

Hydrocarbons and climate change: Analysis of the proposal of Resolution 40066/2022

Hidrocarburos y cambio climático: análisis del enfoque propuesto por la Resolución 40066 de 2022

Hidrocarbonetos e alterações climáticas: análise da abordagem proposta pela Resolução 40066 de 2022

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Abstract

Introduction: This paper presents a legal analysis of Resolution 40066 of 2022 of the Ministry of Mines and Energy, since its implementation in Colombian regulations; the benefits and challenges for companies in the hydrocarbons sector; and its legal connection with hydrocarbon exploration and exploitation contracts. **Objective:** Study the legal framework, balances, challenges, and prospects of Resolution 40066 of 2022, as part of the global strategy to combat climate change in terms of control in the detection, repair of leaks, utilization, flaring, and venting of natural gas. **Methodology:** The methodology of the paper is the documentary analysis of national doctrine and current regulations. With these sources, the information collected in legal and specialized databases was classified and, as a result, the authors analyzed the Colombian constitutional, legislative, and regulatory context. **Conclusions:** The paper presents some considerations of the assembly process of the resolution with the hydrocarbon exploration and/or exploitation contracts.

Keywords: Climate change; Hydrocarbons; Sustainability; Natural gas; Environmental law.

Resumen

Introducción: Este artículo realiza un análisis jurídico de la Resolución 40066 de 2022 del Ministerio de Minas y Energía desde su implementación en el escenario normativo colombiano, los beneficios y retos que supone para las empresas del sector de hidrocarburos, y su acoplamiento jurídicamente con los contratos de exploración y explotación de hidrocarburos. **Objetivo:** Estudiar el marco jurídico, los balances, los retos y las perspectivas de la Resolución 40066 de 2022 como parte de la estrategia global de lucha contra el cambio climático en materia de control en la detección, la reparación de fugas, el aprovechamiento, la quema y el venteo de gas natural. **Metodología:** La metodología escogida es el análisis documental de doctrina nacional y normatividad vigente, con miras a descomponer la información recopilada en bases de datos jurídicas y especializadas. **Conclusiones:** Como resultado, se analiza el contexto constitucional, legislativo y regulatorio colombiano y, a modo de reflexión, se presentan unas consideraciones proceso de acoplamiento jurídico de la citada resolución con los contratos de exploración o explotación de hidrocarburos.

Palabras clave: Cambio climático; Hidrocarburos; Sostenibilidad; Gas natural; Derecho ambiental¹

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¹ Los términos clave han sido recuperados a partir del Tesauro Universidad de Barcelona (Multidisciplinario).



Resumo

Introdução: Este artigo realiza uma análise jurídica da Resolução 4.046 de 2022 do Ministério de Minas e Energia a partir de sua implementação no cenário regulatório colombiano, dos benefícios e desafios que ela acarreta para as empresas do setor de hidrocarbonetos e de seu acoplamento legal com os contratos de exploração e exploração de hidrocarbonetos. **Objetivo:** Estudar o marco legal, os balanços, os desafios e as perspectivas da Resolução 40066 de 2022 como parte da estratégia global de combate às mudanças climáticas em termos de controle na detecção, reparo de vazamentos, uso, queima e ventilação de gás natural. **Metodologia:** A metodologia escolhida é a análise documental da doutrina nacional e das normas vigentes, com o objetivo de desagregar as informações coletadas em bancos de dados jurídicos e especializados. **Conclusões:** Como resultado, é analisado o contexto constitucional, legislativo e regulatório colombiano e, a título de reflexão, são apresentadas algumas considerações sobre o processo de acoplamento legal da referida resolução aos contratos de exploração ou exploração de hidrocarbonetos.

Palavras-chave: Mudança climática; Hidrocarbonetos; Sustentabilidade; Gás natural; Direito ambiental.



Introduction

Resolution 40066 of 2022 of the Ministry of Mines and Energy is an opportunity to bring environmental protection standards in line with the reality of the hydrocarbon sector in Colombia, particularly with regard to the control work in the detection, repair of leaks, use, flaring and venting of natural gas. In this way, Colombian regulations enter into a process of international standardization in terms of control and surveillance of the natural gas industry, and in line with the expectations of the signatory countries of the international instruments for the fight against climate change and environmental matters.

By virtue of the provisions enshrined in Resolution 40066 of 2022, the purpose of this article is to carry out a legal analysis of this regulatory norm, which will be approached from three points. The first corresponds to how its implementation is framed in the Colombian regulatory scenario, the second consists in addressing the benefits of the proper implementation of this resolution for a hydrocarbon operating company and the potential risks associated with its non-compliance, and the third relates to how the application of this regulation is legally coupled with the hydrocarbon exploration or exploitation contracts between the Colombian State and private hydrocarbon operators. Based on this, some conclusions on the legal analysis of Resolution 40066 of 2022 will be presented.

This article, elaborated as a result of the academic exercise of the author as a professor of the Universidad Militar Nueva Granada, and of the authors as professors of the Universidad La Gran Colombia, is generated as a result of a research process based on an analytical methodology and documentary analysis of national doctrine and current regulations. With this, we sought to break down the set of information gathered through keywords in legal and specialized databases, in order to analyze each of its elements.

As a result, the first section presents some preliminary considerations; the second and third sections study the context and scope of Resolution 40066 of 2022, in addition to its articulation in the framework of Colombia's international commitments on climate change; the fourth section analyzes its Colombian constitutional, legislative and regulatory context, and the fifth section outlines by way of a final reflection the process of legal coupling of the aforementioned resolution with hydrocarbon exploration or exploitation contracts.

Theoretical framework

The Colombian State has demonstrated its commitment to the fight against climate change through the adoption of different international treaties, as well as the issuance of multiple laws, regulations and internal policies that set the goal of reducing greenhouse gases (GHG) by 2030 and achieving carbon neutrality by 2050 (Sepúlveda Figueroa, 2022).

At the international level, the 1992 United Nations Convention on Climate Change, whose objective is to stabilize GHG concentrations in the atmosphere at a level that will drive dangerous anthropogenic interference in the climate system, and its respective Kyoto Protocol of



1997, which sets specific GHG reduction targets, as well as the Paris Agreement of 2015, which seeks to limit global warming to temperatures below 2 °C, preferably 1.5 °C, compared to pre-industrial levels, based on the formulation of development strategies with low GHG emissions (Costa Posada, 2007).

Indeed, climate change as a global problem that affects not only human beings but also living species on the planet is a challenge that the international community has proposed to face in a coordinated manner and, in the case at hand, the Colombian State, whose participation in the discussions of the aforementioned international instruments to which it is a party, positioning itself as a key player, and at the same time as part of the countries that are priority interest groups.

This is explained by the serious impact and potential damage that climate change may cause in the Colombian territory, where part of the Amazon, considered the lungs of the world, is located, and also by the great biological diversity it possesses, which is at risk.

Furthermore, climate change as a phenomenon highlights the problem of social and economic inequalities in the world, which divide it into a global north privileged by its economic and industrial development, after having consumed a large amount of resources, and after having impacted the environment with its activities, and a global south that did not reach the same levels of development, but that today suffers from these effects (Rajamani, 2000).

The incorporation of the principle in the international climate change regime is essential in the development of a system of continuous responsibilities, which considers the historical contributions to global warming and the present and future capabilities of each nation. Thus, this system of continuous responsibilities, supported by the principle of common but differentiated responsibilities, is constituted as a driver of national commitments for the establishment and implementation of mitigation and adaptation actions. (Cisterna Gaete, 2020, p. 45).

On this point, it is worth mentioning that, although international climate instruments recognize this situation and attribute to these countries of the global North a differentiated responsibility or, in other words, a greater share of responsibility for addressing the problem, the truth is that, in practice, these dynamics persist in some of these countries (Rodríguez, 2020).

To illustrate the above with a specific case, since the beginning of the 21st century, a single American citizen has been producing GHGs "equivalent to those produced by 19 Indians, 30 Pakistanis or 269 Nepalese, since their consumption patterns involve large consumption of fossil fuels and land use patterns that generate large GHG emissions" (Feldmann and Biderman Furriela, 2001, p. 191). This, without the situation changing, despite the rise of renewable energies or circular economy models, whose positive effects are barely evident in some European countries (Frérot, 2014).

4

However, this is an incipient debate in the countries of the global south, where it is necessary to establish a permanent dialogue between all the actors involved, from the State and its institutions to the stakeholders (Scotton et al., 2023).

This dialogue scenario could not, in any case, depart from a cross-cutting approach, because, although solutions can be found in rules regulating industries, economic development models and,



in general, anthropogenic activities, also those solutions fall on society with its consumption habits and on science, technology and innovation policies aimed at improving products, processes and technologies that have so far impacted the climate in the world (Nubia-Arias, 2016; Oltra et al., 2009).

Particularly in the mining and energy sector, a goal has been set to reduce up to 2,700,000 tons of carbon dioxide equivalent, which translates into 1/4 of the sector's mitigation target for 2030 (Rodríguez, 2020). Based on the fulfillment of this goal, the mining and energy sector has the objective of achieving net emissions equal to zero by 2050 (Ministerio de Minas y Energía [MinEnergía], 2021). To achieve this, five strategic lines have been established, namely: energy efficiency, demand management, energy generation, energy substitution and fugitive emissions.

Within this last line, the Integral Plan for Climate Change Management in the mining-energy sector (PIGCCme) developed by the Ministry of Energy established as a goal the reduction of between 0.39 and 3.24 million tons of carbon dioxide equivalent, through an efficient management of the fuel emissions linked to the production chain of the hydrocarbon sector. This will be achieved through a sustainable and intelligent use of natural gas that is originally captured for other purposes (MinE- nergy, 2023).

Consequently, with the issuance of Resolution 40066 of 2022, the Ministry of Energy determined the technical enabling requirements for the detection and preparation of natural gas leaks, as well as their exploitation, flaring and venting processes within the framework of hydrocarbon exploration and exploitation. This is the first regulation promoted at the regional level to implement strategies focused on GHG reduction.

The purpose of these regulations is to improve the dynamics of hydrocarbon exploration and exploitation operations in order to avoid wasting natural gas by establishing maximum limits for flaring and venting, which are authorized only for safety reasons or duly justified operational conditions. This implies that operators of hydrocarbon exploration and exploitation activities must implement a series of measures and technological tools for the detection, measurement and quantification of GHGs, as well as studies for the use of natural gas (Mi- nEnergía, 2023).

Methodology

This article is the result of a research process based on an exploratory methodology and descriptive documentary analysis of national doctrine and current regulations. With this, we sought to decompose the set of information collected through keywords in legal and specialized databases, in order to analyze each of its elements.

In addition, an exploratory level was reached on which it was considered pertinent to address the regulations and raise new perspectives. By way of clarification, the literature review revealed that there are few studies on this topic, so the exploratory level was considered adequate.

From a second methodological approach, we arrived at a descriptive approach that allowed us to describe the an-

The study of the regulations studied, especially Resolution 40066 of 2022, its interaction with domestic regulations on exploration and exploitation of hydrocarbons, and international regulations on climate change.

Results

Resolution 40066 of 2022: context and scope

The Ministry of Energy issued Resolution 40066 of 2022, which establishes a series of guidelines for detecting and repairing natural gas leaks, as well as its use, flaring and venting in the framework of exploration and exploitation of hydrocarbons in Colombia. This regulation applies to all related activities in both the continental and maritime areas of the national territory.

Resolution 40066 of 2022 is aligned with the regulatory framework issued by the National Government, which guides the implementation of international instruments that bind the Colombian State, in order to achieve the commitments acquired in GHG reduction. In this context, measures for mitigation and adaptation to climate change have been organized in a sectoral manner through the establishment of specific guidelines in the PIGCCme (Asociación Ambiente y Sociedad, 2022).

Likewise, this regulation establishes a series of prohibitions, among which the following stand out: the waste of natural gas in hydrocarbon exploitation and exploration activities, based on the inadequate or inefficient use of gas volumes; inefficient management that allows production to exceed storage, treatment, transportation and commercialization capacity; and the inadequate use of operational lifting systems.

The above is complemented by the inadequate use of natural gas for different operational uses; the performance of depressurization operations of the gas coming from annulars into the atmosphere, except in those cases where it is required for safety reasons, and the waste of natural gas volume, the use of which is economically viable¹.

It is important to specify at this point that part of the motivation of the Colombian State in regulating hydrocarbon exploration and exploitation activities is to mitigate the environmental impacts of methane (CH₄), a dangerous air pollutant that can cause serious health problems in the population (Coronel Carbo and Marzo Páez, 2017), being also responsible for 30% of global warming and ranking as the second largest contributor to climate change, only preceded by carbon dioxide (Pabón, 2005). In particular, because methane emissions from fugitive emissions from hydrocarbon activities contributed 8.1% of the country's total methane emissions between 1990 and 2018 (Instituto de Hidrología, Meteorología y Estudios Ambientales [Ideam], 2021).

Continuing with Resolution 40066 of 2022, it is worth mentioning the scope of its technical framework, which standardizes exploration and exploitation processes. Thus, for example, it enshrines the activities of the

¹ It should be noted that Resolution 40066 of 2022 specified that this category does not include "waste gas volume that is flared for safety reasons or gas that is economically unfeasible to recover and use" (art. 4).



The following is a list of the conditions in which flaring and intentional venting (as an exceptional action) of natural gas are allowed, as well as their maximum volumes.

It also defines the program for the detection and repair of leaks that must be carried out by the operators of hydrocarbon activities, which must be reported annually to the inspection entity, and establishes the minimum actions and equipment that the operators of these activities must have for the prevention and mitigation of natural gas leaks. Likewise, it is established that non-compliance with the provisions contained in this article will be sanctioned in accordance with the applicable regulations, among them, Article 67 of Decree 1056 of 1953 and Article 21 of Law 10 of 1961.

In turn, it also establishes measures to anticipate potential damage, including the mandatory report to be made by the company that carries out the natural gas flaring process in well control operations within 24 hours after the event to the supervisory agency in the periodic report. In this report, the start time, duration, causes/reasons and average volume of natural gas flared must be indicated. Thus, Resolution 40066 of 2022 regulates the roadmap to be followed in application of the precautionary and prevention principles in environmental matters.

On this point it should be specified that, in matters of environmental protection and the fight against climate change, the precautionary principle as a criterion for anticipating risks in a context of uncertainty requires the judicial operator, the official or the person who generates the risk to suspend the process, product, activity or technology that may have potential negative effects on environmental degradation and climate change, thus impacting the living conditions on the planet of present and future generations.

The principle of prevention, on the other hand, operates from the same risk anticipatory approach, but with the difference of requiring a reasonable level of scientific certainty before operating by suspending the risk potentially caused by the activity, process, product or technology.

The prevention principle, like the precautionary principle, is intended to provide the State with a powerful tool to act in the face of a risk capable of causing serious damage to the environment and human health. The difference between one and the other lies in the scientific certainty at the time of invoking them, being in the first case a level of certainty that leads the authorities to doubt about the potential risk, that is, that it is not absolute; and in the second case, to be placed in an absolute certainty about that one. (Vargas-Chaves, 2016, p. 18)

Both the precautionary principle and the prevention principle play a key role in the fight against climate change. This was recognized in the United Nations Framework Convention on Climate Change, adopted in New York on May 9, 1992, which entered into force on March 21, 1994, Article 3 of which establishes the principles that will guide the actions of States and individuals in reducing and stabilizing GHG concentrations. These guidelines simultaneously address the precautionary and preventive approaches.

Article 3. Principles. [The Parties shall take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to address climate change should be cost-effective in order to ensure global benefits at the least possible cost. (United Nations [UN], 1992).



Because the objective of coordinated actions between States and individuals in the fight against climate change is based on the need to regulate the activities and risks that may be caused by certain industries, among which are those to which Resolution 40066 of 2022 applies. The ultimate goal of this entire regulatory framework is to stabilize GHG concentrations in the earth's atmosphere at a level that prevents human-induced interference that could pose a danger to the climate.

Thus, both Resolution 40066 of 2022 and international regulations on climate change seek to maintain a dual approach (precautionary and preventive) to ensure, within a reasonable period of time, that ecosystems can adapt naturally to these climate variations, guaranteeing adequate living conditions and, at the same time, maintaining sustainable economic development.

Apart from the above, it should be pointed out that adaptation is the first approach to climate change, since some of the damage caused is irreversible, the second approach being the mitigation actions, which are materialized in the transition from productive development models based on consumerism, unsustainable industrialization and resource hoarding, to sustainable models that seek to generate low or even zero emissions. This, in this case, will be the articulation of the goal pursued by Resolution 40066 of 2022 and the progressive reduction in the burning of fossil fuels, which is one of the largest GHG generators.

On the other hand, Resolution 40066 of 2022 is also novel in the establishment of permits for natural gas flaring during the exploitation of hydrocarbons, which may be annual or specific, which are requested by the operator to the respective oversight entity.

The annual natural gas flaring permit must contain the cause and justification for natural gas flaring, the maximum volume of natural gas flaring, the estimated volume of economically unviable natural gas supported by a technical-economic study, the estimated volume of gas from planned events supported by the maintenance plan and, in the case of gas flaring from unplanned events, the justification of the operational optimization plan; Likewise, the estimated volume of gas from intentional venting collected for flaring and the alternatives for the use of natural gas when applicable. (MinEnergía, Resolution 40066 of 2022, art. 18).

Regarding the natural gas flaring permit, it is required that it be requested in cases in which there are unforeseen events, which are attributable to causes other than the operation itself:

For gas handling or exceptional situations attributable to causes other than operational ones, which must include the cause and consequence of the unforeseen event, the location, the description of the work to be performed, the duration of the repair activity and the estimated flaring volumes (MinEnergía, Resolution 40066 of 2022).

In addition, regarding its transition regime, without prejudice to the particular transition established for each measure, Resolution 40066 of 2022 provides in Article 83:

1. All burning permits granted by the inspection entity prior to the entry into force of this Resolution shall remain in force for the term indicated therein and shall be governed by the legal provisions in force at the time the permit was granted.
2. The applications for permits of



The burns that are filed and in progress before the inspection entity at the time of the entry into force of this resolution will be processed under the terms of the regulations in force at the time of their filing. (MinEnergía, Resolution 40066 of 2022).

On this point, another regulation that should be taken into consideration is Resolution 40317 of 2023 of the Ministry of Energy, which sought to provide clarity to the hydrocarbon sector operating companies in the fulfillment of their obligations regarding the process of detection and repair of leaks, exploitation, burning and venting of natural gas.

Specifically, the conditions, criteria and times for compliance with the obligations set forth in Resolution 40066 of 2022 are detailed, including the addition of definitions and the definition of requirements for the operability of the plants, as well as the means used for the quantification of emissions and the equipment used in the hydrocarbon production process.

In these terms, Resolution 40066 of 2022, partially modified by Resolution 40317 of 2023 of the Ministry of Energy, was issued based on the goals formulated for the mining-energy sector in terms of GHG reduction. The control of fugitive emissions is part of the actions proposed by this sector to control and reduce methane emissions into the atmosphere within the hydrocarbon production chain.

Resolution 40066 of 2022 in the framework of Colombia's international commitments on climate change.

With Resolution 40066 of 2022, the National Government intends to make progress in the commitments acquired at the international level, in instances such as the United Nations Climate Change Conference, the Paris Agreement and, more specifically, the COP26 held in 2021.

In this last instance, Colombia presented the *E2050 Long-term Climate Strategy*, which is a State policy instrument that establishes socioeconomic development objectives and long-term goals to comply with the commitments agreed upon regarding GHG mitigation, the protection of forests and biodiversity, as well as the reduction of gas emissions such as methane (Calfucoy et al., 2022).

Specifically, the Colombian government committed to convert the national territory into a carbon-neutral territory by the middle of the 21st century and also to achieve a significant reduction of GHG emissions by 51% by 2030 (Dopazo Fraguío, 2020).

This is based on the results of COP26 and, mainly, on the Glasgow Climate Pact, which recognizes the urgency of taking immediate action on climate change mitigation and adaptation, as well as adopting more ambitious commitments to limit global temperature increase, among which is the limitation of methane reductions by 30 percent.

% by 2030. This pact recognizes that methane gas is one of the factors that contribute most to climate change, being the cause of at least 1/3 of global warming of anthropogenic origin (Guzmán Hennessey and Ruiz Soto, 2022).

In line with the above, the Global Pact for Methane was also formulated, which takes into account the fact that methane is the most important greenhouse gas in the world.

GHGs are responsible for 30% of global warming since pre-industrial times, and limiting their emissions is one of the most effective ways to curb climate change.

These commitments were the result of the conclusions of the report presented at COP26, *Climate Change 2021: Physical Basis*, by Panel I of the Intergovernmental Panel on Climate Change (IPCC), which indicates that unless GHG emissions are reduced immediately and on a large scale, the goal of limiting global warming to around 1.5°C or even 2°C will be impossible, as well as the participation of one hundred and twenty global and around forty thousand participants, including scientists, activists, indigenous peoples, youth and others, who call attention to the need to strengthen the foundations for the implementation of the Paris Agreement, through actions to build a more sustainable future with low GHG emissions (Masson-Delmotte and Zhai, 2022).

In this context, in response to the actions planned sectorially for the reduction of greenhouse gas emissions and the adaptation and mitigation of climate change as set forth in the 2020 Nationally Determined Contributions (NDC) update, Resolution 40066 of 2022 seeks to define a series of technical guidelines for the detection and repair of leaks, as well as the flaring, utilization and venting of natural gas, to control and reduce fugitive methane emissions produced in the exploration and exploitation of hydrocarbons.

This is because the fight against climate change requires the reduction of gas emissions into the atmosphere that contribute to global warming and, consequently, to climate change. This, coupled with the fact that oil and gas operations with lower emissions intensity not only provide great environmental benefits, but also represent a greater commercial advantage over sources with higher emissions.

Now, the issuance of Resolution 40066 of 2022, in addition to being based on the international commitments acquired by Colombia on climate change, must be reviewed based on the internal regulations developed on this subject and, specifically, with respect to the regulations related to hydrocarbon activities, as will be done in the following sections.

The Colombian constitutional, legislative and regulatory context of Resolution 40066 of 2022

The Political Constitution of Colombia (1991) has distinguished itself since its issuance for being an "ecological constitution", due to the multiple provisions it enshrines on the importance of nature and the consequent obligations of the State to ensure a healthy environment. Based on these provisions, the Constitutional Court has explained that the healthy environment has a triple dimension in the articles of the Constitution:

It is a principle that irradiates the entire legal order and corresponds to the State to protect the natural wealth of the Nation; it is a constitutional right (fundamental and collective) enforceable by all persons through various judicial channels; and it is an obligation of the authorities, society and individuals, as it implies qualified duties of protection. In addition, the Constitution contemplates "environmental sanitation" as a public service and fundamental purpose of state activity (arts. 49 and 366 above). (Constitutional Court, Sentence C-449/15, 2015).

In these terms, it has been the Constitutional Court itself that has placed the right to enjoy a safe and healthy environment at the center of the right to health.



healthy environment as a transversal axis and legal interest protected in the political charter. It commits the Colombian State to design an institutionality and a policy that is adapted to its safeguard, as well as to the development of norms that efficiently respond to the aspiration of protection and preservation of the nation's natural wealth (Constitutional Court, Sentence C-035/16, 2016).

In this sense, Article 80 of the Political Constitution of Colombia (1991) establishes that the State is responsible for planning the management and use of natural resources, in order to ensure their conservation, replacement or restoration, through the sustainable development of economic, state and social activities. Likewise, it is the State's responsibility to control and prevent environmental deterioration factors, as well as to impose the necessary legal sanctions and demand compensation or reparation for damages caused.

In accordance with the above, Article 334 of the Political Constitution of Colombia (1991) provides that the general management of the economy is the responsibility of the State. For this reason, the State may

intervene by law in the exploitation of natural resources, in the use of land, in the production, distribution, use and consumption of goods, and in public and private services, to rationalize the economy in order to achieve at the national and territorial levels, within a framework of fiscal sustainability, the improvement of the quality of life of the inhabitants, the equitable distribution of opportunities and the benefits of development, and the preservation of a healthy environment.

Regarding the exploitation of non-renewable natural resources, Articles 332 and 360 of the Political Constitution of Colombia (1991) provide, on the one hand, that the subsoil and all non-renewable natural resources are owned by the Colombian State, which may require the payment of royalties as economic compensation; and on the other hand, the need to establish the conditions that will be required for the exploitation of these resources by third parties.

In this constitutional context, the regulatory framework of the hydrocarbons sector is made up of a set of laws, decrees and resolutions that regulate matters related to the contractual regime for the allocation of exploitation and exploitation areas, as well as the control of production, the payment of royalties or other compensation, environmental protection, transparency and access to public information.

Regarding the institutional framework of the hydrocarbons sector, Decree 381 of 2012 and Decree 1617 of 2013 delegated to the Ministry of Energy the function of issuing the necessary regulations for exploitation and exploration activities, as well as other activities within the value chain, such as transportation, distribution, processing and commercialization of non-renewable natural resources and biofuels.

The above must be done within the framework of Decree 1073 of 2015, which provides "that hydrocarbon exploration and exploitation activities in continental and offshore conventional reservoirs must comply with national and international technical standards and norms; especially those recommended by the AGA, API, ASTM, NFPA, NTCICONTEC, RETIE or those that modify or replace them" (art. 2.2.2.1.1.1.5).

Hydrocarbon exploration and exploitation activities in conventional and conventional oil and gas fields



offshore, it is contemplated that "these activities shall be subject to the provisions related to the protection of natural resources, the environment, industrial safety and health; as well as to ILO Convention 174 and all those that modify them" (Decree 1073 of 2015, art. 2.2.2.1.1.1.5). Finally, it contemplates that the functions of the Ministry of Energy are the issuance and review of procedures and technical standards in this area.

In matters of exploration and exploitation of hydrocarbons in conventional inland and offshore reservoirs. However, these rules must be observed by the operators of blocks authorized by the National Hydrocarbons Agency - ANH and other contracts in force or those to be signed, applying best practices and taking into account the technical, operational, environmental and administrative aspects. The foregoing without prejudice to compliance with the environmental obligations established by the competent authorities (Decree 1073 of 2015, art. 2.2.2.1.1.1.1.7).

Now, with the issuance of Law 1931 of 2018, the guidelines for climate change management were established in the decision making of actions for adaptation, as well as for GHG mitigation. In this norm, it was established that, among the guiding principles for its implementation and regulation, is self-management, understood as the development of own actions to contribute to climate change management in harmony with legal provisions and the actions of public entities, and accountability, which refers to the contribution of all actors in the fulfillment of the commitments assumed by Colombia in terms of climate change and that their actions guarantee the sustainability of future generations (Rodríguez Caicedo and Vásquez Lizcano, 2020).

In response to the provisions of Law 1931 of 2018, the MinEnergía, through Resolution 40807 of 2018, adopted the PIGCCme as a planning instrument with the goal of reducing 11.2 million tons of CO₂ equivalent in the mining-energy sector by 2030 and, thereby, contributing 17% to the national GHG reduction target.

However, with the update of Colombia's NDC for the period 2020-2030, which sets more ambitious sectoral goals in terms of GHG mitigation, it was established that the mining-energy sector would adopt measures for the proper management of fugitive emissions associated with the hydrocarbon production chain, tending to take advantage of the natural gas captured and, thereby, reduce between 0.39 and 3.24 million tons of CO₂ equivalent. As a concrete action, it was determined that the Ministry of Energy would issue a regulation on fugitive emissions to monitor and control the uncertainty of the accumulated mitigation in fugitive emissions.

By virtue of this, Law 2156 of 2021, which promotes low-carbon development in the country through the establishment of minimum goals, or base goals, in terms of neutrality and resilience to climate change, established that the mining and energy sector has among its goals to implement measures that "favor the adequate management of fugitive emissions in the hydrocarbon chain, focusing on the reduction of leaks, the recovery of associated gas, the efficiency of flaring and the improvement of activities for its capture, recovery and/or use" (art. 8). 8).

Based on this regulatory mandate, the Ministry of Energy issued Resolution 40350 of 2021, which adopts the update of the PIGCCme, which enshrines a vision of carbon neutrality to 2050 and establishes the goal of monitoring, controlling and reducing fugitive emissions in the hydrocarbon chain to reduce between 0.39 and 3.24 million tons of CO₂ equivalent in this sector by 2030.



Regarding the specific regulation of emissions in the framework of hydrocarbon activities, the Ministry of Energy issued Resolution 181495 of 2009, which established in Article 52 the prohibition of flaring, waste or emission of gas into the atmosphere, through reinjection into the reservoir or recycling, subway or surface storage or commercialization, and Resolution 40687 of 2017, which

on the venting and flaring of gas that, during the development of exploratory drilling, the interested party, in accordance with the provisions established by the environmental authority within the framework of the environmental license, may fry the volumes of gas recovered on the surface as a result of the activities of well control operations and initial production tests (art. 20).

Article 52 of Resolution 181495 of 2009 and Article 20 of Resolution 40687 of 2017 were expressly repealed by Article 84 of Resolution 40066 of 2022.

In the same sense, the Ministry of Energy issued Resolution 40295 of 2020 by which it established the technical criteria for offshore hydrocarbon exploration and exploitation projects in Colombia. Thus, it stipulated that those interested in developing this type of activities must fully comply with the standards, provisions and best practices of the industry, especially those contemplated in this resolution or those previously authorized by the oversight entity.

On the same subject, Law 2056 of 2020 provides that it is the function of the Ministry of Energy to

to establish the guidelines for the exercise of the activities of knowledge and geological mapping of the subsoil; of the exploration and exploitation of non-renewable natural resources; and of the supervision of the exploration and exploitation of non-renewable natural resources, seeking to ensure and optimize the extraction of non-renewable natural resources, as well as in consideration of the best practices of the industry (art. 7). (art. 7).

In this context, in compliance with the actions contemplated in the PIGCCme, the Ministry of Energy issued Resolution 40066 of 2022, which establishes stricter guidelines in terms of fugitive emissions control. This in the framework of the operations of hydrocarbon exploration and exploitation activities, and in compliance with the sectorial goals in this matter.

How is the application of Resolution 40066 of 2022 legally coupled with the hydrocarbon exploration or exploitation contracts between the Colombian State and private hydrocarbon operating companies?

Article 76 of Law 80 of 1993 establishes that contracts for exploration and exploitation of renewable and non-renewable natural resources are governed by the special rules corresponding to this sector. In this regard, Decree 4137 of 2011 provided that the National Hydrocarbons Agency (ANH) has the objective of integrally managing the reserves and hydrocarbon resources owned by the nation, the promotion and optimal and sustainable use of these, as well as the contribution to the country's energy security.

Thus, the current contracting regime in the hydrocarbon sector in Colombia is implemented, where private entities engaged in exploration and exploitation of hydrocarbons are the ones that have the most significant impact on the hydrocarbon sector.



and Empresa Colombiana de Petróleos (Ecopetrol) compete for contracts on equal terms.

Thus, the ANH established through Agreement 2 of 2017 that the development of hydrocarbon exploration and exploitation activities takes place through exploration and production (E&P) contracts, technical evaluation contracts (TEA), special contracts and agreements.

E&P contracts grant the exclusive right to develop exploratory activities in a given area and to produce the hydrocarbons discovered within it. This contractual model includes three stages (exploration, appraisal and production) for both inland and offshore areas.

TEA contracts grant the contractor the exclusive right to carry out technical evaluation studies in a given area, aimed at analyzing its prospectivity. In this type of contract, the holder is not granted the rights to produce hydrocarbons that may exist in the contracted area.

Special contracts correspond to those hydrocarbon exploration or exploration contracts with particular characteristics or stipulations that are different from the E&P and TEA type contracts. These contracts are adopted by the ANH based on the technological development of the sector, among which are those for the execution of exploratory activities, operation, production, incremental production, production and profit sharing.

The agreements are exploration or exploitation agreements entered into between Ecopetrol or its assignees and the ANH. In this type of contracts, the conditions for exploration and exploitation of areas that Ecopetrol operated directly until the entry into force of Decree 1760 of 2003, which ended the association contracts in the hydrocarbon sector provided for in Law 20 of 1969, are defined.

In this contractual context for the hydrocarbons sector, the ANH reported the existence of 254 E&P contracts, 26 TEA contracts, 193 special contracts, 35 agreements and 56 E&P contracts until March 31, 2023 (ANH, 2022).

Now, in this scenario, Resolution 40066 of 2022, partially modified by Resolution 40317 of 2023 of the Ministry of Energy, states that its scope of application is the exploration and exploitation of hydrocarbons both in continental areas and offshore within the national territory. That is to say, its compliance is mandatory in the framework of all contracts in which hydrocarbon exploration and exploitation activities are currently being developed in the national territory, and those that may be subscribed in this matter.

In this way, Resolution 40066 of 2022 proposes the retroactive application of its provisions insofar as it implies the application of regulations to situations that were consolidated prior to its entry into force. This means that the operators of hydrocarbon exploitation activities, in addition to complying with the regulations that restrict the waste of natural gas and promote its use in the hydrocarbon production chain contained in the contracts signed prior to its issuance, must comply with the guidelines and requirements that this regulation establishes regarding the use, flaring and venting of natural gas.

The foregoing is noteworthy in the context of the transition regime enshrined in this norm, which dis-



The permit granted by the inspection body is for the permits issued by the inspection body,

before the entry into force of this regulation are governed by the legal provisions in force at the time the permit is granted and for the term indicated therein, and that applications for burning permits that are filed with the inspection entity at the time this regulation enters into force must be processed under the terms of the regulations in force at the time they are filed. (MinEnergía, Resolution 40066 of 2022).

However, the figure of natural gas flaring permits (annual and punctual) in the hydrocarbon production chain and, specifically, in the exploitation activities was introduced with the issuance of Resolution 40066 of 2022.

Discussion

Resolution 40066 of 2022 is an opportunity to bring environmental protection standards from Colombian domestic law into line with international reality and technical requirements so that the competent authority can exercise control in the detection and repair of natural gas leaks, as well as in the use, flaring and venting of natural gas, depending on the exploration or exploitation phase of the projects. This will standardize the control and monitoring by the State of the natural gas industry, under the conditions expected by the signatory countries of the international instruments to combat climate change and environmental issues.

Resolution 40066 of 2022 also seeks to establish rigorous standards that will lead companies to avoid gas flaring and venting, either because they have not invested in infrastructure, or because they think in terms of profitability versus their environmental and social responsibility to all stakeholders who are impacted by these practices. This is without leaving aside the impact on climate change variations, whose effects, although irreversible, could be mitigable or adaptable with initiatives of this type.

After analyzing the process of incorporating Resolution 40066 of 2022 into the current legal system, and after having studied its context, scope and the international standards that support the adoption of the measures it brings with it, it is necessary to understand that it is not enough to be aware of the problem, but that measures must be adopted to address it.

In this sense, it is a good thing that Resolution 40066 of 2022 in its scope of application extends to all hydrocarbon exploration and exploitation operations within Colombian territory, being, therefore, mandatory compliance in the contracts that are in force, and also in future agreements to be signed by the Government of the day in the framework of exploration activities. By that time, it will be the task of the competent authorities to validate that the company that signs a new contract has the necessary infrastructure for its use and exploitation, as well as that the companies with a current contract adapt their own to these requirements.

On the other hand, it is also necessary for the State to design fiscal norms that can provide incentives for infrastructure investment that complies with the requirements of the law, as well as for the tax framework to allow them to invest in infrastructure that complies with the requirements of the law, as well as for the tax framework to allow them to invest in infrastructure that complies with the requirements of

the law.

The company may allow companies to import machinery with exemptions that are favorable to them or instead invest in innovation and development (R&D) for the design of new equipment or the improvement of existing equipment.

The above is explained in that investments in machinery or R&D in this area currently do not consider the value of natural gas in those local or subsidized markets in that it is not a properly attractive investment in economic terms for companies, as shown by Ayuso (2017), who also insists that it is an issue that should be studied further in the search for other types of incentives.

When the capital costs are evaluated versus the income obtained from the commercialization of natural gas valued at opportunity cost, the results change, indicating that there is an economically viable opportunity to achieve flared and vented gas recovery objectives that should be studied further. (p. 101).

Thus, the opportunity cost of vented or flared gas must be analyzed not only in economic terms from the point of view of the cost compared to alternative fuels that would cover the deficit of natural gas, but it is also necessary to consider the cost in social terms, since the industry itself does not usually estimate the impact on the interruption or impairment of the right of access to gas and electricity services, as household public utilities. This is not to mention the environmental costs and the damage caused to current and future generations, who will not have the conditions to enjoy the right to a healthy environment.

Although Resolution 40066 of 2022 establishes in a detailed and precise manner the technical standards for the use, flaring and venting of natural gas, as well as the limitations and the permit regime before the competent authority when there are leaks that must be detected and repaired, there are still many questions to be resolved in order to achieve an effective transition to a more efficient and sustainable use of this resource.

Indeed, when natural gas associated with crude oil production is detected, companies face two scenarios. In the first, they will be able to put it to productive use, and in the second, they will be able to vent it or burn it; this is the assumption that is the objective of the analyzed regulation. Undoubtedly, it is an important effort made by the Government to "catch up" with regulations in other countries, but it still falls short, since it omits the first scenario, as it does not generate adequate incentives for companies to choose to put natural gas to productive use.

Today, it is possible to see the enormous effort made by some countries that generate incentives to improve the practices of the hydrocarbon industry, including the disposal of natural gas associated with the production of crude oil, among which it is worth mentioning, as success stories, Trinidad and Tobago, which has opted to reduce existing taxes on oil, or Nigeria, Tunisia and Vietnam, which have made a progressive decrease in royalty rates, favoring companies that carry out sustainable and environmentally responsible practices (Toledano et al., 2014).

Because there is little or no point in regulating and restricting certain practices if it is the market, and in this case, the expectations of the *shareholders* in the hydrocarbon sector, that will take precedence over any good intentions of the legislator or the competent authority. It is not for nothing that if the technical requirements and operating costs that this standard entails become high, it is usual for companies not to invest in it, and in their case, to invest in it.



In order to reduce legal risks and maintain their profitability indicators, they may choose to circumvent the sanctions contemplated in the current regulations by seeking experts in different disciplines.

Therefore, in the end, with the right incentives and strict rules regulating the use, burning and venting of natural gas, an "ideal state" will be reached in which companies will be able to implement good practices with a permanent vocation, taking into account their social and environmental responsibility, and with a focus on sustainability. Only in this way will the government begin to make progress on this front in the fight against climate change and in the fulfillment of international commitments.

With Resolution 40066 of 2022 and the current situation in the Government to bring the regulatory standards on hydrocarbons in line with the international reality and the aspirations of the countries that have signed the climate change instruments, we are facing a unique opportunity to promote a change in the current development model. In addition to legislating in favor of decarbonization in the world, it will be necessary for all actors to assume both commitments and risks in order to adapt and mitigate the damage that has been caused by climate variations, which put life on the planet at risk.

Conclusions

Resolution 40066 of 2022 of the Ministry of Energy is an opportunity for companies in Colombia and the State to align with international standards of environmental protection in natural gas and, in this sense, to articulate the fight against climate change. In this sense, the resolution establishes technical requirements for the detection and repair of leaks, as well as for the use, flaring and venting of natural gas.

Thus, the resolution aims to mitigate the environmental impacts of natural gas, particularly methane, a potent GHG that contributes to climate change. It seeks to avoid the waste of natural gas, defining the activities in which the flaring and venting of natural gas is permitted and establishing a program for the detection and repair of leaks.

Resolution 40066 of 2022 is an important step forward, but there is still much to be done; in particular, it is necessary for the State to encourage investment in infrastructure for the use of natural gas. This is necessary so that companies have an economic incentive to avoid gas flaring and venting. In fact, good practices in countries such as Trinidad and Tobago, Nigeria, Tunisia and Vietnam, which have lowered royalty rates for companies that carry out sustainable practices, can be taken as success stories.

Resolution 40066 of 2022 being a positive step forward for environmental protection in Colombia, it is necessary to analyze the possibility of implementing similar tax incentives to promote the use of natural gas. With the right incentives, companies will be able to implement good environmental and social practices, which will help Colombia meet its commitments to combat climate change.

Resolution 40066 of 2022 correctly establishes technical requirements for the detection and repair of leaks, as well as for the use, flaring and venting of natural gas. These requirements are found in the



The challenge ahead of this regulation is key if we consider that it must be articulated with all the regulations in force in the hydrocarbons sector. The challenge ahead of this standard is key if we consider that it must be articulated with all the regulations in force in the hydrocarbons sector; however, as we have insisted, this was a very important step in that direction.

Conflicts of interest

The authors declare that there are no conflicts of interest that may arise in relation to the article submitted for publication and that may involve third parties.



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