RENEWABLE ENERGIES AND THE OIL COMPANIES IN BRAZIL: A STUDY OF ENERGY TRANSITION AND POLICY MIXES

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Abstract

Oil and gas companies have been reinventing themselves, preparing for a future where their old business model will not fit. Companies like Shell, Equinor, Total, and bp have all included renewables in their portfolios in the past few years. This kind of market change is motivated and very dependent on appropriate public policies, like feed-in tariffs and subsidies, which can influence the speed and the direction of an energy transition toward renewables. While most studies about the adoption of renewables by oil companies are from developed countries, the authors have found very few publications about this theme in Brazil, especially involving public policies. Studies for developed countries usually consider an energy transition to reduce oil and gas activity and increase renewables and electrification, but this strategy may not suit Brazil. Brazil already has a large share of renewables in its energy matrix, it has serious social issues, and most of its GHG emissions come from forestry and land-use change. As such, research on the specific case of Brazil is needed. This work aims to understand how public policies in Brazil favor or hinder the adoption of renewables by oil companies and the reduction of efforts in the exploration and production of oil and gas. Through documentary research and interviews of oil and gas professionals, this article analyses the activity and plans of the seven larger oil-producing companies in Brazil and how the public policies influence these companies toward a transition to renewables and a reduction in the oil and gas activity. We analyze the Brazilian energy public policies according to the policy mix conceptual framework proposed by Rogge and Reichardt (2016). As a result, the authors show that though some oil companies in Brazil have made significant renewables investments, their current focus will still be oil and gas in the following years. The authors show the main existing barriers for these companies to adopt renewables. They also make recommendations for Brazil's energy policy mix to facilitate and boost a transition towards low-carbon energy system.

Keywords: Oil and gas; energy transition, public policies, Brazil, renewables.

1. Introduction

In the face of the global energy transition movement, oil and gas (O&G) companies know that their old business model is threatened and should start diversifying their portfolios with other businesses. Shell, Total, bp, and Equinor have all created divisions for renewable energies, and Ørsted has transitioned from a traditional oil company to one of the most sustainable energy companies in the world (PICKL, 2019; TIMPERLEY, 2019; STEVENS, 2016; CORPORATE KNIGHTS, 2022). Public policies are a central element to an energy transition, as they directly affect investment decisions and strategy of companies (MARKARD, 2018; ROGGE, REICHARDT, 2016; SOVACOOL, GEELS, 2016). This article aims to understand how the policy mix of the energy sector in Brazil favors or hinders the transition of oil companies towards renewables and away from fossil fuels.

In a statement about the 2021 IPCC report, UN Secretary-General António Guterres said "[...] *Countries should also end all new fossil fuel exploration and production, and shift fossil fuel subsidies into renewable energy*" (UNITED NATIONS, 2022). Should this be the energy transition strategy for all countries? The authors show that Brazil is going in the opposite direction when ending fossil fuel exploration and its subsidies, at least in the short run. Brazil already has a high renewable's share in its energy matrix. However, it still has to resolve complex social issues on poverty and inequality, whereas developed countries do not have. Most publications on energy transition are from and for developed countries, so it is necessary to have studies on the specific case of Brazil's energy transition (GEELS *et al,* 2017; CHERIF *et al.*, 2020; PICKL, 2019; ZHONG, BAZILIAN, 2018; FATTOU *et al*., 2018; KERN *et al.*; 2019). As such, the central question of this work is "how does Brazil's policy mix favor or hinder its oil companies to reduce efforts in exploration and production of O&G and to increase in renewables?"

To answer the research question, the authors have searched for evidence of activity in renewables and O&G from oil companies (e.g., investment, assets, and investment plans) through documentary research (strategy reports, government reports, news reports, and public interviews). Additionally, we analyzed the public policies for energy in Brazil regarding its consistency with the goals of the transition toward renewables. Our analysis relied on the policy mix framework proposed by Rogge and Reichardt (2016). We also interviewed professionals from O&G and captured their perception of the transition of oil companies and public policies.

We also discuss the main barriers to the transition in Brazilian public policies. We propose directions for the Brazilian policy mix to facilitate the transition of the oil companies toward renewables.

2. The transition of oil companies

Oil companies have sustained their business by continuously finding new reserves, executing enormous projects and not worrying too much about the externalities of their operations (like flaring). In a world with growing preoccupation with climate issues and committed to reducing the use of fossil fuels, this old business model is starting to show signals of failure. One of the pillars of this model is to maximize the company's proved reserves, which means constantly drilling and acquiring new oilfields to increase their expected future revenue. As the access to low-cost oilfields is getting scarce, companies have been exploring oil in places like the ultra-deep waters of pre-salt or from shale. These types of oilfields increase the cost of adding new reserves and producing oil (FATTOUH *et al*., 2018; STEVENS, 2016).

Aware of the increasing difficulties, many oil companies are diversifying their portfolios. One popular strategy is through mergers & acquisition or joint ventures with renewable energy companies, like bp with Bunge and Shell with Raízen in Brazil for ethanol production. Shell has created a "New Energies" division in 2016 to work with hydrogen, renewable energies and electrical vehicles (PICKL, 2019), and Total plans to spend 20% of its CAPEX in renewables and electrical mobility in the 2022-2025 period (TOTAL, 2021a). A case of profound transition was Ørsted's, which was born as a Danish state-owned O&G company in the 1970's and by 2017, it had divested its O&G entirely, and now it is one of the largest renewable energy companies in Europe (TIMPERLEY, 2019).

Oil companies are unlikely to completely transition to renewables, like Ørsted did, as it is very risky to move out of their core business and petroleum products will still be needed for many more decades (STEVENS, 2016). As a first step to decarbonize, oil companies are likely to reduce their carbon intensity, deaccelerate their exploration and production (E&P) of O&G and diversify their business portfolio with cleaner businesses (STEVENS, 2016; FATTOUH *et al*., 2018). According to one of the interviewees, the petroleum politics researcher, national oil companies (NOCs) have different concerns than the international oil companies (IOCs), like ensuring the nation's oil supply and resolving social issues. They are not driven by stock prices as much as the IOCs and they are not pressed for climate actions as the IOCs are, so IOCs are

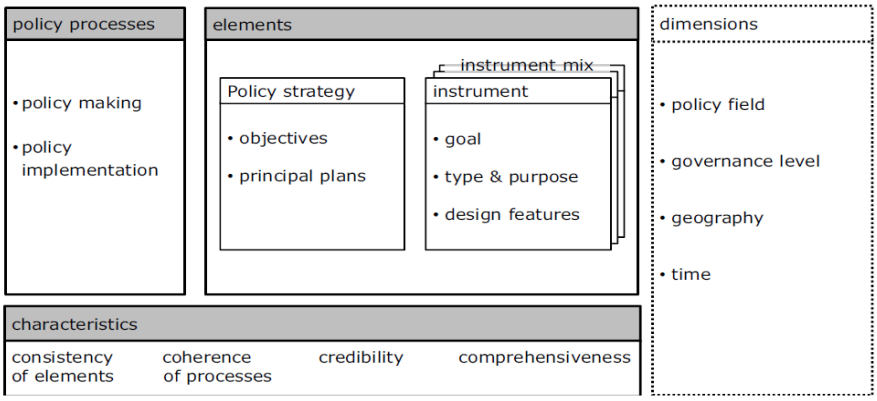
generally pushed to decarbonize faster than NOCs. The interviewee said, "*you don't see protests at CNOOC and Gazprom's doors like you see at Exxon's*". Petrobras, for example, is a NOC and it has a clear strategy to focus on oil and gas production for the next years, with very few activities in renewables (PETROBRAS, 2021a).

3. Policy mixes

Multiple policies influence an energy transition, and there are often conflicting goals among them. Therefore, when studying public policies, it is essential to understand how multiple policies and their sub-elements interact among themselves and how they influence the final goal (GUNNINGHAM, SINCLAIR, 1999; ROGGE, REICHARDT, 2016; KERN et al., 2019). Policy mix refers to a combination of a country's public policies. The policy instrument is a generic term to describe government programs, public measures, laws, regulations, and other tools used by the government to achieve its goals (ROGGE, REICHARDT, 2016). Examples of policy instruments are feed-in tariffs and carbon credits' systems, like the CBIOs from the Brazilian government.

Many authors use policy mixes to advance research on sustainability transitions, especially energy transitions (ROGGE *et al*, 2017; KERN *et al*, 2019). Rogge and Reichardt's (2016) framework for policy mixes is used in the analysis of the policies in this article. Their framework defines three building blocks to classify and break down policy mixes. The first block is the *elements*, which comprises the objectives, plans and instruments of a policy. The second is the *political processes*. The third block is the *characteristics* of the instruments, which is made of the *consistency* among the elements, *coherence* of the process, *credibility* and *comprehensiveness*. The framework helps to limit and explain the scope of what is being compared an analyzed in a policy mix. In this work, for example, the *consistency of elements* is analyzed, while other *characteristics* and the *political processes* are not.

Figure 1 - Building blocks of the policy mix concept



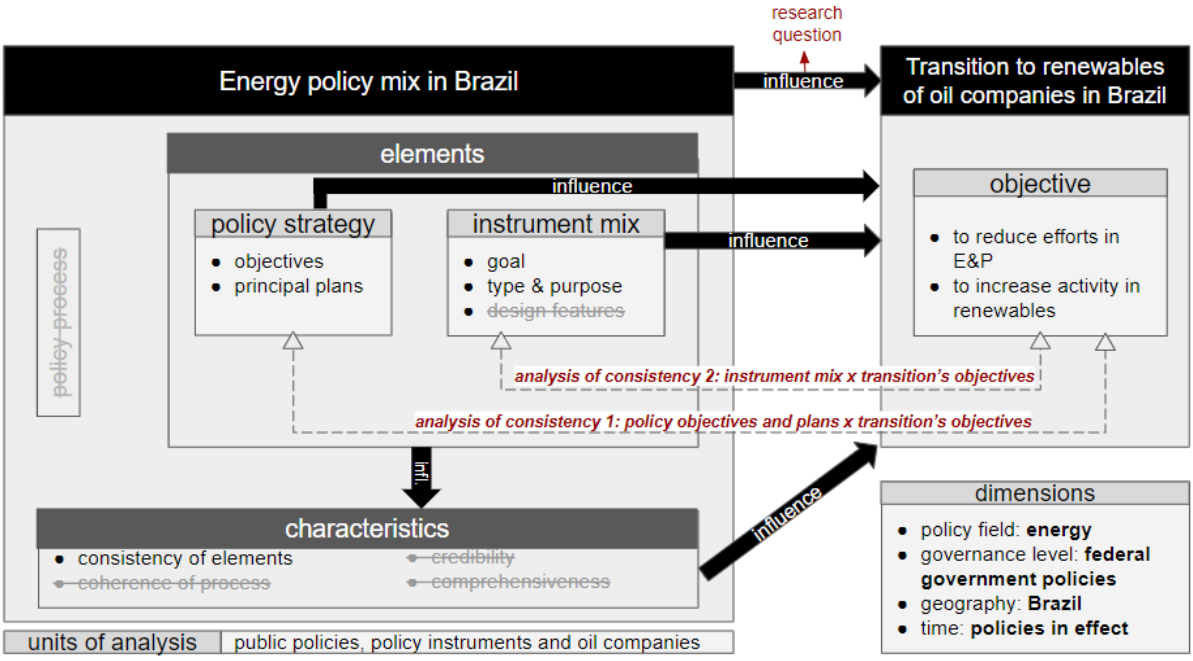
Source: Rogge and Reichardt (2016)

4. Methodology

The central question of this work is "*how does Brazil's policy mix favor or hinder its oil companies to reduce efforts in exploration and production of O&G and to increase in renewables?*". We answer this question by developing knowledge on two interwoven topics in Brazil:

- The current status of energy transition of oil companies;
- The energy policy mix with regards to O&G and renewables.

Figure 2 - Research Design



Source: the authors

Figure 2 shows the research drawing, which was built upon the drawing of the policy mix framework of Rogge and Reichardt (2016, pg. 10-11). The main left box in Figure 2 represents

the universe of the energy policy mix in Brazil. Inside this left box, there are three smaller boxes that represent the three building blocks of a policy mix (the *elements*, the *policy process* and the *characteristics*). Rogge and Reichardt (2016) allege that the link between policy mixes and technological changes are complex, so one can focus on studying only some of the linkages between the blocks to make the analysis simpler.

This study limits the scope of analysis to the linkage between the *elements* and the characteristic *consistency*. According to Rogge and Reichardt (2016, pg. 7), consistency "*captures how the elements of the policy mix are aligned with each other, contributing to the achievement of the policy objectives*", so a consistent policy mix can have all of its goals achieved without trade-offs. An example of two inconsistent policy instruments is Brazil's REPETRO program with the Local Content policy for O&G. The former brings tax exemption for O&G imports, while the latter requires a minimum percentage of goods to be locally acquired by oil companies. REPETRO's tax exemptions hinders the goal of the Local Content policy, which is to develop the Brazil's national industry (SANTOS, AVELLAR, 2017 CBIE, 2021).

This work makes two analyses of consistency:

- Between the objectives of Brazil's National Energy Policy vs. the goals of the transition of oil companies toward renewables (*objective vs objective*);
- Between the energy policy instruments vs. the goals of the transition of oil companies (*instrument mix vs objective*).

It is assumed that the goals of the transition of oil companies toward renewables are:

- To reduce the efforts in exploration and production (E&P) of oil and gas;
- To increase the activities in renewable energy".

Still on Figure 2, the *dimensions* of this study are shown in the bottom right box, defined as per Rogge and Reichardt (2016) and Flanagan's *et al* (2011) classifications. Only current federal policies for energy in Brazil are analyzed. The upper right box represents the transition and its objectives. The black arrows show which elements influence change in each other, like the influence that the instrument mix has on the transition. The research question lies on the influence arrow between the policy mix and the transition. The "policy process" block and the other characteristics (*coherence*, *credibility* and *comprehensiveness*) are crossed out in Figure 1 because they are out of scope of this work.

Through documentary research on government documents and policy articles, the authors started by searching all federal level policy instruments related to E&P and renewable energy, such as the REPETRO and the PROINFA programs. They have all been classified according to their goal, type and purpose, following the classification suggested in Rogge and Reichardt (2016) (see Table 2 and Table 3 in Section 4).

The next step was to analyze the activity of the major oil and gas companies in Brazil regarding E&P and renewables, which is shown in Section 5. The authors wanted to analyze a group of companies that represented most of the oil production in Brazil and included the companies that have most notoriety for renewables activities. This resulted in a group of seven companies: Petrobras, Equinor, Total, Shell, Galp, Repsol Sinopec and bp. This group represents about 95% of oil production in Brazil (according to data from ANP (2021a)) and it includes the oil companies with higher activity in renewables according to the classification of Pickl (2019).

For this group of companies, the authors made documentary research on the annual and strategic reports, news websites, academic articles and reports of energy and petroleum organizations, like the International Energy Agency (IEA), the U.S. Energy Information Administration (EIA), the Brazilian energy research company EPE and the National Agency for Petroleum, Natural Gas and Biofuels in Brazil (ANP). All relevant information about investment, property, investment plans, CAPEX and budget forecasts about both renewables and E&P in Brazil was gathered and they are shown in Section 6.

Based on the ANP database (ANP, 2021c), the history of acquisition of new oil exploratory blocks in ANP bidding rounds has been organized for all these seven companies in charts (Figure 3 and Figure 4). This data is an important indicator of future activity in renewable because if companies have purchased oil blocks recently, it means that they will develop them, and they are likely to produce oil and gas for the next decades. Additionally, it indicates the intention of companies to invest in E&P, as they would not be acquiring new blocks if they plan to reduce their activity in oil production.

Two veteran professionals of the oil and gas industry have been interviewed and their understanding about the transition of oil companies has been captured. The first interviewee is a VP of renewables at an oil and gas multinational that operates in Brazil. The second is a notorious researcher in petroleum politics in Brazil, which has worked in O&G companies in Brazil.

4. Energy policy mix in Brazil

The authors analyzed the goals of the transition against the objectives of Brazil's National Energy Policy (described originally in law 9.478 from 1997 (PLANALTO, 2021)). Results are shown in Table 1.

Table 1 - Consistency Analysis of Brazil's National Energy Policy against the transition

Brazil's Energy Policy Objectives	**Consistency with transition's objectives**
Ensure the supply of petroleum products in all the territory	Inconsistent
Ensure the supply of biofuels in all the territory	Consistent
Increase the use of natural gas	Inconsistent
Increase the share of biofuels in the energy matrix	Consistent
To use alternative energy sources	Consistent
To encourage biomass energy production, as it complements hydro power	Consistent
To promote R&D for renewable energy sources	Consistent
To mitigate GHG emissions, including the use of biofuels	Consistent
Promote a free market and draw new investment for energy production	Neutral

Source: the authors with data from Planalto (2021)

The National Energy Policy aims to increase total production and the share of renewables in the energy matrix, so there are no contradictions with the transition's objective of *increasing renewables activity by oil companies*. There is contradiction in the transition's objective of *reduction in E&P activity* with the Energy Policy's objective of *increasing the use of natural gas*. As for the objective of *ensuring the supply of petroleum products*, it isn't necessarily a trade-off with the *reduction of activity in E&P*, as a reduction can occur, and the supply can still be guaranteed.

Tables 2 and 3 show all the relevant federal policy instruments for renewables and E&P, respectively, classified as per Rogge and Reichardt's (2016) classification regarding to primary type and purpose:

Table 2 - Group of policy instruments promoting renewables

Policy instrument	Instrument description	Desired effect	Primary type	Primary purpose
PROINFA	Feed-in tariff program for long term electricity purchase contracts, with pre-established prices. Includes wind, biomass and small hydropower plants. Participants have a 60% local content obligation.	Demand generation for renewables; diversification of the electricity matrix and development of local industry.	Economic	Demand pull
Net metering	Allows consumers to generate its own electricity and connect it to the grid. The surplus of energy generated creates credits that can be used later or negotiated with others to reduce the bill. Mostly used with solar energy and other renewables.	Promotion of renewable energy and increase of total energy production through small and medium players.	Economic	Demand pull
Tax incentives for solar, wind and biomass	Tax incentives for the use of the energy grid, purchase of equipment and infrastructure.	Promotion of investment in solar, wind and biomass energy production.	Economic	Demand pull
BNDES Finem	Federal financing program for renewable energy projects	Promotion of investment in renewable energy.	Economic	Demand pull
INOVA Energia (BNDES)	Funding for R&D renewables programs	Promotion of R&D investment in renewables.	Economic	Technology Push
EnergIF	Offers training for professionals in renewable energy and energy efficiency areas.	Increased availability of trained professionals in renewable energy.	Information	Technology Push
Blend mandates for biodiesel and ethanol	27% of ethanol blend mandate in gasoline and 15% of biodiesel in normal diesel	Increased of demand for ethanol and biodiesel in Brazil	Regulation	Demand pull
Tax incentives for bi-fuel and ethanol cars	Importation tax for industrialized products is reduced for ethanol and bi-fuel vehicle parts, in comparison with gasoline vehicles.	Promotion of the production of bi-fuel (flex) vehicles	Economic	Demand pull
Tax incentives for production of ethanol	Some taxes, like ICMS (for services and goods), are reduced in the end price of ethanol, in comparison with gasoline's.	Increased competitiveness of ethanol against gasoline	Economic	Demand pull
ABC program	Government financing program for ethanol production, with 6% a.a. interests.	Promotion of investment in ethanol production.	Economic	Demand pull
RenovaBIO and carbon credits	Carbon credit's trading system for biofuel producers, with annual targets of trading volume.	Expansion of biofuels in the energy matrix; predictability for energy investments and contribution to Paris Agreement goals.	Economic	Demand pull
Rota 2030	Federal program to guide the development of vehicles in Brazil. Has a minimum R&D investment for manufacturers and gives tax incentives for cleaner vehicles (efficiency and renewable fuels).	Development of biofuel vehicles; promote investment in R&D for biofuels.	Economic	Technology Push

Source: the authors

Table 3 - Group of policy instruments promoting E&P

Policy Instrument	Description	Desired effect	Primary type	Primary purpose
REPETRO	Importation tax exemption for imported and exported goods for the O&G industry.	Increase the volume and feasibility of local E&P projects	Economic	Demand pull
Local content obligations	Oil companies have minimum quotas of local content in E&P projects for goods and services	Protection and development of local industry	Regulation	Demand pull
BNDES financing	Financing program from federal government (BNDES)	Promotion of investment in oil and gas industry	Economic	Demand pull
PROMAR	Promotion of studies and debates to propose measures (to government) that will increase the production of brown offshore fields through	Increased production of brown offshore fields; increased government income	Information	Systemic
REATE	Program to review taxation and contractual requirements in order to increase production on onshore brown fields.	Increased production of brown onshore fields; increased government income	Economic	Systemic
New gas market	Creation of a committee to implement changes in the gas market; review of law and regulations.	more private investment; more competition; reduction of final price of gas to consumers; harmonization of federal and state regulations, increased production of gas in the pre-salt area.	Economic	Systemic

Source: the authors

Analyzing the instrument mix against the transition goals, the group of instruments promoting renewables (Table 2) has synergy with the transition's objective of *increasing renewables activity*, while the group promoting E&P (Table 3) conflicts intending to *reduce activity in E&P*.

One of the interviewees, the oil company VP, said that "*the oil business would secure our income while our company shifts to renewables*", supporting that instruments that promote O&G may indirectly support and increase investments in renewables by oil companies. In line with that view, the other interviewee said that oil companies have had "waves" of investment in renewables in the past, and all these waves happened in periods of high oil prices, and they ended when oil crises came. This supports the idea that higher profitability in O&G motivates oil companies to invest in renewables, thus policies supporting E&P may indirectly allow more investment in renewables by oil companies.

When asked which factors slow down the most the transition of oil companies toward renewables in Brazil, the interviewees listed:

a) **Lack of an integrated planning for energy in the government**

> *"We are missing a high level plan. From this plan, all public policies would be created. With that you can organize financial incentives, innovation instruments, infrastructure and things will happen because you know the priorities. Today you [the government] are talking about hydrogen while you haven't even finished the Gas Law. You have offshore wind farms requisitions and you don't have its regulatory framework ready. This happens because the federal institutions are uncoordinated." (Interviewee, petroleum politics researcher).*

b) **Lack of regulations for new energy sources, for example, offshore wind.** Oil companies are specially interested in offshore wind due to their know-how in maritime and subsea operations, which is an advantage against traditional energy companies.

c) **Lack of infrastructure.** The interviewee (oil company VP) said "*In the case of offshore wind, transmission lines will be needed in the coast, which involves expropriation. On top of that, public construction in Brazil takes too long*".

d) **Balancing the regulations with regards to tributes and benefits for different energy types** "*policy making takes too long in Brazil and renewables are not a priority in the congress*" (Interviewee, petroleum politics researcher).

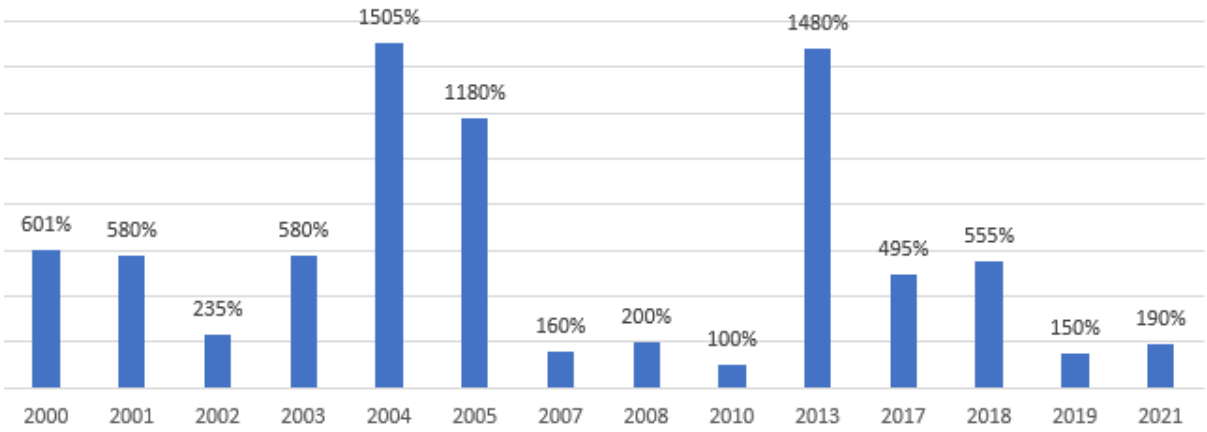
According to the Energy Policy and to Brazil's Decennial Energy Plan (MME, 2021), from the Ministry of Energy, the core energy fuels for Brazil will still be hydro power, biofuels and petroleum products in the 2021-2030 period. Other renewables and natural gas are considered complementary fuels to the core ones, but they are still promoted by government. The strategy for Brazil's Energy Policy is not to transition from fossil fuels to renewables, as there is no policy instrument to limit or reduce E&P activity.

5. Activity of oil companies in Brazil

Figure 2 shows all the acquisitions in bidding rounds by Petrobras and Figure 3 shows acquisitions of the other six oil companies considered in this study. The bars show the sum of

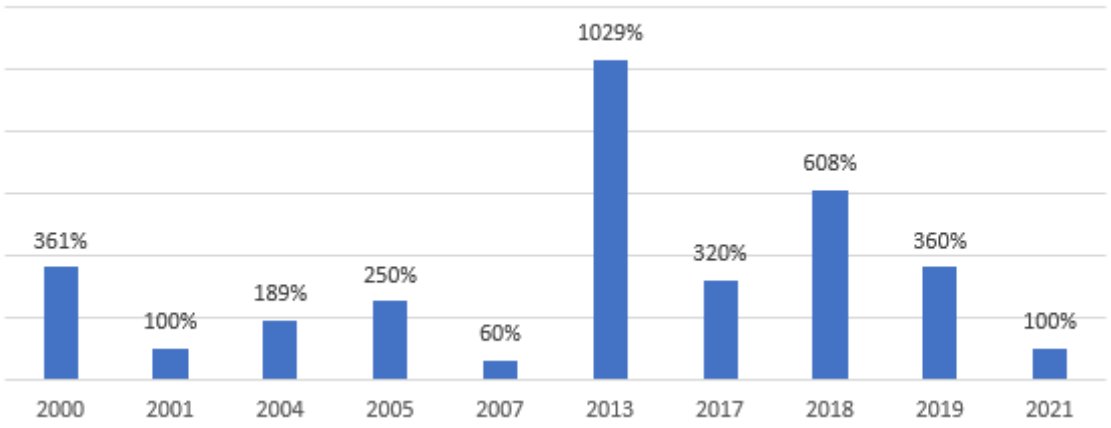
participation shares, where 100% would mean to own an entire block. The period considered is from 2000 to 2021, but bidding rounds started in 1997.

Figure 3 - Acquisition of exploratory blocks per bidding round - Petrobras



Source: adapted from ANP (2021c)

Figure 4 - Acquisition of exploratory blocks per bidding round non-Petrobras - Shell, Galp, Repsol, Total, Equinor and bp



Source: adapted from ANP (2021c)

Table 4 compares the rate of acquisitions of exploratory blocks per year in the 2015-2021 period with the rate of the 2000-2021 period (2015-2021 average ÷ 2000-2021 average) and shows companies daily production. The 2015-2021 period was chosen because it represents recent acquisitions and the period after the Paris Agreement.

Except for Galp, Petrobras and Total, all the other companies have acquired more blocks in bidding rounds in average in the 2015-2021 period than in the 2000-2021 period. This indicates

that the acquisitions of new oilfields in Brazil is still quite active and that companies will be developing many oilfields in the next years.

Table 4 - Average rate of acquisition of blocks in ANP bidding round in 2015-2021 compared to 2000-2021

	Petrobras	Shell	Galp	Repsol Sinopec	Total	Equinor	bp
(2015-2021 rate) / (2000-2021 rate)	63%	153%	46%	274%	68%	188%	180%
Daily production	2.723.491	415.349	128.994	72.637	50.595	33.065	0

Source: adapted from ANP (2021c)

When asked if oil companies are really transition to renewables or if they are trying to maintain the "*status quo"*, both the interviewees said that, in their opinion, the current focus of these companies in Brazil right now is O&G.

> *"Honestly, their [oil companies in Brazil] focus today is to make money with fossil fuels. Period. They have invested a large amount of money in Brazil buying fields, including Shell, Equinor and CNOOC. They'll want a return on their investment" (Interviewee - oil company VP).*

Galp has announced a target to increase by 25% its oil production in Brazil by 2025 (compared to 2021) (PETRÓLEO HOJE, 2021). Total has a target to reach 150.000 boe/d, 150% more than 2021 (TOTAL, 2021a). Other companies did not inform a target but they will keep developing their blocks, like Bacalhau and BM-C-33 for Equinor and Pau Brasil for bp.

Although these companies do not show signs of reduction of their E&P activity in Brazil in the next few years, most of them are increasing their renewables activity. Petrobras, Shell, Total, Equinor and bp, they all have renewable energy assets already producing in Brazil, like biofuels, biogas, onshore wind and solar power. Shell and bp are notable for ethanol production, both through joint ventures (with Raízen and bp Bunge, respectively). In solar and wind, Petrobras, bp, Total and Equinor are producing significant amounts of energy already. Repsol Sinopec and Galp are the only ones of the seven companies considered here that do not have any renewables assets producing or planned for Brazil (Petrobras, 2021a; Shell, 2021c; Galp, 2021b; Repsol Sinopec, 2021a; 2021d; Total 2021a; 2021b; Equinor, 2021b; 2021c; bp, 2021a; 2021c; 2021d).

Table 5 - Summary of activities in renewables for the oil companies in Brazil

	Petrobras	Shell	Galp	Repsol Sinopec	Total	Equinor	bp
Current activities in Brazil with renewables	Small hydro, onshore wind participations and solar	Ethanol (1st & 2nd gen.), biogas	None	None	Onshore wind, solar	Solar	Biofuels, solar
Planned activities for renewables in Brazil	Development of HBIO diesel technology	Solar plants projects (total 1.8 GW); Ethanol production expansion to 3.75 bi liters per year	Intention of investing in solar and wind, but no concrete plans	None	2 onshore wind plants under construction	To start the offshore wind segment and to increase solar power capacity	2 GW of extra solar power capacity planned
Renewables Power capacity in Brazil estimate	Onshore wind 52MW, solar 5MW *(includes participations)*	2,5 bi liters/year ethanol; 21 MW biogas	None	None	Solar 140 MW; Onshore wind in construction 160 MW	Solar 70 MW *(joint venture with Scartec)*	3,2 GW [13] from solar and biomass electricity; 1,8 bi liter/year ethanol *(j.v. w/Lightsource bp and bp Bunge)*

Source: Petrobras (2021a); Shell (2021c); Galp (2021a); (2021b); Repsol Sinopec (2021a); (2021d); Total (2021a); (2021b); Equinor (2021b); (2021c); bp (2021a); (2021c) and (2021d).

Five of the seven analyzed companies already have renewables activities in Brazil, and all these five companies have concrete plans to increase their renewable production capacity from a very diverse range of energy sources. It is important to note that oil companies are relevant players in the renewables market. In the ethanol market, Shell's joint venture with Raízen is the largest producer in Brazil, while bp Bunge are in the top 4 (UDOP, 2022b), and Lightsource bp has a huge capacity of 2.2 GW from solar.

Table 6 shows the average share of CAPEX planned for the renewables segment for the next few years for these oil companies globally. We can see that, except for Petrobras, all the companies are securing a significant amount of their resources with renewables, even though they might not be spent in Brazil.

Table 6 - Estimate declared share of renewables in CAPEX for the next few years (2021-2025)

	Petrobras	Shell	Galp	Repsol Sinopec	Total	Equinor	bp
Share of CAPEX for renewables	0%	12,20%	35%	26%	20%	12% (2021)	15% (2021)

Source: same as Table 6

Total, Shell, Equinor and bp all have informed values around 2 to 3 billion USD per year to be spent in renewables in the next years, globally. For comparison, Shell will spend USD 8 billion in E&P in the next few years, and bp had planned USD 9 billion for 2021 in E&P (Total, 2021b; Equinor, 2021c; bp, 2021c; Shell, 2021c).

6. Conclusion and results

One of the main expectations of the current global energy transition is to radically reduce GHG emissions from energy use, and many people understand that this will be done by quitting fossil fuels and replacing them with renewables and electrification. Brazil is ahead of most countries regarding total use of renewable energy, with a vehicle fleet that can run almost entirely with biofuels, a meager share of coal, and most of its electricity coming from hydropower (EPE, 2020). Unlike most developed countries, Brazil's GHG emissions don't come from energy use. They come primarily from land-use change and the forestry sector (CARBON BRIEF, 2022).

The petroleum politics researcher interviewed said, "*each country will make the energy transition that it can afford*". She said that Brazil has poverty and inequality issues that developed countries do not have, so it is a legitimate strategy to maintain the oil business for economic and social reasons and reduce emissions in non-energy sources. As developed countries pressure their oil companies to decarbonize, IOCs might seek new projects in countries without restrictions and with subsidies to O&G, like Brazil and some African countries. Many major oil companies in Brazil have plans to increase O&G production and make a significant investment in the renewable segment.

Brazil's public policies seem to favor O&G more than renewables as the petroleum segment has a more comprehensive set of political benefits than other energy sources. Petroleum has federal institutions to coordinate the market (e.g., ANP and SPG), a mature regulatory framework, tax benefits (e.g., REPETRO), financing programs, and R&D mandates. Petroleum also does not have the distribution infrastructure problems of natural gas and electricity in Brazil.

According to Rogge *et al.* (2017), transformative policy mixes for sustainability transitions "*need to combine different instruments addressing multiple market and system failures by fulfilling different purposes, such as technology push and demand pull*". In order to speed up investments in renewables in Brazil, the authors recommend that public policies should have:

- **Regulatory frameworks for all renewable energy sources**, which will allow new projects to be developed, predictability for investment and a competitive energy market;
- **Regulatory agencies for all renewable energy sources**;
- **Established plans for the energy sector**, which will guide the creation of new policies and instruments;
- **Policies to speed up the development of infrastructure for energy;**
- **Restrictions and removal of subsidies for fossil fuels** while creating more subsidies for renewable technologies that are still not competitive, like 2nd generation ethanol and offshore wind.

We should expect oil companies in Brazil to maintain oil as its main business for the next decade, and renewables will be complementary and a growing business. For now, oil companies will most likely invest in renewables because they want to de-risk their future operations, not relying solely on petroleum products, and because they want to keep their "license to operate" to satisfy their stakeholders. However, certainly an energy transition toward renewables by the oil companies will not occur if public policies do not lead that way.

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