

Energy transition ambitions of four national oil and gas companies in South America

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Authors' contributions

While employed at SEI, Patricio Calles Almeida collected the data and developed the conceptual framework for the analysis with support from Elisa Arond. Claudia Strambo updated the research and led the report writing, with support from Elisa Arond. Strambo and Arond addressed the peer-reviewer's and editor's comments and finalized the text for publication.

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Key messages

- National oil and gas companies, or NOGCs, must transform to survive and fit into a new global dynamic for mitigating the impacts of climate change. While navigating their roles in generating public revenue and domestic employment, enabling public services, and other characteristics, they will also have to overcome institutional barriers in order to accelerate their diversification into non-fossil fuel businesses.
 - Diversification to new low-carbon businesses is a part of but not the priority for decarbonization for four of South America's NOGCs. These four South American NOGCs have limited capacity to expand into new low-carbon businesses.
 - More research is needed to assess and strengthen South American NOGCs' preparedness for a transition to a low-carbon future, including factors such as financial, technical and managerial capabilities, and their role in national and global political economies.
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1. Introduction

A rapid phase-out of fossil fuels is critical to addressing climate change (Pye et al., 2020; Rogelj et al., 2018). To meet the goal of limiting global warming below 1.5°C and well below 2°C (SEI et al., 2021), global fossil fuel production must start decreasing right away.

Nevertheless, governments of major oil and gas-producing countries plan to double production of fossil fuels by 2030. Intended investments by 71 of the more than 100 national oil and gas companies (NOGCs) in the world could amount to almost USD 2 trillion in hydrocarbon extraction over the next 10-year period, thus risking hundreds of billions of dollars becoming economically unviable or stranded (Fleming, 2022; Manley & Heller, 2021).

These companies hold around 66% of global oil reserves and 58% of gas reserves (IEA, 2021), and they provide 40% of the capital invested in the global oil and gas industry (Manley & Heller, 2021). Because of their important role in countries' fiscal, economic and governance systems, NOGCs face institutional and technical challenges to adapt and transform in the context of the energy transition and climate mitigation.

A low-carbon energy transition represents an existential threat to NOGCs because of their current missions and fossil fuel-dominated asset portfolios. However, NOGCs can play a crucial role in efforts to achieve domestic and global climate goals, as well as to harness new opportunities in the energy sector, such as low-carbon electricity, power trading and aggregation, or energy efficiency (International Energy Agency, 2020). Navigating such a transition represents a significant challenge, and NOGCs have taken diverse approaches to navigate the transition.

This report explores what (if any) diversification strategies NOGCs are employing to engage in an energy transition, with a focus on four South American countries: Argentina, Brazil, Colombia and Ecuador. The primary audience for this report is energy and finance researchers, professionals working within NOGCs, and policymakers shaping NOGCs' missions, strategies and investments. This report aims to serve as a resource for comparative analysis and to inform transition strategies in oil and gas-producing countries.

Like international oil and gas companies, NOGCs have historically had a focus on providing a financial return to shareholders, whether public, private or mixed. However, due to their public nature, NOGCs have a wider range of objectives compared to international oil and gas companies, including financing the owner state, contributing to energy security, fostering technological development, and generating employment domestically (Eichengreen et al., 2016; McPherson, 2003; Tordo, 2011). Typically, an NOGC's mandate is primarily determined by its country's government, allowing it to play a key role in a country's political system. As a result, they face

political pressure to operate efficiently and not deviate from their core businesses (Fattouh et al., 2019) and are limited in their transformational capacities by political cycles and instability (Åhman, 2021).

Because of their importance to national and regional economies, NOGCs can play a significant role in supporting or even leading economic diversification to improve the resilience of national economies and help address climate goals (International Energy Agency, 2020). Indeed, states with a pronounced dependence on fossil fuel revenues are more vulnerable to rapid changes in global markets. Such dependency was made clear, for instance, after the 2014 oil price crash, when multiple NOGCs' fiscal contributions decreased more steeply than their revenues (Heller & Mihalyi, 2019).

The future role of NOGCs in energy systems is also pertinent because of these companies' increased global relevance in oil and gas supply and energy security. As established companies that have been influenced by both sector-specific and general macroeconomic threats, such as "peak oil" and financial crises, their transformational ambitions and capacities will be the basis for reorienting future energy systems to support or even lead energy transitions and mitigate climate change.

Around the world, NOGCs may respond to a carbon-constrained world in different ways (van de Graaf & Verbruggen, 2015). For example, many IOGCs and NOGCs have made commitments to reduce their greenhouse gas emissions through adopting low-carbon technologies in their operations, reducing fugitive methane emissions, and carbon offsetting (Viscidi et al., 2020). The four South American NOGCs studied here have done the same (see Table 1, which describes their emissions target and climate mitigation pathways). However, such an approach alone does not address the root cause of the climate problem, and some critics have argued it is a distraction from the need to phase out fossil fuel production and change core business strategies completely (Kenner & Heede, 2021).

Table 1. Emissions target and climate mitigation pathways for four South American NOGCs (presented in alphabetical order)

Company	Long-term emissions target	Climate mitigation pathways	Source
Ecopetrol (Colombia)	Net-zero greenhouse gas emissions by 2050 (Scope 1 and 2) Reduce total emissions by 50% by 2050 (Scope 1, 2, 3) Reduce methane emissions by 55% by 2030	Energy efficiency improvements Flaring reduction Renewables Fugitive emissions reduction Nature-based climate solutions	(Ecopetrol, 2021; Ecopetrol Group, 2022, 2023)
EP Petroecuador (Ecuador)	Reduce greenhouse gas emissions by 410 000 tCO ₂ e by the end of 2023 — compared with 2022 — by 610 000 tCO ₂ e in 2024 and by 1.32 million tCO ₂ e/year in 2025–2030	Energy efficiency improvements Flaring and fugitive emissions reduction Biofuels in operation	(EP Petroecuador, 2023; Viscidi et al., 2020)
Petrobras (Brazil)	Neutrality of operational emissions in 2050 (Scope 1 and 2)	Eliminating flaring Fugitive emissions reduction Carbon capture use and storage Electrification of operations Energy efficiency improvements Renewables Nature-based climate solutions	(Petrobras, 2022, 2023)
YPF (Argentina)	Reduce the intensity of direct operational CO ₂ e emissions by 10% by 2023 compared to 2018	Energy efficiency improvements Flaring and venting reduction Operations electrification Use of low-carbon energy sources	(YPF, 2018)

An alternate response is business diversification. Such strategies include transitioning from fossil fuels into renewable energy, electricity distribution or energy services, such as energy efficiency, battery storage and electric vehicle charging, or data analytics and energy audits (International Energy Agency, 2020). Some international oil and gas companies and even some NOGCs (e.g. Ørsted in Denmark) have already started to diversify due to shareholder or citizen pressures (Danish Energy Agency & State of Green, 2021; Pickl, 2019).

Business diversification is an important indicator of an oil and gas company's preparedness for a low-carbon energy transition (Shaw & Donovan, 2021). For international oil and gas companies and NOGCs, other advantages to diversification can be had besides reduced emissions; examples include improved resilience and reduced vulnerability to external and domestic pressures, such as oil and gas price volatility, supply disruptions, environmental disasters and investor pressure. For the NOGCs that have so far failed to adapt to the industry's ongoing transformation, gradually reducing the weight of oil and gas assets in their portfolios could also serve to minimize exposure to such risks. For those that have already begun to adapt, they have an opportunity to develop their leadership and grow in importance in a fossil fuel transition.

In this paper, we identify how four South American NOGCs are preparing to transform in the face of climate change and the energy transition. We do so by looking at these companies' publicly stated ambitions regarding diversification: we focus in particular on whether and how they are leaving fossil fuels behind, as a sign of transforming their core business and moving towards a more structural transformation overall in society.

The four South American NOGCs on which we focused are Ecopetrol (Colombia), Petrobras (Brazil), Yacimientos Petrolíferos Fiscales (YPF, Argentina) and EP Petroecuador (Ecuador). While all four companies are controlled by their national governments, three are also public companies that are traded on domestic and international stock markets.

The analysis is based on publicly available information, including official communications such as energy transition strategies, business plans, investor relations presentations, press releases and earning calls, as well as public comments made in conferences, webinars and media appearances. An important caveat to this research is the recognition that companies may increase their financial risk by publicly sharing medium and long-term detailed business plans, and thus publicly available information may not fully represent the long-term plans of each company and limits the scope of this investigation. Nevertheless, public information provides useful information on the scale of NOGCs' activities, influence, performance and strategies (Natural Resource Governance Institute, 2019).

The academic literature on corporate diversification contains many approaches to identifying, defining and measuring diversification of firms. We do not take a quantitative approach to measuring diversification of NOGCs, nor do we attempt to evaluate the success or strategic fit of firms' diversification strategies (see for instance Halttunen et al., 2023; Zhong & Bazilian, 2018). We drew on publicly available documents (primarily focusing on those available through firms' websites) to identify types or categories of firm activities or proposed priorities that we characterized as diversification away from core fossil fuel-based businesses. In other words, we searched for any indication of efforts or future strategies indicating unrelated diversification, with a focus on those that explicitly move away from fossil fuels.

The paper is organized as follows: Section 2 introduces some key conceptual considerations about business diversification strategies, including the difference between related and unrelated diversification. Section 3 presents analyses of the four South American NOGCs' diversification approaches. And Section 4 closes with reflections on the main takeaways and important governance implications.

2. Diversification strategies

Most theory on corporate diversification – also referred to as business diversification (Wiersema & Beck, 2017) – was formulated and advanced during the 1970s and 1980s, driven by unpredictable economic cycles and primarily oriented towards formulating strategies for risk reduction and profitable expansion into conglomerates (Rumelt, 1982). Diversification is characterized as either related or unrelated, based on the similarities or differences in technological requirements and market overlap between existing and new (diversified) businesses or products. Related diversification refers to businesses that have similar markets, distribution systems, production technologies or build on similar science-based research. Unrelated diversification refers to new businesses that generally do not share the same attributes or strategic connections to existing business. Applying a similar reasoning to international oil companies, Halttunen et al. (2023) referred to these approaches as “transition of the oil business” and “transition through other business”, respectively (pp. 5–6).

Companies may pursue both related and unrelated diversification, but some studies have characterized unrelated diversification as more challenging (Zhou & Delios, 2012) and less likely to become profitable due to the costs associated with managing a more complex portfolio, whereas related diversification can benefit from existing capabilities and resources and foster economies of scale and scope (Palepu, 1985). However, unrelated diversification can be an appealing strategy to firms when internal financial resources are available for investment, for example, to acquire another business, or based on strong research and innovation capabilities (Chatterjee & Wernerfelt, 1991). Unrelated diversification may be sought when core businesses are threatened by changing economic or social circumstances (markets, regulatory environments, consumer preferences, etc.).

International oil and gas “majors”, for example, have diverged in their strategies since the pandemic and in response to climate change concerns by shareholders. Their divergence highlights differences between European and North American international oil and gas companies, with the former placing greater emphasis in expanding their portfolios of renewable energy and services, and the latter tending to “double down” on oil and gas production, while their concessions to climate have focused on technologies to improve efficiency (Fitz et al., 2021). Table 2 provides examples of related and unrelated diversification in the oil and gas sector.

Table 2. Examples of related and unrelated diversification in the oil and gas sector

Related diversification	Unrelated diversification
Oil and gas in new geographies	Geothermal energy and subsurface studies
Refining and fuels	Renewable energy production
Fossil fuel transport and storage	Energy storage and electricity systems
Fossil fuel marketing	Strategic minerals
Fossil fuel-intensive infrastructure	Road infrastructure
	Bioproducts

In the context of NOGCs, related diversification strategies include expanding exploration and production activities – especially of natural gas – to new locations and developing other parts of the petrochemical supply chain. While these activities may reduce risk (Gould & Al-Saffar, 2018) and thus could succeed in pleasing shareholders (e.g. of international oil and gas companies or publicly traded NOGCs), they deepen the dynamics of “carbon lock-in”. In other words, they can reinforce the interlinked technological, institutional and cultural factors that perpetuate carbon-intensive pathways, despite the existence of economically and technically equivalent or superior low-carbon alternatives (Erickson et al., 2015; Seto et al., 2016).

In turn, this increases the risk of assets being stranded and NOGCs failing to fulfil their public responsibility and mission (Bauer & Fontenit, 2021; Manley & Heller, 2021). Related diversification also maintains states’ economic and fiscal dependence on the oil and gas industry. Unrelated diversification, which usually requires developing some innovative capacity, however, presents the opportunity for the company to capture value in the long-term and to increase resilience in the face of market volatility and other challenges (International Energy Agency, 2020; Peszko et al., 2020). Some types of unrelated diversification may still be energy-intensive or have limited or questionable sustainability benefits, as indicated by some examples in Table 2.

3. Diversification strategies of four South American NOGCs

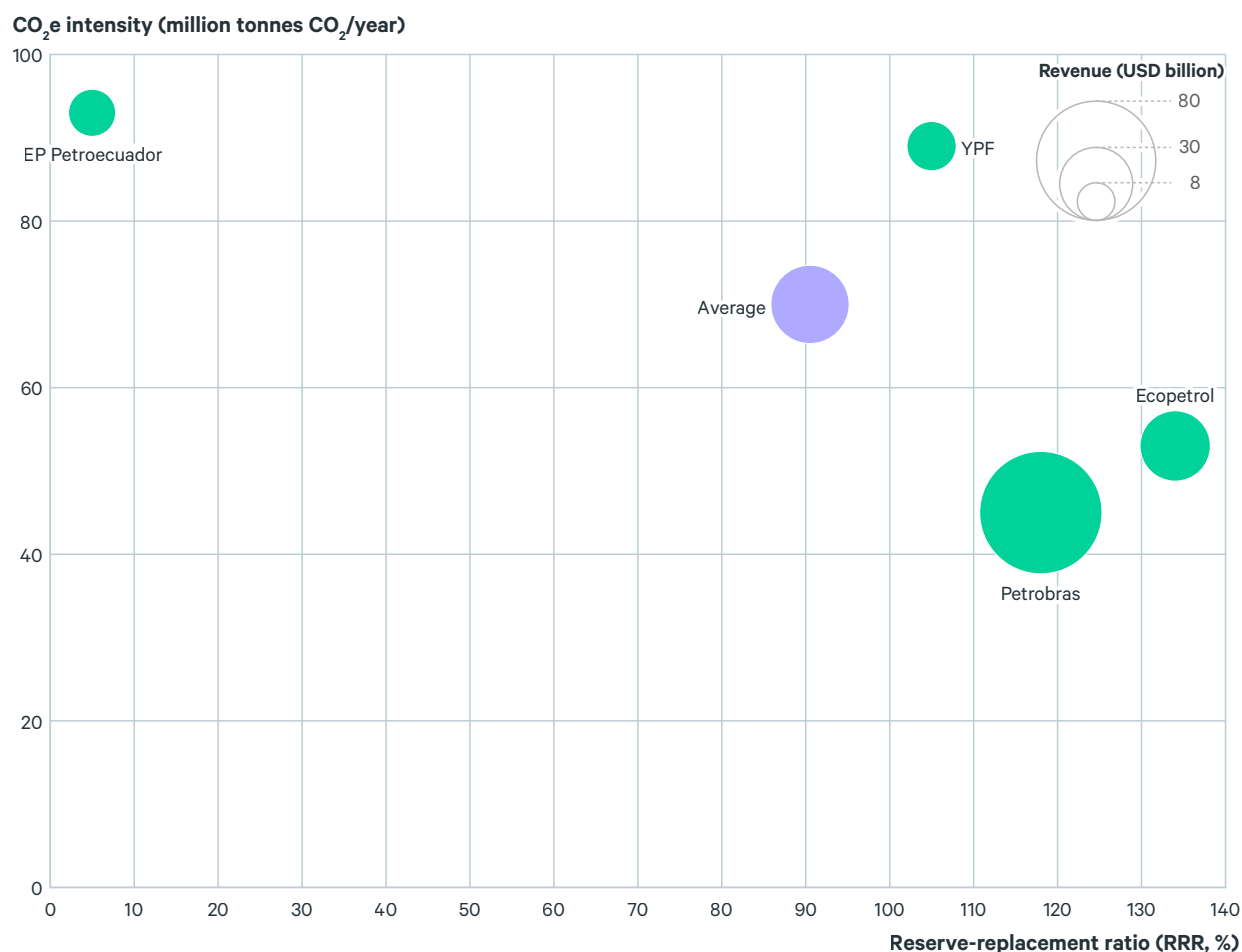
After providing some background information about the four NOGCs on which we focused, we describe our findings. First, we discuss their unrelated diversification strategies, followed by analyses of their approaches to unrelated diversification.

3.1 Differences in NOGCs’ characteristics

In general, NOGCs are not a homogeneous group, including the four on which we focus here (Hartley & Medlock, 2013; Rousseau, 2015). For instance, NOGCs might differ in terms of the extent of their climate impacts, the level of their production costs, and the level of economic dependence of their home country on oil and gas (Natural Resource Governance Institute & International Institute for Sustainable Development, 2021). Companies’ size can differ too, spanning from global players that develop and manage international projects independently, to small companies that manage small equity stakes or oversee their own country’s oil sector (Manley & Heller, 2021). While some NOGCs are high-performing, many are ill-prepared to adjust to shifts in the global energy landscape (International Energy Agency, 2020). Producers with high production costs and more carbon-intensive extraction processes are particularly at risk (Gupte & Hickin, 2021).

The four NOGCs studied in this report differ in a variety of ways. For example, these companies have different reserve-replacement ratios (RRRs) – the quantity of oil and gas added to a company’s reserves divided by the amount extracted for production – and carbon intensities, as illustrated in Figure 1. Both EP Petroecuador and YPF have very intensive emissions; YPF can barely compensate production at its current RRR, while EP Petroecuador is in clear deficit, which suggests they both already face significant challenges with their oil and gas assets and might lack resources to navigate a low-carbon transition. Meanwhile, Petrobras and Ecopetrol are less carbon-intensive and have higher RRRs, which is an indicator of their future profitability and financial capacity to allocate resources to bolster energy transition efforts (Branson, 2021; Vivoda, 2009).

Figure 1. Variation in four South American NOGCs' key characteristics for a clean energy transition.



The reserve-replacement ratios (RRRs) presented here are the average for the period 2017–2021, except for EP Petroecuador. There is very little information publicly available on the state of EP Petroecuador's oil and gas reserves. The company's RRR is calculated based on 2020 data only (Salvador & García Álvarez, 2023; Vera Grunauer, 2021). Moreover, in a 2023 national referendum, Ecuadorians voted to stop oil extraction in the Ishpingo, Tambococha and Tiputini fields (ITT), which are located in the Yasuni natural reserve. The ITT has some of the largest reserves in the country and provided about 12% of national production (Collins, 2023). The specific implications and long-term effects of this decision on EP Petroecuador's operations and Ecuador's overall energy landscape remain uncertain.

Source: Authors' analysis from companies' investor relations reports (2017–2022), as well as news reports (Argus, 2023; Statista, 2023).

3.2 Evidence of unrelated diversification

Our review indicates that Petrobras, Ecopetrol and YPF have included unrelated diversification in their long-term strategies. For example, Petrobras' 2040 Strategic Plan mentions the goal of increasingly seeking diversification by investing in new businesses such as renewable energy installations, especially solar and wind energy in Brazil (Petrobras, 2018). Ecopetrol's long-term strategy includes diversification through developing transmission and road tolls, green hydrogen (or hydrogen produced with renewable energy), renewable energy generation, large-scale storage and distributed energy services (Ecopetrol Group, 2022, 2023). And YPF highlights the development of green hydrogen, lithium and other inputs essential for advancing "clean energy" systems as one of the main paths to "evolving their primary focus" to 2050, although the company does not mention "diversification" as such (YPF, 2021, 2023).

Publicly available information suggests that EP Petroecuador does not have unrelated diversification plans. Instead, the company aims to contribute to the country's national objectives for an "ecological transition" (Ministerio del Ambiente, Agua y Transición Ecológica, 2021; Prieto Benavides, 2021) through improving efficiency and reducing the environmental impacts of oil

and gas production (EP Petroecuador, 2022). In July, EP Petroecuador announced a new “Decarbonization and Business Sustainability Plan” (Government of Ecuador, 2023). However, at the time of writing, the plan was not yet publicly available and could not be incorporated into our analysis (EP Petroecuador, 2023).

Besides diversification statements and objectives in long-term strategies, we also look at capital expenditures (CAPEX) intended for unrelated diversification, as a measure of actual commitment towards unrelated diversification. Identifying data on CAPEX for unrelated diversification is difficult in the companies’ long-term strategies because of how they combine unrelated diversification with related diversification, such as developing activities in gas production and commercialization or in “blue hydrogen”, produced with fossil fuels using carbon capture and storage. Companies sometimes report CAPEX for unrelated diversification together with decarbonization measures, such as developing carbon capture and storage, implementing emission compensation programs, or reducing flaring. This blending also occurs in companies’ official press statements (see for example Addison, 2022). Of the three NOGCs with unrelated diversification goals, only Ecopetrol provides explicit information on the CAPEX allocated to unrelated diversification goals in its long-term strategy, for expanding their road tolls and power transmission activities (Ecopetrol Group, 2022).

The same challenges arise with finding publicly available information about CAPEX for unrelated diversification with short- and midterm business plans; however, these plans can provide some additional information on NOGCs’ take on unrelated diversification. For example, Petrobras’ 2022–2026 Strategic Plan includes USD 100 million for research and development (R&D) in “profitable diversification” and activities not related to its operations (Petrobras, 2023). That amounts to half of the company’s R&D budget earmarked for decarbonizing operations, while less than 3% of the overall budget is for decarbonizing operations. Petrobras’ plan also indicates wind energy as an area of interest for new business, but it does not specify allocated CAPEX for wind sources (Petrobras, 2023). There are indications that CAPEX for renewable energy may increase in the company’s 2023–2028 Strategic Plan (Reuters, 2023).

Ecopetrol’s 2022–2024 plan includes about USD 2.6 billion in CAPEX for developing its transmission and road tolls business (Ecopetrol Group, 2022), but it does not provide information regarding CAPEX for other unrelated diversification activities in the short-term. The plan, however, includes CAPEX for developing renewable generation to power the company’s operations. This could be interpreted as a first step to developing a new line of business. One challenge here is that Ecopetrol is currently not legally allowed to participate in the power generation and power transmission businesses at the same time (Contraloría General de la República, 2023).

Indications show that CAPEX can be directed to unrelated diversification outside the realm of the companies’ public strategic investment planning. One example is YPF Litio, which YPF launched in 2021 to develop lithium extraction and related R&D activities in the lithium supply chain, together with YPF’s technological arm Y-TEC (BNamericas, 2021). YPF started exploration projects in the Catamarca region in 2022, in collaboration with the provincially owned mining company Catamarca Minera y Energética (La Nación, 2022). In addition, Y-TEC is building a battery manufacturing plant (Espina, 2022). The Argentinian government, as a shareholder of the company, has a strong interest in developing these activities, as reflected by the draft law it is working on to promote industrialization of lithium (El Economista, 2023).

Another example is Ecopetrol’s acquisition in 2021 of the government of Colombia’s stake in Interconexión Eléctrica S.A. ESP (ISA), a company that owns operations in electricity transmission, roads and telecommunications across Latin America (Reuters, 2021). The acquisition was explicitly framed as a diversification move (Griffin & Acosta, 2023). Ecopetrol bought a majority stake in ISA before the publication of the 2040 Strategy, and ISA has now been explicitly incorporated into the updated 2040 Strategy (Ecopetrol Group, 2023).

The fact that these investments by Ecopetrol and YPF were not originally included in the companies' long-term strategic investment plans suggests that the investments constitute responses to specific market opportunities. This shows the intention of these companies to start diversifying their core businesses, although the sectors and projects to prioritize remain flexible. Petrobras might be opening up to new businesses too: in March 2023, the company signed a letter of intent with the Norwegian NOGC, Equinor, to study the feasibility of offshore wind power generation projects along the Brazilian coast (Pulice & Frontini, 2023).

Overall, our analysis shows a mixed picture regarding unrelated diversification among NOGCs, with Ecopetrol and YPF being more advanced and EP Petroecuador not having engaged yet. Table 3 summarizes the level of unrelated diversification in the four South American NOGCs.

Apart from a few key projects in which Ecopetrol and YPF have invested, unrelated diversification plans by the NOGCs remain vague. Unrelated diversification efforts are also far less significant than the companies' efforts to decarbonize oil and gas operations and promote related diversification.

These observations are in line with IEA's finding that all oil and gas companies have allocated less than 1% of their total capital expenditure to investments outside their core business areas (International Energy Agency, 2020). The lack of clarity of intent and limited CAPEX for unrelated diversification also illustrate companies' perceptions of risk and commitment levels: as long as the technological winners of a low-carbon transition remain uncertain, oil and gas companies perceive a combination of competing low-carbon technologies as less risky and thus prefer to keep flexible strategies and not to commit fully to specific sectors or technologies (see Fattouh et al., 2019).

Table 3. Unrelated diversification in strategic planning for four South American NOGCs

	Petrobras	Ecopetrol	YPF	EP Petroecuador
Does the long-term strategy include unrelated diversification?	✓	✓	✓	✗
Does the long-term strategy allocate CAPEX for unrelated diversification?	✗	✓	✗	✗
Do shorter-term strategic documents include CAPEX for unrelated diversification?	✓	✓	✗	✗
Has CAPEX been allocated to unrelated diversification outside of long- and short-term strategies?	✗	✓	✓	✗

3.3 Results analysis: diversification approaches

Even though the concept of diversification does appear in the energy transition strategies of YPF, Ecopetrol and Petrobras, their levels of commitment to unrelated diversification remain unclear. Their current takes on diversification can be classified in two main approaches, building on the literature about oil and gas companies' corporate management (e.g. Abel et al., 2023; Al-Fattah, 2013; McPherson, 2003):

- An opportunistic approach, in which potential new businesses opportunities are assessed on a case-by-case basis. Here, diversification is not included in the company's long-term strategy; instead, it is a response to government mandates.
- A disciplined approach, centred around conservative ambitions similar to those of international oil and gas companies, where diversification means rebranding as "energy groups", with a broad approach to diversification.

For the "disciplined approach", two of the four NOGCs – Ecopetrol and Petrobras – have highlighted diversification as an important part of their long-term brand but have until now lacked practical steps in this direction, justified by cautious and disciplined decisionmaking. Here, the companies have no urgency to decide which sector or sectors to enter for diversification; they are waiting for the right market conditions to move forward. This approach is similar to that of major international oil and gas companies. At the same time, Ecopetrol has also shown signs of taking an opportunistic approach, for example, when the opportunity to buy a majority stake in ISA came up. Though it was not part of the long-term strategy, it has been incorporated into the 2040 strategy and fits within goals toward diversification in the energy transition (Cárdenas & Palacios, 2021).

Various factors can explain the preferences of the four South American NOGCs we studied for these approaches. One factor is their need to maintain access to international capital markets to keep operating, which explains a switch in the long-term to forming and branding themselves as energy groups, but also the lack of detail in planning. Most NOGCs do not want to share too much about their long-term plans due to fear of creating instability and frightening investors. Another factor is the role these companies play in domestic governance and their need to maintain their social licence to operate, which leads to prioritizing reducing carbon emissions of oil and gas production over unrelated diversification. That way, they can argue that they can reduce emissions without putting at risk revenues, at least in the short and midterm.

Also, NOGCs' ownership structure influences their diversification strategy, as illustrated by Ecopetrol's and Petrobras' shareholders' pressures on the companies to raise climate ambition and become more resilient (Cahill, 2022; Pooler & Ingizza, 2022). Many NOGCs' risk management practices have evolved over the past decade to become more like those of international oil and gas companies: they would rather gradually explore new ventures, while remaining cautious about making significant changes to their investment portfolio until other companies have already done so and the future direction of energy markets becomes clearer (Natural Resource Governance Institute & International Institute for Sustainable Development, 2021).

4. Discussion

Our synthesis above allows us to make three key observations, with related recommendations: first, the four NOGCs examined here have not prioritized a shift away from fossil fuels, but are instead diversifying their portfolios in order to decarbonize their products and services, as well as their own management systems. Second, the four NOGCs have limited capacities for unrelated diversification, and third, they will need to overcome institutional barriers within their countries to transition to low-carbon operations and strategies.

4.1 Diversification away from fossil fuels is part – but not the priority – of decarbonization of NOGCs

The four South American NOGCs we examined are, at best, in the early stages of unrelated diversification efforts. While they are in the process of rebranding themselves as energy groups, the pathway to achieve this goal remains unclear. Their strategies to address climate change mostly rely on reducing and compensating for emissions from their operations and moving towards a portfolio that relies more on gas. These NOGCs' energy transition strategies not only seek to maximize the value of their existing oil and gas assets, but also to expand oil and gas production. This finding is consistent with recent analyses of IOGCs, which show that these have not yet engaged in meaningful decarbonization (Green et al., 2022; Ihlen, 2009; Nasiritousi, 2017; Tillotson et al., 2023).

The context of the energy crisis following the Russian invasion of Ukraine has reinforced this trend. For example, Ecopetrol stated that additional investment enabled by windfall revenues would be directed towards energy security rather than a low-carbon energy transition (Reuters, 2022). However, as demand for oil and gas decreases, the sector will become more competitive globally, and not every oil and gas company can be the “last one standing” (Natural Resource Governance Institute & International Institute for Sustainable Development, 2021). For example, the costs of production in Colombia and Brazil are relatively high compared with some countries in the Middle East (Government of Colombia, 2023).

Unrelated diversification therefore is crucial for navigating the transition successfully. At the same time, accelerating a low-carbon energy transition requires oil and gas companies, including state-owned ones, to significantly shift their capital allocations towards low-carbon sectors (International Energy Agency, 2020).

4.2 NOGCs' unrelated diversification capacities are limited

The fact that the NOGCs examined here have not yet identified unrelated diversification as an operational priority suggests that financial and technical challenges must be limiting their capacity to transform. From a financial perspective, and as exemplified by Ecopetrol's case above, the windfall profits associated with the energy crisis have not led to a radical increase in investments into activities unrelated to the companies' core businesses. This can be explained by other pressures on companies and states, for example, to meet shareholders' expectations of receiving returns on their investments. Other pressures include the need to recover revenues lost during the early part of the Covid-19 pandemic, when fossil fuel prices were low, and governments' preferences to use revenues to subsidize fuel consumption for political reasons.

From a technical perspective, identifying and taking advantage of new low-carbon business activities requires new capabilities within the companies (International Energy Agency, 2020). Ecopetrol and YPF provide examples of how to do so through acquisitions or by setting up subsidiaries for new segments. Because such strategies are difficult for companies with a disciplined approach to diversification, a first step can be setting up specialized units that are trained to understand new businesses and can help NOGCs to take advantage of existing and

emerging opportunities. For instance, Petrobras recently established specific governance to identify and assess diversification opportunities in the electricity market, decarbonized fuels and non-energy products (Petrobras, 2022).

In the case of Ecopetrol, the NOGC transformed its “Vice-presidency on Gas” to a “Vice-presidency of Low Emissions Solutions” in 2022, to include biogas, energy, renewables and hydrogen, alongside gas, liquid petroleum gas, and carbon capture and storage (Ecopetrol, 2022). For the acquisition of ISA to contribute to the transformation of Ecopetrol also requires that learning be shared to other areas of the company, both technological and other types of spillovers (Cárdenas & Palacios, 2021). Ideally some of the staff in ISA or these newly created units different from Ecopetrol’s traditional core businesses can serve as “institutional entrepreneurs” or change agents within the company.

The next step of integrating this knowledge into other areas of the company, however, is not an easy task, as these are very large companies with institutional inertia embodied in technologies, investments and people, including employees’ daily routines and operations (Battilana et al., 2009; Sotarauta, 2020). Also key for the successful development of unrelated diversification strategies is an understanding of the employment- and skills-related implications of a transition to low-carbon energy systems.

Various factors will determine how prepared NOGCs are to address climate change and navigate an energy transition. Development of technical capabilities and prioritization of financial resources are a determining factor, but factors such as managerial adaptability and political pressure from governments and other shareholders also play a role. The strategic fit of diversification strategies, i.e. the complementarity of technical skills and required infrastructure, is also a key factor (Halttunen et al., 2023; Zhong & Bazilian, 2018). Overall, more research is needed to define what transition preparedness would mean for the region’s NOGCs, beyond just the four studied here, and how to assess and strengthen their preparedness overall.

4.3 Overcoming institutional barriers is crucial for NOGCs to accelerate their diversification efforts

In general, NOGCs have economic, financial and institutional incentives to continue investing in new oil and gas projects (Manley & Heller, 2021). State ownership implies that NOGCs need a clear mandate from their host countries’ governments to accelerate their unrelated diversification, as well as a consistent development and climate policy context to guide and support unrelated diversification. Such a mandate is unlikely when the social contract and a government’s political influence depends heavily on the distribution of revenues from oil and gas production, and when a country’s institutions are oriented towards preserving the dominant position of oil and gas production (Åhman, 2021). Unrelated diversification by an NOGC thus goes hand in hand with the diversification of its country’s economy, fiscal revenue base and trade balance.

The four South American NOGCs’ responses to energy transition pressures have been varied. These companies and their host countries, as well as other NOGCs in the region, might therefore benefit from more comparative research on the institutional and political mechanisms that prevent or enable NOGCs to engage in unrelated diversification. Such research could show how these efforts interact with governments’ development and climate strategies. The results could help inform strategies and policies to address the challenges posed by an ongoing energy transition.

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