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Colombia's Energy Transition

Between Export Dependency and High Ambitions

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- Colombia's energy supply is fairly renewable, as most of it derives from hydroelectric sources. However, as the energy system is highly dependent on natural resources, especially water, it is particularly vulnerable to climate change and exposed to variations in precipitation levels. It is therefore necessary to promote the development and integration of other renewable energy sources to reduce the vulnerability of the system to climatic variations.

- The dependence of the Colombian economy on the export of raw materials has generated resistance to the implementation of stricter climate policies. The pressure to maintain high levels of natural resource extraction hinders a transition towards a low-carbon economy, given that the country's export portfolio is heavily reliant on an extractivist and mining-based economic model.

- International cooperation is essential for the energy transition in Colombia, especially regarding the technical expertise necessary for implementing sustainable energy solutions.

- Reducing hydrocarbon exploration and exploitation diminishes state revenues that could be allocated to the implementation of renewable energy projects. Colombia's energy transition must be gradual and progressive to minimize negative economic impacts and ensure the availability of resources necessary for investments in clean energy.

- In order to reduce the country's dependence on fossil fuel exploitation, the energy transition in Colombia must be accompanied by reindustrialization policies and the diversification of exports.

- It is crucial to involve communities in the energy transition process to develop renewable energy projects that are tailored to local needs and characteristics, fostering acceptance and commitment to new initiatives. In addition, education and training of local populations in sustainable technologies can help create jobs and strengthen the regional economy, consolidating sustainable and resilient development.

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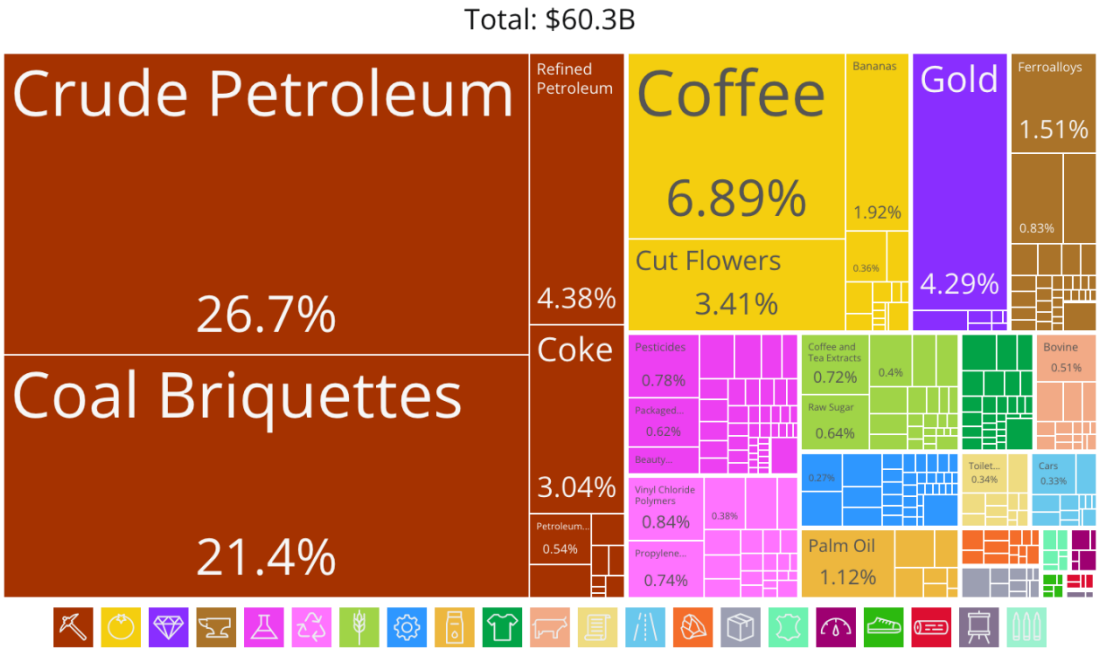
Development, Environment and the Extractivist Economy

Colombia is a minimal contributor to global pollution, accounting for only 0.4% of the greenhouse gases (GHG) responsible for climate change. In contrast, the G20 are responsible for 78% of global GHG emissions. In Germany, the primary sources of pollution are the energy, industrial, residential, and transportation sectors, accounting for a combined 91% of emissions. Conversely, in Colombia, it is not electricity generation or industry that are the main sources of emissions (31%), but rather agriculture, deforestation, and land use change, which together contribute 59%.[1] In terms of climate change, Colombia's biggest challenge is to stop deforestation and not to stop its economic development. However, according to the Ministry of Environment and Sustainable Development, deforestation increased by 40% during the first quarter of 2024 compared to 2023, after having decreased by around 30% that year.[2]

Since the beginning of the 21st century, Colombia's economy has been characterized as extractivist, based on the intensive exploitation of natural resources, primarily for export. This includes significant amounts of coal, natural gas, and oil.[3] Most of the coal extracted is exported, while oil production meets both external and domestic demand; natural gas is used almost entirely for domestic consumption.

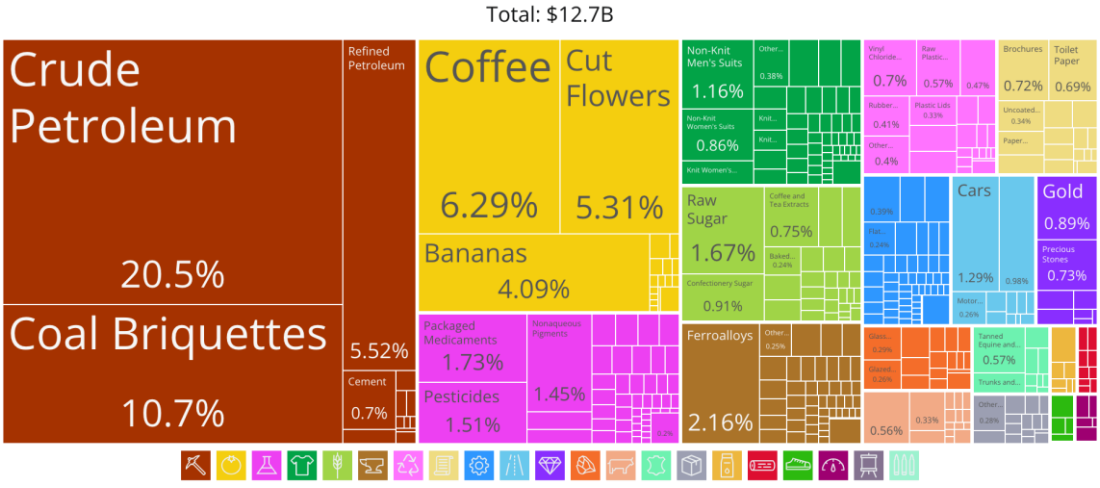
The export orientation of resources such as oil and coal has been crucial for the country's economic growth since the turn of the century. However, it has also presented significant challenges regarding environmental sustainability and economic diversification. In 2023, 57% of Colombian exports were derived from fossil fuels, followed by agricultural and manufacturing products (see Figure 1), highlighting the critical role of hydrocarbon exploitation in generating income.[4] This reliance is not new in Colombia as oil has been a prominent component of the country's exports in the last decades (see Figure 2).

Figure 1: Products Exported by Colombia in 2023



Source: Observatorio de Complejidad Económica (2024)[5]

Figure 2: Products Exported by Colombia in 2002

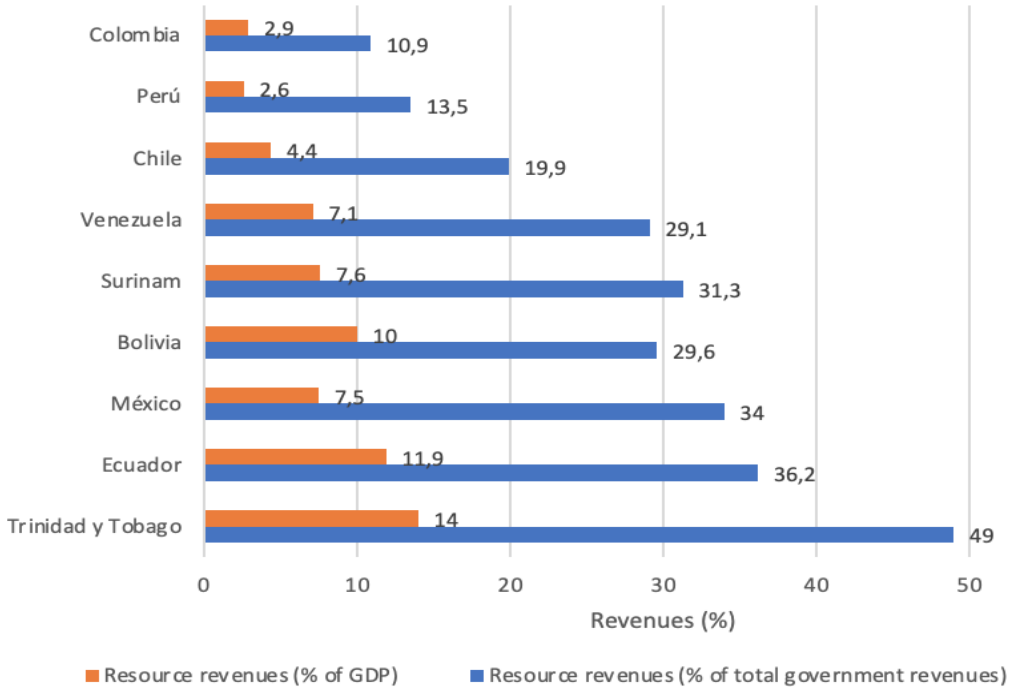


Source: Observatorio de Complejidad Económica (2024)[6]

As a result, the dependence of the Colombian economy on the export of raw materials has generated resistance to the implementation of stricter climate policies. The pressure to maintain high levels of natural resource extraction hinders a transition towards a low-carbon economy, given that the country's export portfolio is heavily reliant on an extractivist and mining-based economic model. Consequently, any accelerated and unplanned action to reduce hydrocarbon exploitation could negatively affect the country's economy.

As a significant portion of government revenues stems from the extractive industry (see Figure 3), the adoption of stricter environmental policies for hydrocarbon extraction is generally constrained. State revenues derive from three main sources: taxes, royalties, and profits from public sector industrial and commercial enterprises. Although the majority of revenues, approximately 70%, comes from tax collection, 15-20% is generated from royalties and profits from state-owned companies.[7] The Colombian petroleum company Ecopetrol, one of the most important state-owned companies, is focused on the exploration, production, transportation, and commercialization of oil and natural gas. The government currently owns 88% of the company's shares.[8] Therefore, adopting environmental policies to limit the exploitation of fossil fuels has a significant effect on an important source of income for the state. This financial dependency has led Colombian governments in the past to be cautious in adopting public policies aimed at reducing the exploration and exploitation of fossil fuels.

Figure 3: Latin American Government Revenues Derived from Extractive Industries



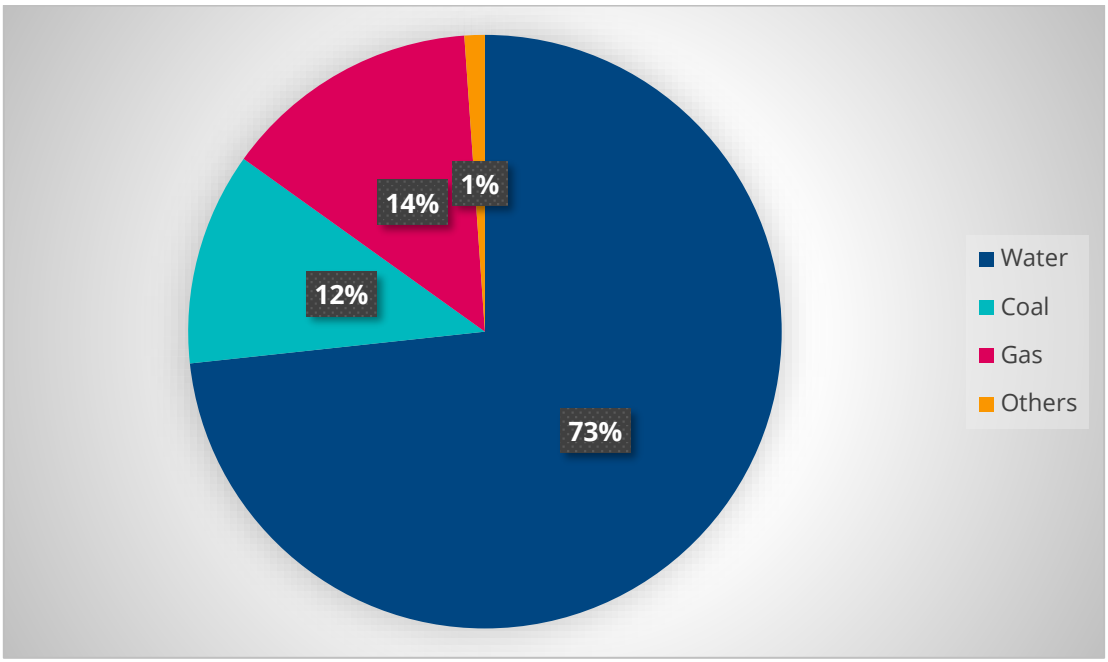
Source: Arbeláez and Parra (2020), p.17[9]

Furthermore, much of the foreign direct investment (FDI) entering Colombia has been channelled into financing projects related to mining and oil. Although there is now investment in the implementation of renewable energies, investment in extractive industries continues to be predominant. This becomes evident in the investment flows during the first half of 2024, where the majority (35%) was allocated to projects in the mining and oil sector.[10] Given the importance of fossil fuel exploitation in attracting FDI, Colombian governments in the past have adopted policies that favour the extraction of natural resources, especially through the promotion of tax incentives. This focus has hindered the implementation of more environmentally friendly measures.

Energy Generation in Colombia

While fossil fuels play an important role in Colombia's export earnings, their role in the national energy generation is less prominent. Power plants in Colombia are mainly hydroelectric and thermal (see Figure 4): 73% of energy generation in the country comes from hydric resources, while 26% comes from thermal resources like gas, coal, and fuel oil.[11] While the energy supply is fairly renewable, it must also be recognized that the energy system is highly dependent on natural resources, especially water, making it vulnerable to climate change and exposed to variations in precipitation levels.

Figure 4: Electric Power Generation in Colombia (2023)



Source: CECODES (2024, p.33)[12]

Despite the high share of renewable energies in the national energy mix, there is still a rather high dependence on thermal resources for energy generation, which poses environmental challenges associated with high GHG emissions. Residential energy consumption comes mainly from sources such as firewood and gas, while the industrial sector consumes mostly natural gas, coal, and bagasse. Colombia's passenger and cargo transportation system is also still dependent on fossil fuels. Although most of the electricity generation plants are renewable, there is still a significant amount of fossil fuels that are being consumed. In order to reduce emissions and fulfil the agreed upon climate targets, it is therefore necessary to implement strategies to reduce dependence on these energy sources, especially in the transportation sector.

The Environmental Agenda in Colombia

Since the adoption of the Paris Agreement in 2015, Colombian governments have set the goal to reduce GHG emissions by 30% by 2030.[13] However, other issues, including the 2016 Peace Agreements between the government of Juan Manuel Santos and the FARC[14] and the COVID-19 pandemic during the term of Iván Duque[15], pushed environmental concerns further down the government agenda. The current government under Gustavo Petro[16] has now given great relevance to environmental protection and the fight against climate change, at least in its rhetoric.

The main objectives are the protection of the Amazon and the transition towards a decarbonized economy. To achieve these goals, the Petro government decided to halt the issuance of new hydrocarbon exploration contracts.[17] Consequently, no new exploration and production agreements have been signed, and the authorization for new opencast coal mines has also been withheld. Further policies focus on transforming Colombia's current export matrix by promoting ecotourism and investing in renewable energies, and ensuring energy access for the entire Colombian population.[18] In many international scenarios, including the Amazon Summit, the COP28 of the UN Framework Convention on Climate Change, and the United Nations General Assembly, President Petro has stressed the importance of reducing fossil fuel consumption globally and proposed debt cancellation for developing countries that implement significant measures in climate change mitigation and adaptation.[19] This would enable the Colombian government to allocate necessary financial resources to biodiversity conservation.[20] In order to achieve these objectives, instruments like the National Development Plan, the Foreign Trade Policy for Internationalization and Sustainable Productive Development, and the National Reindustrialization Policy have been created.

The National Development Plan sets the goal of transforming Colombia into a 'World Power for Life'[21], with environmental protection and energy transition as its fundamental pillars.[22] The document includes a comprehensive section on the energy transition, proposing several initiatives to reduce dependence on fossil fuels and promote the use of clean energies. Key measures include the prohibition of new mining projects for the extraction of open-pit thermal coal, the enhancement of research to develop policies addressing environmental challenges (articles 225 and 226), and the creation of a programme by the Ministry of Mines and Energy to substitute firewood, coal, and oil with transitional energies (article 232). Additionally, the National Development Plan highlights the importance of expanding electric transportation in the country and mentions the possibility of the national government financing more than 70% of mass public passenger transportation rail systems (article 172), as well as promoting electric school mobility (article 221).

The Foreign Trade Policy, for its part, proposes shifting from a productive model based on the extraction of natural resources to one that is decarbonized, inclusive, and sustainable.[23] This objective is complemented by the central goal of the National Reindustrialization Policy, which seeks to enhance the added value in the production of goods and services of the economic sectors that make up the country's productive base in four key ways: a fair energy transition, agribusiness and food sovereignty, reindustrialization of the health sector, and reindustrialization from the defence of life sector.[24] Based on this, both instruments propose measures such as increasing non-mining-energy exports with higher added value, greater investment in sustainable development, and the establishment of inclusive and environmentally friendly tourism.[25] Additionally, both instruments emphasize the importance of diversifying and sophisticating the domestic and exportable supply of products to better integrate into global supply chains, with a focus on energy transition and the decarbonization of the economy. However, although the proposed measures represent a paradigm shift in comparison to previous governments, there are still no concrete measures for their implementation to achieve the proposed objectives.

Relevant and Priority Areas for the Energy Transition

Despite the lack of concrete measures, Colombia has the advantage of an extensive variety of natural resources that have allowed it to meet the energy demand of its population. Therefore, the country's energy transition should focus on guaranteeing energy supply through the use of renewable resources and improvements in energy efficiency.

There are, in effect, four key areas relevant to the transition. First, it is essential for Colombia to diversify its energy matrix. Although the country's energy generation is considered highly clean, heavy reliance on hydropower necessitates the expansion of energy sources and improvements in energy efficiency in all sectors. According to experts, one of the best alternatives for Colombia is natural gas, since its cost is lower compared to other renewable energies like wind and solar. Additionally, gas is more competitive because it is cleaner than oil and coal, and Colombia already has the infrastructure to support its massification.[26] Thus, adopting this alternative would allow for reduced GHG emissions without incurring the exorbitant costs associated with the establishment and maintenance of other renewable energies.[27]

The adoption of natural gas does not mean that other energy sources should be left aside. Several studies have shown that Colombia has potential to establish wind and solar energy. However, these renewable energies depend on specific conditions, such as adequate wind speed and optimal solar irradiation. Therefore, these projects are more viable in northern departments of the country like La Guajira and César.[28] The implementation of wind and solar energy projects in central Colombia is significantly more challenging as the environmental conditions of these areas are insufficient to generate energy with these sources.

Second, the Colombian transportation system is in need of reform, as this sector is the main consumer of fossil fuels and a major generator of GHG emissions, given that the "transportation sector consumes 40% of the country's energy and 96% of that energy is concentrated in the consumption of fossil fuels"[29]. Additionally, the country's public transportation systems are outdated and require modifications to enhance their efficiency. Implementing cleaner technologies and promoting the use of electric or hybrid vehicles could significantly reduce the environmental footprint of urban and interurban transportation in Colombia. These actions must be accompanied by infrastructure with recharging adaptability and lower energy consumption. It would make sense to include vehicle charging stations in the planning of all new housing, offices, and shopping malls.[30]

Third, it is crucial to involve communities in the energy transition process. This allows for the development of renewable energy projects that are tailored to local needs and characteristics, fostering acceptance and commitment to new initiatives.[31] Engaging communities in the planning and implementation of such projects not only promotes a sense of ownership and responsibility, but also ensures that the economic, social, and environmental benefits of the energy transition are distributed equitably. In addition, education and training of local populations in sustainable technologies can help create jobs and strengthen the regional economy, consolidating sustainable and resilient development. Therefore, to achieve a fair and responsible energy transition, it is essential to listen to community needs to achieve better outcomes.

Finally, as mentioned above, the Petro government argues that achieving a just and sustainable energy transition necessitates halting new hydrocarbon exploration contracts.[32] While it is essential for Colombia to reduce its reliance on fossil fuels, the absence of a medium-term transition strategy to replace this economic activity and revenue source could severely impact the country's economic stability. A significant portion of the state's income is derived from the extractive industry. Consequently, reducing hydrocarbon exploration and exploitation also diminishes state revenues that could be allocated to the implementation of renewable energy projects. Colombia's energy transition must be gradual and progressive to minimize negative economic impacts and ensure the availability of resources necessary for investments in clean energy.

Economic and Social Challenges, and Energy Transition Scenarios

Having discussed the four key areas relevant to the energy transition process in Colombia, it is now important to address the potential effects of the transition, which can be both positive and negative. First, the adoption of renewable energies is initially costly, leading to significant changes in the government's fiscal balance. Furthermore, there is no single energy source that is preferable over others.[33] However, depending on the chosen option, the costs can vary significantly. Electricity generation with non-conventional renewable sources can be significantly more expensive than other alternatives.[34] Therefore, if an energy transition relying on these sources is adopted, government expenditures will inevitably rise for their establishment and maintenance. Such a scenario may result in a fiscal deficit if the transition is not implemented gradually.

Second, the high dependence of the Colombian economy on fossil fuels means that an accelerated transition poses challenges to the country's economic development. The abrupt end of oil, coal, and gas exploration could lead to the underutilization of substantial natural resources, which currently account for 57% of Colombia's exports. Without a clear strategy to replace these products, the transition will create economic difficulties. The problem is that the energy transition will not be achieved before 2030, as evidenced by both national and international realities. Regarding coal, global production continues to rise, having reached 8.5 billion metric tons in 2023. Currently, over 200 large coal-fired thermoelectric plants are being built, with more than 350 already approved or in the pre-construction process. China, India, and Indonesia are leading this still thriving market. Similarly, the decline of oil consumption seems even further away, with the peak of consumption – which today amounts to around 103 Mbl of crude oil per day – projected to be reached in 2034 or even in 2040 if the adoption of electric vehicles is not widespread. In contrast, if current trends continue, Colombia will lose its capacity to exploit its oil by 2030 and its gas by 2029, which will generate significant negative effects for the economy and society, without making a substantial positive contribution to responding to the global climate crisis.[35] It is important to note that a reduction in Colombia's fossil fuel extraction would not necessarily lead to a decrease in global consumption, as demand will likely be met by other suppliers. Thus, the country risks forfeiting crucial revenue without affecting global fossil fuel demand. As a result, the Colombian state is failing to generate the income the country needs to move forward. Via Ecopetrol alone, fossil fuels contributed 11% of the national budget in 2023, some 14.5 billion USD, 5.5 billion USD in dividends, 6.5 billion USD in taxes and 2.5 billion USD in royalties.[36]

The economic impact of the political decision to abruptly halt new hydrocarbon exploration contracts is already evident. Colombia's gross domestic product (GDP) increased by a modest 0.6% in 2023, which is 6.7 percentage points lower than in 2022 (7.3%). The construction sector was the hardest hit, declining by 4.3%, followed by a 3,5% drop in manufacturing industries and a 2.8% decrease in the trade sector. These three sectors constitute the primary sources of employment in the country. Investment has also declined, falling by 13.4% in 2024, on top of a 24.8% decrease in 2023, largely due to the political and regulatory risks perceived by investors. Consequently, from a languid growth rate of 0.6% in 2023, Colombia will see a rate of, at best, 1.7% in 2024.[37] The interruption of fossil fuel exploration can generate a significant reduction in the country's total exports, a decrease in FDI as well as an increase in the exchange rates of the Colombian peso against the US dollar.[38]

Despite the described negative effects that the interruption of fossil fuel exploration would entail, the transition to renewable energy sources would enhance energy security in Colombia. While 80% of the world's population consumes between 90 and 100 gigajoules (GJ) of energy per capita annually, the situation in Colombia is markedly different, with per capita energy consumption at only 40 GJ per year.[39] It has been reported that 9.6 million people in the country lack access to

energy or gas.[40] Therefore, transitioning to renewable energies could expand energy consumption to populations that have historically been disconnected from the electricity grid or have had limited access to energy.

Overall, the energy transition presents an opportunity for communities to play a more active role in decision-making processes.[41] This involves not only informing and educating local residents about available renewable energy options, but also engaging them in the planning stages of the transition. By doing so, energy solutions can be tailored to better meet the specific needs of each community, promoting equitable energy development. Additionally, investment in renewable energy can create new job opportunities for the Colombian population.[42] The installation, maintenance, and operation of wind farms or solar plants require both skilled and unskilled labour, providing job opportunities in emerging sectors.

Emerging Conflicts of Interest

As the energy transition involves a multitude of stakeholders, various conflicts of interest have arisen. The government is committed to achieving a fast-track, total decarbonized energy transition instead of a gradual approach. However, the views of other sectors diverge from the government's position.

Experts widely acknowledge the urgent need for Colombia to reduce GHG emissions to mitigate the impacts of climate change, although some economists warn that a rapid transition could harm the country's economic development and lead to unemployment in the mining-energy sector. Natural gas is often proposed as a viable option to function as a bridge for Colombia's energy transition. Nonetheless, if the government fully achieves its goals, the extraction of hydrocarbons, including natural gas, would be restricted. This divergence in perspectives has caused tensions between the government and economic stakeholders.

Furthermore, there are conflicts of interest between civil society groups. In Colombia, oil-related activities have significantly impacted the social conditions of communities near exploitation sites, leading to increased community displacement, land appropriation by private companies, and contamination of essential natural resources.[43] These adverse effects have created tensions between local communities that seek to protect their territorial and environmental rights, and oil companies prioritizing resource exploitation. Conversely, other local communities are economically dependent on the oil industry and fear that an accelerated energy transition could lead to a loss of jobs, generating conflicts regarding the energy transition across the country.

Congress is also divided on the issue. Some members of opposition parties argue that decarbonizing the economy may make Colombia dependent on oil imports from countries like Venezuela, leading to higher energy costs for the Colombian population.[44] This opposition to the objectives of the Petro government may potentially hinder the development and implementation of public policies that promote an accelerated decarbonization of the economy.

Recommendations

The Colombian government should follow a series of recommendations to achieve a gradual energy transition that benefits multiple sectors of the country. First, every measure taken should be guided by coordination, collaboration, and consensus among the various levels and agencies of the government, the private sector, and civil society.[45] This will ensure the transparency and effectiveness of the implemented policies, fostering an environment of trust and cooperation. It is crucial for the government to work closely with different stakeholders to establish and implement effective strategies for a sustainable energy transition. Recently, discontent has risen because the

government has not responded to the concerns of many sectors regarding the execution of environmental policies, further complicating the realisation of the energy transition.

Second, the energy transition in Colombia must be accompanied by reindustrialization policies and the diversification of exports to reduce the country's dependence on fossil fuel exploitation. While instruments and measures like the National Reindustrialization Policy 2022-2026 aim to address this need, they lack precise strategies for reindustrializing the Colombian economy. Therefore, it is essential to develop public policies, approved by Congress, that provide specific guidelines on how the country can diversify its exports.

Third, it is crucial to implement financial and regulatory incentives that promote investment in renewable energy, ensuring that these incentives are accessible to both large companies and small and medium-sized ones. Incentives could include direct subsidies, tax credits, preferential financing rates, tax reductions, and the simplification of administrative procedures for the implementation of plans and initiatives. This will encourage private companies to increase renewable energy projects, ensuring that the energy transition process does not rely solely on government actions and budget.

Fourth, the Colombian government must diversify the energy supply. Since the country's energy production is primarily generated by hydroelectric plants, it is necessary to promote the development and integration of other renewable energy sources. This will not only contribute to a more balanced and resilient energy matrix but also reduce the vulnerability of the system to climatic variations that may affect the availability of water for hydroelectric plants. Therefore, the proposals contained in the update to the National Energy Plan 2022-2052 must be implemented. These proposals include the generation of electric energy in addition to strengthening hydroelectric generation, the introduction of Carbon Capture and Storage (CCS) technology, the installation of geothermal generation plants, the development of wind generation, and the addition of nuclear energy from 2038.

In this context, the Colombian government is exploring the use of Small Modular Reactors (SMRs) as part of its nuclear strategy. These reactors are considered ideal for the country due to their smaller size, shorter construction times, and ability to be deployed in remote areas with limited infrastructure. SMRs are also viewed as a safer and more flexible alternative compared to traditional nuclear plants that maintain low greenhouse gas emissions. The government's long-term plan aims to achieve a total nuclear capacity of 1,884 MW by 2052 through the gradual expansion of its nuclear infrastructure. This investment in nuclear power will enable Colombia to meet growing energy demands, enhance energy security, reduce reliance on fossil fuels, and reinforce its commitment to international climate goals. However, there are still no well-defined strategies for incorporating nuclear energy into the country's energy matrix.[46]

Fifth, the Colombian transportation system must undergo reform. To achieve this, a gradual replacement of fossil fuels with more sustainable alternatives is needed. This process can begin with the replacement of hydrocarbons with biofuels, which offer a more sustainable and less polluting option. Progress can also be made towards the use of natural gas in freight transport. Ultimately, the long-term objective must be the implementation of electric alternatives in public transport to significantly reduce the emission of polluting gases.[47]

Sixth, increased investment in research and the education sector is important to boost innovation and develop advanced technologies that facilitate the energy transition. Investment in research will enable progress in the efficiency and sustainability of renewable energy, as well as the

creation of new technical solutions adapted to local needs. At the same time, strengthening the education sector will ensure the development of a skilled workforce knowledgeable about emerging renewable energy technologies. This will contribute to a more effective implementation of energy policies and foster the growth of a competitive industrial sector in the field of clean energy.

Lastly, international cooperation plays a vital role in Colombia's energy transition. To be truly effective, this cooperation must focus on providing the technical expertise needed to implement sustainable energy solutions. Additionally, international cooperation can facilitate technology transfer, allowing Colombia to benefit from the latest innovations in the energy sector. Moreover, international financing is crucial to support investment in infrastructure and renewable energy projects. This financial support can be complemented by government incentives to increase FDI in wind or solar energy projects. Therefore, it is recommended that international cooperation for Colombia's energy transition focuses on technology transfer, knowledge exchange, and the provision of financing.

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[12] Ibid.
[13] Martínez, A. (2021), Transición Energética y Retos del sector energético en Colombia, Fedesarrollo.
[14] The Revolutionary Armed Forces of Colombia (FARC) were a guerrilla group that operated in Colombia from 1964 until their demobilization in 2016, following the signing of the Peace Agreements with the Colombian government. See Pastrana, E., Villota, A.M., Burgos, M. (2021), El discurso y la acción exterior del gobierno de Iván Duque: ¿la ideologización de la política exterior colombiana?, in: E.Pastrana / S.Reith (Eds.), La política exterior de Iván Duque: una mirada de sus primeros dos años, Bogotá: Fundación Konrad Adenauer.
[15] Liendo, N. A., González, C. (2021), La gestión política de la pandemia en Colombia, PROCESOS ELECTORALES EN LATINOAMÉRICA, 243.

[16] For the first time in the history of Colombia, a 'left-wing' movement called the Pacto Histórico (Historic Pact), headed by Gustavo Petro, won the presidential elections in 2022. The Pacto Histórico is a coalition of diverse political movements that won the electoral race with proposals including agrarian reform, energy transition, gender equity, and redistributive social justice.

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[21] The main objective of the Petro government is for Colombia to become a 'World Power for Life'. According to the National Development Plan, aiming for the country to become a leader in the protection of life through the construction of a new social contract that favours the overcoming of historical injustices and exclusions, the non-repetition of conflict, a change in our relationship with the environment, and a productive transformation based on knowledge and in harmony with nature. See: Departamento Nacional de Planeación (2022), Plan Nacional de Desarrollo 2022-2026, https://www.dnp.gov.co/plan-nacional-desarrollo/pnd-2022-2026 (last accessed on 24 September 2024).

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Appendix

Table 1. Comparison of Energy Generation Sources

Source	Cost of production	Cost of storage & transportation	Availability risk	Energy & power density	GHG pollution	Exhaustion
Hydroelectricity	Competitive	Reservoirs Transmission cost that depends little on energy volume	Low with monthly or higher reservoirs	Low	Low	No
Thermoelectricity	Competitive in peaks and in absence of other sources	Supply contracts	Low	Low	High	Yes, in the long term
Non-conventional renewable electricity	Competitive when available	No competitive	High	Low	Low	No
Batteries	-	No competitive	Restricted to battery life	Low	Low	No
Coal	Competitive in industry	Competitive	Low	High	High	Yes, in the long term
Natural gas	Competitive in industry	Competitive	Low	High	Medium	Yes, in the long term
Gasoline and diesel	Competitive in long distance transportation	Competitive	Low	High	High	Yes, in the long term
Hydrogen	No competitive	No competitive	Low	High	Low	No
Nuclear	Competitive	No competitive	Low	Low	Low	No

Source: Benavides, Cabrales and Delgado (2022, p.8).

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