionaire (Petrobras). According to the American Petroleum Institute scale, the API gravity⁹ of the oil produced in the field is gradated at 30.6 degrees, which is considered a light oil (relative to its density).

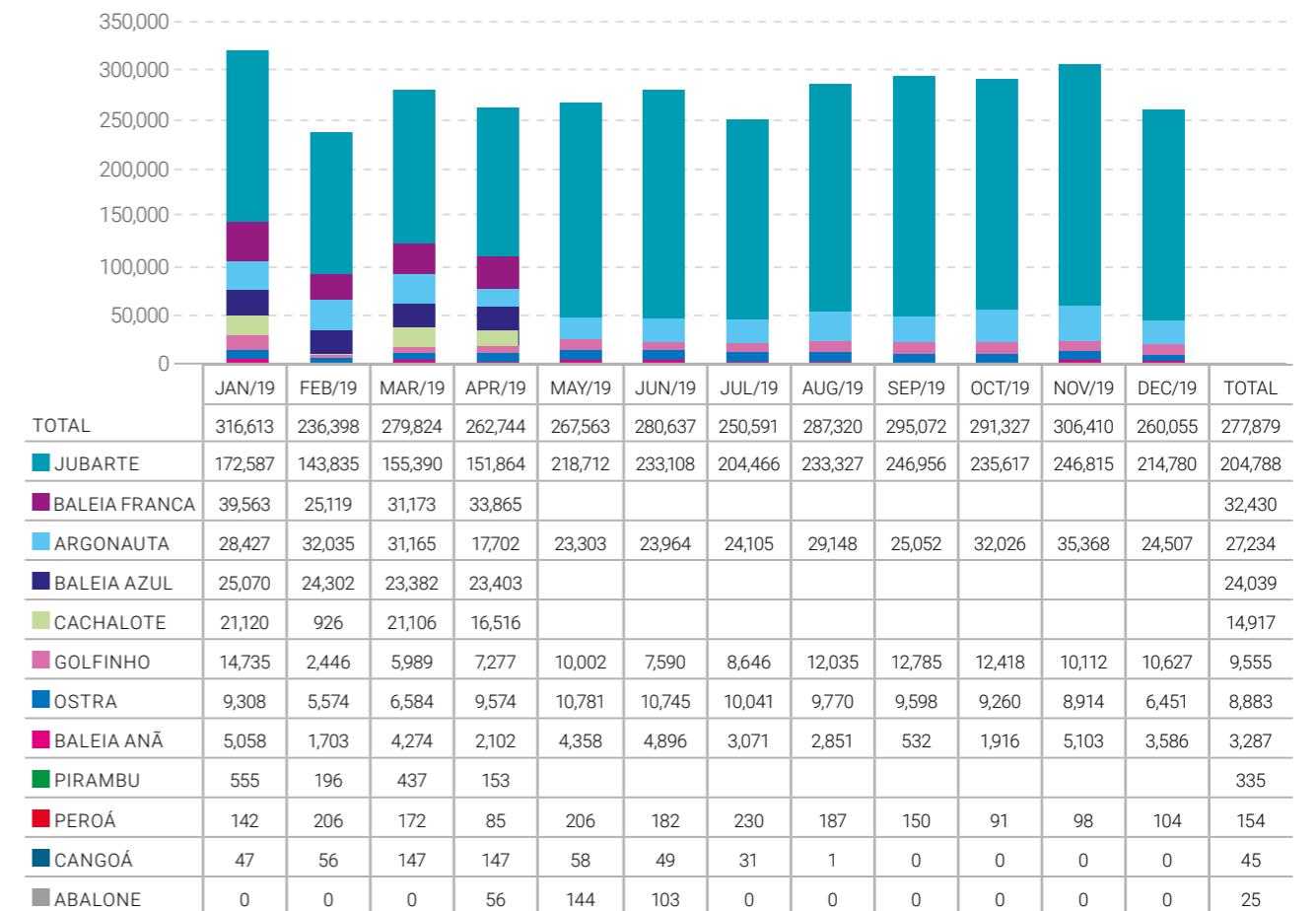
In the share of the Campos basin located in Espírito Santo, according to the Dynamic Dashboard

of Oil and Natural Gas Production by ANP, the production was on average 268.1 thousand bbl/day in 2019. The production level was 12.0% lower compared to the level of the previous year.

In 2018, the Parque das Baleias Project underwent changes in the limits of the producing fields due to a request of the State of Espírito Santo Government to ANP. The proposal was to consider only one reservoir for the purpose of calculating Royalties and Special Participations¹⁰.

In summary, only one reservoir was considered, the Novo Campo de Jubarte reservoir, including the areas comprised by Jubarte, Baleia Azul, Baleia Franca, parts of Cachalote, Mangangá, and Pirambu. In the previous edition of the Oil Industry Yearbook, the monthly evolution of these fields was presented. However, due to the recent unification, we will not present this evolution in the present edition. Due to these changes and the few months of production observation, a disaggregated analysis of the fields in the Espírito Santo share of the Campos basin is not recommended.

Chart 20 - Monthly production of offshore fields in Espírito Santo (daily average, bbl)



Source: Dynamic Dashboard for Oil and Natural Gas production - ANP;
Elaboration: Ideies/Findes

⁹ The API gravity is a scale created by the American Petroleum Institute (API). The degree measures the density of petroleum-derived liquids. The denser the oil, the lower its API gravity and the lower its value in the international market.

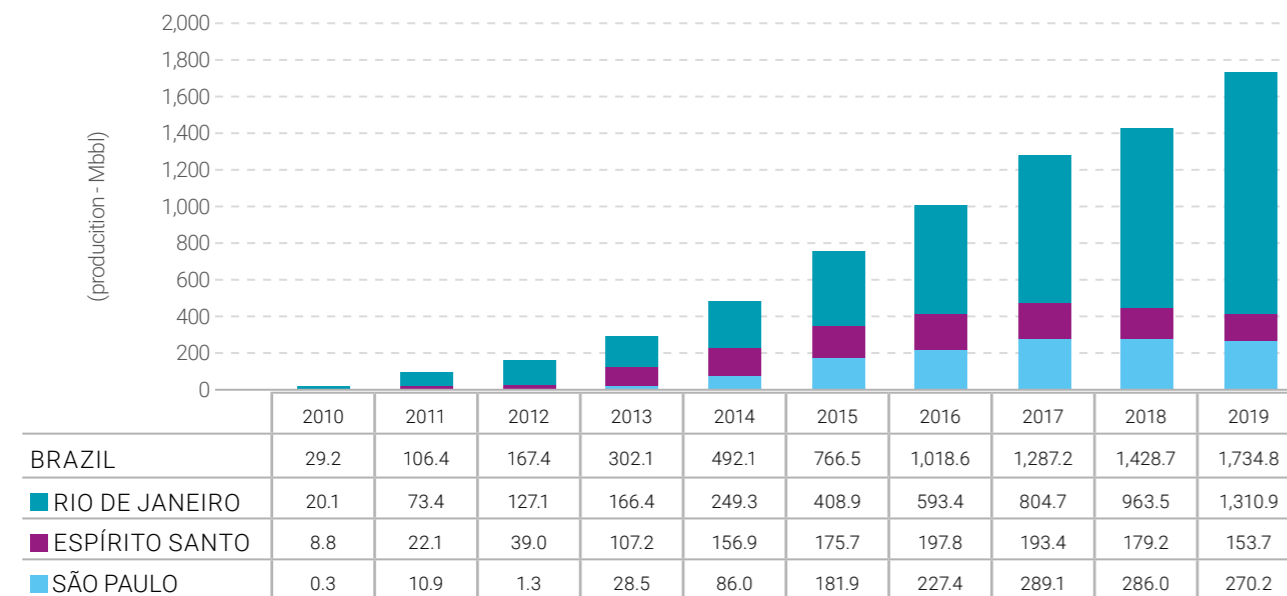
¹⁰ For more information access the Highlight 2 of the Espírito Santo Oil Industry Yearbook, 2019 edition, available at: <https://portaldaindustria-es.com.br/categorias/anuario-do-petroleo/arquivos>.

2.5.1.1 Pre-Salt production in Espírito Santo

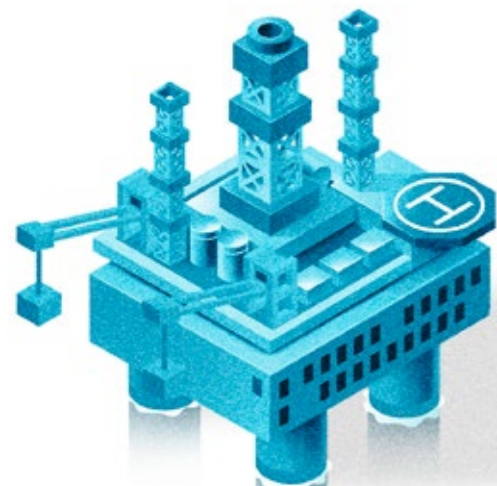
In 2019, production at the pre-salt layer in Espírito Santo reached 153.7 thousand bbl/day, a reduction of 14.3% compared to the previous year. In contrast, national production at the pre-salt layer increased 21.4% reaching 1.7 million bbl/day. It is the third consecutive year that the pre-salt production in Espírito Santo registered a fall. During the transition from 2017 to 2018 production fell by 7.3% (Chart 21).

The pre-salt production in the state of Rio de Janeiro (which covers part of the Campos basin and part of the Santos basin) registered an increase of 36.1% in 2019. The production registered in the area reached 1.3 million bbl/day, the highest level in the historical series. At the São Paulo part, in the Santos basin, there was a 5.5% drop in production in 2019. The pre-salt production in São Paulo reached 270.2 thousand barrels/day (Chart 21).

Chart 21 - Pre-salt production in Brazil and in Espírito Santo (monthly average, Mbbbl)



Source: Dynamic Dashboard for Oil and Natural Gas production - ANP;
Elaboration: Ideies/Findes



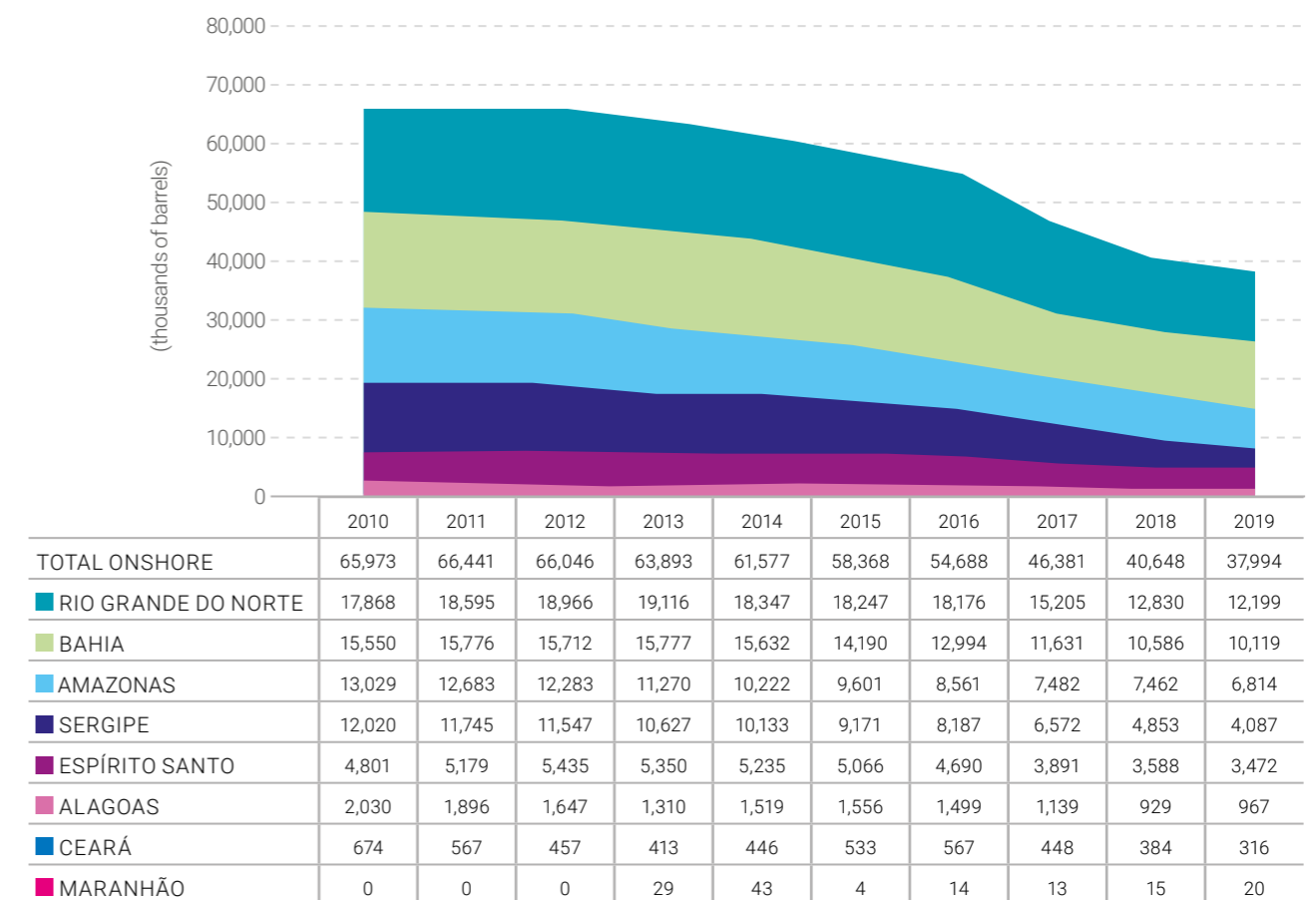
According to the American Petroleum Institute scale, the API gravity of oil produced in the pre-salt fields is gradated at 29.4 degrees, considered an average oil (in relation to its density). In the Espírito Santo share, the API gravity is 27.1 degrees, while in the Rio de Janeiro share it is 26.7 degrees and, in the São Paulo share, it is 29.8 degrees. paulista é de 29,8 pontos.

2.5.2 Onshore production

With regard to the onshore production, in 2019 Brazil produced 38.0 million oil barrels, 6.5% less than the production of the previous year. Onshore production had an average annual drop of 5.4% between 2010 and 2019. In 2019, Rio Grande do Norte produced 12.2 million oil barrels (32.1%), followed by Bahia, which produced 10.1 million

barrels (26.6%), by Amazonas, which produced 6.8 million barrels (17.9%), by Sergipe, which produced 4.1 million barrels (10.8%), and by Espírito Santo, whose total onshore production was 3.5 million barrels (9.1%). Chart 22 shows the evolution of onshore production in these states.

Chart 22 - Onshore oil production



Source: ANP
Elaboration: Ideies/Findes

Regarding the production in Espírito Santo, the Fazenda Alegre and Cancã fields, with respectively 40.5% and 18.8% of share of the onshore production in Espírito Santo, increased their production in 2019. The Fazenda Alegre field

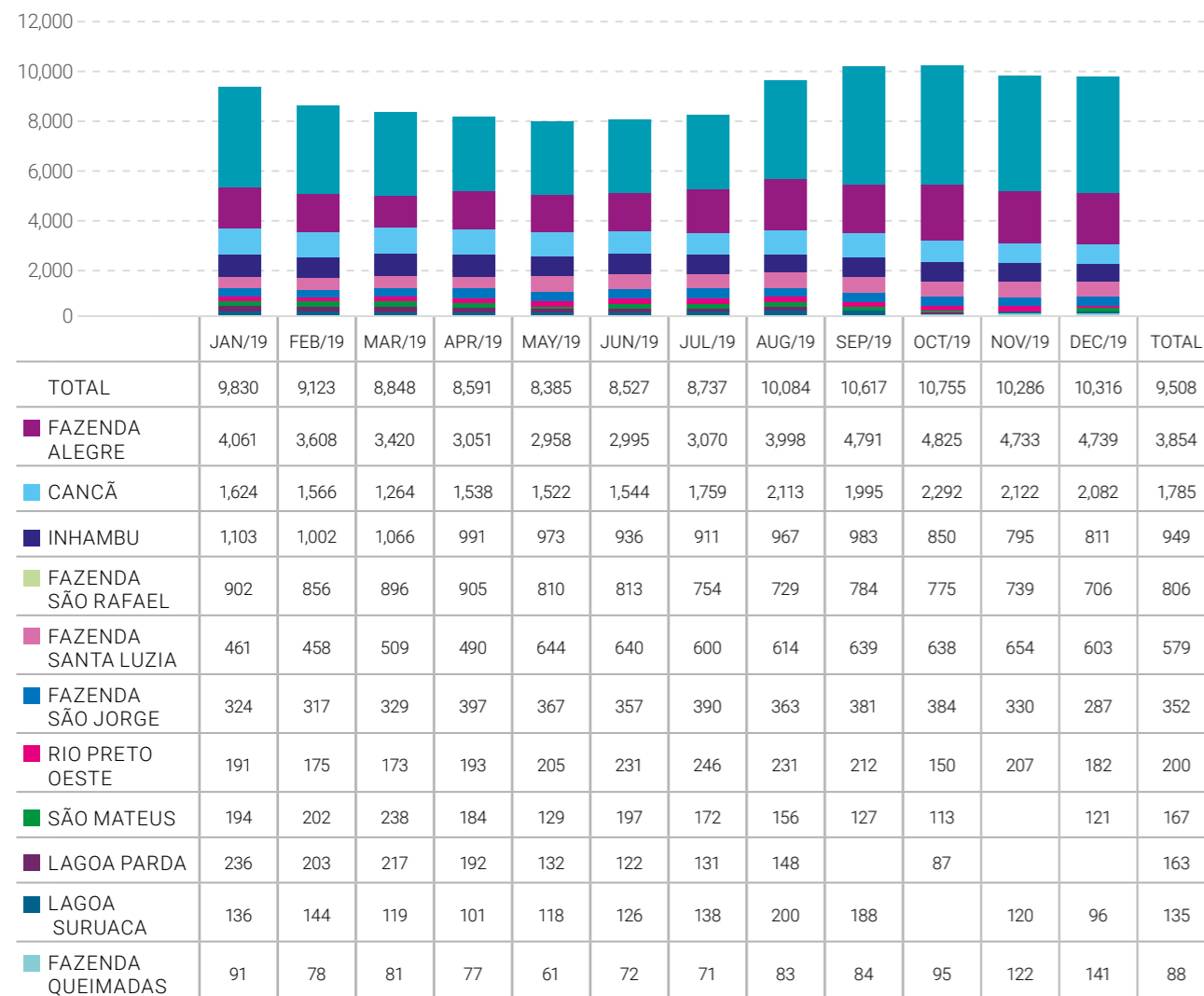
produced an annual average of 3.9 bbl/day, 8.7% higher than the production of the previous year. Cancã, in turn, produced an annual average of 1.8 bbl/day, with a 15.5% growth compared to the production in 2018 (Chart 23).

The Fazenda Alegre Station (EFAL) is located at the Fazenda Alegre field, in the municipality of Jaguaré, north of Espírito Santo. The station processes the production of the Fazenda Alegre field and receives (by truck or pipeline) the oil produced in 12 fields of the region¹¹. After processing, the oil is transported by pipeline to the Norte Capixaba Terminal (TNT), where it is sent by ship to be refined. The TNT also receives oil from three

other stations: Fazenda São Rafael Station (FSR), Santa Luzia Station (FSL) and São Mateus Station (SM-08).

Chart 23 shows the monthly production evolution of the 12 fields that concentrated 97.8% of onshore production in 2019. In 2008, this group concentrated 92.6% of production, an increase of 5.2 percentage points in twelve years.

Chart 23 - Monthly production of onshore fields in Espírito Santo (daily average, bbl) – 2019



Source: Dynamic Dashboard for Oil and Natural Gas production - ANP
Elaboration: Ideies/Findes

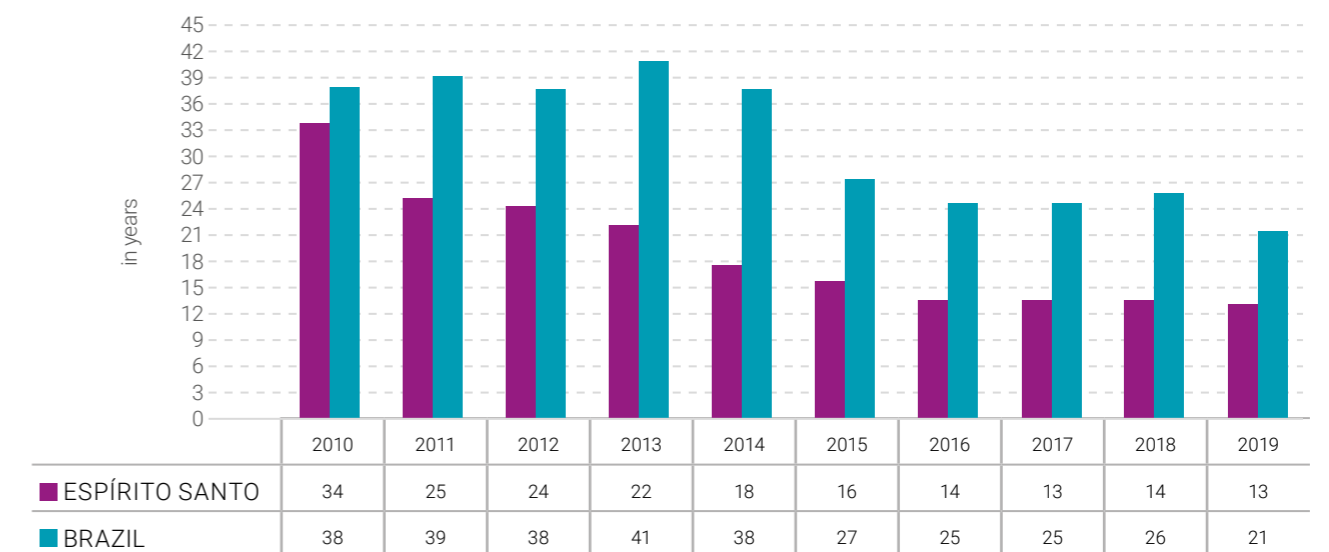
¹¹ Cancã, Inbu, Fazenda São Jorge, Córrego Dourado, Córrego Cedro Norte, Jacutinga, Seriema, Campo Grande, Fazenda Cedro Norte, Cancã Leste, Tabuiaíá, and Fazenda Cedro.

2.6 Lifespan of oil reserves

The lifespan of oil reserves evaluates the time (in years) of sustained production, given the volume of reserves. The higher the indicator, the longer the oil production time available. In 2019, the lifespan of Brazilian reserves was 21 years, the lowest value since 2010, a 5-year decline compared to 2018. That can be explained by the increase in production in the last year and the consequent fall in the total reserves of the country.

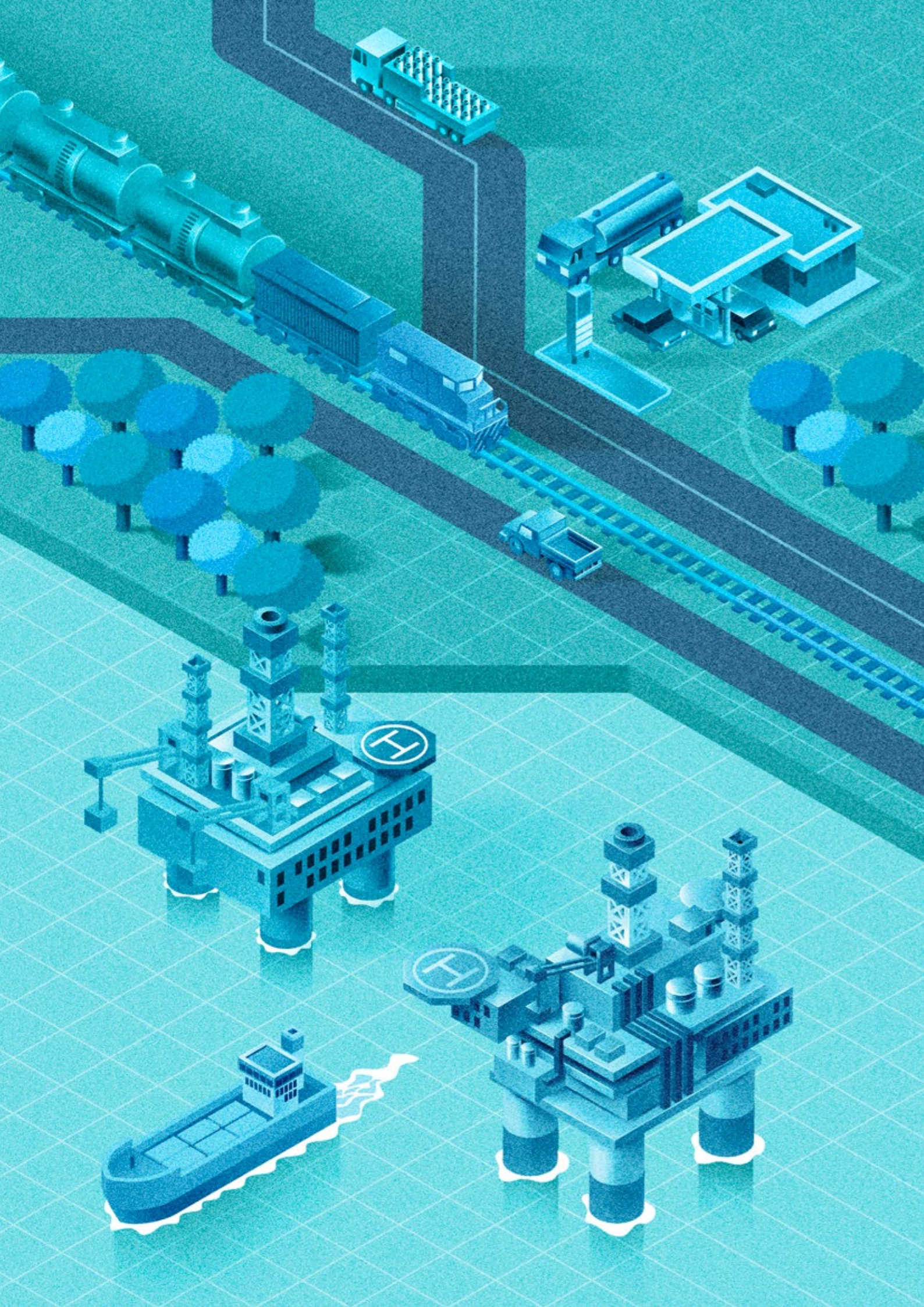
In Espírito Santo, the reserve lifespan indicator registered 13 years of production in 2019, with a difference of 1 year compared to 2018, when the indicator registered 14 years. The 14.2% drop in the state oil production in 2019 was not enough to keep the indicator stable, as reserves fell more intensively, -16.8%. The maintenance of oil production capacity depends on investment in geological research and in exploration and development to verify new oil reserves.

Chart 24 - Relationship between oil reserve (R) and production (P) (R/P) in Brazil and Espírito Santo



Notes: 1. The concept of total reserves was used.
Source: Dynamic Dashboard for Oil and Natural Gas production - ANP
Elaboration: Ideies/Findes





Chapter 3

GOVERNMENT PARTICIPATIONS AND ECONOMIC IMPACTS

The oil and natural gas industry demand creates around it a significant specialized market for the performance of the activity. This leads to an expansion in the number of jobs and suppliers, as well as to payments of financial compensations and taxes linked to the production and distribution activities. These positive spillover effects increase in 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) Financial compensations paid when the oil and natural gas E&P activity is performed, called government participation; 2) Payment to the owner of the land where there is an active well; 3) generation of employment and income through the O&G chain; 4) and trade relations external to this chain.

3.1 Government participations

Brazilian oil and natural gas deposits are owned by the Federal Government (Article 20 of the Federal Constitution), and the development and exploration of these hydrocarbons are granted to companies that win bidding rounds promoted by ANP (Law No. 9,478/1997). Oil companies need to pay E&P financial compensations to the Federal Government, states, and municipalities for exploring a national asset.

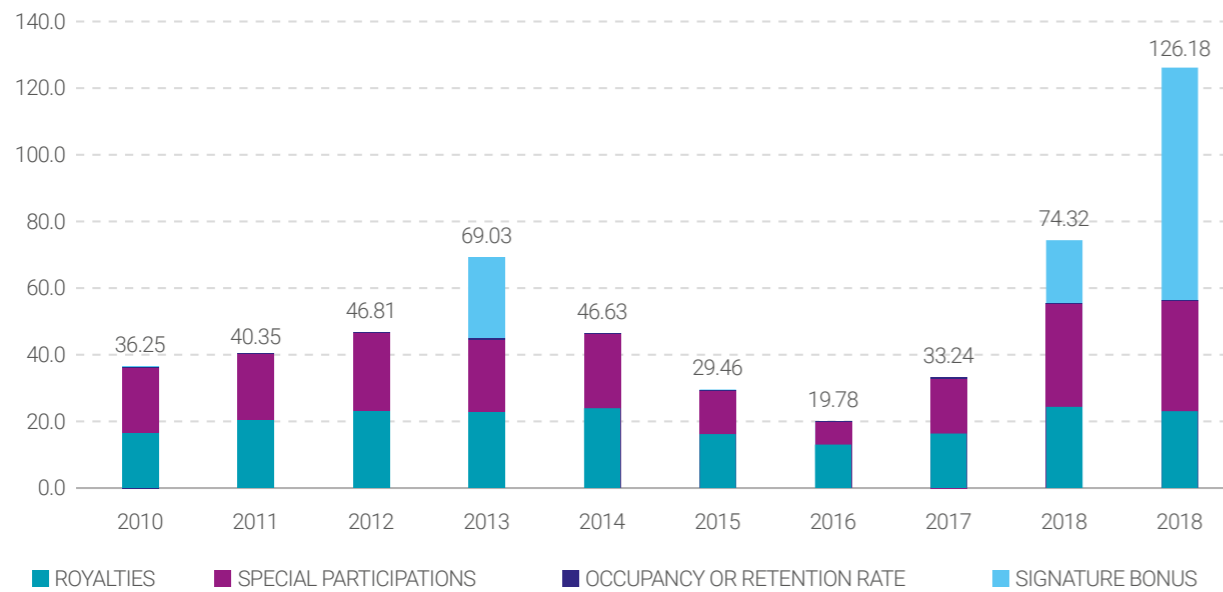
bonus made by the winning companies of bidding rounds¹² and the permanent offer round. In 2019, the total amount paid as government participation was divided as follows: 55.4% in subscription bonus¹³; 25.8% in special participations; 18.6% in royalties; and 0.2% in occupancy or retention rates (Chart 25).

In 2019, the Brazilian oil and natural gas exploration activity paid BRL 126.2 billion as government participation, an amount that was distributed between the Federation, the states, and the municipalities. This value was 69.8% higher than that registered in 2018, a result influenced by the payment of BRL 69.9 million as a signature

¹² In 2019, we had the 16th bidding round of blocks under the concession regime (blocks in the Campos, Camamu-Almada, Jacuipe, Pernambuco-Paraíba, and Santos basins) and the 1st round of pre-salt production sharing (areas of Aram, Bumerangue, Cruzeiro do Sul, Norte de Brava, and Sudoeste de Sagitários). None of them were within the Espírito Santo state. Learn more at: <http://rodadas.anp.gov.br/pt/>

¹³ The signature bonus is government participation that must be paid to the Federation only.

Chart 25 - Evolution of government participations in Brazil (% from the total)

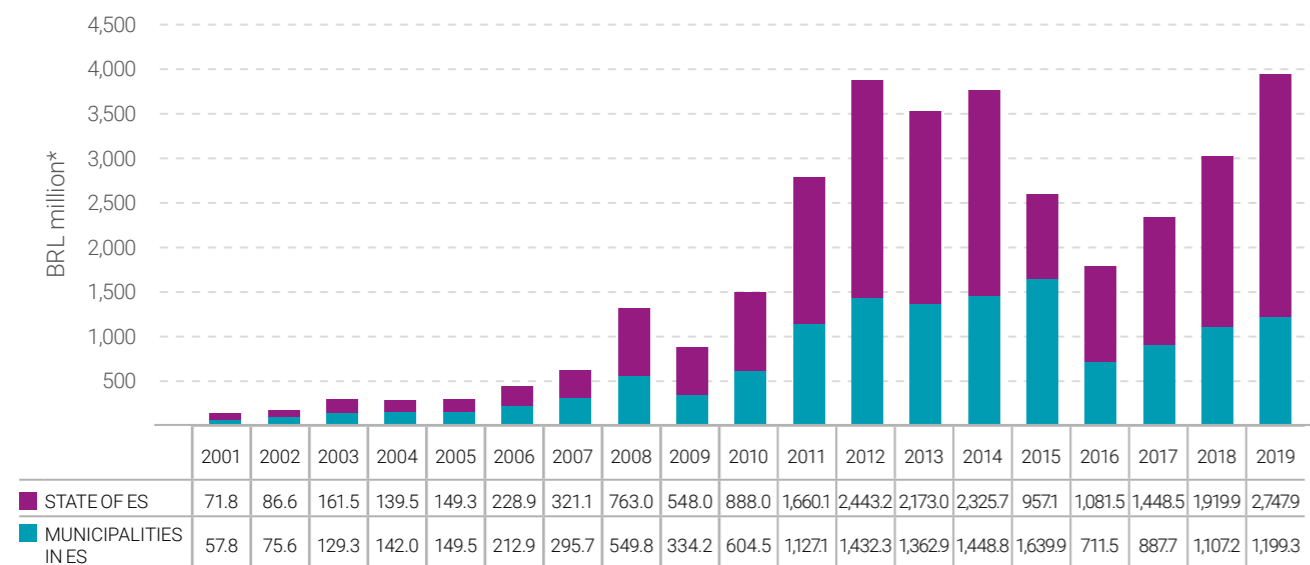


Source: ANP.
Elaboration: Ideies/Findes

Among the government participations, only royalties and special participations (EP) are paid to states and municipalities. From 2001 to 2019, the sum of these two payments increased by an average of 20.9% per year in Espírito Santo, better than the average rate of

the country (9.0% p.y). In 2019 alone, Espírito Santo received BRL 3.9 billion in government participation, 30.4% higher than the inflow of the previous year¹⁴. From this total, 64.4% were special participations and 35.6% were royalty payments (Chart 26).

Chart 26 - Government participation revenues in Espírito Santo (BRL million)

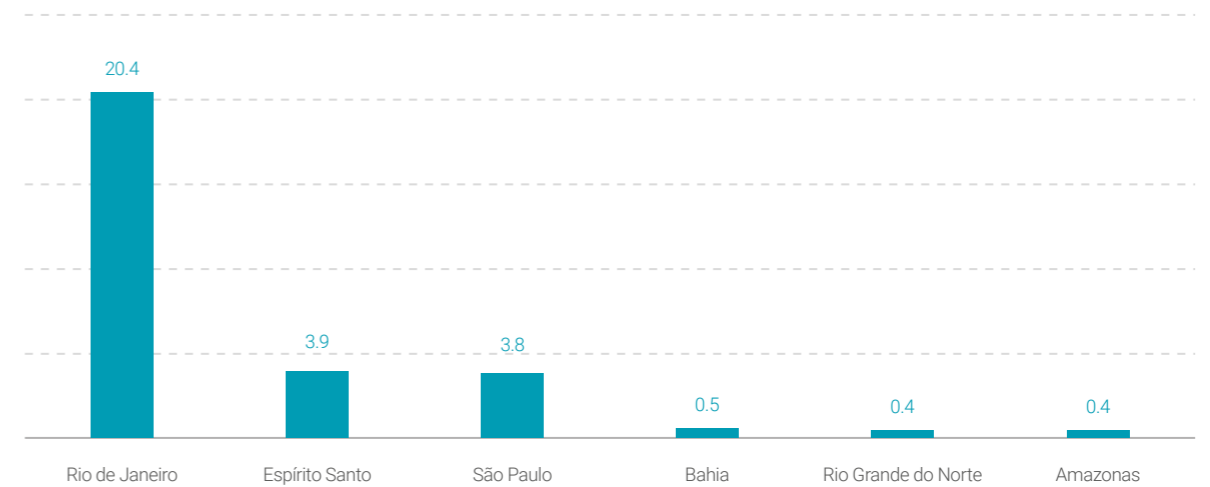


(*) Values deflated by the average IPCA rate of 2019.
Source: ANP. Elaboration: Ideies/Findes

The states of Espírito Santo and São Paulo received practically the same revenue from government participation (Chart 27), while Rio de

Janeiro is highlighted after absorbing BRL 20.4 billion from these participations in 2019.

Chart 27 - Distribution of royalties and special participation payments in the federative units – 2019*



(*) Others states that also received government participations: AL; AP; CE; MA; MG; PA; PB; PE; PR; RS; SC; and SE.
Source: ANP. Elaboration: Ideies/Findes.

Table 1 - Royalties and special participation collection in the state and municipalities of Espírito Santo (BRL millions)

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Government Participations	Municipalities of ES	549.8	334.2	604.5	1,127.1	1,432.3	1,362.9	1,448.8	1,639.9	711.5	887.7	1,107.2	1,199.3
	ES state	763.0	548.0	888.0	1,660.1	2,443.2	2,173.0	2,325.7	957.1	1,081.5	1,448.5	1,919.9	2,747.9
	Brazil Total	41,656.9	28,951.7	35,961.3	40,077.5	46,512.8	44,356.0	46,420.4	29,058.7	19,775.5	32,975.0	52,753.8	55,948.5
	% of Brazil	3.2%	3.0%	4.2%	7.0%	8.3%	8.0%	8.1%	8.9%	9.1%	7.1%	5.7%	7.1%
Royalties	Municipalities of ES	475.7	259.9	506.3	928.1	1,072.6	1,075.0	1,141.8	770.9	582.8	692.8	824.8	691.2
	ES state	466.4	250.5	495.2	864.0	1,004.4	1,021.5	1,097.8	739.9	566.8	669.0	790.5	715.4
	Brazil Total	20,117.6	14,047.2	16,532.2	20,303.6	23,094.6	22,743.9	24,286.4	16,410.8	13,190.3	16,560.3	21,850.1	23,428.8
	% of Brazil	4.7%	3.6%	6.1%	8.8%	9.0%	9.2%	9.2%	9.2%	8.7%	8.2%	7.4%	6.0%
Special participation	Municipalities of ES	74.2	74.4	98.2	199.0	359.7	287.9	307.0	217.2	128.7	194.9	282.3	508.1
	ES state	296.6	297.5	392.8	796.1	1,438.9	1,151.5	1,227.9	869.0	514.7	779.5	1,129.4	2,032.4
	Brazil Total	21,539.3	14,904.6	19,429.1	19,773.9	23,418.2	21,612.2	22,134.0	12,647.9	6,585.3	16,414.7	30,903.7	32,519.7
	% of Brazil	1.7%	2.5%	2.5%	5.0%	7.7%	6.7%	6.9%	8.6%	9.8%	5.9%	4.6%	7.8%

(*) Constant values deflated by IPCA rate (accumulated from Jan-Dec 2019).
Source: ANP
Elaboration: Ideies/Findes

¹⁴ This increase in government participation was spurred by the significant increase in special participation, because of the agreement to unify Parque das Baleias, and offset by the reduction of royalty payments. These explanations will be detailed ahead.

3.1.1 Royalties

Royalties are financial compensations monthly paid by the concessionaires, based on the gross revenue of oil and natural gas producing fields, for their exploration¹⁵. This revenue is calculated¹⁶ based on the quantity of oil and natural gas produced in the field, the reference price¹⁷, and the rates provided for in the contract, which range from 5% to 15%.

The royalties value generated in each field is distributed among states, municipalities, and the Federation, considering criteria such as location of the producing field (onshore or offshore) and the presence of facilities to move oil and natural gas.

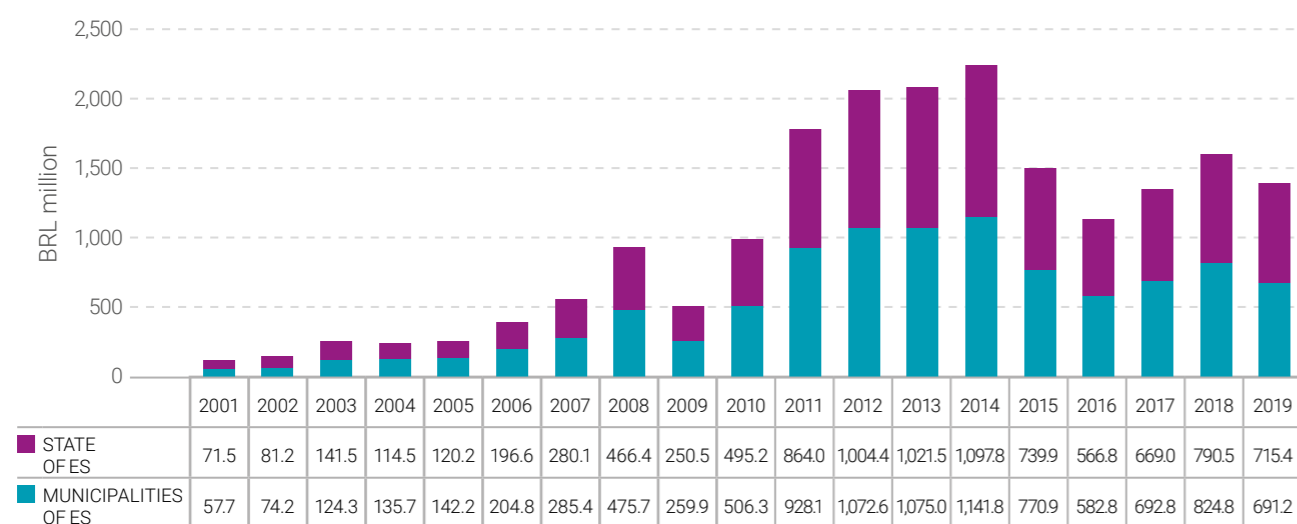
From 2001 to 2019, the sum of royalties generated by the oil and natural gas extraction and production activity in Espírito Santo increased by BRL 1.3 billion (Chart 28). In these years, the royalties collection for the Government of Espírito Santo increased 14.8% per year, and that of Espírito Santo's municipalities increased by 13.7% per year.

In 2019, Espírito Santo received BRL 1.4 billion in royalties, which represented 6.0% of the total collected in royalties in Brazil. From the Espírito Santo amount, BRL 691.2 million were paid to the municipalities and BRL 715.4 to the state government (Chart 28). When compared to 2018, this total fell by 12.9%.

This drop happened both in state revenues (-9.5%) and revenues destined to the municipalities (-16.5%). This drop has two main explanations. The first was the reduction in oil production (-14.2%) and natural gas production (-22.8%) in Espírito Santo during this period, as a result of the drop in exploration activity. The second is the oil barrel price drop (-9.8%). On the other hand, the increase in currency exchange rates has positively offset this price drop in the amount paid in royalties¹⁸.

In 2019, the collection of Espírito Santo was the third largest among the Brazilian states, registering a 6.0% share of the total royalties collected

Chart 28 - Royalties revenues in Espírito Santo (BRL million)



(*) constant values deflated by IPCA rate (accumulated from Jan-Dec 2019).
Source: ANP
Elaboration: Ideies/Findes

in Brazil, BRL 23.4 billion. Rio de Janeiro (BRL 9.2 billion) and São Paulo (BRL 1.8 billion) hold the first and second places, respectively, in collections, and the state of Rio de Janeiro accounted for 39.5% of Brazil's royalties.

In 2019, offshore fields bordering Espírito Santo generated BRL 3.8 billion in royalties. The largest amounts were generated by the fields of Roncador¹⁹ (BRL 1.3 billion) and Jubarte (BRL 1.7 billion), both at the Campos Basin, in the pre-salt polygon. This year, the amount collected from onshore fields in Espírito Santo totaled BRL 63.6 million (Table 2), from which the greatest financial compensation was paid by the fields of Fazenda Alegre (BRL 23.3 million), Cancã (BRL 13.1 million), and Inhambu (BRL 7.1 million).

¹⁵ According to Pinto Junior et. al. (2016), its payment is linked to the concepts of: (i) reparation to future generations for the depletion of the existing resource; and (ii) compensation mechanisms for the possible negative impacts of oil and natural gas production. It is worth mentioning that royalties are a financial compensation also paid for other exploration activities of natural resources owned by the Federation, and mining is an example of that.

¹⁶ For more details on how the amount to be paid in royalties is calculated, see the box in the chapter 3 of the Espírito Santo Oil Industry Yearbook, 2019: https://portaldaindustria-es.com.br/system/repositories/files/000/000/577/original/Anuario_Petroleo-ES_2019_port.pdf?1588180009

¹⁷ The oil reference price is calculated monthly by ANP, using the monthly average of Brent oil price, in dollar per barrel. On the other hand, the reference price for natural gas is calculated monthly by the sum of the products of the NG volumetric fractions.

¹⁸ The US dollar exchange rate (annual average purchase price) was BRL 3.65 in 2018 and R\$ 3.94 in 2019.

¹⁹ The Roncador field also borders the state of Rio de Janeiro. Therefore, its royalties are also paid to the state government and municipalities of Rio de Janeiro.

Table 2 - Royalties paid by producing fields in Espírito Santo – 2019

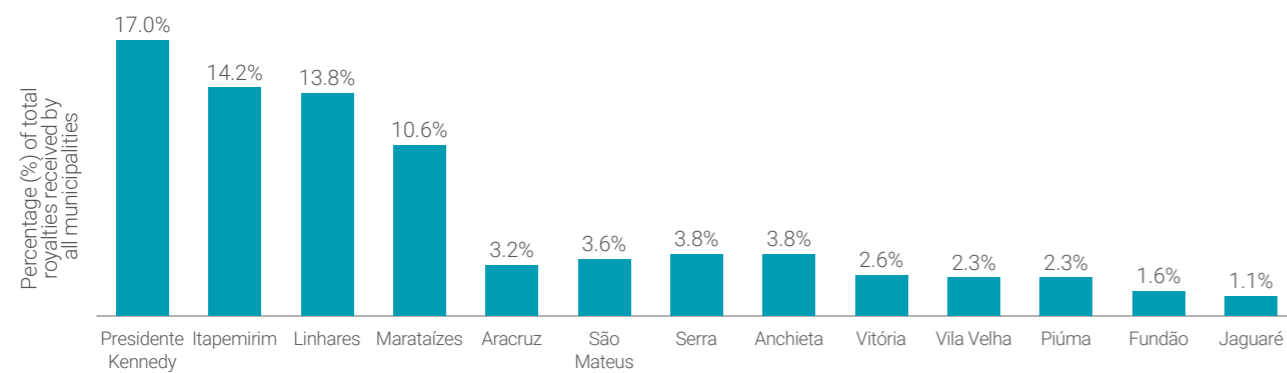
Field	Royalties (BRL million)	Share (%)
Fazenda Alegre	23.34	36.7
Cancã	13.09	20.6
Inhambu	7.10	11.2
Fazenda São Rafael	6.33	9.9
Fazenda Santa Luzia	3.53	5.5
Fazenda São Jorge	2.07	3.3
Lagoa Parda	1.09	1.7
Lagoa Suruaca	0.86	1.4
São Mateus	0.97	1.5
Rio Preto Oeste	1.16	1.8
Fazenda Queimadas	0.65	1.0
Rio Preto	0.44	0.7
Jacutinga	0.27	0.4
Córrego Cedro Norte	0.29	0.5
Rio Preto Sul	0.45	0.7
Biguá	0.13	0.2
Córrego Dourado	0.32	0.5
Rio São Mateus	0.28	0.4
Cacimbas	0.01	0.0
Lagoa Piabanha	0.19	0.3
Gaivota	0.12	0.2
Córrego das Pedras	0.19	0.3
Rio Itaúnas	0.03	0.0
Seriema	0.18	0.3
Lagoa Parda Norte	0.00	0.0
Fazenda Cedro Norte	0.10	0.2
Rio Ipiranga	0.01	0.0
Tabuiaíá	0.09	0.1
Campo Grande	0.10	0.2
Fazenda Cedro	0.08	0.1
Mariricu	0.04	0.1
São Mateus Leste	0.04	0.1
Mariricu Norte	0.03	0.1
Córrego Cedro Norte Sul	0.01	0.0
Crejoá	0.01	0.0
Tucano	0.00	0.0
Guriri	0.03	0.1
Total onshore royalties	63.62	100
Jubarte	1,720.40	45.6
Roncador	1,321.30	35.0
Argonauta	193.92	5.1
Frade	146.83	3.9
Baleia franca	97.81	2.6
Golfinho	86.97	2.3
Baleia azul	75.51	2.0
Ostra	64.30	1.7
Cachalote	42.41	1.1
Baleia anã	26.16	0.7
Pirambu	1.02	0.0
Abalone	0.22	0.0
Canapu	0.03	0.0
Total offshore royalties	3,776.89	100

Note: The royalties paid by the producing fields of Espírito Santo were distributed among the municipalities, state government, and the Federation.
Source: ANP
Elaboration: Ideies/Findes

In 2019, as observed in the previous years, the municipalities in Espírito Santo that received most royalties were: Presidente Kennedy (BRL 121.69 million), Itapemirim (BRL 101.45 million), and Linhares (BRL 132.8 million), which accounted for 47.2% of the total royalties received by the municipalities in Espírito Santo. Together

they concentrated 55.6% of the total municipal revenues. This high participation is explained by the fact that they are municipalities with areas bordering high production oil and gas fields and because they have facilities to meet the needs of the offshore activity. Among them, only Linhares also has land production.

Chart 29 - Municipalities in Espírito Santo that received most royalties – 2019

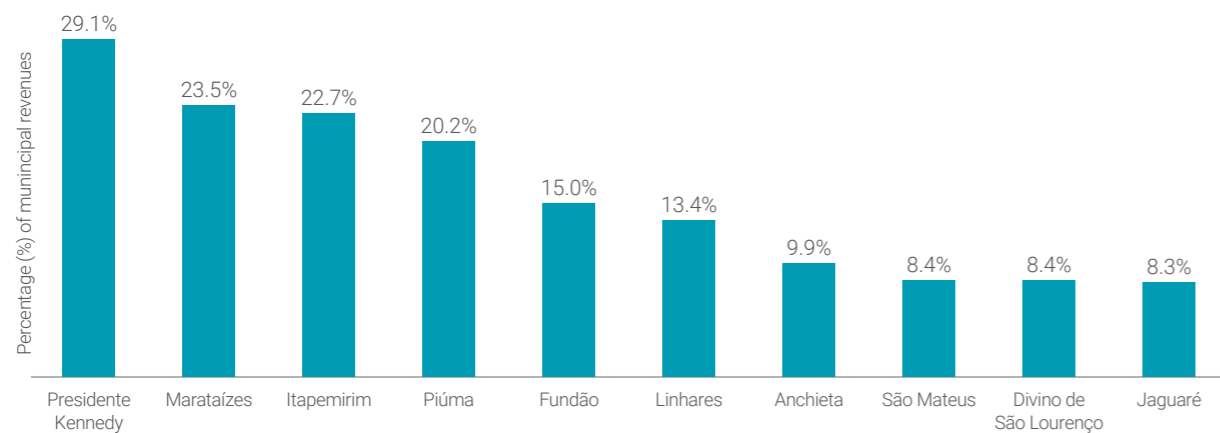


Source: ANP
Elaboration: Ideies/Findes

In 2019, the Espírito Santo municipalities that registered the greatest share of royalties in their total collected revenues were: Presidente Kennedy (29.1%), Marataízes (23.5%), and Itapemirim (22.7%). Ex-

cept for the case of Linhares, the municipalities with the largest collections of government participations are those with the greatest dependence on royalties in their revenue composition.

Chart 30 - Municipalities of Espírito Santo with the largest share of royalties income in their total revenues (%) – 2019



Source: TCU and ANP
Elaboration: Ideies/Findes

3.1.2 Special Participation (PE)

The special participation is also a financial compensation paid by the oil and natural gas E&P concessionaires that have fields with a large volume of production. This is an extraordinary payment. It is regulated by Law no. 9,478/97 (The Oil Act) and Decree no. 2,705/1998.

Special participation in the oil and natural gas production are ascertained by the application of progressive charges – which vary according to the location, the number of years in production, and volumes of the quarterly production – on the net revenue of the quarterly production in each field, considering the predicted discounts (royalties, investments in exploration, operational costs, depreciation, and taxes).

In 2019, Espírito Santo received BRL 2.5 billion in special participation, a record value for the

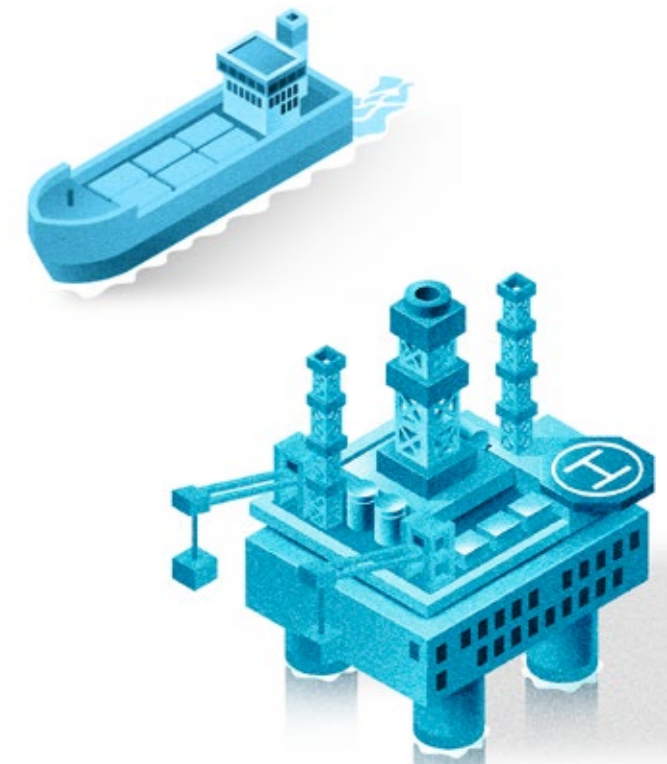
state and 80% more than the amount registered in 2018 (Chart 31). From this amount, BRL 2.0 billion (or 80.0% of the total) were destined to the state government and BRL 508.1 million (or 20.0% of the total) to the municipalities of Marataízes, Presidente Kennedy, and Itapemirim which border the fields that generate PE.

This expressive increase happened because in April 2019, the unification agreement was signed for the fields belonging to Parque das Baleias, made up of the areas Jubarte, Baleia Azul, Baleia Franca, parts of Cachalote and Pirambu, at the Campos Basin. Therefore, a single large producing field was formed and is now called “New Jubarte Field”²⁰. It is worth highlighting that the collection expansion happened in the same scenario as the productivity drop in the fields of Espírito Santo and the lowest Brent barrel price²¹.

Table 3 - Government participations (royalties and special participations) paid by offshore field – 2019

Field	Royalties (BRL million)	Special participation (BRL million)	Total Government Participations
Jubarte	120.61	3,033.39	3,154.01
Roncador*	126.78	718.56	845.34

(*) These Fields also border the state of Rio de Janeiro; therefore, part of this value is also distributed to the government of Rio de Janeiro and to the municipalities of Campos dos Goytacazes, and São João da Barra.
Source: ANP. Elaboration: Ideies/Findes



²⁰ For further details on this agreement, see the box in the 2nd chapter of the Espírito Santo Oil Industry Yearbook, 2019: <https://portaldaindustria-es.com.br/categorias/anuario-do-petroleo/arquivos>.

²¹ From USD 71.6 per barrel in 2018 to USD 64.6 in 2019.

Chart 31 - Special participation Revenues in Espírito Santo in constant values (BRL million)



Constant values deflated by IPCA rate (Jan-Dec 2019)
Source: ANP
Elaboration: Ideies/Findes

This year, Espírito Santo was second in special participation revenues with a 7.8% share of the total special participations received by the country, only behind Rio de Janeiro (BRL 11.1

billion). Other states that received this kind of revenue: São Paulo (BRL 2.0 billion), Amazonas (BRL 89.2 million), and Bahia (BRL 2.5 million).

3.2 Payment to landowners

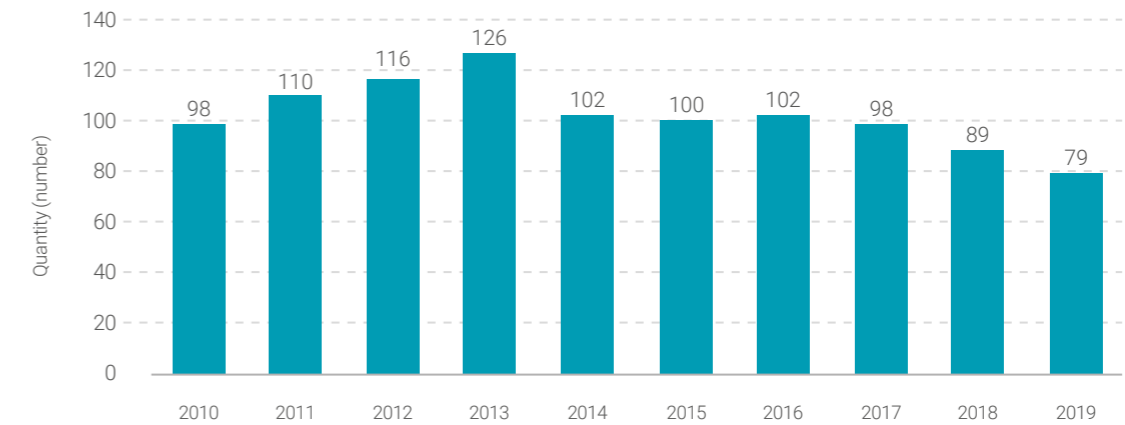
Law No 9,478/1997 (the Oil Act) also determines the payment by the concessionaires of an O&G production stake to the owners of the land where the Exploration and Production (E&P) activities take place. They receive a monthly participation – ranging from 0.5% in marginal fields to 1% – on the gross production revenue in each well located in their land (ANP Ordinance No 143, dated 9.25.1998). This obligation is an income source for states with onshore production in the country.

The gross revenues from these onshore fields are calculated using the same criteria as gover-

ment participation, i.e., quantity produced, natural gas, and oil value (based on Brent prices); and considers quality criteria.

Onshore production in Espírito Santo only happens in the Espírito Santo Basin, located in the north of the state. From 2010 to 2019, the number of owners regularized to receive a share of the concessionaire's gross revenues fell by -19.4% in Espírito Santo, totaling 79 at the end of the last year (Chart 32). In the country, this reduction was -17.0%, with a total of 2,197 owners at the end of the period.

Chart 32 - Quantity of landowners with shares in the oil production of Espírito Santo

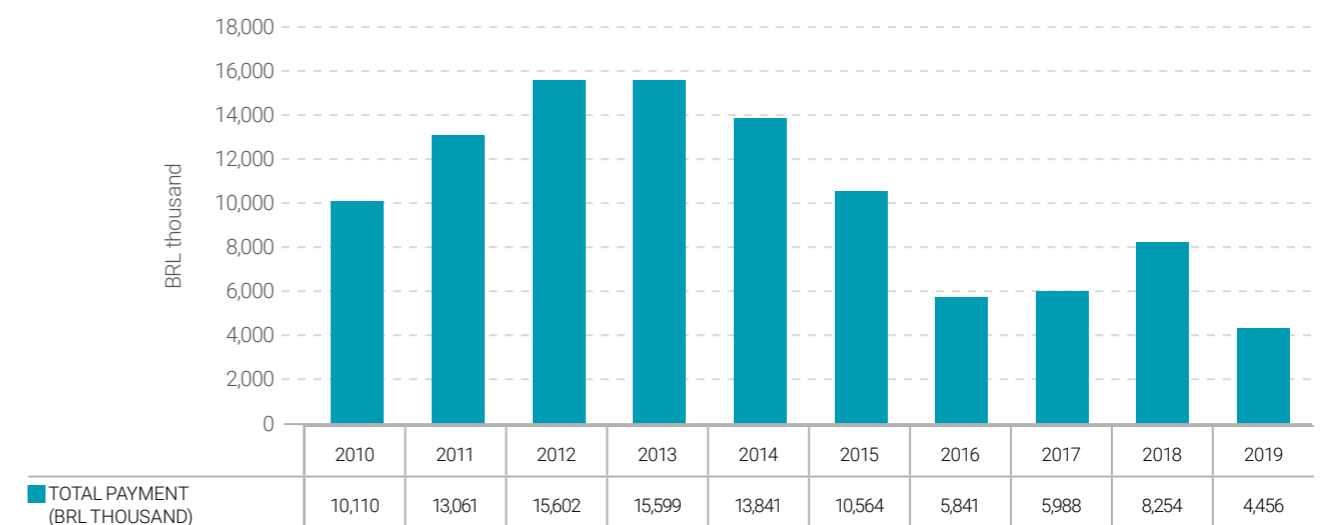


(* quantity in December of each year.
Source: ANP
Elaboration: Ideies/Findes

The amount received by the landowners of Espírito Santo fell -55.9% in these nine years, a greater drop than the national retraction (-28.4%). This reduction occurred because of

the natural decline process of onshore O&G production, due to the absence of bidding rounds and the lesser interest of Petrobras in its onshore assets.

Chart 33 - Payment of O&G production shares to landowners in Espírito Santo (BRL thousand)



(* Value without incidence of income taxes and deflated by IPCA.
Source: ANP
Elaboration: Ideies/Findes

In 2019, the concessionaires paid, before income tax expense, BRL 4.5 million to the landowners in Espírito Santo, a value -46,0% lower

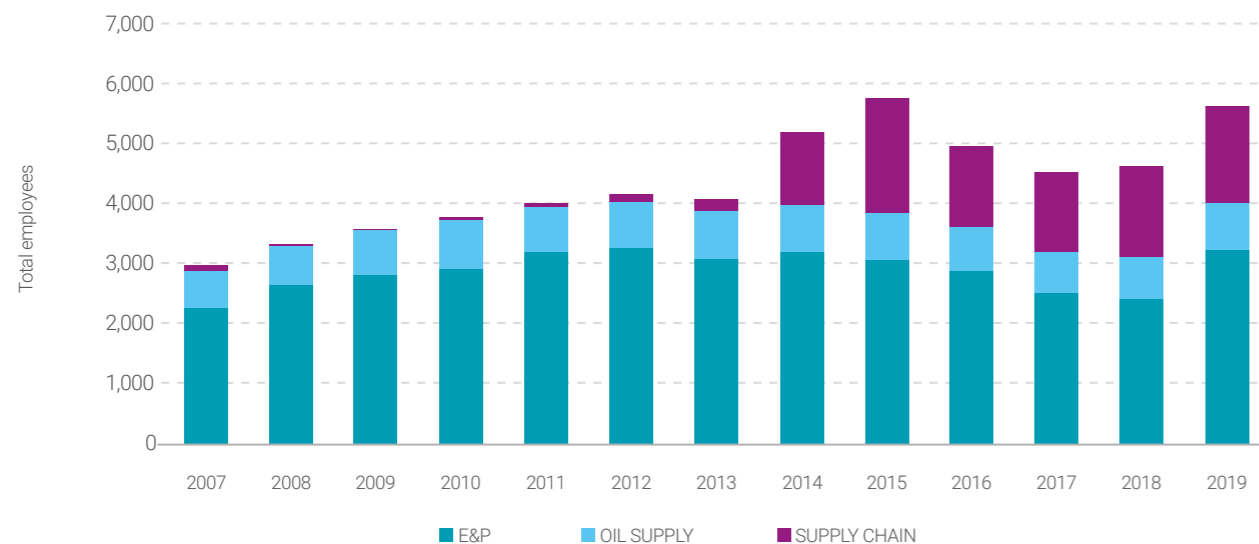
than that disbursed in the previous year. This total represented 4.3% of the amount paid throughout the country.

3.3 Labor Market

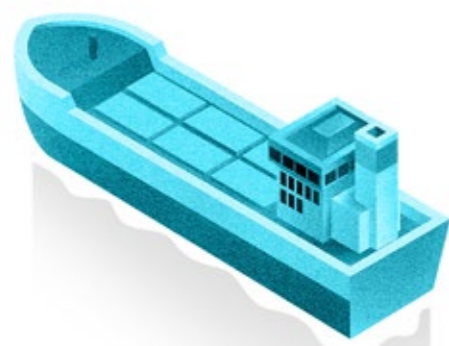
The oil and gas industry promotes the job market growth and improvement. In this yearbook, the oil and natural gas chain in the state of Espírito Santo was divided into three axes²²: (i) exploration and production (E&P), also known as upstream, which consists of the activities of O&G extraction and production; (ii) oil supply, which consists of the transformation and commercialization²³ of O&G products; and (iii) supply chain²⁴, with the industrial activities that provide specific products and services for the E&P activities.

From 2007 to 2019, the formal job numbers in Espírito Santo's oil and gas chain grew by 5.1% per year, a result mainly influenced by the expansion of the O&G industry, after the beginning of the pre-salt exploration, and by the installation of a vessel company. In the turn of 2018/2019 only, there was an absolute increase of 22.2% in the number of people employed in the O&G industry in the state. All axes in the chain increased their number of employees, with particular emphasis on the expansion of 32.6% in E&P and 13.4% in oil supply.

Chart 34 - Distribution of formal employees in the O&G productive chain – Espírito Santo



Source: RAIS/ME
Elaboration: Ideies/Findes



In 2019, the oil and gas production chain employed 5,620 formal employees, representing 3.4% of the national chain and 3.56% of all formal jobs in the state (Table 4). In Espírito Santo, this amount was distributed as follows: 57.6% in the E&P axis; 13.7% in oil supply; and 28.7% in the supply chain axis.

Table 4 - Formal jobs in the O&G productive chain in Espírito Santo

Chain Axes	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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	3,239
Oil supply	596	641	739	817	747	785	788	749	759	714	704	677	768
Supply chain	112	44	27	41	72	122	197	1,232	1,928	1,362	1,318	1,473	1,613
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	5,620
% of the total jobs in the industry of ES	1.9%	2.0%	2.1%	2.0%	2.1%	2.1%	2.1%	2.7%	3.2%	3.1%	2.9%	2.9%	3.5%
% of the ES chain in the total Brazilian chain	2.0%	2.0%	2.0%	2.0%	2.0%	1.9%	1.8%	2.3%	2.8%	2.7%	2.8%	2.9%	3.4%

Source: RAIS/ME
Elaboration: Ideies/Findes.

Due to the multidisciplinary needed to carry out the activities in the oil industry, the profile of the workers that make up the oil and gas chain is heterogeneous, covering several occupations and different levels of qualification (Table 5). In 2019, 18.0% of the workers in the state O&G chain were working with STEM activities (1,011). Other highlights were the STEM mid-level technicians (935) and the metal and composite processing workers (682).

The activity that generated most jobs this year was oil exploration operator (541), which corresponds to 82.7% of the total jobs in the O&G industry of Espírito Santo. Following, we have mechanical technicians (255) and administrative assistants (222). Besides, the O&G chain employed 98.6% of the chemical engineers (oil and rubber) and 90.1% of the mechanical engineers in the industry of Espírito Santo.

In relation to the age group (Table 4), 69.8% of the workers in the O&G chain of Espírito Santo are between 30 and 49 years old (3,922). And 15.1% of the employees are over 50 years old.

Due to the capital intensity employed, the technological complexity, and the high degree of

knowledge necessary to exercise certain occupations, the oil chain has a high level of qualification in Espírito Santo. At least 38.7% have at least completed higher education. This Espírito Santo chain absorbs 2.4% of employees with master's degrees employed in the state.

As a result of the qualification of its employees, the average remuneration in the O&G production chain in Espírito Santo was BRL 12.2 thousand and in Brazil it was R\$10.9 thousand in 2019. These values were well above the average total remuneration of the state (BRL 2.5 thousand) and the country (BRL 2.9 thousand).

²² In this yearbook, the chain covers the following National Economic Activity Classifications (CNAES): 06.00-0; 09.10-6; 19.21-7; 19.22-5; 20.21-5; 20.31-2; 28.51-8; 30.11-3; 46.81-8; 46.82-6. We understand that the oil and gas chain encompasses far beyond these segments. However, because the other CNAES are not limited to this activity alone, their inclusion would inflate this section's results.

²³ In this chain, we did not consider the retail of fuels, since we understand that this activity exists in practically all regions of Brazil, regardless of O&G exploration and production activities.

²⁴ For the state of Espírito Santo we considered the construction of vessels and floating structures as a supplier of E&P activities because we understand that the existence of this activity in the state is derived from the existence of E&P in the O&G sector.

Table 5 - Characteristics of the labor market in Espírito Santo's O&G chain - 2019

	Espírito Santo	Brazil	ES % in the Brazilian chain	% in total ES
Main Occupations				
Oil exploration operator	541	9,579	5.6%	82.6%
Mechanical technician	255	3,937	6.5%	12.5%
Administrative assistant	222	7,119	3.1%	0.6%
Chemical Engineer (Oil and rubber)	215	2,773	7.8%	98.6%
Instrumentation technician	177	2,119	8.4%	45.2%
Industrial mechanical engineer	173	2,812	6.2%	90.1%
Welder	150	1,990	7.5%	3.6%
Occupational safety technician	138	3,123	4.4%	5.1%
Truck driver (regional and international routes)	131	9,310	1.4%	0.6%
Electrical maintenance technician	126	1,947	6.5%	21.9%
Pipeline installer	98	406	24.1%	38.0%
Sub-group of jobs				
STEM professionals	1,011	21,260	4.8%	11.3%
Medium-level STEM technicians	935	15,180	6.2%	5.6%
Workers in the processing of metals and composites	682	9,213	7.4%	4.0%
Workers in continuous process industries and other industries	639	17,399	3.7%	20.1%
Clerks	431	16,837	2.6%	0.3%
Cross-functional workers	418	23,231	1.8%	0.5%
Mid-level technicians in the administrative sciences	318	9,284	3.4%	1.4%
Age Group				
10 to 17	46	307	15.0%	0.5%
18 to 24	226	7,469	3.0%	0.2%
25 to 29	579	15,932	3.6%	0.5%
30 to 39	2,425	63,551	3.8%	0.8%
40 to 49	1,497	43,809	3.4%	0.7%
50 to 64	822	32,620	2.5%	0.5%
65 or more	25	2,254	1.1%	0.2%
School Level				
Illiterate	0	119	0.0%	0.0%
Until 5th Grade (Incomplete)	20	1,185	1.7%	0.1%
Primary School (Until 5th grade)	24	1,438	1.7%	0.1%
Primary School (6th to 9th grades)	46	4,099	1.1%	0.1%
Completed Primary School	148	7,741	1.9%	0.2%
Incomplete Secondary School	210	5,027	4.2%	0.3%
Complete Secondary School	2,832	76,595	3.7%	0.6%
Incomplete Higher School	163	7,214	2.3%	0.5%
Complete Higher Education	1,957	57,842	3.4%	1.0%
Master's Degree	196	4,014	4.9%	2.4%
Doctoral Degree	24	668	3.6%	0.3%
Value of the O&G chain average remuneration (BRL)	BRL 12,178.52	BRL 10,952.05		
Average Remuneration Value (BRL)	BRL 2,538.53	BRL 2,902.96		

Source: RAIS
Elaboration: Ideies/Findes System.

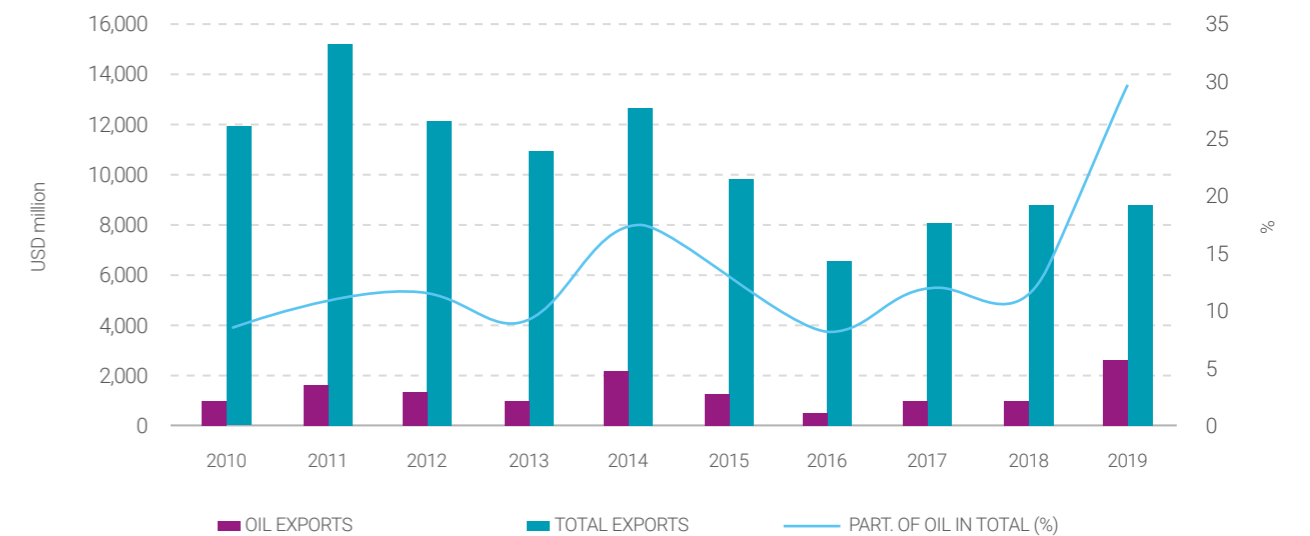
3.4 External sector

The production of the oil industry can be consumed in the country or sold abroad. The oil exports include crude oil, coke and oil products, petrochemical products, and the Repetro²⁵ eligible products.

With the beginning of the production of the fields in Espírito Santo in the pre-salt polygon, the

exports of the state's oil sector increased significantly. From 2010 to 2020, the exported value grew by 118.0%. But, as of 2015, the sector went on to reduce the external sales of this industry due to the reduction in world demand, after the US shale oil rush in the international market, and the lower oil production in the state since 2017.

Chart 35 - Total oil exports and total exports in Espírito Santo



Source: MDIC/Secex.
Elaboration: Ideies/Findes

However, the total value exported by the Espírito Santo oil industry expanded substantially by 151.4% in the transition from 2018 to 2019, totaling USD 2.6 billion in the last year (Chart 35). This exponential growth occurred due to the external sale of a drilling and exploration rig (USD 1.5 billion), manufactured by a shipyard from Linhares. However, this FPSO was a "ficta" export²⁶ of the Repetro-sped regime, and it was destined for the Santos Basin. This special customs regime computes as exports all products classified as "Repetro eligible" to exempt them from the payment of federal and state taxes.

²⁵ Repetro is the special customs regime applicable to exports and imports of assets dedicated to research activities and the exploration of the oil and natural gas deposits - REPETRO, provided by Law 9,478 of August 6, 1997. This procedure allows, as the case may be, the following customs treatment to be applied: Decree-Law no. 37, from 1966, art. 93, with the wording of Decree-Law no. 2.472, from 1988, art. 3rd.

²⁶ Accounting operation for the sale of domestic products to companies based abroad without the goods leaving the national territory.

The external sale of crude oil in the state represented USD 1.01 billion in 2019, 5.7% higher than the previous year. Exports of oil products totaled USD 58.8 million, 52.7% higher than in 2018. The result of the latter was influenced by the increase of 153.1% in sales of fuel oil²⁷ during this year (Table 6).

Due to the USD 1.5 billion expansion in the Repetro eligibles from 2018 to 2019, the share of the oil industry in the total amount exported by Espírito Santo jumped from 11.7% to 29.5% in this period. Moreover, still in the year turn, the representativeness of crude oil in the total value exported by the sector fell from 92.9% to 39.0%.

Table 6 - Oil exports in Espírito Santo (USD Million)

Period	Total oil exports		Crude Oil		Oil products		Petrochemical products		Repetro Eligible Products	
	Total ES	%ES/BR	Total ES	%ES/BR	Total ES	% ES/BR	Total ES	%ES/BR	Total ES	%ES/BR
2010	1,019.9	4.4	899.2	3.9	0.0	2010	1,019.9	4.4	899.2	3.9
2011	1,635.1	5.2	1,510.6	4.8	0.0	2011	1,635.1	5.2	1,510.6	4.8
2012	1,397.1	4.4	1,322.3	4.1	0.0	2012	1,397.1	4.4	1,322.3	4.1
2013	1,011.2	3.4	931.6	3.1	0.0	2013	1,011.2	3.4	931.6	3.1
2014	2,223.2	8.2	2,000.7	7.4	0.0	2014	2,223.2	8.2	2,000.7	7.4
2015	1,277.7	6.4	1,128.5	5.7	0.1	2015	1,277.7	6.4	1,128.5	5.7
2016	535.4	2.8	465.1	2.4	0.0	2016	535.4	2.8	465.1	2.4
2017	967.6	4.1	919.9	3.9	0.0	2017	967.6	4.1	919.9	3.9
2018	1,033.7	2.7	960.0	2.5	38.5	2018	1,033.7	2.7	960.0	2.5
2019	2,598.5	7.1	1,014.5	2.8	58.8	2019	2,598.5	7.1	1,014.5	2.8

Source: MDIC/Secex
Elaboration: Ideies/Findes

In the period between 2010-2018, the crude oil exports in Espírito Santo were mainly concentrated in the United States, India, and China. Among these countries, the main foreign buyer was the US, but its position was not dominant during the years 2013 and 2015. From 2015 on, India became the second largest buyer of this product from Espírito Santo.

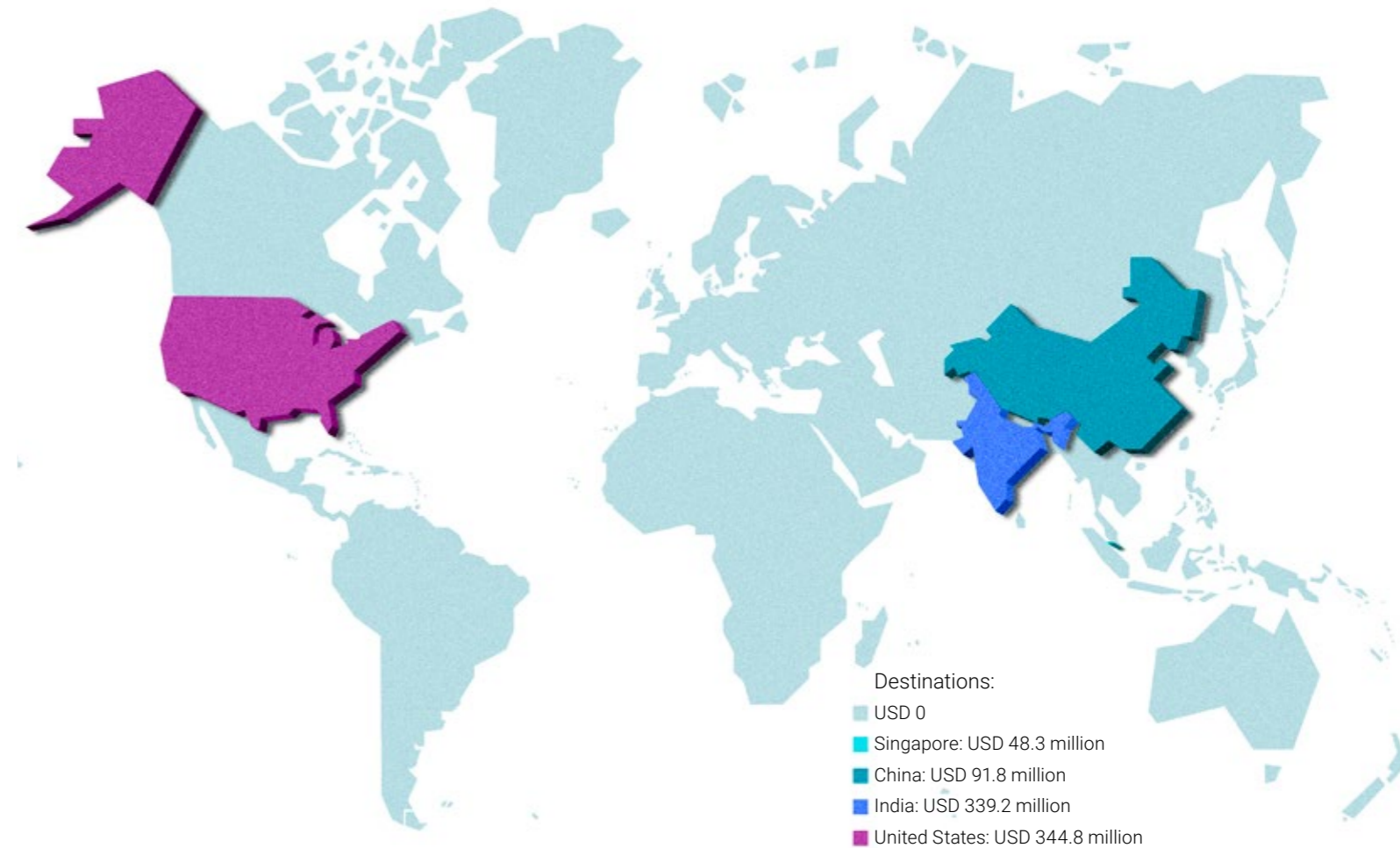
In 2019, crude oil was exported only to the United States (41.8%), India (41.8%), China (11.1%), and Singapore (5.9%) (Figure 1). As described in the first chapter, especially the first three countries cited are major oil consumers and have the largest refining capacities in the world.

In relation to imports, Espírito Santo acquired from other countries mainly Repetro eligible products and petrochemicals from 2010 to 2019. There was no record of external purchases of crude oil during this period (Table 7).

The total of products imported by the oil industry of Espírito Santo was USD 748.7 million in 2019, the highest value since 2010 (Table 7). From this amount, 85.3% is related to the import of Repetro eligible products, 7.8% of petrochemical products, and 6.9% of oil products.

²⁷ Also known as heavy or residual fuel oil.

Figure 1 - Main destinations of crude oil exports from Espírito Santo in 2019

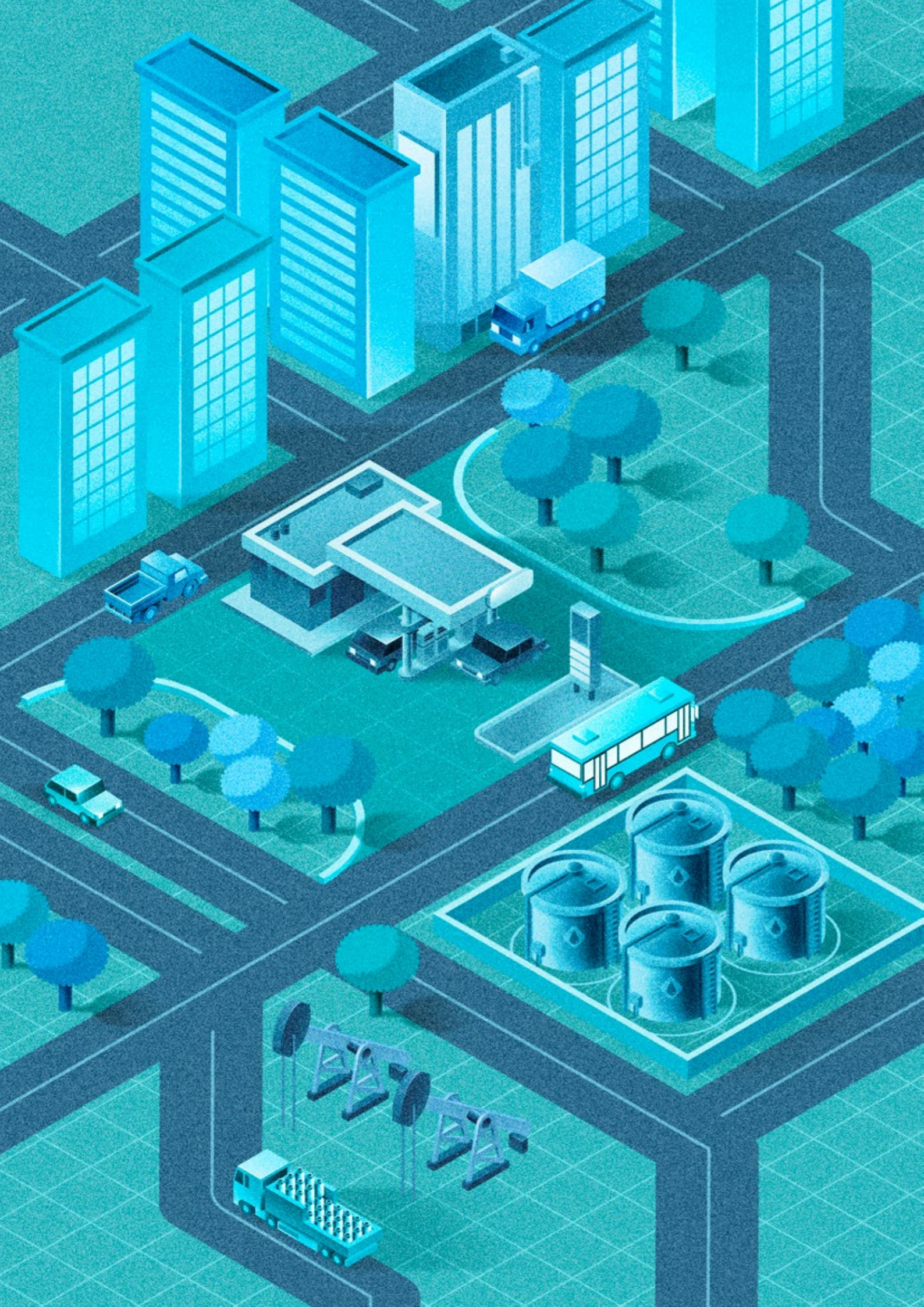


Source: MDIC/Secex.
Elaboration: Ideies/Findes System.

Table 7 - Oil imports in Espírito Santo (USD Million)

Period	Total oil imports		Crude Oil		Oil products		Petrochemical Products		Repetro Eligible Products	
	Total ES	%ES/BR	Total ES	%ES/BR	Total ES	% ES/BR	Total ES	%ES/BR	Total ES	%ES/BR
2010	230.9	0.8	-	-	46.3	2010	230.9	0.8	-	-
2011	243.9	0.6	-	-	17.1	2011	243.9	0.6	-	-
2012	290.0	0.7	-	-	34.6	2012	290.0	0.7	-	-
2013	264.5	0.6	-	-	37.8	2013	264.5	0.6	-	-
2014	315.5	0.7	-	-	35.5	2014	315.5	0.7	-	-
2015	228.0	0.9	-	-	67.0	2015	228.0	0.9	-	-
2016	132.1	0.8	-	-	33.8	2016	132.1	0.8	-	-
2017	156.9	0.7	-	-	81.1	2017	156.9	0.7	-	-
2018	177.7	0.5	-	-	46.3	2018	177.7	0.5	-	-
2019	748.7	2.4	-	-	51.6	2019	748.7	2.4	-	-

Source: MDIC/Secex
Elaboration: Ideies/Findes



Chapter 4

RESEARCH, DEVELOPMENT, AND INNOVATION

The Oil and Gas (O&G) industry must constantly overcome several technological challenges, and the development of these technological solutions is essential for maintaining production capacity and competitiveness in the sector. In this scenario, innovation is a key point, and most of these innovations arise from the production of research and knowledge.

In Brazil, there is an important mechanism to encourage the production of knowledge and new technologies for this sector: the research, development, and innovation clause (RD&I), created by Law No 9.478, dated 06/08/1997, and regulated by ANP Resolution No 50/2015, in the respective ANP Technical Regulation No 03/2015.

4.1 Regulations

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

The percentage to be applied varies according to the specific conditions of each contract modality: 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 executed by the oil company itself, by Brazilian companies, or by accredited institutions from all over the country²⁸.

Gross revenue from the 15 fields operated through the concession scheme that collected special participations totaled around BRL 173 billion in 2019, generating BRL 1.7 billion in compulsory ex-

Table 8 - Percentage applied in the gross revenue of the concessionaires for the RD&I clause, by the contractual modality of the fields in production.

		Value of the obligations in RD&I by the concessionaires
Contractual arrangements	Concession	1.0% of the monthly gross revenues for each field that generate 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

²⁸ The oil company is a company that has signed concession, onerous transfer, or production sharing contracts for the production and exploration of oil and natural gas. The research institutions correspond to a university or research and development institution accredited by ANP. Finally, Brazilian companies are economic organizations, duly registered with the Commercial Board or the Civil Registry of Legal Entities.

penditure qualified in research and development. From these fields, 2 are from Espírito Santo (Jubarte and Roncador²⁹), which together totaled a gross revenue of approximately BRL 27 billion, thus generating BRL 278 million in resources qualified for RD&I.

The clause was created by the Oil Act (Law No 9.478/97) and is currently regulated by ANP Resolution No 50/2015, in the respective ANP Technical Regulation No 03/2015. In 2019, the resolution was revised, thus increasing the possibilities of the

research institutions, encouraging the execution of projects in partnerships between universities and companies that are developing technology with RD&I programs, which enables the execution of the new project and program models³⁰.

With the current regulation, few modalities of expenses needed authorization from ANP to be executed³¹. Most of these projects or programs have remained needless of prior authorization, simply because the executors account for the resource used at the end of the project or program.

Box 1 - Legal and normative references for distribution per type of executing entity for resources of the RD&I clause

Concession contract until 10th round	Concession contract after 10th round and production sharing	Concession contract after 14th round and production sharing	Onerous transfer contracts
Investment of at least 50% of the resources in projects and programs executed by Accredited Institutions (ICs). From this portion, up to 30% can be invested directly in Brazilian companies, in projects or programs executed in partnership with ICs, aiming at a product, process, or service innovation.	Investment of at least 50% of the resources in projects and programs executed by Accredited Institutions (ICs). From this portion, up to 30% can be applied directly to Brazilian companies, to projects or programs carried out in partnership with ICs aiming at product, process, or service innovation.	Investment of 30% to 40% of resources in national universities or research and development institutes accredited by ANP.	Investment of 100% of the resources in projects and programs executed by Accredited Institutions (ICs).
From the remainder of the resource, up to 50% may be allocated to any of the allowed executing authorities: Oil Company, Brazilian Company, or Accredited Institution.	Investment of at least 10% of the resources in projects and programs executed by Accredited Institutions (IC). The remainder, up to 40%, can be invested in a project or program carried out at the premises of the oil company itself or its affiliates (provided that they are located in Brazil), or contracted with Brazilian companies or ICs	Investment of 30% to 40% of the resources in Research, Development, and Innovation activities aiming at products or processes with technological innovation alongside Brazilian companies. The remainder may be invested in research, development, and innovation activities performed at the Concessionaire's own premises or its affiliates (located in Brazil) or in Brazilian companies, universities, or research and development institutes accredited by ANP.	From this portion, up to 30% can be invested directly in Brazilian companies, in projects or programs carried out in partnership with ICs aiming at a product, process, or service innovation.

Source: ANP. Elaboration: Ideies/Findes

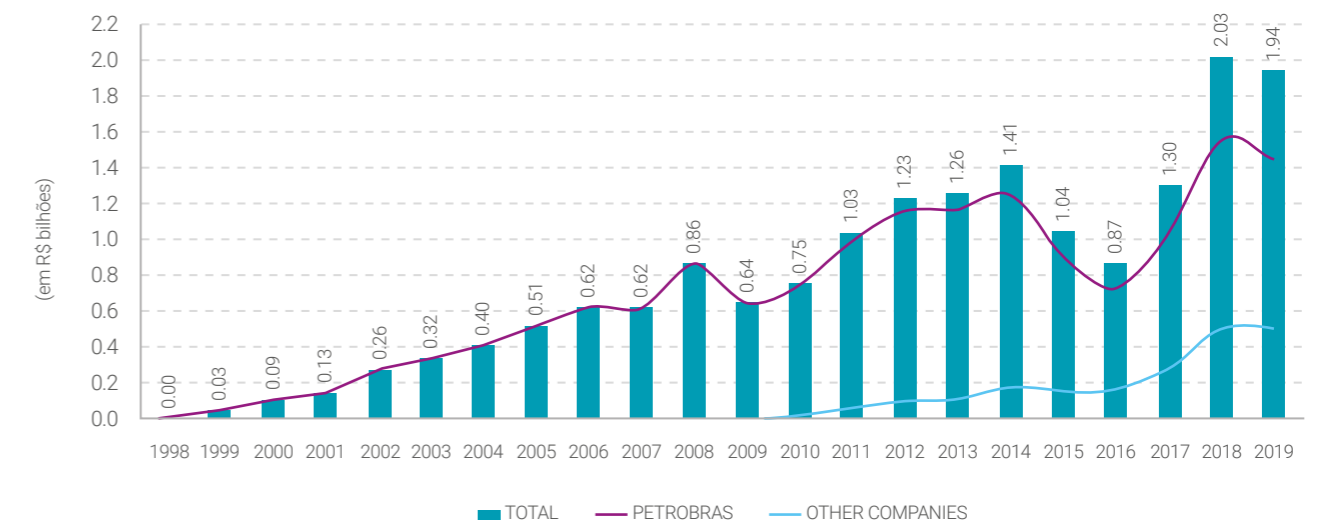
4.2. Projects and programs developed with resources from the RD&I clause

Between 1998 and 2019, the RD&I clause generated approximately BRL 17.3 billion in volumes of obligations in Brazil. Petrobras was responsible for 88.7% of this value and the other companies, 11.3%.

In 2019, the value generated by the clause was BRL 1.94 billion, a decrease of 4.6% in comparison to the previous year (2018).

The relative participation of Petrobras in relation to the other oil companies in 2019 was 74.6%. Despite this still concentrated result, there has been an increase in the participation of the other companies since 2010. This year, these companies accounted for 1.6% of the total value of the generated obligations, representing 25.4% in 2019.

Chart 36 - Obligations generated by the RD&I clause in Brazil (BRL billion)



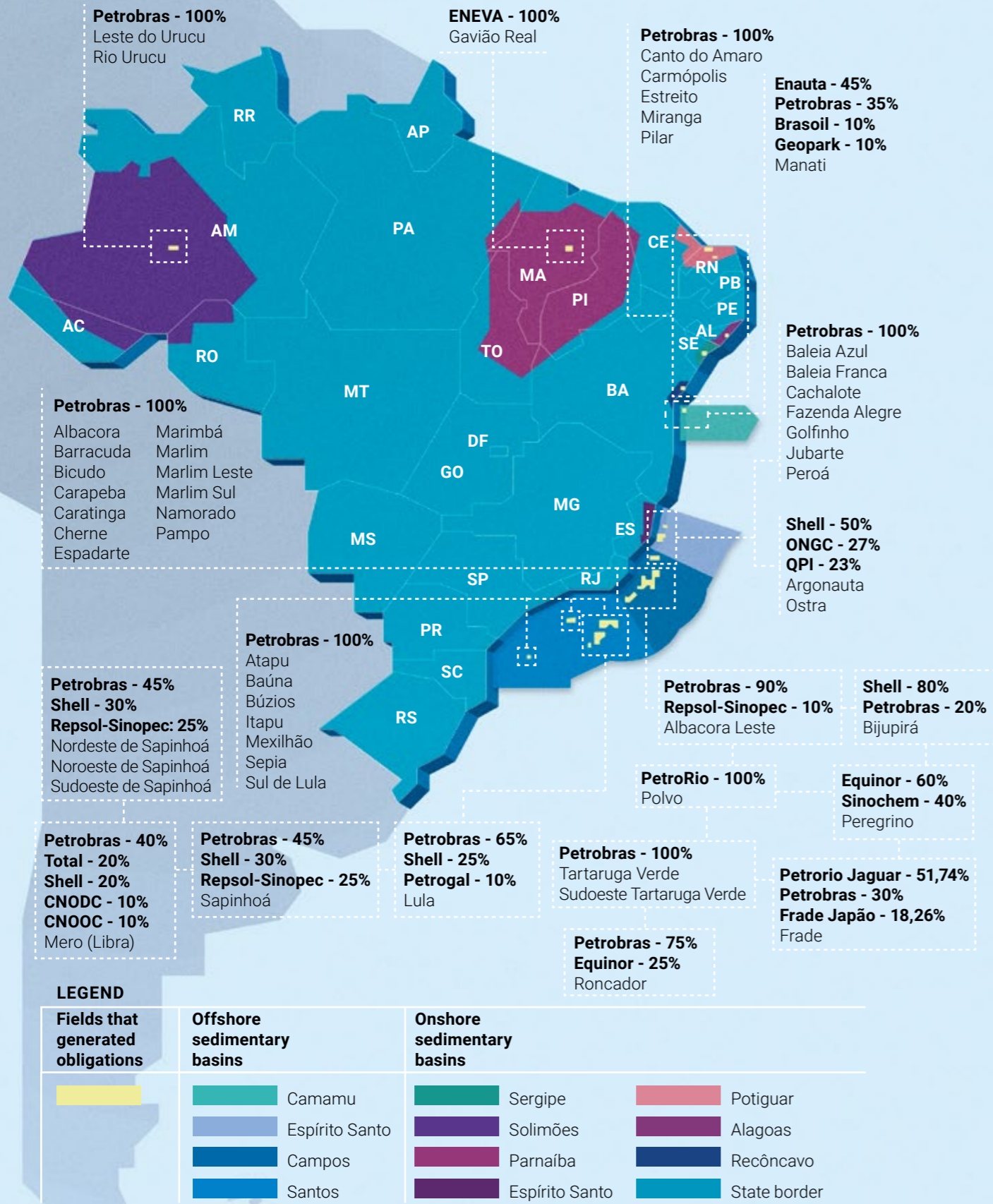
Source: ANP
Elaboration: Ideies/Findes

²⁹ Roncador is on the border of Espírito Santo and Rio de Janeiro.

³⁰ The amendments are contained in resolution 799 from September 2nd 2019, which is available at : http://www.anp.gov.br/images/Pesquisa_Developmento/Investimentos_PDI/Regulamentacao_tecnica/resolucao-799-2019.pdf.

³¹ The categories of projects and programs in RT No 03/2015 that must be submitted for authorization are: (a) technological programs for technical development and training of suppliers; (b) specific improvement projects for laboratory infrastructure; (c) projects for study of sedimentary basins with new borders that involve data acquisition activities; (d) specific projects of basic industrial technology; (e) specific training program on human resources; (f) specific projects of non-routine basic engineering; (i) specific support projects for laboratory and RD&I facilities.

Figure 2 - Participation of oil companies in fields that generated RD&I obligations

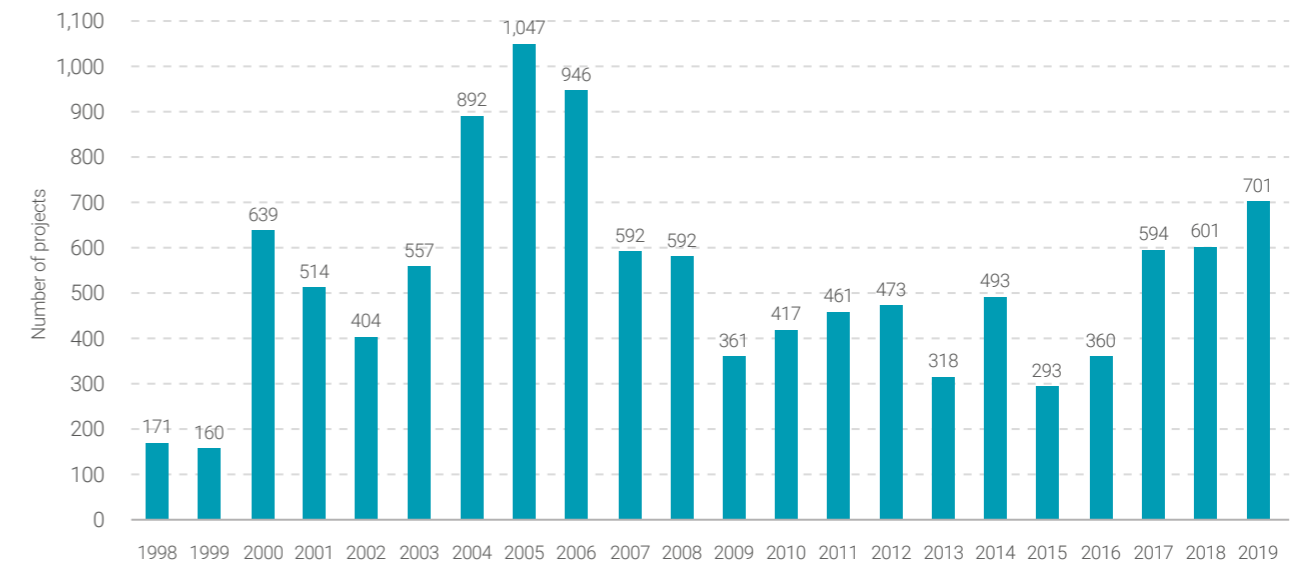


Source: ANP
 Elaboration: Ideies/Findes
 Note: Information until the first quarter of 2020.

According to the data provided by ANP³², 11,577 projects were developed between 1998 and 2018³³ in Brazil, funded with the resources of the obligations generated by the clause. The peak in the number of projects occurred in 2005 (1,047

projects), the year before the beginning of Technical Resolution No 05/2005. By comparing 2019 (701) and 2018 (601), the number of projects has increased 16.6% and it has been the largest number of projects since 2006 (946).

Chart 37 - Projects initiated that received resources from the RD&I clause in Brazil (No of projects)



Source: ANP
 Elaboration: Ideies/Findes

From 2000 to 2019, a total of 86 projects were started in Espírito Santo, developed with the resources of the RD&I clause.

of this yearbook, the data of the projects developed in the state with the resources of the clause are presented, with the aim of promoting the use of the clause, through a better understanding of

From the four oil companies³⁴ that generated RD&I obligations, because they have production fields on the state border, only Petrobras (85) and Queiroz Galvão (1) had projects developed with this resource in Espírito Santo³⁵.

³² The list of projects presented by oil companies that were financed with the resources of 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>

³³ This number of projects refers to those that needed and did not need the authorization of ANP.

³⁴ Petrobras; Shell; ONGC; and QPI.

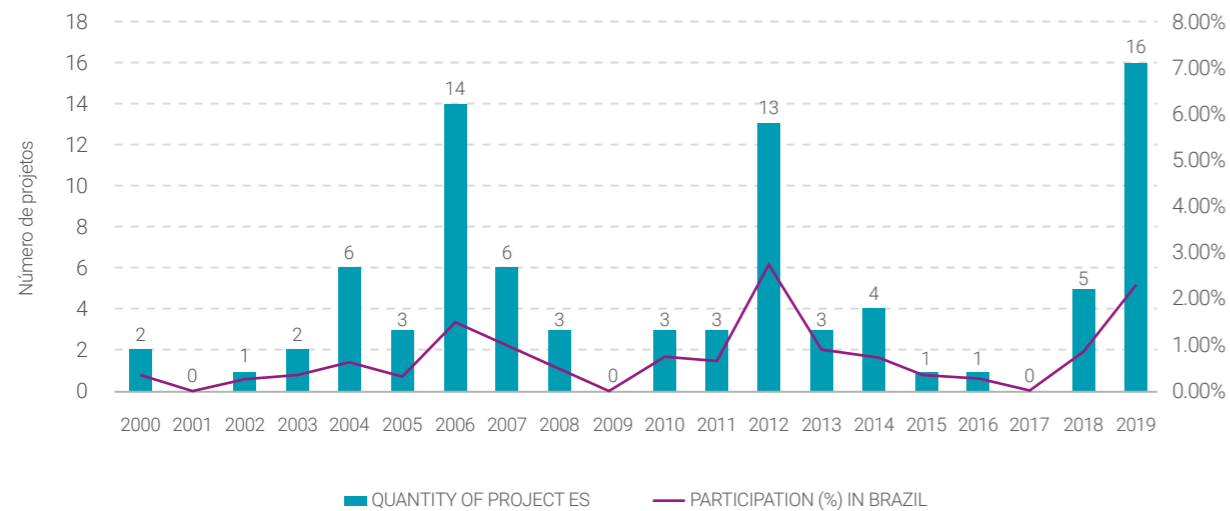
In 2019, a record amount of 16 projects were started, significantly higher when compared to 2018 (5), and the largest amount since 2000, the first year when projects occurred in the state (according to data provided by ANP). In the years 2001, 2009, and 2017, no project was carried out. It should be pointed out that, since the first edition

³⁵ The resources of the RD&I clause do not necessarily need to be applied in the locations where they were generated.

how administrative and legal mechanisms work and possible causes for the lack of use of such resources by the institutions of Espírito Santo.

In 2019, the number of projects developed by the state represented only 2.28% from the total of Brazil. In 2018, this representativeness was only 0.83%.

Chart 38 - Projects initiated that received resources from the RD&I clause in Espírito Santo



Source: ANP
Elaboration: Ideies/Findes System

From the total of projects developed in Brazil with the resources from the RD&I clause, 1,751 projects were authorized by ANP. It is worth pointing out that, as a rule, most projects do not require prior analysis of the agency before being hired by the oil company, as provided for in the aforementioned technical regulations. From this total, 87.5% were performed by Petrobras.

These projects authorized by ANP totaled an approved expenditure of 6.2 billion, from 2005 to June 2020. The oil companies with the largest authorized volumes were Petrobras, Shell, and Quei-

roz Galvão with, respectively, 88.5%, 89.6%, and 6.7% of the total amount.

In Espírito Santo, as well as in the rest of Brazil, only a part of the projects funded with the resource from the clause required authorization. Only 19 of the 86 projects developed in the state required prior analysis of ANP before hiring. A big part of these resources was allocated to the creation and adaptation of infrastructure in laboratories and the acquisition of necessary research equipment.

³⁶ Quantity related to the total research, development, and innovation projects and programs released by ANP to receive resources from the RD&I clause. The fact that these projects/programs are approved does not guarantee their execution.

³⁷ ANP issued a consolidated table with project information and its respective values, authorized between November 2005 and June 30th, 2020.

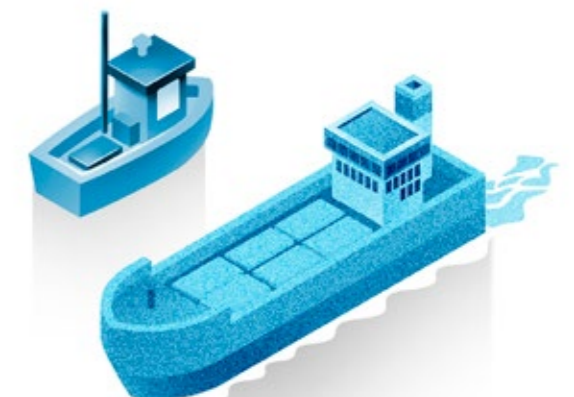
Table 9 - RD&I investments authorized by ANP in Brazil through the main concessionaires – Accumulated between November/2005 and June/2020

Oil Company	Nº authorized Projects	Participation %	Authorized values (BRL million)	Participation %
PETROBRAS	1,532	87.5	5,531.89	89.6
SHELL	79	4.5	412.94	6.7
QUEIROZ GALVÃO	32	1.8	9.62	0.2
EQUINOR	25	1.4	56.66	0.9
PETROGAL	26	1.5	78.43	1.3
SINOCHEM	14	0.8	21.52	0.3
REPSOL	17	1.0	45.76	0.7
CHEVRON	9	0.5	6.37	0.1
GEPARK	3	0.2	0.67	0.0
BP	2	0.1	2.32	0.0
ONGC	3	0.2	0.65	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	1	0.1	0.09	0.0
SOMATÓRIO	1,751	100.0	6,176.18	100.0

Source: ANP
Elaboration: Ideies/Findes System

4.3 Executing parties of the projects and programs funded by the RD&I clause

The research and development projects performed with the resources from the clause may be executed by the oil company, research institutions, and Brazilian companies. For the two last ones, the studies developed aim at answering specific demands from the oil exploration and production companies. Usually, the connection between the requester and the candidates for project execution is established through institutional articulation, and the oil company chooses the institution/company they deem more capable for the work.



4.3.1 Registered institutions

In Brazil, until June 30, 2020, there were 160 research institutions registered with ANP for the execution of projects with resources from the RD&I clause. These institutions are divided into a total of 975 research units (UP) and a total of 4,272 re-

search lines, distributed in seven thematic areas, focused on the scientific and technological development of the sector (Table 10). The states with the most registered research units were Rio de Janeiro (34) and São Paulo (28).

Table 10 - Quantity of Research Lines per Area

Area	Research Line	Part. (%)
Cross-sectional Themes	1,543	36.00
Oil and Gas Exploration and Production	1,290	30.00
Biofuels	611	14.00
Oil Supply	351	8.00
Other Sources of Energy	239	6.00
Natural Gas	158	4.00
Sector Regulation	80	2.00
Total	4,272	100.00

Source: ANP
Elaboration: Ideies/Findes
Note: Until June 2020

In Espírito Santo, until 2019, the Federal University of Espírito Santo (UFES), the Federal Institute of Espírito Santo (IFES), and the University Centro Leste (UCL) executed projects with resources from the RD&I clause, and UFES was in charge of 97.7% of the total quantity of projects performed in the state.

In 2019, Espírito Santo developed 16 projects with the resources of the RD&I clause, totaling BRL 33.4 million³⁸, all carried out by research units of UFES. From these projects, 12 were related to production, 2 were on well engineering, 1 on exploration, and 1 on refining. This year, three research institutions were registered with ANP: UFES, with 17 research units registered, IFES, with 3, and UVV, with 1³⁹.

This small amount of research units explains, to some extent, the 86 projects/programs developed within the state, with three possible reasons: (i) the small number of professors, scholars, and laboratories in these UPs; (ii) the complexity and deadline of the projects; (iii) professors' obligations with other academic activities. These points, altogether, reveal why the UPs have limited capabilities of receiving the investments from the RD&I clause. One option to increase the number of projects developed with resources from the RD&I clause is by increasing the number of registered research units.

Table 11 - Institutions of Espírito Santo that received resources from the RD&I clause – 1998-2019

	UFES	IFES*	UCL	UVV	Total ES
No of research units registered at ANP in 2017	17	4	0	1	22
No of projects that received RD&I resources without authorization by ANP	66	1	1	0	68
No of projects that required authorization by ANP	18	0	0	0	18

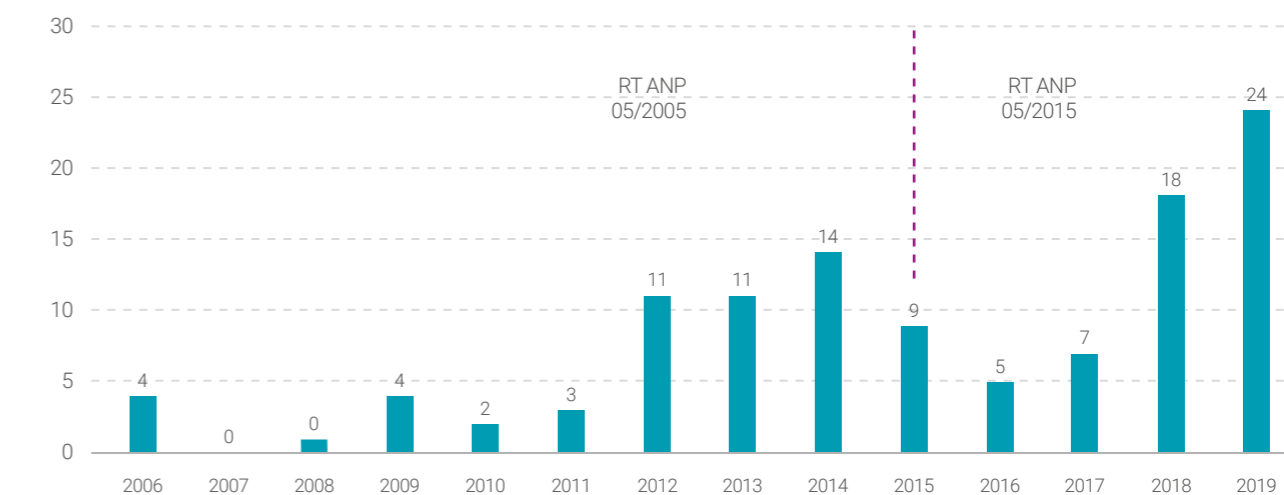
Source: ANP
Elaboration: Ideies/Findes System
Note: One research unit is not included on this list, since it was registered in March 2020: the Energies Laboratory, at IFES.
* Until the date of this publication, UCL was not accredited at ANP.

4.3.2 Brazilian companies

Brazilian companies developed 113 RD&I projects in the country with the resources of the clause from the years 2006 to 2019, and only eight of them needed the approval of ANP, i.e., they were in the categories of projects and

programs that should be submitted for authorization. These companies can be the only executor of the project, they can subcontract a research institution or, also, they can be subcontracted by the oil company.

Chart 39 - Projects developed by Brazilian companies with the resources of RD&I clause



Source: ANP
Elaboration: Ideies /Findes
Note: Oil companies have been excluded for the preparation of this information.

The companies in Espírito Santo have not yet developed research, development, and innovation projects with these resources, but the state has the potential to do so. In 2019, companies in Espírito Santo stood out in bidding rounds in the oil and gas sector. In Repsol-Sinopec's Digitalization Challenge, from the five companies approved in

³⁸ In 2019, 5 projects needed authorization by ANP. These values were authorized to be used throughout the duration of the project. And each project has different durations, ranging from 24 to 42 months.

³⁹ UCL started a project in 2010 (ending in August 2014). However, in 2019, the institution was no longer registered with ANP. UVV is registered at ANP but has not yet carried out a project.

the bidding, two were from Espírito Santo: Mogai and Factum. The challenge was to develop new technological solutions for the sector, through artificial intelligence techniques, robotics equipment, computer modeling, or digitalization⁴⁰.

In the 2019 call by FindesLab 2019, Shell's challenge was led by companies from Espírito Santo, with 14 projects submitted and 1 selected, by the startup from Espírito Santo Dersalis. Whereas in 2020, at the Call Connections for Innovation, promoted by Petrobras and the Brazilian Support Service for Micro and Small Businesses (Sebrae), 2 companies from Espírito Santo, among more than 300 companies, were selected in the first phase: Mogai and Wize Company.

In the final result, Mogai was selected by Petrobras, along with 17 other Brazilian companies, to participate in the innovation program to develop solutions that improve production processes. Companies will receive a total investment of BRL 10 million, which will be divided among them and invested in the development of solutions in the areas of digital technologies, robotics, energy efficiency, corrosion, among others. Initially, each company will receive BRL 500 thousand⁴¹.

In the 2020 Digital Oil and Gas Mission by ApexBrasil, whose objective is to encourage the development of international partnerships focused on the O&G sector, guiding the insertion of Brazilian companies in the global supply chain of the sector, especially those innovative and technological based, Espírito Santo also stood out. In phase 1, from the 150 applications, only 30 were selected and, among them, 6 were from Espírito Santo: Endserv, 2Solve and Inside, Marca Ambiental, R1 Engenharia, and Vixteam. In phase 2, from the 25 companies selected, 4 were from Espírito Santo: 2solve, Orion, R1 Engenharia, and VPS Group⁴².

Aiming at the acquisition of resources through innovation calls and bidding notices, the Capixaba Forum of Oil and Gas (FCP&G), with executive coordination of the Federation of Industries of Espírito Santo (Findes), supports the companies through advice, training, and guidance, alongside with Sebrae⁴³.

To increase the the assertiveness in generating business with the companies in the Oil and Gas chain, FCP&G and Sebrae launched, earlier this year, the Competitive Supplier Program. Through a specialized consultancy to help promote the activities and development of each company's business model, the program aims to generate business opportunities for the entire O&G industry's production chain, fostering innovation for the development of new products and services, in addition to process improvement. The program undertakes to train 44 registered companies from Espírito Santo, among them 30 traditional suppliers and 14 Startups/Technology-Based companies⁴⁴.

The FCP&G has been working strongly to disseminate the projects developed by the participating companies, in view of the fact that the maintenance of production capacity and competitiveness of the oil and gas sector goes through the development of new technologies. Using the resources of the RD&I clause will be important to foster greater opportunities and to foster, in a challenging way, technological development and innovation within the state. With the new rules established by ANP to de-bureaucratize the use of mandatory research and development resources, startups and suppliers of the oil industry are expected to have greater access with less bureaucracy to the resources of the clause.

Table 12 - Performance of companies from Espírito Santo in wide competition processes and programs

Year	Challenge	Competition	Result for companies from Espírito Santo	Company Selected	Proposal
2019	Shell-Call FindesLab	14 proposals submitted and 1 approved	1 selected	Dersalis Brasil Tecnologia e Inovação e Saúde Ltda	Dersalis HS2 Smart Wristband
	Repsol Sinopec - Digitalization Challenge	5 companies approved in the country	2 selected	Mogai Tecnologia de Informação S.A ES FACTUM Centro de Desenvolvimento Tecnológico e Empresarial Ltda ES	Underwater 3D Camera: Dimensional inspections on hulls or submerged equipment "SNAIL" Inspection System - Obtaining Data in confined environments
2020	Petrobras x Sebrae - Connections for Innovation	363 submitted projects - 30 selected in 1st phase	2 selected	Mogai Tecnologia de Informação S.A ES	Corrosion monitoring system and industrial paint management Wizegrid Detection - IoT methane leakage monitoring system on offshore production platforms
	2020 Digital Oil and Gas Mission ApexBrasil Phase 1 - Innovation	150 applications, 75 validated and 30 selected	6 selected	Endserv	Solutions for special welding and inspections, manufacturing and maintenance of pipes, fittings, equipment, and metal structures
				2 Solve	Engineering services and software and hardware technologies for automation
				Inside	Virtual and Augmented reality Solutions for Training Capacity Building for Professionals in the Industry.
				R1 Engenharia	Integrated engineering solutions for equipment and structures, through numerical simulation, inspections, and Reliability Engineering.
				Marca Ambiental	Integrated Waste Management; Collection and Transport; Treatment and Disposal
				Vixteam	Systems support and software development services
	2020 Digital Oil and Gas Mission ApexBrasil Phase 2 - Internationalization	150 applications, 75 validated and 25 selected	4 selected	Orion Industrial e Salvagem	Liferafts, Lifeboats, Rescue Boats, Davits & Winches, GMDS, VDR, Fire-Fighting, Safety, Life-saving Appliances, Portable and Fixed system of gas detector. Integrated engineering solutions for equipment and structures, through numerical simulation, inspections, and Reliability Engineering.

Source: Capixaba Forum of Oil and Gas.
Elaboration: Ideies/Findes

⁴⁰ Learn more at: <https://esbrasil.com.br/projeto-capixabas-repsol-sinopec/>

⁴¹ Mogai has presented a 3D technology project to monitor platform corrosion and manage the painting of Petrobras vessels.

⁴² Learn more at: <http://fcpeg.org.br/category/negocios/>

⁴³ It is worth pointing out that from these companies mentioned in the Yearbook, which were selected for the bidding notices of innovation, some worked independently, without taking advantage of the direct support of the Capixaba Forum of Oil and Gas.

⁴⁴ Learn more about the Competitive Supplier Program at: <http://fcpeg.org.br/wp-content/uploads/2020/08/Cata%CC%81logo-PFC.pdf>

The importance of synergy between federal laboratories and innovative companies

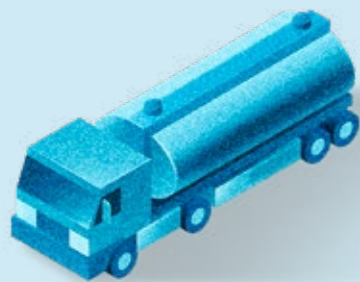
As in other sectors, in the Oil and Gas sector, the engine of economic growth and competitiveness is intrinsically related to technological innovation. To this end, these development strategies must be interlinked between companies, the academia, and the government, to leverage each of the different actors involved, generating synergy capable of spreading the continuous process of technological change toward the strategic objectives of the sector.

However, companies, universities, and governments do not always work in synergy. The creation of the Research Center Leopoldo Américo Miguéz de Mello (Cenpes)⁴³ in 1963 was a great step towards improving the research and development infrastructure. With the center, Petrobras could establish

technological partnerships with the main scientific institutions and technology-based companies in Brazil and abroad.

Through the experience of Cenpes, it can be noted that one of the fundamental pillars for innovation capacity is the appropriate combination of scientific knowledge with the needs of the oil and gas industry. In this sense, in September 2020, the Capixaba Oil and Gas Forum – FCP&G, Sebrae/ES, the Federal University of Espírito Santo (UFES), and Findes-Lab held an on-line event, with the aim of promoting the approximation and establishing partnerships between federal laboratories and innovative companies from Espírito Santo in the O&G sector.

The partnership between federal laboratories and companies of the sector can leverage investment attraction for Espírito Santo; strengthen the state's image at the national level; induce the development of solutions, products, and services for the sector; generate opportunities for companies from Espírito Santo; generate employment and local income. All this articulation is important for an important step to be made, which is leveraging the use of the resources from ANP's RD&I clause for innovation projects in the State of Espírito Santo.



⁴³ Learn more about Cenpes at: <https://petrobras.com.br/pt/nossas-atividades/tecnologia-e-inovacao/#:~:text=Criado%20em%201963%2C%20o%20Centro,aplicada%20mais%20importantes%20do%20mundo.&text=A%20miss%C3%A3o%20do%20Cenpes%20%C3%A9,processos%20para%20o%20Sistema%20Petrobras.>

Figure 3 - Key competences of the laboratories at UFES

Espírito Santo Foundation of Technology – FEST

Activities focused on teaching, research, knowledge transfer and environmental protection, with the main purpose of fostering and executing the technological development of Espírito Santo.

Laboratory of Outflow in Porous Means and Drilling and Completion Fluids

Determination of the physical and chemical properties of drilling fluids, fracturing fluids, completion fluids, acid treatment fluids, cement slurry, water, and oil emulsions.

Telecommunications Laboratory – LABEL

Applications in Internet of Things (IoT), 5G, rehabilitation robotics and nanotechnology.

Laboratory of Experimental Methods in Transport Phenomena – LAMEFET

Developing basic research applied to the industry involving complex outflows and heat transfer.

Laboratory of Geotechnics and Pavimentation

Teaching, research and extension courses in the area of Civil Engineering.

Study Group in Oil and Gas Outflow and Measurement – NEMOG

Study of technologies associated to the challenges related to mediation in the sector of oil and gas.

Laboratory of Tribology, Corrosion and Materials – TRICORRMAT

Characterization of the microstructure and its relationship with the mechanical properties of materials, ruin of materials and mechanical systems subject to wear and/or corrosion, failure analysis of several mechanical components.

Laboratory of High Performance Computation – LCAD

Computational environment that supports processing of several applications that demand or benefit from parallel/distributed processing.

Laboratory of Industrial Installations and Automation

Instrumentalization and control, operation and management of automatized equipment, management and monitoring of industrial processes and factory projects.

Laboratory of Polymers – LABPOL/LA-BPETRO

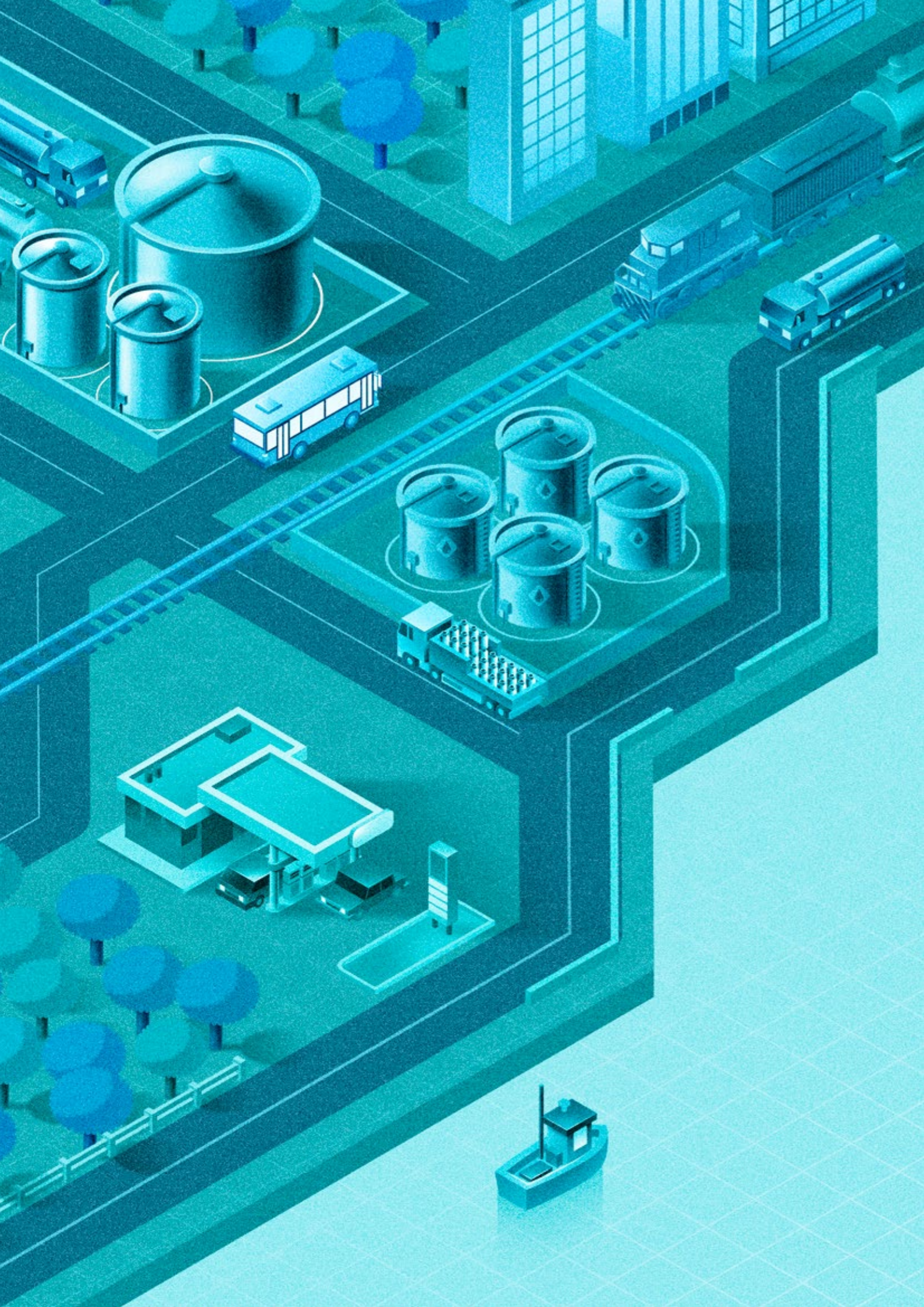
Chemical analyses of crude oils; studies of physical-chemical profiles, tests and development of chemical products, production of waste and formation waters.

Laboratory of Polymers – LABPOL/LA-BPETRO

Study of polymers.

Source: Capixaba Forum of Oil and Gas.
Elaboration: Ideies/Findes

Note: Laboratories that presented their skills in an on-line meeting held on September 25, 2020. For more information, access: <http://fcpeg.org.br/laboratorios-da-ufes-apresentam-suas-competencias-a-empresas-e-entidades/>



Chapter 5

OPPORTUNITIES FOR ESPÍRITO SANTO

The scenario of the coming years for the oil and gas sector will be marked by a fall in global investments and the maintenance of production in priority areas by the major oil companies. Nevertheless, this new background requires greater adaptability and predictability from the actors involved. Espírito Santo will be impacted by the priority projects of

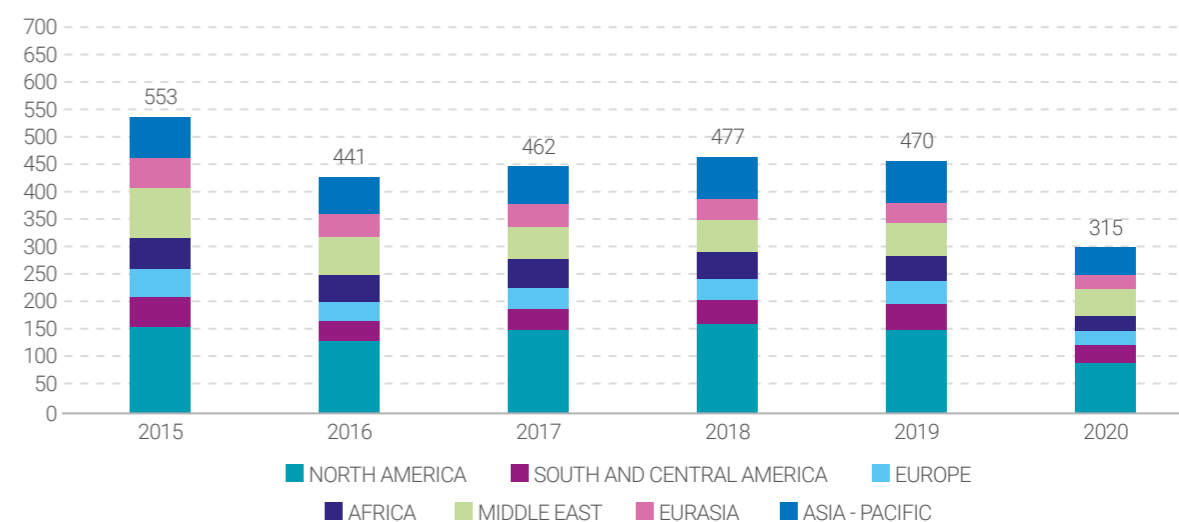
the large oil companies and by the new market for small and medium-sized enterprises operating in new areas of the sector. The opportunities can be summarized in five groups: i) Announced Investments ii) Schedule of Rounds iii) Permanent Offer iv) Petrobras' Disinvestment Plan and v) Decommissioning of Platforms.

5.1 Announced Investments

In 2020, investments in the energy sector fell by 18.3%, compared to 2019, reaching USD 1.5 trillion. The main reason for this fall is related to uncertainties regarding future energy demand,

driven by the deceleration of the economy caused by the novel coronavirus pandemic. In the oil sector, the drop in investments was 34.3% worldwide, reaching USD 315 billion in 2020 (Chart 40).

Chart 40 - World Investments in the oil sector (USD billions)



Source: International Energy Agency
Elaboration: Ideies/Findes

In 2020, the global economic downturn led to an oil supply greater than the oil demand and, consequently, a sharp drop in the international oil price. This weakened demand scenario led to the investment drop in O&G, since it changed the strategy of companies and investors in the sector. By the end of the year, the recovery of the oil price gave signs of a possible improvement in 2021. According to the consultancy Restad Energy, investments could recover to the pre-pandemic level by 2023 if oil prices rise to a price close to USD 65.0 per oil barrel. For 2021, the consultancy expects a global investment in exploration and production of USD 380 billion.

It should be noted that, despite the estimated increase in the investment level of oil exploration and production in the world, the amount invested is lower than in 2015: USD 553 billion (Chart 40).

Much of this reduction in global investments has been achieved through greater efficiency in the supply chain worldwide, which can demonstrate greater competition for this industrial cluster in the coming years.

In Brazil, the consultancy estimated a total investment in oil exploration and production of USD 12.5 billion for 2019. In 2020, a 20.0% decrease is estimated, reaching USD 10 billion. However, investments are expected to grow close to

USD 15 billion by 2025, in the country. This new cycle will be spurred by the following projects: Mero, Sepia, Búzios V, and the Lula recovery factor. In addition, investments are expected in the fields Bacalhau (Carcará), Berbigão/Sururu II, Búzios VI and VII in addition to Mero 3 and 4 and in Jubarte field, in Espírito Santo.

According to the FDI Markets platform, there are currently 742 signs of investment worldwide for the oil and gas extraction sector. Brazil is cited in 25 projects, 3.36% of the total. Most projects involve new investment strategies or even expansion of already consolidated projects. The origins of the capital to be invested are mostly from Spain, Norway, the Netherlands, and the United Kingdom. Brazil is competing to receive these investments mainly with countries such as Indonesia, the United States, and India.

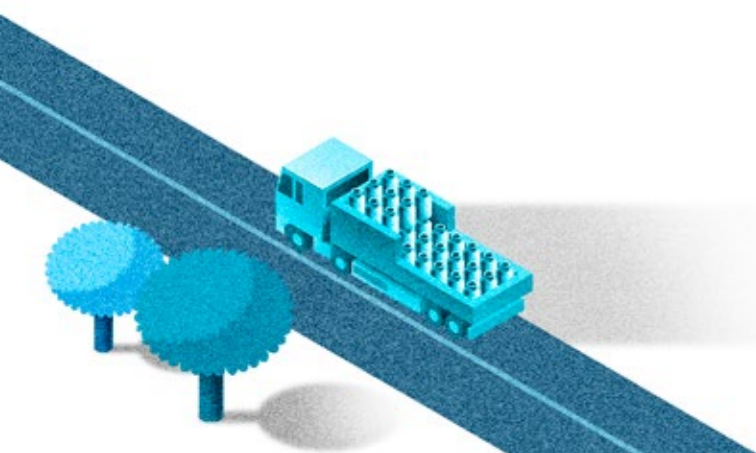
In Espírito Santo, according to the investment survey carried out by Ideies, it is estimated that the state will receive a total of USD 2.5 billion in investments in the oil and gas sector. In total, 9 projects were launched in the State, mainly involving the companies Petrobras and Shell. The highlight is the Petrobras disinvestment plan and the Jubarte Field project.

According to the Jones dos Santos Neves Institute (IJSN), the project in the Jubarte field is estimated at BRL 5 billion or USD 933 million. The project includes the development of the New Jubarte Field, formed by the areas of Jubarte, Baleia Azul, Baleia Franca, parts of Cachalote, and Pirambu. Table 13 presents the main projects surveyed by the Ideies' program Bússola do Investimento.

Table 13 - Main investments announced in the Oil and Gas sector of Espírito Santo for the next 5 years.

Investor	Project	Project summary	Municipalities	Description	Value (USD million)
Imetame	Expansion of productive activity	Expansion	Linhares	The company acquired, with Petrobras, all shareholdings of the Lagoa Parda hub onshore fields, in Espírito Santo. The investment encompasses the purchase of operating rights of the Lagoa Parda hub's onshore fields from Petrobras.	7.5
ESGÁS	Construction of new distribution pipelines	Construction	Espírito Santo	Extension of the distribution network by more than 292 meters and connection to more than 96 thousand new consumers.	48.5
ESGÁS	Construction of new distribution pipelines	Construction	Linhares	The initial project will be the interconnection of the Linhares distribution network to the Cacimbas-Catu transport pipeline, to expand the supply capacity to the municipality of Linhares.	7.5
Petrobras	Construction of new infrastructure for oil and gas production	Construction	Anchieta, Piúma, Itapemirim, Marataízes, and Presidente Kennedy	Development of the New Jubarte Field.	933.5
Petrobras	Construction of new infrastructure for oil and gas production	Construction	Vila Velha, Vitória, Serra, Fundão, Aracruz, Linhares, São Mateus, and Conceição da Barra	Oil and Gas exploration and production in the Espírito Santo Basin	706.8
Petrobras	Construction of new infrastructure for oil and gas production	Construction	Aracruz	Construction of the drilling vessel Arpoador for drilling and extraction of oil.	188.9
Shell	Construction of new infrastructure for oil and gas production	Construction	Anchieta, Piúma, Itapemirim, Marataízes, and Presidente Kennedy	Development and production of the fields of the South Coast of ES	653.4
Karavan Oil & Gas	Sale of the Cricaré Hub with 27 oil producing fields	Sale	São Mateus, Barra de São Francisco, and Jaguaré	Opportunity for investment in exploration and production areas in Petrobras disinvestment plan	24.8
Imetame and ENP Ecossistemas	Permanent Offer	Concession	São Mateus, Barra de São Francisco Jaguaré, and Linhares	Minimum Investment Program (PEM) of the Permanent Offer	1.1
Total					2,572.0

Note: Average dollar in January/2021 = BRL 5.36
Source: Jones dos Santos Neves Institute, Imetame, Petrobras, ESGÁS and ANP
Elaboration: Bússola do Investimento/Ideies



5.2 Next rounds

In April 2020, the ANP board approved the temporary suspension of the 17th bidding round of areas for exploration and production of oil and natural gas, in the concession regime, which was scheduled to take place that year. The reasons given by the Agency were the fulfillment of the Ministry of Mines and Energy's (MME) request, due to the Covid-19 pandemic.

According to the ANP schedule, areas will be offered in three rounds, in Espírito Santo: 17th bidding round of blocks, 8th round of produc-

tion sharing, and 18th bidding round of blocks. Figure 4 presents the round schedule of the areas in Espírito Santo.

In the 17th bidding round, 92 blocks with exploratory risk will be offered, located in 11 sectors in 4 sedimentary basins: Campos (sectors SC-AP1, SC-AP3, and SC-AUP2) Pelotas (sectors SP-AR1, SP-AP1, and SP-AUP1), Potiguar (sector SPOT-AP2 and spot-AUP2) and Santos (sectors SS-AP4, SS-AUP4, and SS-AUP5).

Figure 4 - Schedule of rounds announced by ANP for Espírito Santo

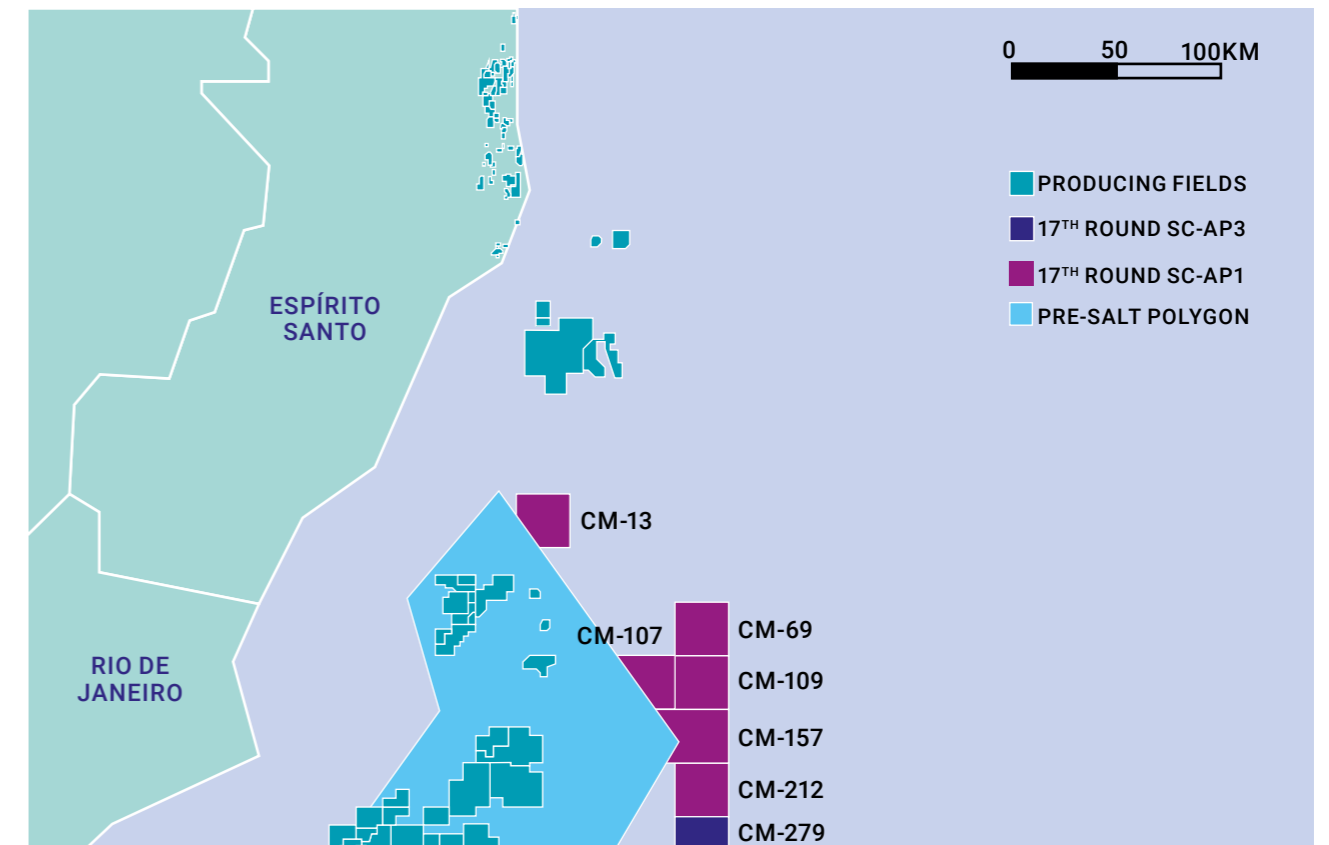


Source: ANP
Elaboration: Ideies /Findes

From the expected rounds, 6 blocks border Espírito Santo in the sector SC-AP1 and 1 block in the sector SC-AP3 (Figure 4). The area is exploratory and, therefore, with no register of drilling activity. Only the block C-M-13 (Figure 5) was drilled in 2003 and classified as dry with traces of oil, but that did not justify production at that time. The bordering municipalities in Espírito Santo are: Anchieta, Piúma, Itapemirim, Marataízes, Presidente Kennedy, Vila Velha, and Guarapari.

It should be highlighted that maintaining the bidding round schedule in Brazil is paramount for the investments in the oil and gas sector, improving its potential and ensuring more predictability for the representative agents in the sector, the society, and the municipal, state, and federal governments.

Figure 5 - Bidding areas in the 17th ANP round - Espírito Santo



Source: ANP
Elaboration: Ideies /Findes

5.3 Permanent Offer

The Permanent Offer is a concession modality in which exploration blocks and areas with marginal accumulations are offered. It is the continuous offer of returned fields or fields in the return process, of exploration blocks offered in previous bids and not purchased, or blocks returned to the agency, besides the new exploration blocks in onshore basins being studied by ANP.

In December 2020, the public presentation of offers was carried out during the 2nd round of the Perma-

nent Offer. Due to the novel coronavirus pandemic, this was the only offer modality of oil and natural gas E&P areas promoted by ANP in 2020.

Throughout Brazil, areas were offered in 14 sectors divided into 9 basins, in addition to 2 areas with marginal accumulations: 1 in the Solimões basin and 1 in the Recôncavo basin. Seven companies participated in the offer, which together won 17 exploration blocks in 6 basins – Campos, Paraná, Amazonas, Espírito Santo, Potiguar, and

Tucano. The Juruá area, in Solimões, was also purchased with marginal accumulation.

The total bonus offered for the 17 exploration blocks was BRL 30.9 million and the total minimum investment for the first phase of contracts will be BRL157.0 million. In the Juruá area, a bonus of BRL 25.8 million was offered by Eneva and a minimum investment of BRL 3.6 million was offered in the first phase of the contract.

In Espírito Santo, areas were offered in three sectors: The SES-AP2 sector, in the Campos basin, and the SES-T4 and SES-T6 sectors, in the onshore section of the Espírito Santo basin. As highlighted in the last edition of the yearbook, the main characteristic of these areas is the proximity to known reservoirs of the Espírito Santo and Campos basins, besides having few wells drilled.

The SES-AP2 sector has a low success rate in well drilling since from the total of 7 wells drilled in the area, 5 wells were classified as dry. This area has a greater exploratory risk and since its location is offshore, the need for technology is greater when compared to onshore blocks. In the permanent offer auction, this area did not receive bids.

The SES-T4 and SES-T6 sectors, despite the low drilling activity, are close to fields with known reservoirs and in the ongoing production process. These exploration blocks are close to the fields Fazenda Alegre, Inhambu, and Cancã, classified among the 20 highest production onshore fields in Brazil. In the permanent offer auction, both sectors were purchased by the group composed of Imetame and ENP Ecosystemas.

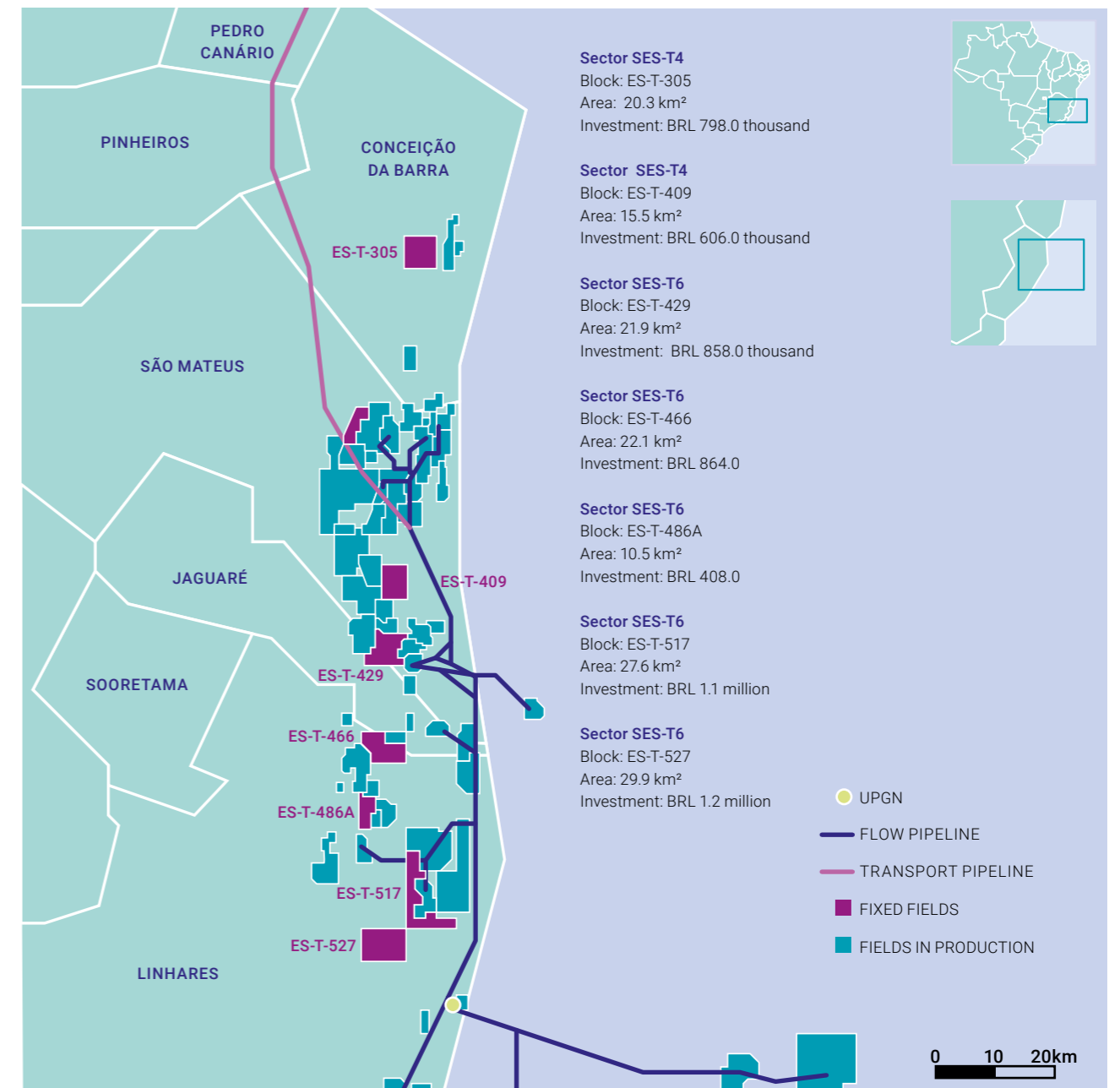
The SES-T4 sector (encompassing the ES-T-305 and ES-T-409 areas) is located in the municipalities of Conceição da Barra and São Mateus. The area has 35.7 km² and was purchased by a total bonus of BRL 101.8 thousand, with a total minimum investment in the first contract phase of BRL 1.4 million (Figure 6).

As for sector SES-T6 (comprised of areas ES-T-429, ES-T-466, ES-T-486A, and ES-T-527), it is located in the municipalities of Jaguaré, São Mateus, and Linhares. The area is 111.9 km² long and was purchased by a total bonus of BRL 254.4 thousand, with a total minimum investment of BRL 4.4 million in the first phase of the contracts (Figure 6).

The Ministry of Mines and Energy (MME) and ANP are working with several measures so that different characteristics are considered among areas of oil production. The Permanent Offer is part of this effort and guarantees investments in areas located in different exploratory environments, allowing the participation of companies of different sizes.

It is worth highlighting that, given the scope of the Permanent Offer, other areas have an elevated potential of being on the next cycles, depending on the inspections and regulation by ANP. In total, 18 areas vary from marginal accumulations to exploratory models in deep waters awaiting inclusions in the next bidding rounds. Ideies is following up on these potential areas found in table 14.

Figure 6 - Areas purchased in the 2nd Cycle of the Permanent Offer in Espírito Santo



Source: ANP
Elaboration: Ideies/Findes

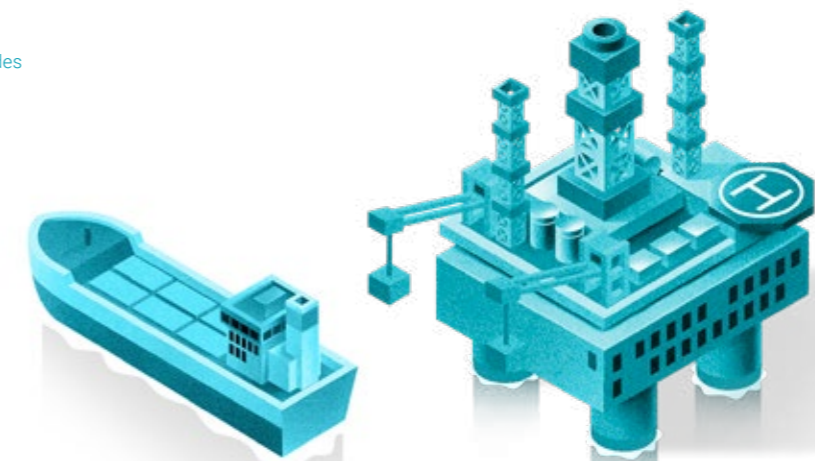


Table 14 - Follow-up of areas in opportunity for Permanent Offer (OP) in Espírito Santo

Basin	Sector	Area	Origin	Status
Espírito Santo	-	Rio Ibiritas	Area with marginal production	Awaiting inclusion in OP
Espírito Santo	-	Barra do Ipiranga	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Jacupemba	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Mariricu Oeste	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Nativo Oeste	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Rio Barra Seca	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Rio Itaúnas Leste	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	-	Rio São Mateus Oeste	Area returned to ANP	Awaiting new bidding processes
Espírito Santo	SES-AP2	ES-M-595; ES-M-665; ES-M-739; ES-M-741	Exploratory model Deep waters	Not purchased on the 2nd Cycle of OP
Espírito Santo		ES-M-590	Exploratory model Deep waters	Removed from the bidding of the 2nd Cycle of OP
Espírito Santo	SES-T4	ES-T-408; ES-T-399; ES-T-407; ES-T-304; ES-T-290; ES-T-362; ES-T-363; ES-T-331; ES-T-352; ES-T-389; ES-T-398; ES-T-371; ES-T-380ES-T-344; ES-T-353; ES-T-291; ES-T-318	Exploratory model Mature	Not purchased on the 2nd Cycle of OP
Espírito Santo	SES-T6	ES-T-528; ES-T-504; ES-T-514; ES-T-525	Exploratory model Mature	Not purchased on the 2nd Cycle of OP
Espírito Santo	SES-T2	ES-T-86; ES-T-87; ES-T-106; ES-T-201; ES-T-214; ES-T-226	Exploratory model Mature	Removed from the bidding of the 2nd Cycle of OP
Campos	SC-AR2	C-M-58	Exploratory model Shallow waters	Removed from the bidding of the 2nd Cycle of OP
Campos	SC-AR2	C-M-99	Exploratory model Shallow waters	Removed from the bidding of the 2nd Cycle of OP
Espírito Santo	SES-AP1	-	Exploratory area	Areas undergoing study by ANP
Espírito Santo	SES-AP2	-	Exploratory area	Areas undergoing study by ANP
Espírito Santo	SES-AUP 3	-	Exploratory area	Areas undergoing study by ANP

Source: Bússola do Investimento – Ideies
Elaboration: Ideies/Findes

5.4 Disinvestment plan from Petrobras

In 2018, Petrobras started the process of selling a set of onshore and offshore areas as part of the new market positioning of the company. Currently, they are undergoing a process of selling 20 assets in Espírito Santo, 7 onshore and 13 offshore (Table 15).

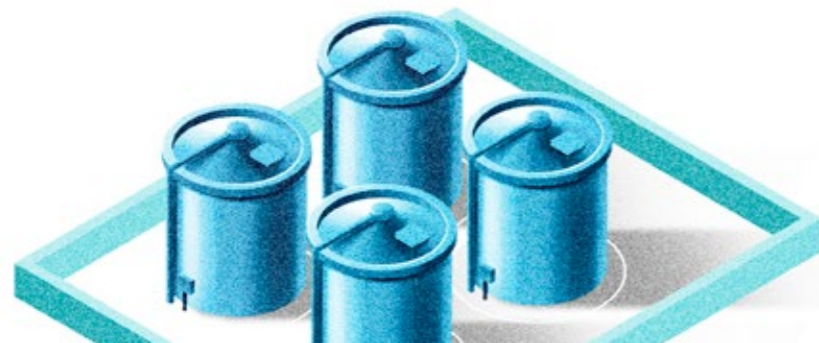


Table 15 - Follow-up of areas in the process of selling by Petrobras

Division	Area	% of Petrobras on sale	% of Petrobras in Field	Other Partners	Status
Hub Norte Capixaba	Fazenda Alegre	100%	100%	-	Binding Proposal
Hub Norte Capixaba	Fazenda Santa Luzia	100%	100%	-	Binding Proposal
Hub Norte Capixaba	Fazenda São Rafael	100%	100%	-	Binding Proposal
Hub Norte Capixaba	Cancã	100%	100%	-	Binding Proposal
Hub Norte Capixaba	Cancã Leste	100%	100%	-	Binding Proposal
Onshore block	ES-T-506	100%	100%	Cowan Petróleo e Gás	Binding Proposal
Onshore block	ES-T-516	100%	100%	Cowan Petróleo e Gás	Binding Proposal
Hub Golfinho	Golfinho	100%	100%	-	Binding Proposal
Hub Golfinho	Canapu	100%	100%	-	Binding Proposal
Hub Golfinho	BM-ES-23	100%	100%	PTTEP e Inpex	Binding Proposal
Hub Camarupim	Camarupim	100%	100%	-	Binding Proposal
Hub Camarupim	Camarupim Norte	100%	100%	-	Teaser
Offshore block	ES-M-596_R11	50%	50%	Equinor	Binding Proposal
Offshore block	ES-M-671_R11	50%	50%	Equinor and Total	Binding Proposal
Offshore block	ES-M-598_R11	40%	40%	Equinor and Enauta	Binding Proposal
Offshore block	ES-M-673_R11	40%	40%	Equinor and Enauta	Binding Proposal
Offshore block	ES-M-743_R11	50%	50%	Equinor and Total	Binding Proposal

Source: Bússola do Investimento – Ideies
Elaboration: Ideies/Findes

Furthermore, in May 2020, Petrobras offered to the market part of the idle capacity of natural gas processing of UPGN de Cacimbas, in Linhares. UPGN de Cacimbas is the third largest unit in processing capacity in the country (18.1 million m³ daily) and has 73.0% of installed idle capacity⁴⁶.

Between 2019 and 2020, the company has already sold 32 fields and 1 exploratory block in the territory of Espírito Santo. The companies Karavan O&G Participações e Consultoria Ltda and Seacrest Capital Group Limited purchased 27 fields. Imetame Energia Lagoa Parda Ltda purchased 3 fields, all in the North of the state. Whereas OP Energia and DBO Energia purchased the cluster Peroá, made up of two fields (Cangoá and Peroá) and the exploratory block B-M-21, which holds the discovery of natural

gas from Malombe. According to Petrobras, Malombe has an estimated production potential of 2.5 million m³/day of gas.

The cluster Peroá was sold at the beginning of 2021 and it has a production system with six wells connected to the disabled platform PPER-1, besides a well directly connected to the gas pipeline which links PPER-1 and the Gas Treatment Unit of Cacimbas (UTGC).

In terms of onshore, the Hub Norte Capixaba⁴⁷ is for sale (non-binding proposal phase), as well as

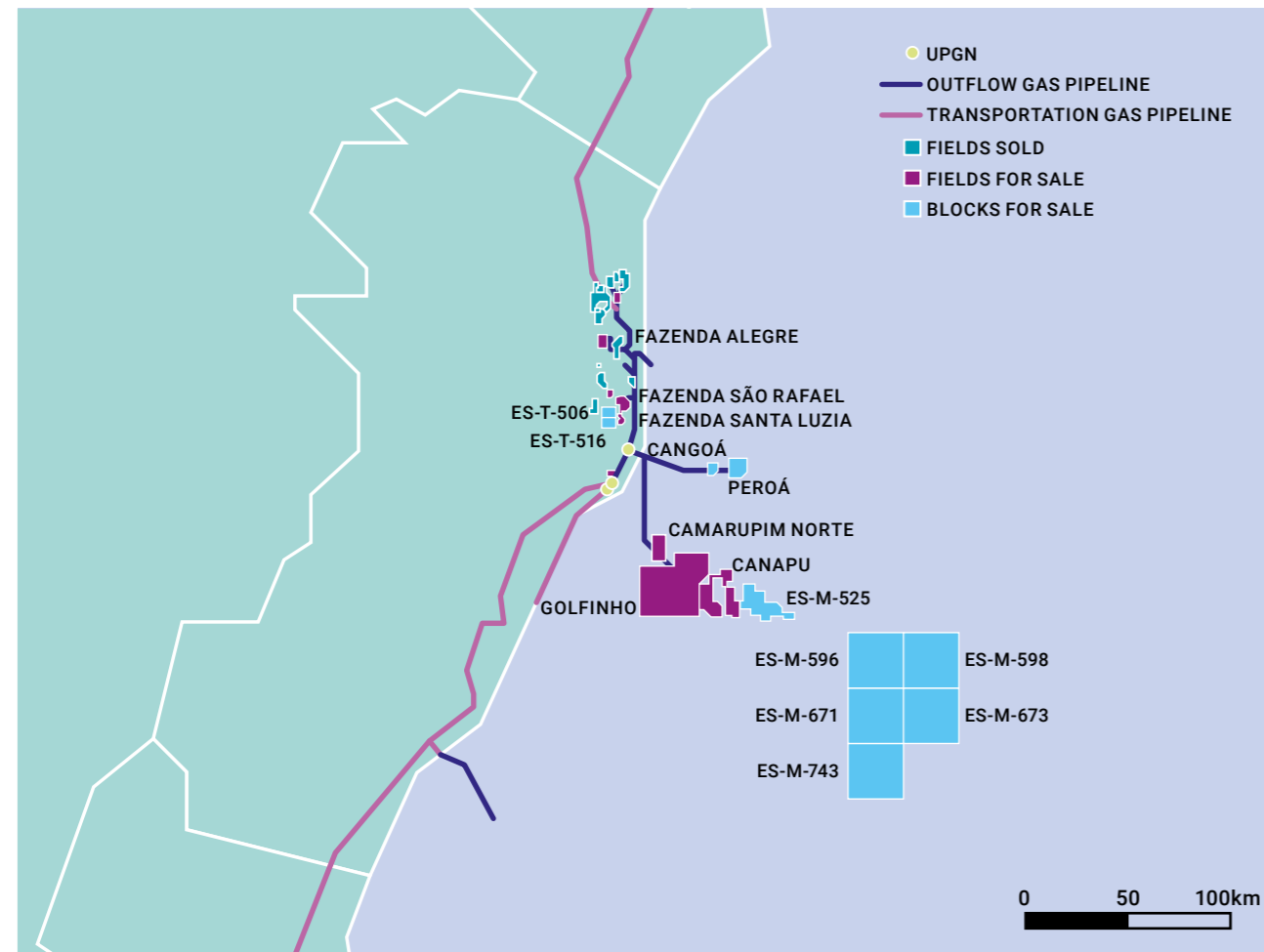
⁴⁶ For more information access the study GÁS NATURAL DESAFIOS E OPORTUNIDADES PARA O ESPÍRITO SANTO. Available at <<https://portaldaindustria-es.com.br/categorias/estudo-especial/arquivos>>

⁴⁷ Disclosure of the Opportunity Teaser in August 2020.

the participation in the exploratory blocks ES-T-506 and ES-T-516⁴⁸ (bidding proposal phase). The Hub Norte Capixaba is made up of the fields Fazenda Alegre, Cancã, Cancã Leste, Fazenda São Rafael, and Fazenda Santa Luzia (all in produc-

tion). Besides the concession right of these areas, the hub also contemplates equipment that carry out the separation of water and oil, and it also comprises the Terminal Norte Capixaba (TNC) and all production facilities.

Figure 7 - Opportunities with the sale of assets from Petrobras in Espírito Santo

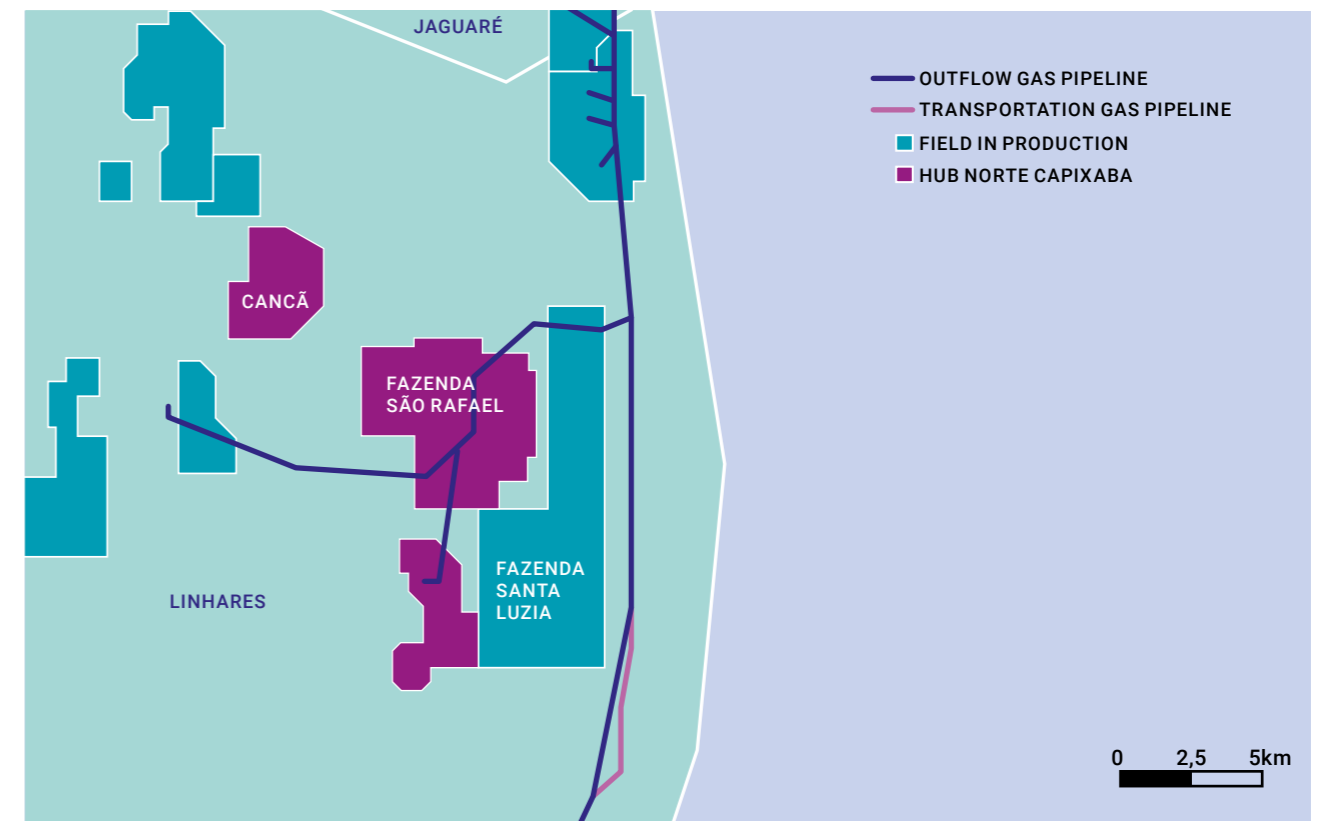


Source: ANP
Elaboration: Ideies/Findes

The field Fazenda Alegre, located on the border of São Mateus and Jaguaré, has 199 drilled wells and 51 wells in production. The volume of the field corresponds to 655.9 million cubic meters (Mm³) of natural gas and 39.3 million cubic meters (Mm³) of oil, estimated for 2017. The oil is transported for processing and separation at the Station Fazenda Alegre (EFAL).

The station processes the production of the fields Fazenda Alegre, Cancã, Inhambu, Fazenda São Jorge, Córrego Dourado, Córrego Cedo Norte, Jacutinga, Seriema, Campo Grande, Fazenda Cedro Norte, Cancã Leste, Tabuiaia, and Fazenda Cedro. The oil is directed by pipelines to the Terminal Norte Capixaba (TNC). There is no processing of natural gas at the station, only internal consumption by the station's facilities.

Figure 8 - Hub - Norte Capixaba



Source: Bússola do Investimento - Ideies
Elaboration: Ideies/Findes

The Cancã field, located in Linhares, has 51 wells drilled and 22 wells in production. The volume of the field was estimated, in 2014, to be 164.9 million cubic meters (Mm³) of associated gas. And 6.7 million cubic meters (Mm³) of oil, estimated in 2015. The production is transported by trucks to Station Fazenda Alegre (EFAL). After processing, the production is transported through oil pipelines, to Terminal Norte Capixaba (TNC).

The Fazenda São Rafael field, located in the municipality of Linhares, has 83 wells drilled with 25 wells in production. The volume of the field corresponds to 1.1 billion cubic meters (Mm³) of associated natural gas and 127 million cubic meters (Mm³) of non-associated natural gas. Regarding the oil, the field has a reserve of

9.3 million cubic meters (Mm³), both estimated in 2015. Oil processing is carried out at the Station Fazenda São Rafael (FSR).

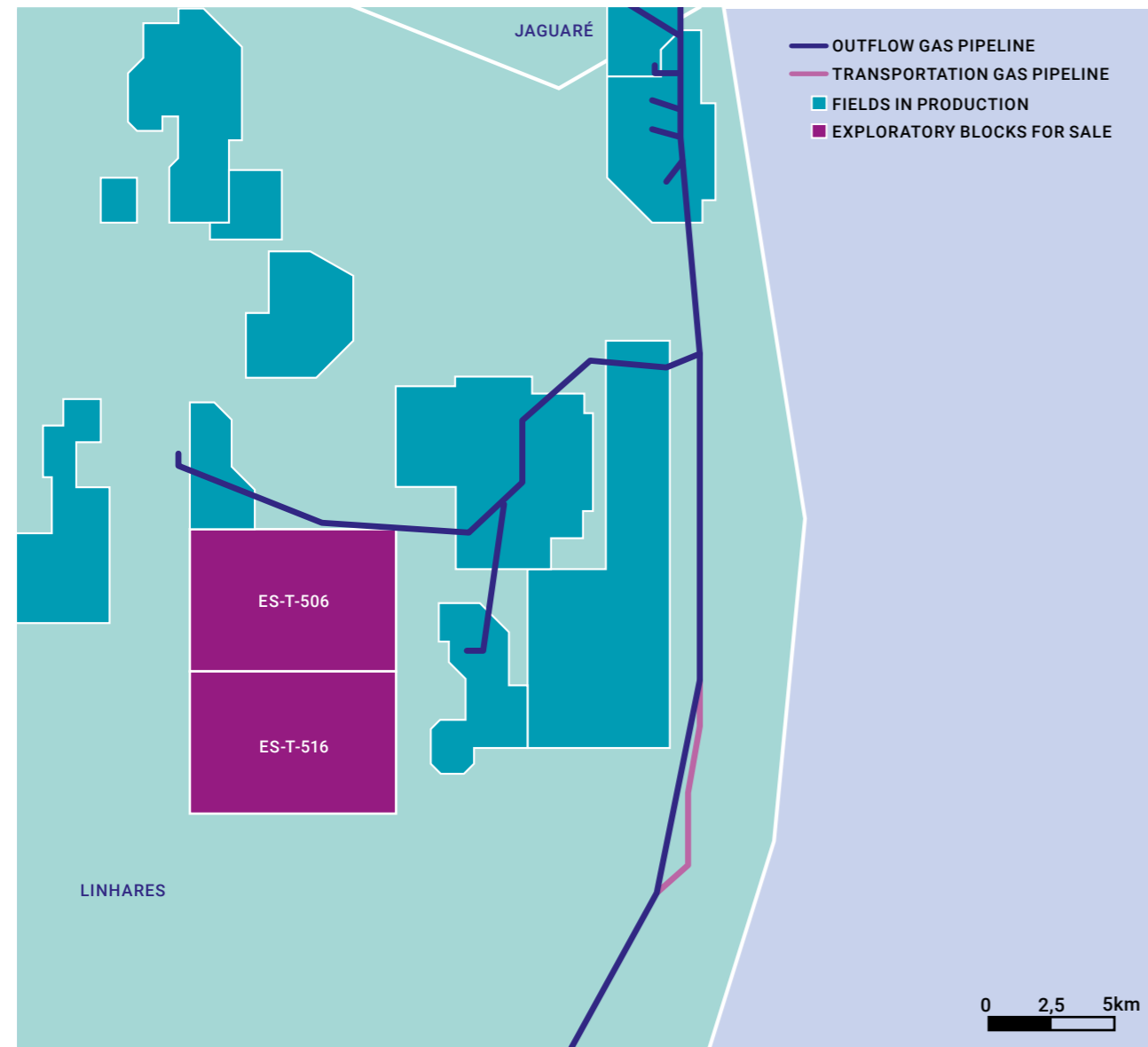
FSR processes the production of the Fazenda São Rafael, Lagoa Parada, Lagoa Suruaca, Lagoa Piabanha, and Lagoa Parada Norte fields. The station carries out oil processing and separation, treatment, and destination of the water. The oil is directed by pipelines to the Terminal Norte Capixaba (TNC). And natural gas is separated and sent by pipelines to the Unit of Gas Treatment of Cacimbas (UTGC), also in Linhares (ES).

⁴⁸ Disclosure of the Opportunity Teaser in December 2019.

The Fazenda Santa Luzia field, also located in the municipality of Linhares, has 74 drilled wells with 36 wells in production. The volume of the field corresponds to 680 million cubic meters (Mm³) of associated natural gas and 228.1 million cubic meters (Mm³) of non-associated natural gas. Regarding oil, the field has a reserve of 10.0 million cubic meters (Mm³), both estimated in 2015. Oil processing is carried out at the Station Fazenda Santa Luzia (FSL).

FSL processes the production, mainly, from Campo de Santa Luzia. The station carries out oil processing and separation, treatment, and water destination. The oil is directed by pipelines to Terminal Norte Capixaba (TNC). Whereas natural gas is purified and transferred by pressure differential to the Station Fazenda São Rafael, in which the hydrocarbon is compressed and, afterwards, sent to the Unit of Gas Treatment Cacimbas (UTGC).

Figure 9 - Exploratory blocks ES-T-506 and ES-T-516



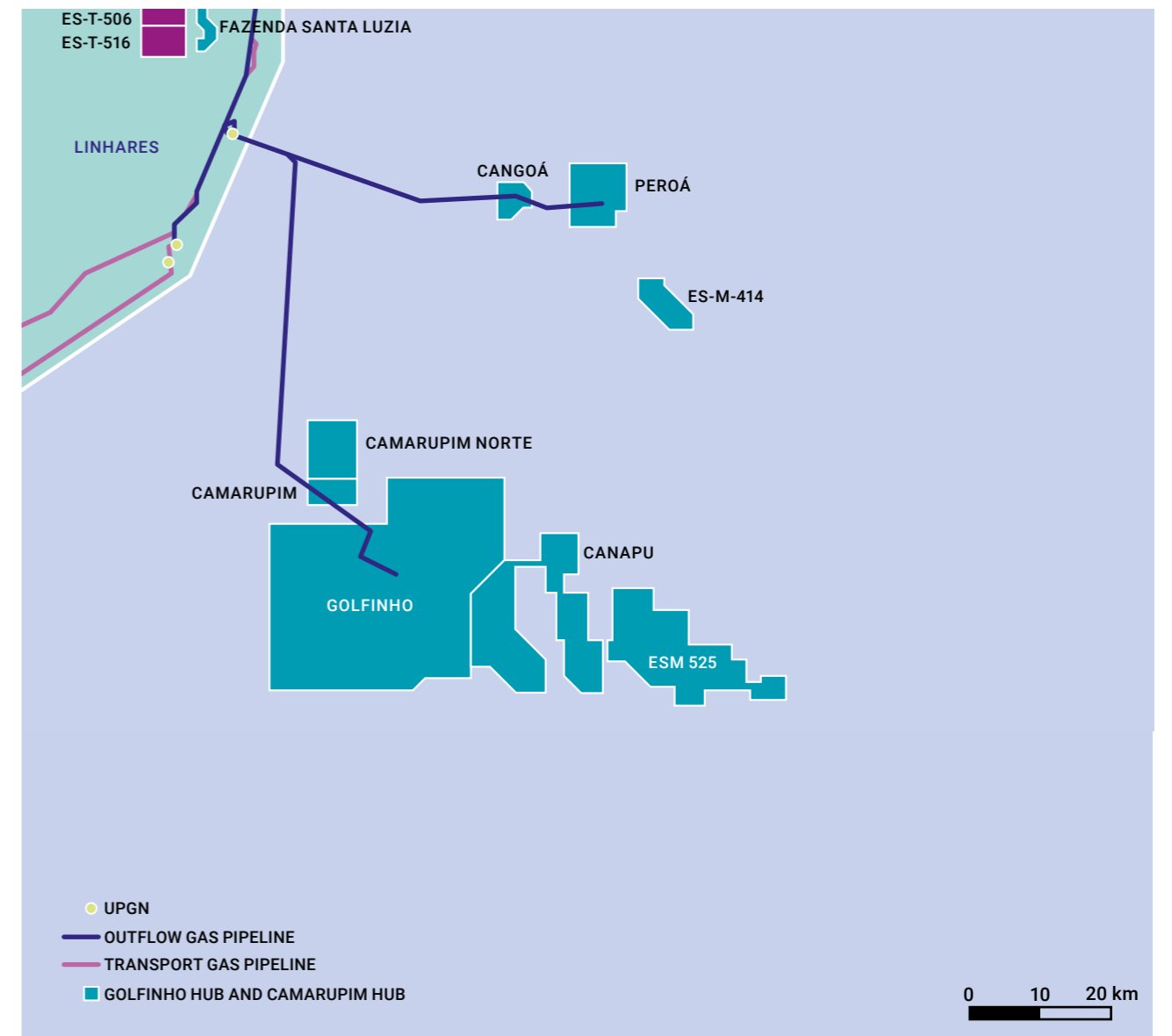
After the primary treatment of oil in the stations of the hub, it is directed by oil pipelines to Terminal Norte Capixaba (TNC), located in Barra Nova (São Mateus/ES). At TNC, the oil is transferred through an underwater pipeline to the transport ships. The ships are responsible for the transportation of hydrocarbon to the refineries.

TNC has a capacity of 78,000 m³, using 4 reserve tanks for heavy oil and 1 tank for light oil (Petro-

bras, 2020). The infrastructure is administrated by Transpetro, a subsidiary of Petrobras.

Besides these the participation of Petrobras is also for sale in 2 onshore exploratory blocks of Espírito Santo, both located in: ES-T-506 and ES-T-516. In total, 9 wells were drilled in this area: 7 drillings in block ES-T-506 and 3 drillings in block ES-T-516.

Figure 10 - Golfinho Hub and Camarupim Hub



Concerning offshore exploratory areas, Golfinho Hub⁴⁹ and Camarupim Hub⁵⁰ are for sale. Besides them, the exploratory blocks in the Espírito Santo basin⁵¹ are offered.

The Golfinho Hub (binding proposal phase) includes the fields Golfinho, Canapu, and block BM-ES-23, both located in deep waters, in the north of the Espírito Santo basin. The offer contains the total transfer of the operations, including all existing wells and facilities. Petrobras has 100% participation in the fields Golfinho and Canapu and 65% in the exploratory block BM-ES-23.

The Golfinho field has 87 drilled wells and 5 producing wells. The volume of the field corresponds to 16.8 billion cubic meters (Mm³) of natural gas and 647.2 million cubic meters (Mm³) of oil, estimated for 2015. The Canapú field has 7 drilled wells and the volume of the field corresponds to 5.2 billion cubic meters (Mm³) of natural gas and

7.6 million cubic meters (Mm³) of oil, estimated for 2015. In block BM-ES-23, 8 wells were drilled, and they were all abandoned.

As for the Camarupim Hub, it is formed by the Camarupim and Camarupim Norte fields. The offer contains the total transfer of operations, including all existing wells and facilities. The area has 10 drilled wells and 2 producing wells. The volume of the field corresponds to 9.1 billion cubic meters (Mm³) of natural gas and 9.5 million cubic meters (Mm³) of oil, estimated for 2015. Camarupim Norte has 7 drilled wells and 1 producing well.

The participation of Petrobras in 5 exploratory blocks is also for sale. The blocks ES-M-596, ES-M-598, ES-M-671, ES-M-673, and ES-M-743 have between 40% to 50% of participation of Petrobras and the partners Equinor, Total and Enauta have between 20% and 50%. On the opportunity teaser disclosed, Petrobras states that these areas have the potential of proving significant volumes of oil and consolidating its position in a new exploratory border, both for pre-salt and post-salt.

In general, Petrobras announced the sale of 50 oil and gas assets in Espírito Santo. From this total, 1 asset is in the teaser phase, 16 assets are in the binding proposal phase, and 33 assets were sold. The exit of the company from the area gives room for the diversification of actors in the market, enhancing competition in the oil and gas offer.

⁴⁶ Disclosure of the Opportunity Teaser in January 2020

⁴⁷ Disclosure of the Opportunity Teaser in January 2020

⁴⁸ Disclosure of the Opportunity Teaser in June 2020

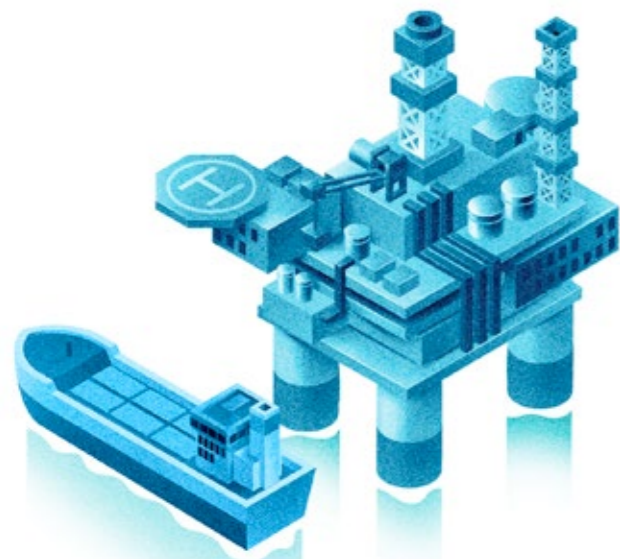
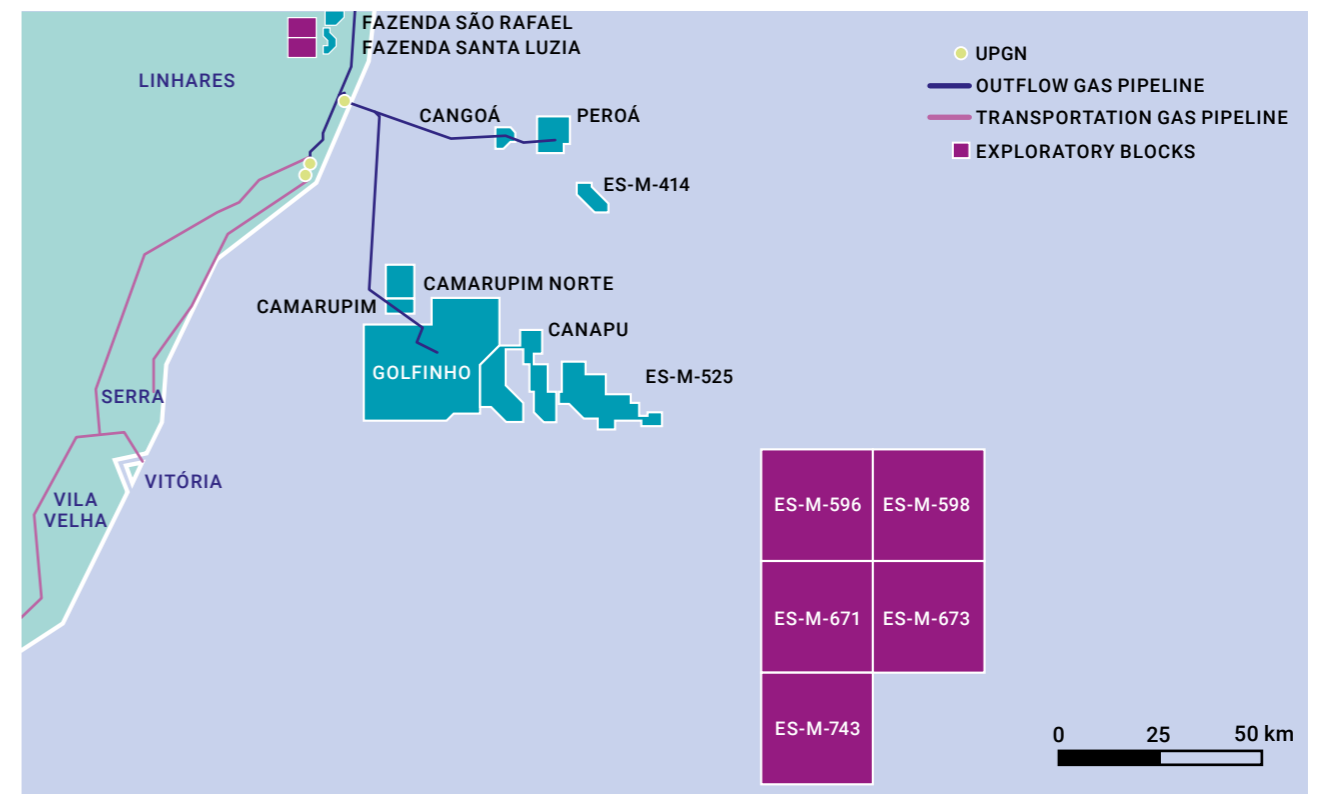


Figure 11 - Exploratory blocks



5.5 Decommissioning of facilities

Resolution nº 817, from April 24th, 2020 was an important milestone for the national oil industry because it modernized the regulation that approaches the decommissioning of E&P facilities, the return procedure of areas to ANP, and the alienation and reversion of assets.

The decommissioning of facilities consists of a set of associated activities: the definitive interruption of the operation at the facilities; the permanent abandonment of wells and surface abandonment, i.e. permanent abandonment which includes removal of the wellhead and site restoration; the removal of installations; the appropriate destination of materials, waste and rejects; and the environmental recovery of the area.

This process occurs when areas are returned to ANP due to lack of economic feasibility in E&P, because of the ceasing or cancellation of concession/sharing contract and due to revitalization projects in the oil and gas fields⁵². The resolution determines that the definitive interruption of the operation in the facilities happens only when all economically and environmentally feasible op-

⁴⁹ In this last case, the units are deactivated so other ones may replace them, enabling an increase in the recovery factors. This is the case predicted for the platform FPSO Capixaba in the Jubarte field in 2022. The intention of Petrobras in this project to replace this production unit for another one with greater capacity, which will increase the productivity of Parque das Baleias.

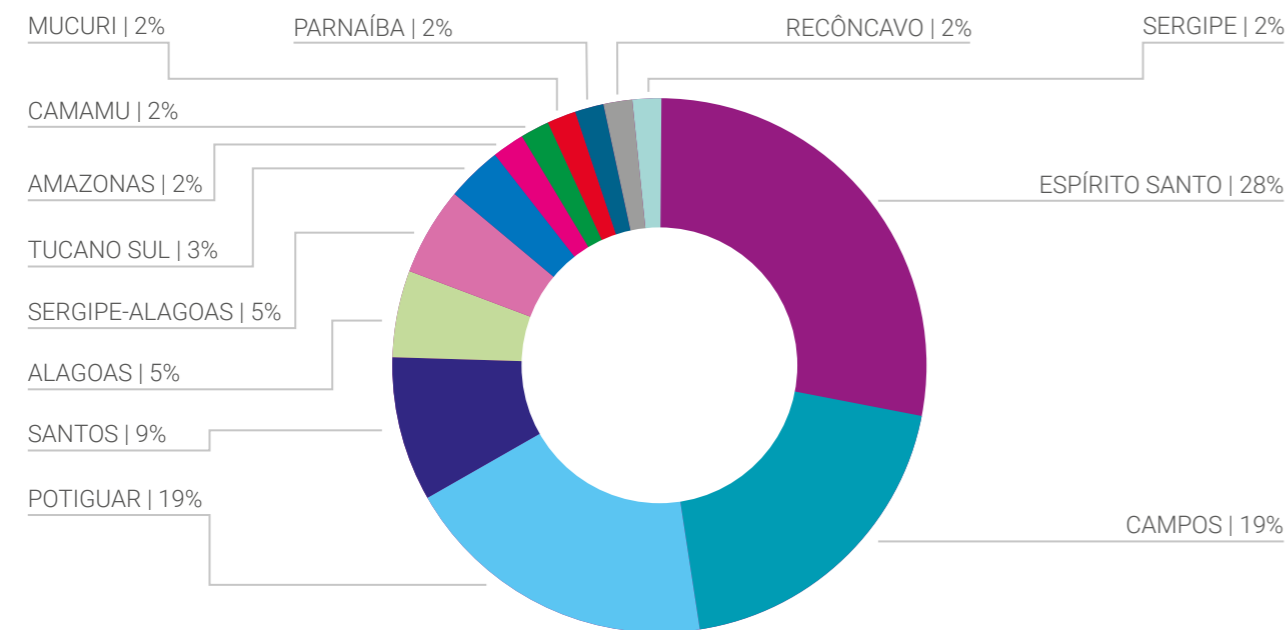
tions of development are explored. This caution in the legislation has the purpose of maximizing the recovery of the reservoirs and avoiding premature decommissioning of the production facilities.

Thus, when it is still economically and environmentally feasible to explore a field, it is returned to ANP for placement in the Permanent Offer⁵³. Therefore, the resolution simplifies and dynamizes the process of transferring fields from one company to another, which will allow extending the useful life of the areas and increasing their recovery factors, generating employment, income, and a higher collection of taxes and governmental participation such as royalties (ANP, 2020).

Until the date of the elaboration of this yearbook⁵⁴, ANP approved 57 proposals of Facility Decommissioning Programs (PDI) in Brazil, 35 of them onshore and 22 offshore. Besides, 4 PDIs are under analysis, 6 are awaiting a response from the agency and 11 are on hold.

In total, 13 basins had their PDIs approved by ANP. Most of the projects are located in the Espírito Santo Basin (28.1%), followed by Campos (19.3%) and Potiguar (19.3%). At the Espírito Santo basin, 16 PDIs were approved, 15 onshore projects and 1 offshore project (Cação field), and 14 PDIs are concessions from Petrobras, 1 of them from Petrosyenergy, and 1 from Vipetro.

Chart 41 - Distribution of Facility Decommissioning Programs (PDI) approved by ANP, per Basin



Source: ANP.
Elaboration: Ideies/Findes.

Table 16 - List of Decommissioning Programs (PDI) in the Espírito Santo Basin, approved and under analysis

Status	PDI	Basin	Field	Location	Company
Approved	Albatroz	Espírito Santo	Albatroz	terrestre	Petrisyenergy
	Cação	Espírito Santo	Cação	marítimos	Petrobras
	Corruíra	Espírito Santo	Corruíra	terrestre	Petrobras
	Jacupemba	Espírito Santo	Jacupemba	terrestre	Petrobras
	Lagoa do Doutor	Espírito Santo	Lagoa do Doutor	terrestre	Vipetro
	Mariricu Oeste	Espírito Santo	Mariricu Oeste	terrestre	Petrobras
	Mosquito	Espírito Santo	Mosquito	terrestre	Petrobras
	Nativo Oeste	Espírito Santo	Nativo Oeste	terrestre	Petrobras
	Rio Barra Seca	Espírito Santo	Rio Barra Seca	terrestre	Petrobras
	Rio Doce	Espírito Santo	Rio Doce	terrestre	Petrobras
	Rio Itaunas Leste	Espírito Santo	Rio Itaunas Leste	terrestre	Petrobras
	Rio Mariricu	Espírito Santo	Rio Mariricu	terrestre	Petrobras
	Rio Mariricu Sul	Espírito Santo	Mariricu Sul	terrestre	Petrobras
	Rio Preto	Espírito Santo	Rio Preto	terrestre	Petrobras
	Rio São Mateus Oeste	Espírito Santo	Rio São Mateus Oeste	terrestre	Petrobras
	Barra do Ipiranga	Espírito Santo	Barra do Ipiranga	terrestre	Petrobras
Under analysis	Lagoa Parda Sul	Espírito Santo	Lagoa Parda Sul	terrestre	Petrobras
	Mosquito Norte	Espírito Santo	Mosquito Norte	terrestre	Petrobras

Source: ANP
Elaboration: Ideies/Findes

According to ANP, the investments planned for decommissioning of facilities in the country add up to BRL 28.2 billion. These investments will be destroyed throughout the years 2021 to 2025.

From this amount, in the country, BRL 1.4 billion will be invested in the Espírito Santo Basin, which mostly occurred in 2024 (BRL 203.3 million; 14.4%) and will occur in 2025 (BRL 728.8 million; 51.8%). From this total of investments in the North of the Espírito Santo basin, BRL 1.0 billion will be for surface abandonment, i.e. permanent abandonment which inclu-

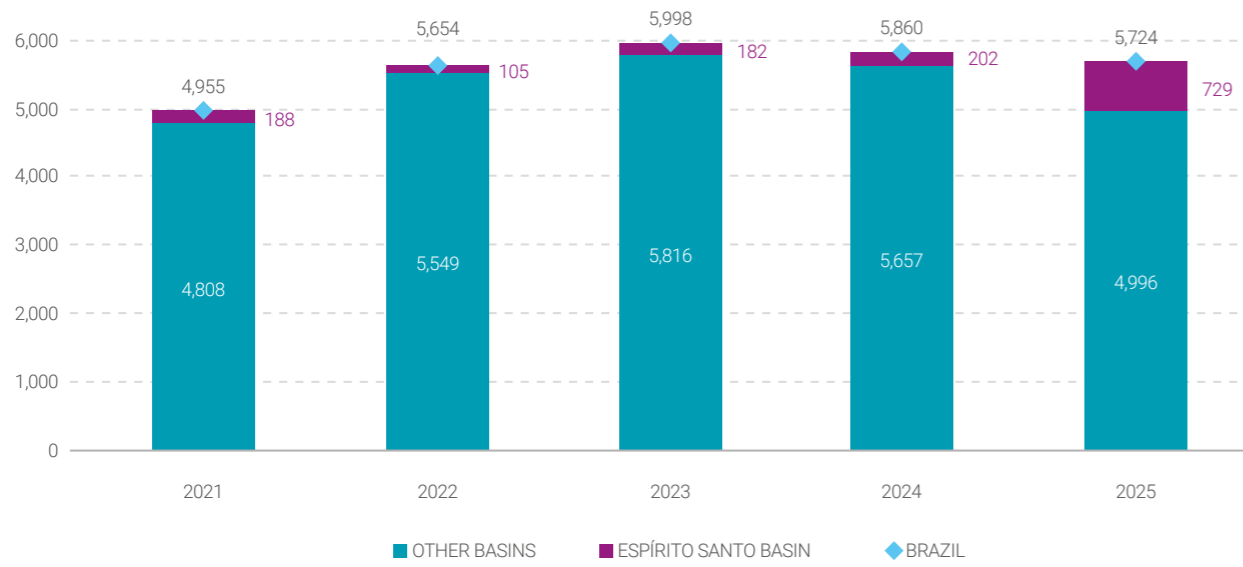
des removal of the wellhead and site restoration and well abandonment, and BRL 390.9 for equipment removal. Besides these values invested in the closure of activities in the fields of this basin, other BRL 7.8 million will be dedicated to the environmental recovery of these areas.

Thus, there is a wide range of opportunities in thirteen basins for the suppliers from Espírito Santo to work in facility decommissioning, which is the final stage in the oil and natural gas chain.

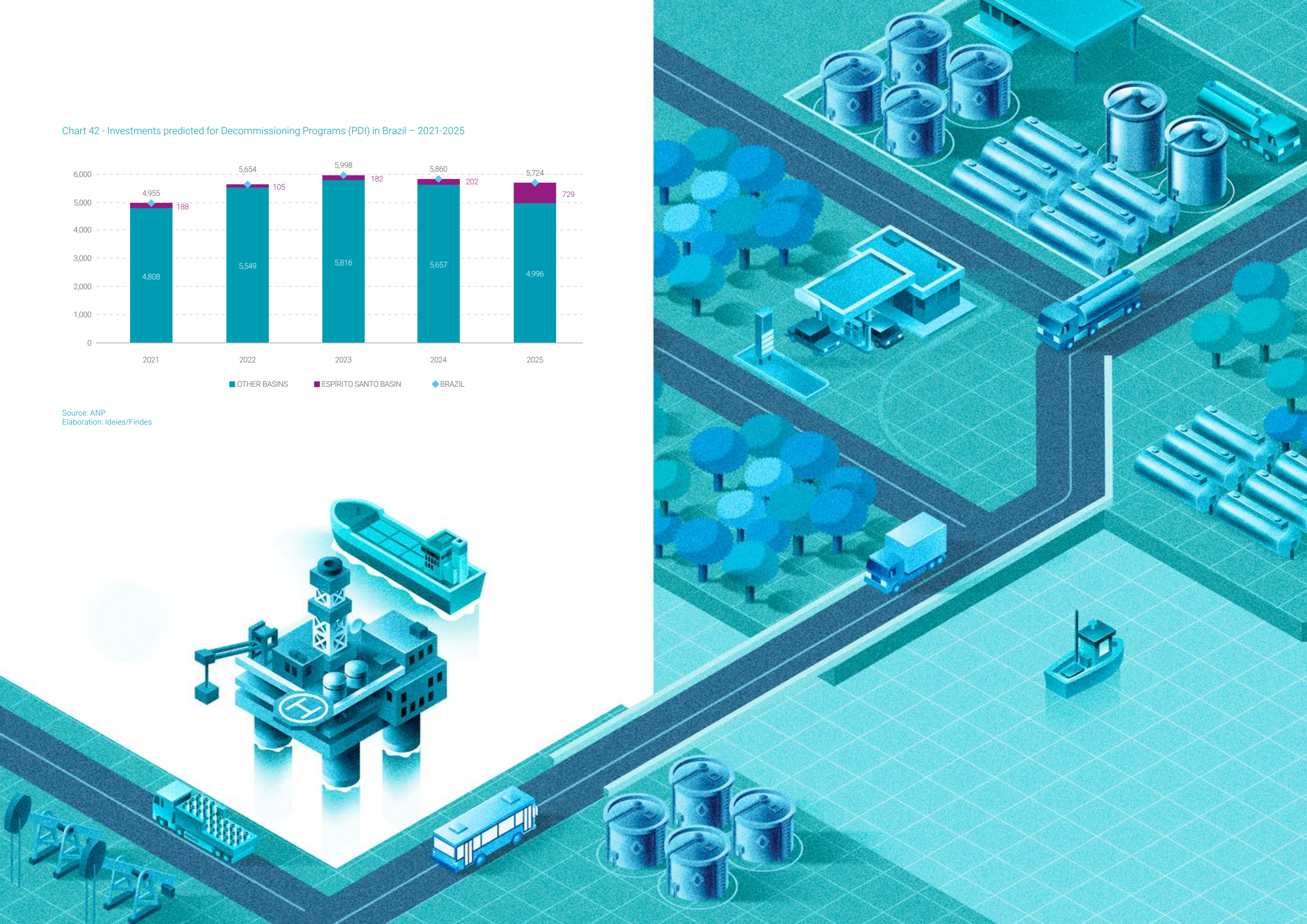
⁵³ According to ANP (2020), "the resolution also defined that ANP may place under Permanent Offer the onshore field in the process of being returned, as of 24 months before the date predicted for the end of the production, so there is a transition of operators without interrupting the production".

⁵⁴ Until the 4th of February 2021.

Chart 42 - Investments predicted for Decommissioning Programs (PDI) in Brazil – 2021-2025



Source: ANP
Elaboration: Ideies/Findes



GLOSSARY

A

Abandoned surface: permanently abandoned well where all equipment related to the well head assembly was removed and the surface coating cut at the bottom of the well.

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

ANP (National Agency of Oil, Natural Gas and Biofuels): the regulatory agency of the oil, natural gas, and biofuel market in Brazil. Regulates the whole market, except for the distribution of natural gas, which is regulated by each state.

B

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

Barrels per day (bpd): a unit used to measure the daily production of oil barrels.

Bidding rounds: actions organized by ANP that aim to auction exploratory areas in concessions or sharing regimes to companies and/or consortiums.

Brent: oil extracted in the North Sea and traded on the London Stock Exchange. Its international reference price is the price of oil.

C

Closed well: completed well that has already entered production or injection operation, but is closed, awaiting normalization of surface conditions, additional studies for decision making, or intervention with a probe for re-evaluation, re-completion, restoration, abandonment, among others.

Concession: delegation of an economic activity by the public power, usually through a competitive process, to an economic agent that proves capacity for its performance, at its own risk and for a determined period. In Brazil, the concession agreement is drawn out by ANP, granting the companies the exploration and production (E&P) activities of oil and natural gas in Brazilian territory.

Concessionaire: a company incorporated under the Brazilian law, with headquarters and administration in Brazil, that is granted by ANP the exploration and production of oil or natural gas in a sedimentary basin located in the national territory, after concluding a concession agreement.

Coke: fuel formed by the agglomeration of coal, consisting of mineral matter and carbon, fused together. It is a solid and cohesive material derived from the destructive distillation of coal, oil or other carbonaceous residues that mainly contains carbon.

D

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

Declaration of hydrocarbon traces: the concession agreements establish the deadlines and work programs for the exploration and production activities. According to these agreements, the concessionaire must notify ANP of any hydrocarbon or other mineral resource discovery at the concession area within 72 hours after the occurrence.

Decommissioning: a set of legal actions, engineering techniques and procedures applied in an integrated manner to a Pipeline, aiming to ensure that its decommissioning meets the conditions of safety, preservation of the environment, reliability, and traceability of information and documents.

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

Development plan: the development and production planning instrument that covers the entire life cycle of the oil field. It describes the future activities and investments. All other medium and short-term plans have to comply with it.

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, and must comply with the Minimum Exploration Program (PEM) agreed upon with ANP.

Exploratory Block: areas geographically outlined by a sedimentary basin, where oil and natural gas exploration activities are developed.

Exploratory injection well: well that aims to inject fluids into the reservoir to improve hydrocarbon recovery.

Exploratory production well: a well that aims to drain one or more reservoirs from a field.

Exploratory well for deeper prospecting: well that aims to test the occurrence of deeper favorable accumulations or geological conditions in a given area.

Exploratory well for shallow prospecting: well that aims to test the occurrence of favorable accumulations or shallower geological conditions in a given area.

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

Extraction: set of coordinated operations for the extraction of oil or natural gas from a deposit and for the preparation for this activity.

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 holdings: payments to be made by concessionaires of oil and natural gas exploration and production activities, in accordance with the provisions of the arts. 45 to 51 of Law No 9.478 from 1997 and Decree No 2.705 from 1998.

H

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

I

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

M

Marginal fields: inactive areas with no oil or natural gas production or with interrupted production due to lack of economic interest.

Mature basin: oil sedimentary basin with declining production.

Mature fields: oil fields with declining production.

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

N

Notification of Return of Area: written communication on the return of areas, from the Concessionaire to ANP, stipulated in the Contract, containing the list of Reversible Goods in the portion to be returned and the polygon delimitation of the areas to be retained.

O

Offshore: marine environment and land-sea transition zone, or area situated at sea.

Onshore: land environment or area located on land.

Oil: any liquid hydrocarbon in its natural states such as crude and condensed oil, which has its exploration and production governed by Law 9,478 of August 6, 1997.

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

Oil fields: an area producing oil or natural gas. It can be comprised of one continuous reservoir or more than one reservoir, at various depths, and include production facilities and equipment (Source: Law 9,478 from August 6th, 1997).

Oil Production: set of coordinated operations for the extraction of oil or natural gas from a deposit and the preparation for its development, in the terms defined in article 6, subsection XVI of Law 9,478 from 1997. Or, yet, the volume of oil or natural gas extracted during the production phase, as may be inferred from the text, in each case.

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

Oil products: products derived from the oil as it is processed.

Oil refining: activity developed by an industrial unit that uses oil from an E&P field as raw material. Oil products are then generated, through processes of heating, fractioning, pressure, vacuum, and reheating in the presence of catalysts. The products range from lighter ones (refinery gas, LPG, naphtha) to heavier ones (bunker, fuel oil), including solid fractions such as coke and asphalt residue.

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

Onerous transfer: type of agreement for transferring an exploratory area to Petrobras. It is a bilateral negotiation that provides for the payment of a certain amount, determined under the Law 12,276 from June 30th, 2010, that limits exploration to a maximum of 5 billion boe.

P

Payment for occupation or area retention: amount paid by the concessionaires to the 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 the concession area established in the bidding notice and in the contract, being applicable, in succession, to the exploration, development, and production phases. To determine this value, ANP considers the geological characteristics and the location of the sedimentary basin; (ii) monthly, by multiplying the equivalent of 1% of the total oil and natural gas production volume in the field (during the calculation month) by their respective reference prices.

Permanent offer: continuous offer of returned fields (or under return process) and at exploratory blocks offered in previous tenders and not purchased or blocks returned to the agency (Article 4 of CNPE Resolution 17, dated 06/08/2017).

Permanently abandoned well: well where there is no interest in future re-entry and operations were conducted to establish solidary sets of permanent barriers.

Pioneering exploratory well: well that aims to test the occurrence of oil or natural gas in one or more objectives of a geological prospect not yet drilled.

Pre-salt: underground region formed by a vertical prism of indefinite depth, with a polygonal surface defined by the geographical coordinates of its vertices established in the Annex to Law 12,351/2010. May also comprise other regions outlined in a future act of the Executive Branch, according to the evolution of geological knowledge.

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

Production Sharing: regime of oil and natural gas E&P, which provides 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 governed by Law 12,351 from December 22nd, 2010.

Production unit (exploration and production): a set of facilities to promote the separation, treatment, storage, and disposal of fluids produced and moved in an oil and natural gas field.

Producing well: well operating as a producer of hydrocarbons.

R

Repetro eligible products: goods under a special export and import customs regime, that are allocated for the research and prospection activities of oil and natural gas deposits, with suspension of customs taxes.

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

Royalties: financial compensation due to the Federal Government, States and Municipalities, by the oil and natural gas E&P concessionaires. It should be paid monthly, according to the production volume of the month in a given field, from the beginning of production.

S

Sedimentary basin: depression of the earth crust which accumulates sedimentary rocks that may contain oil and/or gas.

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

Shallow waters: ocean waters located at any distance from the coast with seabed depth up to 300 meters.

Signature bonus: an asset offered by the winning bidder in the proposal for obtaining the oil or natural gas exploration concession, that may not be lower than the minimum value set in the bidding document. This resource is destined partially to the Federal Government and partially to ANP.

Special Participation: according to ANP Resolution 12/2014, it is an extraordinary financial compensation due to the Federal Government, States and Municipalities by the oil and natural gas E&P concessionaires, in cases of large production volume or high profitability.

Special well: well that targets specific objectives that do not fit the previously defined purposes.

Storage well: well that aims to allow natural gas storage operations, including injection, withdrawal, and monitoring.

Stratigraphic exploratory well: a well that aims to know the stratigraphic column and obtain other surfaces geological information in a poorly explored basin or region.

T

Temporarily abandoned well with monitoring: well where there is an interest of future re-entry and operations have been conducted to establish joint barriers, which should be periodically monitored and/or checked.

Temporarily abandoned well without monitoring: well where there is an interest of future re-entry and operations were conducted to establish solidary sets of unmonitored and/or verified barriers.

U

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

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

W

Well injecting for storage: well operating as an injector of fluids for natural gas storage.

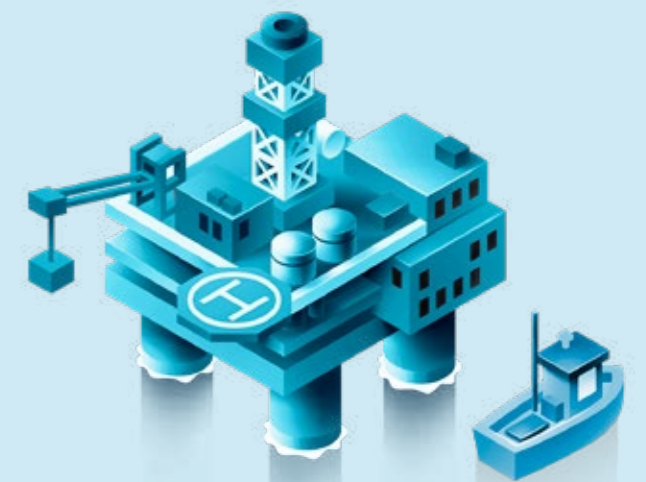
Well under observation: well instrumented for pressure monitoring in hydrocarbon producing reservoir or natural gas storage.

Well operating for disposal: well operating for disposal of fluids produced by other wells or disposal of various effluents generated in exploration and production activities, in zones that do not produce at that time.

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

Well removing stored natural gas: well operating for natural gas withdrawal from a storage reservoir.

WTI (West Texas Intermediate): oil extracted from the Permian Basin in western Texas and eastern New Mexico, traded on the New York Stock Exchange. Its price quote serves as an international reference for the oil price.



ANNEXES

Table 17 - Projects financed with the resources from the RD&I clause in Espírito Santo – 2000-2019

Accredited executing institution	Project title	Oil Company	Start date	End date	ANP authorization
UFES	Technical, environmental, and economic viability of the application of oily sand on neighboring roads and concrete artifacts.	Petrobras	11/23/2000	05/22/2002	-
UFES	Plasma for oil refining and natural gas processing.	Petrobras	11/23/2000	12/25/2002	-
UFES	Oceanographic characterization of the Espírito Santo Basin based on past data.	Petrobras	01/18/2002	08/15/2002	-
UFES	Plasma for oil and natural gas refining.	Petrobras	09/30/2003	09/28/2005	-
UFES	Scientific studies on measuring natural gas flow through ultrasonic sensors.	Petrobras	01/05/2004	12/29/2005	-
UFES	Studies on water resources and continuity of hydro-geological studies of the aquifers of the formations Barreiras and Rio Doce	Petrobras	12/29/2003	12/22/2005	-
UFES	Bi-degradation of marine well drilling fluids to avoid environmental impact.	Petrobras	06/25/2004	12/31/2005	-
UFES	Implementation of methodology for the characterization of oil.	Petrobras	11/03/2004	01/31/2005	-
UFES	Development of a study on the characterization of oily residues	Petrobras	11/29/2004	11/28/2005	-
UFES	Plasma for processing 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 Chemistry Department of UFES.	Petrobras	12/14/2004	06/14/2007	-
UFES	Effects of acid oils on polyamide 11 in flexible pipes DQUI-CCE-UFES.	Petrobras	03/10/2005	03/09/2007	-
UFES	Implementation of the competence center for the exploration and production of heavy oils.	Petrobras	05/01/2005	08/31/2008	-
UFES	Distillation system for curved PEV - ASTM D2892 of oil at LABPETRO UFES and suitability for heavy and ultra-heavy oils.	Petrobras	12/15/2005	12/15/2008	-
UFES	Hydro-geological survey of Espírito Santo.	Petrobras	02/26/2006	02/25/2008	-
UFES	Studies on water resources and water monitoring in the North of Espírito Santo.	Petrobras	04/17/2006	04/16/2010	-
UFES	Implementation and development of methodologies for the determination of metals and sulfur compounds in extra-heavy, heavy oils and oil products.	Petrobras	11/29/2006	11/27/2008	-
UFES	ADD-RPD: Smart system for recognizing defect patterns in motor pumps	Petrobras	12/06/2006	05/18/2011	-

UFES	Suitability of Methodology for Obtaining PEV Curves for Heavy and Extra Heavy Oils	Petrobras	12/18/2006	12/18/2010	-
UFES	Implementation of the laboratory of nuclear magnetic resonance at LABPETRO - UFES	Petrobras	12/20/2006	06/20/2011	-
UFES	Plasma for pyrolysis and natural gas processing	Petrobras	12/20/2006	06/20/2010	-
UFES	Effects of acid oils on polyamide 11 in flexible pipes - Phase II.	Petrobras	07/16/2007	07/09/2011	-
UFES	Numerical simulation for Heavy Oils.	Petrobras	10/11/2007	04/02/2011	-
UFES	Development of scientific studies in Natural Gas flow measurement through Ultrasonic sensors	Petrobras	11/05/2007	04/30/2010	-
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 Near-Dual Formulation of the Contour Element Method in Wave Propagation Problems: Analysis of Complexity Conditions in the Sequence of Radial Functions and Implementation of an Iterative Solution Scheme.	Petrobras	11/18/2008	05/16/2011	-
UCL	Study of Topics in Control and Flow of Fluids and Particulates During Drilling of Wells in Deep Waters.	Petrobras	02/22/2010	08/19/2014	-
UFES	Elaboration of the Executive Project for the Additive of the Scope for the Construction of the Facilities for the Study Group on Oil and Gas Flow and Measurement - NEMOG.	Petrobras	06/16/2010	07/09/2013	-
UFES	Hydro-Geological 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 by the finite volume method, application of the recursive procedure of the dynamic contour element method and optimization of representation of discrete surfaces, potentials and data set through radial base functions.	Petrobras	04/27/2011	11/21/2014	-
UFES	Recognition of defect patterns in centrifugal pumping systems	Petrobras	12/13/2011	04/05/2015	-
UFES	Modeling and Simulation of the Electromagnetic Effect on the Mitigation of Carbon Incrustation	Petrobras	01/02/2012	09/27/2015	-
UFES	Development and Application of New Technologies in the Field of Oil Chemistry related to the Exploration and Production Segment - E&P	Petrobras	01/05/2012	12/28/2016	-
UFES	Development of methodology to study the hydrolysis of chlorides and degradation of naphthenic acids in oils during the process of atmospheric distillation and vacuum	Petrobras	05/02/2012	04/21/2015	-

UFES	Socioeconomic diagnosis of fishing communities in the Espírito Santo Basin and the northern portion of the Campos Basin	Petrobras	08/31/2012	08/19/2017	-
UFES	Phytoremediation of heavy metals	Petrobras	09/03/2012	08/07/2017	-
UFES	Application of alternative analytical technique and chemometrics in the development of a new method for the oil evaluation.	Petrobras	10/31/2012	10/29/2017	-
UFES	Optical Fiber Sensor for Simultaneous Temperature and Oil level Measurement in Onshore Production Tanks	Petrobras	10/31/2012	08/25/2017	-
UFES	Characterization of Asphaltenes and Paraffins through Very-High Resolution and Accuracy Mass Spectrometry (FT-ICR MS)	Petrobras	10/31/2012	10/29/2017	-
UFES	Application of Broadband Powerline Communication Technology for Automation, Oversight and SISP in Onshore Oil Wells	Petrobras	10/31/2012	06/16/2017	-
UFES	Studies of 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 Nuclear Magnetic Resonance Laboratory of NCQP - UFES	Petrobras	10/31/2012	10/29/2017	-
UFES	Studies of the velocity profile behavior in the flare gas measurement section and its influence on the measurement quality: Numerical Simulation, Experimental Studies and Field Analyses	Petrobras	11/13/2012	08/03/2016	-
UFES	Environmental characterization of the Espírito Santo Basin and the northern portion of the Campos Basin (Pelagic and Physical-Chemical System of Water and Sediment) - AMBES Project	Petrobras	11/14/2012	11/12/2016	-
UFES	Assembly of Manual Distillation Unit for Determination of the Evolution of Chlorides in Brazilian Oils	Petrobras	08/21/2013	08/20/2015	-
UFES	Analytical Methods of Oil Evaluation for Use by the Environmental Sector	Petrobras	11/04/2013	12/27/2017	-
UFES	Development of analytical techniques for characterization and quantification of paraffins in oils with focus on logistics and supply activities	Petrobras	02/03/2014	02/02/2016	-
UFES	Expansion of Learning Mechanisms in the Methodology of Recognizing Defect Patterns in Submerged Centrifugal Pumping Systems.	Petrobras	09/25/2014	09/23/2017	-
UFES	Evaluation of the corrosion rate of pre-salt oils and mixtures	Petrobras	12/17/2014	12/15/2017	-
UFES	Diagnosis of the root-cause of UEP oscillations and disturbances	Petrobras	01/07/2015	01/05/2018	-
UFES	Construction of the facilities for the Study Group of Oil and Gas Flow and Measurement - NEMOG.	Petrobras	08/30/2006	02/13/2015	229/2006
UFES	Implementation of the Study Group of Heavy and Extra Heavy Oil Chemistry of the Federal University of Espírito Santo	Petrobras	08/30/2006	02/17/2013	229/2006 153/2009

UFES	Infrastructure adequacy of the Materials Laboratory of the Technology Center at UFES	Petrobras	08/30/2006	02/03/2014	229/2006
UFES	Modernization and expansion of the welding laboratory infrastructure of the Technology Center at UFES	Petrobras	08/30/2006	01/29/2014	229/2006
UFES	Assembly of an outlet simulation loop for the Study Group of Oil and Gas Outlet and Measurement - NEMOG	Petrobras	11/01/2006	05/22/2015	236/2006
UFES	Acquisition of equipment for the implementation of the Study Group of Chemistry of Heavy and Extra Heavy Oils at the Federal University of Espírito Santo	Petrobras	11/01/2006	01/07/2013	236/2006
UFES	Structuring and implementation of five laboratories of Biological and Chemical Oceanography with focus on environmental monitoring of deep waters	Petrobras	11/24/2006	05/05/2014	262/2006 189/2013
UFES	Acquisition of equipment for the implementation of the Environmental Geochemistry Laboratory (Lab GAM) of the oceanographic base at the Federal University of Espírito Santo	Petrobras	07/23/2007	07/10/2013	066/2007
UFES	Physical adaptation of the Laboratory of Computational Transport Phenomena (LFTC)	Petrobras	10/11/2007	12/03/2008	074/2007
UFES	Acquisition of equipment for the assembly of analytical laboratories of research and development support of the Study Group of Chemistry of Heavy and Extra Heavy Oil at UFES	Petrobras	06/06/2008	05/30/2015	064/2008
UFES	Implementation of specific laboratories for the study group of oil and gas outlet and measurement - NEMOG	Petrobras	11/24/2008	05/21/2015	080/2008
UFES	PRH 29 - Promotion of the training in human resources for Oil and Gas, through the support to PRH 29	Petrobras	12/07/2011	05/06/2016	424/2011
UFES	Promotion of human resources training through the granting of scholarships for students of technical courses of interest in the Oil, Gas, Energy and Bio-fuels sector	Petrobras	04/16/2013	03/30/2016	396/2013
UFES	Marine environmental characterization and monitoring in the Espírito Santo Basin (Biological and Chemical Oceanography).	Petrobras	12/09/2014	12/07/2017	341/2014
UFES	Institutional Program of the Federal University of Espírito Santo in Oil and Gas	Queiroz Galvão	09/27/2016	08/31/2017	-
UFES	Research Project for the Numerical and Experimental Study of Physical Methods for Mitigating Incrustation in Wells with Sand Containment	PETROBRAS	07/30/2018	42 months	
UFES	Physical and Physical-chemical effects: Influence of salts in oil acidity - Development of Analytical Methodology to Eliminate Salt Interference in the Determination of the Total Acidity Number (NTA) in Oil.	PETROBRAS	07/30/2018	24 months	
UFES	Optical Fiber in Level and Water-Oil Interface Measurement in Production Tanks	PETROBRAS	09/17/2018	36 months	
UFES	Numerical Simulation of 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 bulk sulfate reducing bacteria from oil reservoirs to high hydrostatic pressure	PETROBRAS	11/29/2018	24 months	
UFES	Optical Fiber in Level and Water-Oil Interface Measurement in Production Tanks	PETROBRAS	01/22/2019	24 months	0698/2018
UFES	Study of asphalt aging, aggregation of asphalt and resins, naphthenates and characterization of lignocellulosic materials by RMN, FT-ICR MS and chemometrics.	PETROBRAS	03/28/2019	36 months	
UFES	Evolution of NST in production lines: Aspects of flow cushioning and optimization of geometries	PETROBRAS	05/03/2019	36 months	
UFES	Development of unstructured numerical methods for seismic modeling	PETROBRAS	06/03/2019	36 months	
UFES	Study, Development and Application of Deep Neural Networks for the Recognition of Defect Patterns in Submerged Centrifugal Pumping Systems	PETROBRAS	06/27/2019	36 months	
UFES	Analysis of Asphaltenes and their subfractions by FT-ICR MS	PETROBRAS	07/04/2019	36 months	
UFES	Acquisition of infrastructure for update and development of R&D project related to the development of methodologies for the evaluation of operational parameters on the flow rate measurement performance of multiphase outlets	PETROBRAS	07/18/2019	24 months	0085/2019
UFES	Evolution of the Size Distribution of Emulsion Drops in the Production Line	PETROBRAS	08/22/2019	36 months	
UFES	Study on the effect of acidity on the quality of oils and water-in-oil emulsions at the stage of primary processing.	PETROBRAS	08/30/2019	36 months	
UFES	Rheological analysis of formations and inhibition of gas hydrates	PETROBRAS	08/30/2019	24 months	
UFES	Laboratory infrastructure project for the acquisition of equipment for the study of emulsions and oils.	PETROBRAS	09/05/2019	24 months	0139/2019
UFES	Elaboration of methodologies for evaluation of operational parameters on the multi-phase flow rate measurement performance	PETROBRAS	09/13/2019	24 months	
UFES	Infrastructure for procurement of R&D project development equipment: Evolution of the Distribution of the Size of Emulsion Drops in the Production Line	PETROBRAS	11/22/2019	36 months	0679/2019
UFES	Study of Carbonate Incrustation Aspects	PETROBRAS	12/17/2019	36 months	
UFES	Expansion of the Laboratory Infrastructure of La-MEFT to Enable Studies of Carbonate Incrustation	PETROBRAS	12/17/2019	24 months	0784/2019
UFES	Evaluation of corrosion on metallic electrode conductor supports, internal to the electrostatic tracer type AC/DC.	PETROBRAS	11/26/2019	24 months	

Fonte: Fórum Capixaba de Petróleo e Gás
Elaboração: Ideies/Findes

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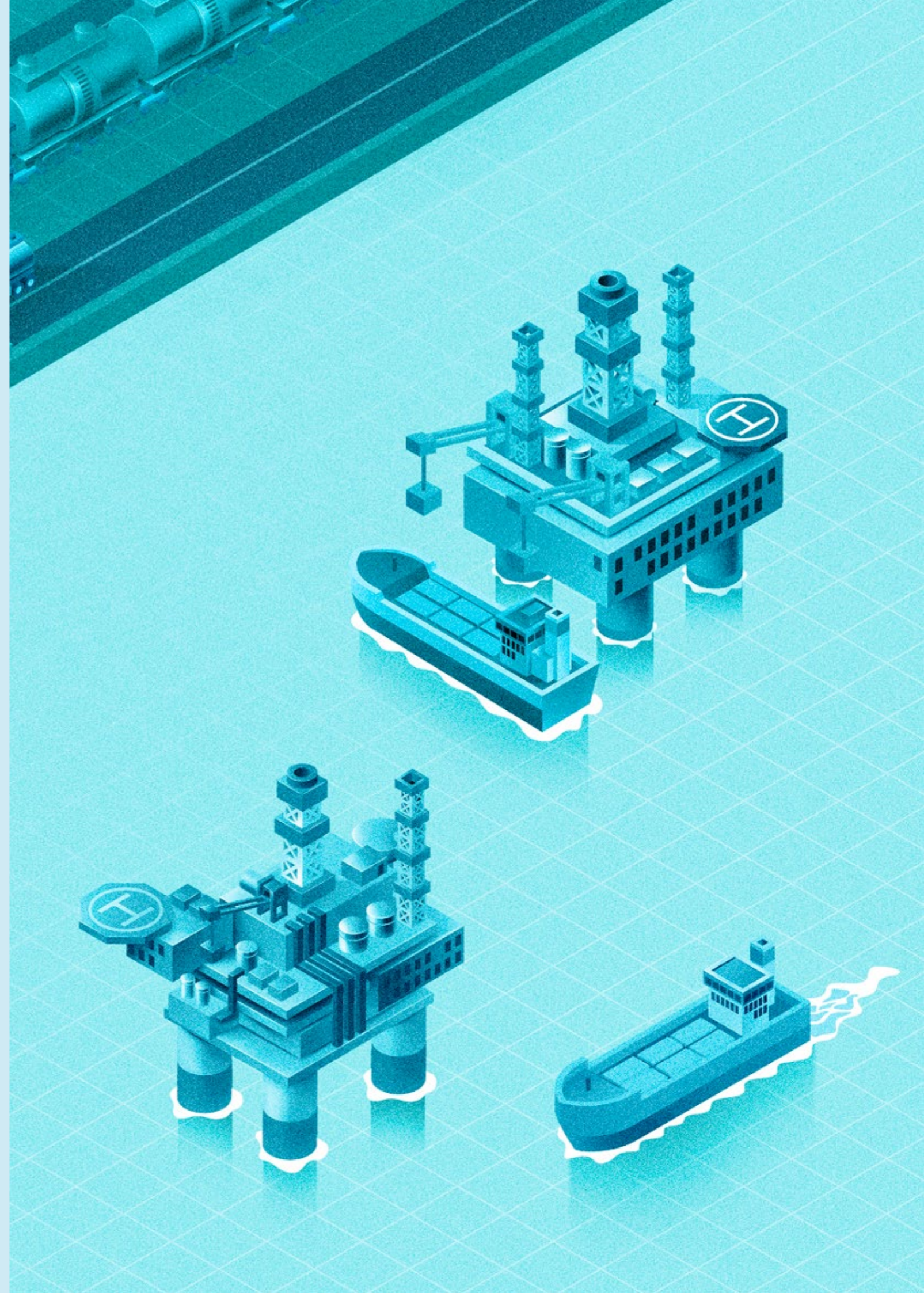
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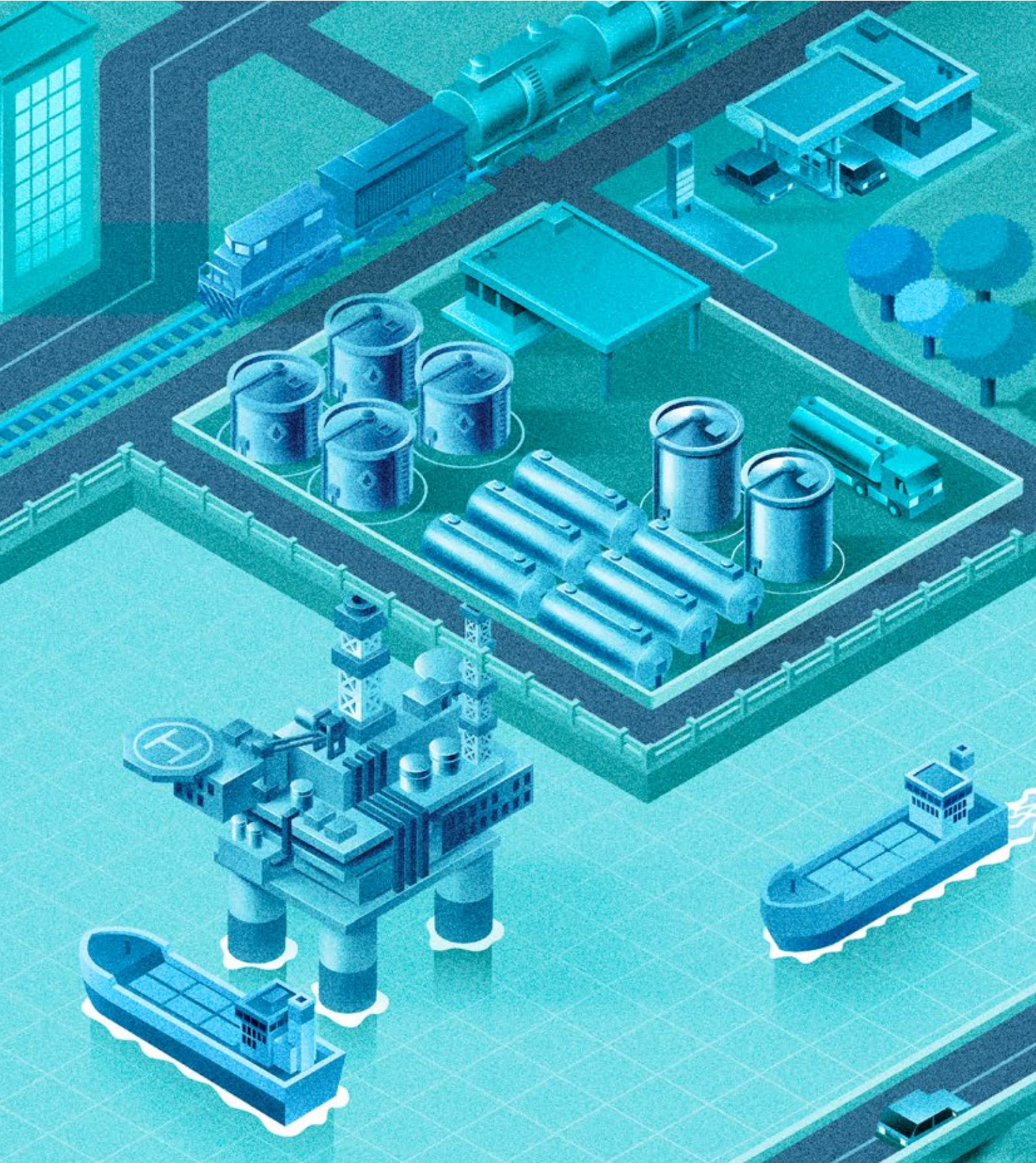
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