CNH

Comisión Nacional
de Hidrocarburos

CNH GAZETTE

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Terms and units of measure

Term	Definition
AAPG	American Association of Petroleum Geologists
AGA	American Gas Association
AIPM	Petroleum Engineers Association of Mexico (Asociación de Ingenieros Petroleros de México)
AMEXHI	Mexican Association of Hydrocarbons Companies (Asociación Mexicana de Empresas de Hidrocarburos)
ANCAP	National Administration of Fuels, Alcohols and Portland (Uruguay) (Administración Nacional de Combustibles, Alcohol y Pórtland)
ANH	National Hydrocarbons Agency (Bolivia) (Agencia Nacional de Hidrocarburos)
ANP	National Agency of Petroleum, Natural Gas and Biofuels (Brazil) (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis)
ANPHI	National Hydrocarbon Producer Association (Asociación Nacional de Productores de Hidrocarburos)
API	American Petroleum Institute
ARIAE	Ibero-American Association of Energy Regulators (Asociación Iberoamericana de Entidades Reguladoras de la Energía)
ARPEL	Association of Oil, Gas and Renewable Energy Companies of Latin America and the Caribbean (Asociación de Empresas de Petróleo, Gas y Energía Renovable de América Latina y el Caribe)
ASTM	American Society for Testing and Materials
CEN	European Committee for Standardization (Comité Européen de Normalisation)
CNH	National Hydrocarbons Commission (Comisión Nacional de Hidrocarburos)
CRE	Energy Regulatory Commission (Comisión Reguladora de Energía)
DGMCP	Directorate-General of Production Metering and Commercialization (Dirección General de Medición y Comercialización de la Producción)

Term	Definition
DOF	Official Gazette of the Federation (Diario Oficial de la Federación)
DTI	Department of Trade and Industry
EDP	Extraction Development Plan
EEI	Energy Efficiency Index
EP	Exploration Plan
ApPr	Appraisal Program
IMP	Mexican Petroleum Institute (Instituto Mexicano del Petróleo)
Inmetro	National Institute of Metrology, Quality and Technology (Brazil) (Instituto Nacional de Metrologia,Qualidade e Tecnologia)
ISO	International Organization for Standardization
NOM	Official Mexican Standard (Norma Oficial Mexicana)
NPV	Net Present Value
OPEC	Organization of the Petroleum Exporting Countries
PEMEX	Petróleos Mexicanos
PEP	Pemex Exploración y Producción
PIV	Present Investment Value
SEMARNAT	Ministry of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales)
SPE	Society of Petroleum Engineers
TrPr	Transition Program
UE_E	Units of Energy Employed
UE_O	Units of Energy Obtained
UI	Utility Index
UNAM	National Autonomous University of Mexico (Universidad Nacional Autónoma de México)
UWG	Upstream Working Group
YPFB	Yacimientos Petrolíferos Fiscales Bolivianos

Volume (liquids)

Unit	Description
b	barrels
bd	barrels per day
Mb	thousand barrels
Mbd	thousand barrels per day
MMb	million barrels
MMbd	Million barrels per day

Distance and surface

Unit	Description
m	meters
km	kilometers
m^2	square meters
km^2	square kilometers

Volume (gases)

Unit	Description
cf	cubic feet
cfd	cubic feet per day
Mcf	thousand cubic feet
Mcfd	thousand cubic feet per day
MMcf	million cubic feet
MMcfd	million cubic feet per day
Bcf	billion cubic feet
Bcfd	billion cubic feet per day

Currency

Unit	Description
MXN$	Mexican Pesos
M MXN$	Thousand Mexican Pesos
MM MXN$	Million Mexican Pesos
US$	U.S. Dollars
M US$	Thousand U.S. Dollars
MM US$	Million U.S. Dollars

Digital Storage

Unit	Description	Factor
PB	Petabyte	1024 TB
TB	Terabyte	1024 GB
GB	Gigabyte	1024 MB
MB	Megabyte	1024 KB
KB	Kilobyte	1024 byte
B	byte	8 bits

Energy

Unit	Description
boe	barrels of oil equivalent
boed	barrels of oil equivalent per day
Mboe	thousand barrels of oil equivalent
Mboed	thousand barrels of oil equivalent per day
MMboe	million barrels of oil equivalent
MMboed	million barrels of oil equivalent per day

The Relevance of Extraction Development Plans for Mexico's Energy Future

By **Rafael Guerrero Altamirano**
Head of the Technical Unit of Extraction and its Supervisionn
Francisco Castellanos Páez
Director General of Extraction Rulings

Hydrocarbon Extraction Development Plans are fundamental to ensure Mexico's energy future, as they are the strategic backbone of national growth, energy independence and innovation in the industry. Designed to maximize resource recovery for the benefit of the Mexican State, these plans incorporate technical, technological, economic and financial components within a robust regulatory framework and a long-term vision.

Between December 2018 and July 2024, the National Hydrocarbons Commission processed 218 Extraction Development Plan (EDP) applications and 83 Transition Programs (TrPr), approving projected investments of 132,154 MM US$ over a 2024-2030 horizon. With this investment, from national and international companies, hydrocarbon production in Mexico is expected to keep its current trend and contribute to energy sovereignty by strengthening and diversifying national production and the State's planning for expected revenue.

CNH ensures a rigorous and comprehensive evaluation process, in addition to providing strategic value by implementing a responsible and transparent technical management framework. Moreover, it encourages best practice adoption in the industry, as it ensures that each EDP is not only profitable, but also has a sustainable and balanced impact on Mexico's energy future.

Examples like the Amoca, Ayatsil, Kayab, Miztón, Maloob, Pit, and Zaap offshore fields have proved the positive impact of these EDPs and have enabled the implementation of advanced recovery technology that optimizes production and extends well life. In onshore fields such as Quesqui and Ixachi, characterized by extreme pressure and temperature conditions, the approved strategies facilitate adequate resource development, which is why these plans have been consolidated as backbones of growth for the industry.

Finally, EDPs are integrated with a holistic approach that includes the environmental and social impact of extractive activities in accordance with the existing safety, environmental, infrastructure and Local Content framework, thus ensuring a balance in sustainable development for the country's benefit.

Development Plans: a long-term commitment to Mexican society

By **Alberto de la Fuente**
Mexican Association of Hydrocarbon Companies (AMEXHI)

In our country, the State, through CNH, takes part in the strategic decision-making process of hydrocarbon projects by approving Exploration Plans and Extraction Development Plans.

The approval of the Development Plan may be the most important milestone of an exploration and extraction project, since this plan is the fruition of the exploration process and specifies the strategy that will guarantee recovery factor maximization and hydrocarbon value over time. ***A Development Plan is a long-term investment commitment and represents the joint will of government and industry.***

AMEXHI is a non-profit civil association that gathers the main oil and gas investors and operators in Mexico. It currently has 27 members operating in the country under hydrocarbon exploration and production contracts signed with the Mexican State. AMEXHI shares best practice analyses to enhance the development of the national energy industry.

Development Plans for hydrocarbon projects

Between the discovery of a hydrocarbon reservoir and production, several elements influence the viability of a project. According to international practice, in the case of hydrocarbon discoveries, the start of production can take from four to more than ten years, depending on its location and characteristics. To achieve first production, crucial decisions must be made. This includes the exploration process, the determination of commercial viability of the discoveries and the design of a development strategy. Additionally, the particular conditions of a project of this nature must be navigated, such as high-risk level (due to geological, operational, economic factors, etc.), the large investments required and the long payback period.

Development Plans as a social phenomenon

The main challenge in designing a Development Plan is defining a comprehensive strategy that allows for viability under optimal conditions of the different elements that converge in a project. This includes each project's technical background (production capacity, physical activities, production metering, and commercialization, among others), market conditions, the environmental and sustainability component, and very importantly, the social factor that frames our industry's activities.

The hydrocarbon industry in Mexico, whose leading exponents are members of AMEXHI, is deeply committed to the social development of our country, as evidenced by the compliance with Local Content Programs, training and technology transfer, in addition to the implementation of social programs that go beyond contractual or regulatory obligations. Beside being a source of hydrocarbon production underpinning national energy security and sovereignty, ***Development Plans have an influence as direct and indirect employment generators, local economy and supplier promoters, scientific and technological development drivers and, in general, are a source of well-being for the Mexican society.***

CNH as a reliable source for long-term investments

The design of a Development Plan involves complex processes within each company. Project leaders become promoters of investment in their organization to get the parent companies or shareholders to invest in our country. Development Plan viability depends not only on technical and economic components, but also on factors that build investment confidence, such as openness to private participation in the sector, legal stability, long-term certainty, strength and maturity of the regulatory system, the possibility of establishing economies of scale, opportunities for virtuous collaboration with state-owned companies, stability and social license.

CNH has played a key role in these confidence-building factors. As the main regulator of hydrocarbon exploration and extraction, CNH has created a mature, efficient and transparent regulatory framework that balances regulatory requirements with operational flexibility and the use of best practices. This reflects both trust and mutual recognition between regulators and regulated parties.

As both counterpart and administrator of Assignments and Contracts, ***CNH is a source of confidence for Mexican society and investors.*** Thanks to CNH, national and international companies have found the right conditions to commit to long-term investments for our country's benefit. On the other hand, Mexican society has open and transparent access to the activities of our sector to ensure that the Nation's resources are used to the profit of our society.

Oilfield Development Plans. General aspects

By **Pedro José Carmona Alegría**
Petroleum Engineers Association of Mexico (AIPM)

AIPM groups professionals in Engineering and related fields who work for the Mexican Oil Industry. It guides and promotes the industry's development, and provides safety and welfare for its 2,129 associates, grouped in ten regional delegations in Reynosa, Tampico, Monterrey, Poza Rica, Veracruz, Mexico City, Coatzacoalcos, Villahermosa, Comalcalco and Ciudad del Carmen.

The development of a hydrocarbon reservoir requires safe and efficient execution of highly complex projects. It considers technical aspects, location, existing infrastructure, available technology, financial resources, regulations, and foreseeable risks.

A Development Plan is an oil company's proposal on how it intends to develop one or more reservoirs and manage the associated risks.

Oilfield Development Plans have evolved over time: let us remember that the oil and gas extraction industry began in 1859, when Edwin Drake drilled the first oil well in Titusville, Pennsylvania, USA. At that time, the objective of oilfield development was only to extract oil to obtain kerosene, which was used in lighting and, therefore, development was limited to obtaining enough oil to supply cities with kerosene. A grease by-product was obtained and was used to lubricate steam machinery at the time. All by-products and gas obtained were not used because there was nothing to use them for.

The only means of transportation for oil was barrels, wagons or steam trains. The market conditions between 1800 and 1900 only allowed for the development of very simple fields. However, as time went by, the oil industry developed to what we know today. Consequently, Oilfield Development Plans have evolved and reflect the implementation of technologies such as internal combustion engines, the use of petroleum by-products for the petrochemical industry and the technological development of the oil and gas extraction industry itself.

Today many aspects must be considered to develop an oilfield:

Reserve estimates: This is one of the most important and complex aspects to consider when preparing a reservoir or oilfield's Development Plan because the infrastructure for hydrocarbon exploitation, production, transportation, treatment, refining and commercialization will be built depending on reserve levels.

Location: It can be onshore, located in the desert, the jungle, in remote places and far from existing infrastructure, or offshore, in shallow, deep or ultra-deep waters.

Available technology: Regarding oil and gas extraction systems, drilling depths, layer conditions, pressure control, temperatures, sour gases, drilling equipment characteristics, storage infrastructure, transportation, separation, repumping or recompression equipment installation, refining capacity among others, must be taken into account.

Target market: Development Plans must consider whether oil and gas production is for domestic use, foreign market sale, or both purposes. This is very important, as it largely defines the infrastructure to be built.

Financial aspects: In this regard, the most important aspect is the production cost vs. sales cost ratio. It should be noted that the cost of sales depends on many variables beyond the control of oil and crude producers. Adequate cost margins should always be established to allow investment returns.

Government Regulations: Through regulations, the State protects social, economic, political, technical, industrial safety, environmental, labor and tax collection aspects. Their objective is to guarantee efficient operation of Oilfield Development Plans, thus creating legal certainty and guaranteeing the rights of the State and of the companies developing oilfields. Mexico has several Regulatory Bodies, the main one being CNH, which made and published the *Guidelines regulating Hydrocarbon Exploration and Development Plans* in the Official Gazette of the Federation.

Sources:
- The Commonwealth (2024). *Field Development Plans: A Handbook for Government Officials.*
- National Commission of Regulatory Improvement (2024). *Regulations, Procedures and Inspections.*

Economic risk analysis and energy feasibility assessment in the elaboration of Hydrocarbon Extraction Development Plans

By **Irma Glinz Férez and Ana Paulina Gómora Figueroa**
Department of Petroleum Engineering, Faculty of Engineering, National Autonomous University of Mexico, (UNAM)

The **Faculty of Engineering of the National Autonomous University of Mexico** is the first scientific research institute in the Americas, dating back to the founding of the Royal Mining Seminar in 1792 in what was then New Spain. After Mexico's independence, it became the College of Mines and, with the creation of the UNAM in 1910, it was transformed into the National School of Engineering before receiving the rank of Faculty in 1959.

The Faculty of Engineering currently offers 15 undergraduate engineering programs, including Petroleum Engineering, 13 specializations, as well as the Master's and Doctoral programs in Engineering. In addition to running the *Palacio de Minería*, the Faculty also organizes the annual *Palacio de Minería* International Book Fair and founded the *Minería* Music Academy and Symphony Orchestra, which also originated from the Royal Mining Seminar.

Economic risks and energy balances are essential for elaborating Hydrocarbon Extraction Development Plans in Mexico. Therefore, it is desirable to strengthen current planning methodologies that include economic and financial risks and the incorporation of energy feasibility in evaluation models, thus prioritizing the Energy Efficiency Index over the traditional Utility Index.

Current Status

Methodologies to elaborate Hydrocarbon Extraction Development Plans are similar around the world, and their technical intersection points are what are commonly referred to as *Best Practices*. In Mexico, to promote the energy sector's efficient development, CNH coordinates submission, approval and supervision of compliance with Hydrocarbon Exploration and Extraction Plans by means of the *Guidelines Regulating the Hydrocarbon Exploration and Extraction Development Plans* (National Hydrocarbons Commission, 2023).

The *Business Plan of Petróleos Mexicanos and its Subsidiary Productive Companies* 2023-2027 (Petróleos Mexicanos, 2022) states that the objective of Petróleos Mexicanos (PEMEX) is to develop solid, liquid and gaseous hydrocarbon exploration, extraction, collection, sale, and commercialization, in alignment with the Government of Mexico, with aims at consolidating energy independence and strengthening the State's finances. PEMEX's strengths feature prospective resources, 3P reserves that support long-term viability and 1P reserves that support the company's economic value. These resources must be extracted in accordance with the approved Hydrocarbon Extraction Development Plans.

On the other hand, forecasts of international organizations such as the *International Energy Agency, OPEC and BP* (bp Energy Economics, 2024), to mention a few, show that the demand for fossil fuels, will continue with a decreasing trend in 2050, due to decarbonization and the sustained growth of cleaner energies. Regardless of this trend, the elaboration of Development Plans will require quantitative methods for risk analysis and structural amendments to the evaluation models.

Risk

The *Guide for risk analysis elaboration in the hydrocarbon sector*, integrating hazard identification, process risk analysis and assessment, prevention recommendations and measures, and control and mitigation to reduce risks to an acceptable level, was published in 2020 (Ministry of Environment and Natural Resources, National Agency for Industrial Safety and Environmental Protection in the Hydrocarbons Sector). However,

other risks are not considered in Development Plans, such as geopolitical tensions, market volatility, and political changes in hydrocarbon exporting countries. For this reason, it is suggested to comprehensively include all technical, social, environmental, economic and financial risks in a stochastic model that strengthens the portfolio of hydrocarbon extraction development plans and projects, thus maximizing economic or energy benefits and simultaneously minimizing risks (see ***Figure 1***).

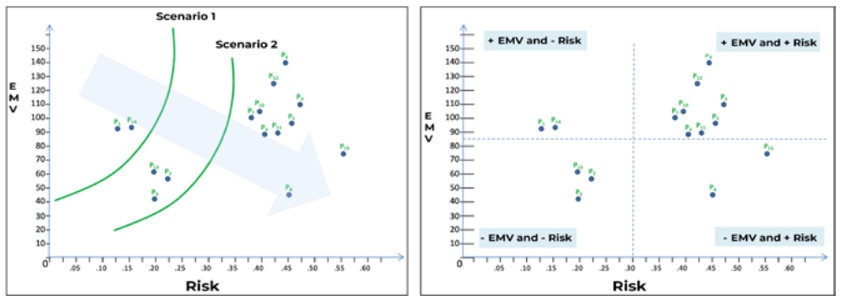


Figure 1. Mapping of a Hydrocarbon Extraction Development Plan Portfolio.
Source: The authors with data from Berumen Glinz Consultores Asociados.

Structural change in the evaluation model of the Plan or Project

Since the new administration of PEMEX seeks to consolidate the company as a modern entity that is both open to change and not solely limited fossil fuel development, PEMEX is expected to significantly change the management of its investments and project portfolios. Consequently, investment methodologies for the evaluation of plans or projects must be adjusted.

Current methodologies are aimed at sustainable Hydrocarbon Extraction Development Plans, thus obtaining technical, economic, social and environmental feasibility assessments, to name a few. However, a methodology that evaluates energy feasibility has not been considered.

Energy feasibility evaluation would enable comparing different Development Plans to generate energy, derived or not from hydrocarbons. Thus, instead of an economic efficiency index, or Utility Index (UI), quantifying monetary units obtained for each invested monetary unit, there would be an Energy Efficiency Index (EEI) indicating Units of Energy Obtained per each Unit of Energy Employed (see ***Figure 2***). The complexity of this approach lies in obtaining the energy equivalence of the infrastructure required in hydrocarbon extraction processes.

$$UI = \frac{NPV}{PIV}$$

where
UI = Energy efficiency index
NPV = Units of Energy Obtained
PIV = Units of Energy Employed

$$EEI = \frac{UE_o}{UE_e}$$

where
EEI = Energy Efficiency Index
UE_o ***= Units of Energy Obtained***
UE_E ***= Units of Energy Employed***

Figure 2. Description of the economic utility and energy efficiency indexes. **Source:** The authors.

Finally, the inclusion of the economic risk analysis will support the decision-making process to select investment opportunities foreseen in Development Plans. Additionally, the energy feasibility analysis of a portfolio's hydrocarbon extraction projects will enable balancing between energy employed and energy obtained. As a result of changes in public administration, these methodological suggestions may be consolidated within the *Guidelines regulating Hydrocarbon Extraction Development Plans*.

Sources:
- bp Energy Economics. (2024). bp Energy Outlook 2024 Edition.
- National Hydrocarbons Commission. (2023). Guidelines Regulating Hydrocarbon Exploration and Extraction Development Plans.
- Petróleos Mexicanos. (2022). Business Plan of Petróleos Mexicanos and its Subsidiary Productive Companies 2023-2027.
- Ministry of Environment and Natural Resources, National Agency for Industrial Safety and Environmental Protection in the Hydrocarbons Sector. (2020). Guide for risk analysis elaboration in the hydrocarbon sector.

Institutional checks and balances, compatible management for hydrocarbon commercialization[1]

By **Layla Vargas**
National Hydrocarbon Producer Association (ANPHI)

ANPHI is an organization committed to the development of the energy sector in Mexico. Its objectives include collaboration with Regulatory Bodies in regulation design, contribution to production increase and hydrocarbon reserve strengthening, and promotion of employment generation to boost national economy.

This article seeks to acknowledge the importance of the technical expertise and power differentiation of the hydrocarbon sector authorities, especially the National Hydrocarbons Commission (CNH) and the Energy Regulatory Commission (CRE), whose institutional coordination efforts have enabled successful regulation of essential activities within the value chain prior to hydrocarbon commercialization, following operational challenges.

The current institutional and regulatory design of the hydrocarbons sector —in line with international practices— includes a power distribution system for regulators with the purpose of providing objective compliance surveillance, based on fundamental administrative aspects such as autonomy and technical expertise to apply and interpret the sector's highly complex rules.

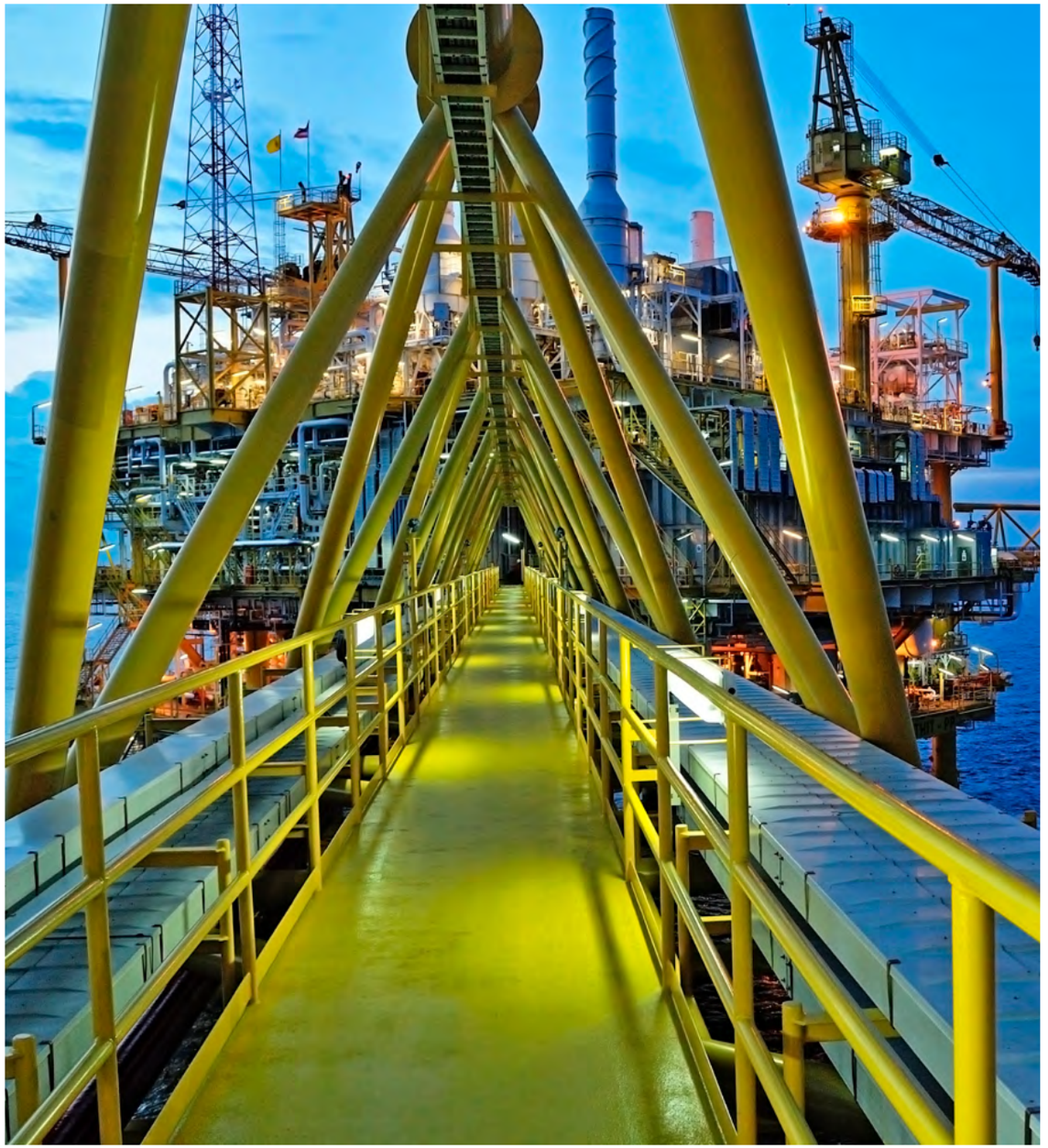
This structural design intertwines with the operational reality during the execution of the hydrocarbon value chain, starting with production, through collection, transportation, storage, and commercialization, "allowing public policy, regulation and operation of the sector to move in a compatible direction" (Hernández, 2017, p. 252). The openness promoted towards Oil Operators has also positively impacted on the effectiveness of regulation at the time of its execution and on prompt attention to operational challenges exceeding legal assumptions.

1 Capitalized terms used herein have the same meanings established in the current regulation.

A very graphic and successful instance of institutional coordination, technical specialization and adequation to the operational reality is competency delimitation in Collection and Transportation, whose regulatory boundaries are not circumscribed to a physical limit such as the polygon of a Contractual Area, but to operational, infrastructure, logistics and commercialization conditions.

Collection Systems may thus be extended to the Transportation System's starting point, as determined by CRE, or even to the infrastructure limit after the Separation Battery, when they may be considered as Collection Facilities due to their technical characteristics, provided their corresponding Evaluation, Transition and Development Plans are duly authorized by CNH (National Hydrocarbons Commission, 2022).[2]

2 Determination that impacts on the Point of Sale's location, which may or may not coincide with the Provisional Metering Point or Metering Point, therefore, may or may not be located in the contractual polygon.



The foregoing is only a practical example of the coordination between CNH and CRE to regulate essential activities for hydrocarbon commercialization, for the benefit of the State, the Contractors and the Entitlement holder.

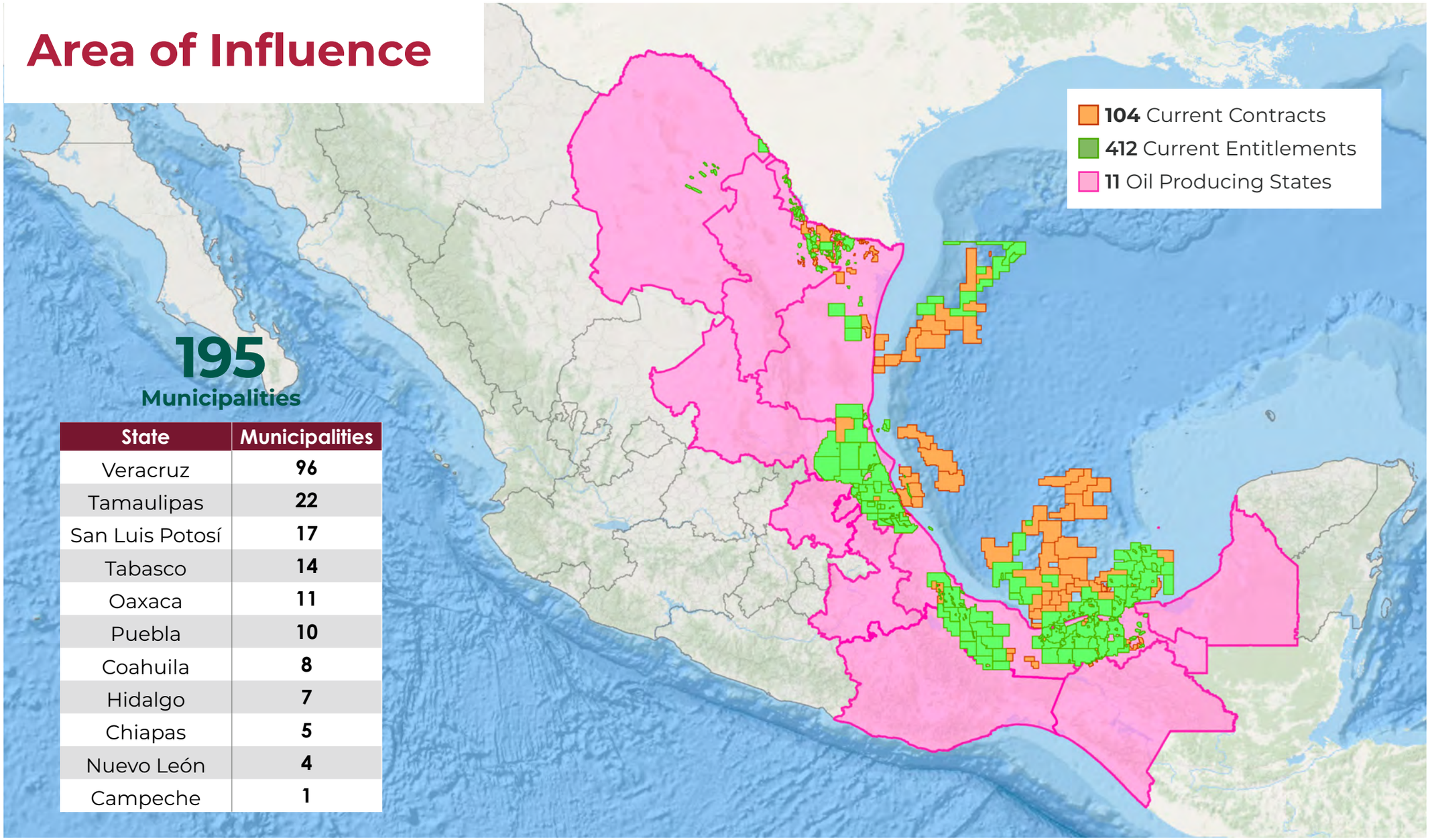
We would like to emphasize that institutional checks and balances both ensure that decisions are made on an objective, impartial and consistent basis, free of any conflict of interest, and impact on the development of duly permitted activities within the value chain, thus yielding revenue as a result of direct and indirect employment creation.

In this context, it is impossible to disregard the contribution of regulatory body and stakeholder coordination towards maintaining a competitive, efficient and consolidated sector, regulated in accordance with best practices, and whose continuity is therefore desirable.

Fuentes:

- National Hydrocarbons Commission (2022). Technical Guidelines on Hydrocarbon Collection
- Hernández, C. (2017). Mexico's New Energy Constitution and its implementation

Area of Influence



195
Municipalities

State	Municipalities
Veracruz	96
Tamaulipas	22
San Luis Potosí	17
Tabasco	14
Oaxaca	11
Puebla	10
Coahuila	8
Hidalgo	7
Chiapas	5
Nuevo León	4
Campeche	1

CNH's regulated activities according to the Hydrocarbon Value Chain

2019-2024

Exploration

National Potential Prospecting → Incorporation of Oil Reserves → Oilfield Evaluation

Compliance Verification on:

23,146
MMboe
Total Reserves as of January 1, 2024.

412
Entitlements
(PEMEX)

104
Contracts
(Private Operators -PEMEX)

465
B US$
Approved and Ongoing Exploration and Production Plans[1]

20,483
MM US$
estimate Local Content[1]

Extraction

Drilling and infrastructure → Extraction and Commercialization → Completion and Restoration

1,822
Mbd
of liquid hydrocarbons[2] on average during September 2024.

10,429
MM US$
from the Commercialization of hydrocarbons of the State from Production Sharing Contracts[2]

9
million samples
Safeguarded and managed at the Hidalgo and Yucatán Core Centers Onshore and Offshore Subsoil Digital Data Banks

1 Inflation adjustment not included. Regarding Entitlements, approved investment amount updated with producer index prices amounts to 473 billion dollars.
2 Includes oil and condensate.

Exploration (2019-2024)

Resource Evaluation

National Potential Prospecting

112,900
Bboe
Prospective Resources

Incorporation of Exploration and Development Reserves

23,146
MMboe[1]

486[1]
Oilfields with
793[1]
Reservoirs
12[1]
Discoveries

Oilfield Evaluation

6,341
MMboe[2]
Contingent Resources

Exploration Rulings

National Potential Prospecting

372
Approved Exploration Plans

Incorporation of Exploration and Development Reserves

149
Work programs and budgets for Production Sharing Contracts

Oilfield Evaluation

78
Approved Appraisal **Programs**

1 With reserves as of January 1, 2024
2 Data as of September, 2024
3 Inflation adjustment not included. Regarding Entitlements, approved investment amount updated with producer index prices amounts to 9.062 billion dollars

Exploration Authorizations

National Potential Prospecting

37
Superficial Reconnaissance and Exploration Authorizations (ARES)

Incorporation of Exploration and Development Reserves

302
Exploration Well **Authorizations**

Oilfield Evaluation

60
authorized appraisal **wells**

SENER

5
Technical Opinions on the Five-Year Bidding Plan issued to the Ministry of Energy

Authorized Investment in Exploration Plans and Programs

18,790[3]
MM US$

Extraction (2019-2024)

Drilling and infrastructure

1,035
drilled development **wells**

1,351
drilled **wells**[1]

Extraction and Commercialization

1,822,286
bd
with
4,231
operating **wells**

Completion and Restoration

922
sealed **wells**

446,700[2]
MM US$
Authorized Investment in Extraction Plans and Programs

2,616
Hydrocarbon **Metering Systems**

128.45
MMb
commercialized in Production Sharing Contracts

10,429
MM US$
direct contribution to public funds

1 Includes exploration, delineation and development wells.
2 Inflation adjustment not included. Regarding Entitlements, approved investment amount updated with producer index prices amounts to 464.17 billion dollars

Local Content and Technology Transfer

Total Investment in Local Content

20,483

MM US$[1]

Goods, services, labor, training programs, technology transfer, and infrastructure.

Local Content Percentage in Hydrocarbon Exploration and Extraction Contracts

Type of Area	Exploration Stage	Evaluation Stage		Development Stage	
Onshore	26 % per term	22 % - 26 %		27 % - 28 % in the first year, with annual increases to reach 38 % by 2025	
Shallow Waters	13 % - 15% per term	17%		25 % in the first year, with annual increases to reach 35 % by 2025	
Deep Waters	**Initial Term**	**1st Additional Term**	**2nd Additional Term**	**Development Start**	**Production**
	3 %	6 %	8 %	4 %	10 %

Applicable Legislation

Hydrocarbons Law, **Article 46**

Hydrocarbon Exploration and Extraction Contracts, **Clauses 17 to 20:** Local Content, Training, and Technology Transfer

1 Includes investment in Training and Technology Transfer Programs. Figures as of September 2024

Actions with States: Campeche, Tabasco, Tamaulipas, Veracruz

- Implementation of joint strategies aimed at hydrocarbon industry local supplier development.
- Joint work to launch projects regarding Training and Technology Transfer to benefit local Higher Education Institutions and professionals.
- Promotion of infrastructure and social development projects between operators and authorities of thew three levels of government, academic institutions, civil society organizations and productive sectors.

Investment in Training Programs: 29.18 MM US$

Investment in Technology Transfer Programs: 81.19 MM US$

Petroleum Geophysics Laboratory

Exploration Laboratory

Visualization Rooms

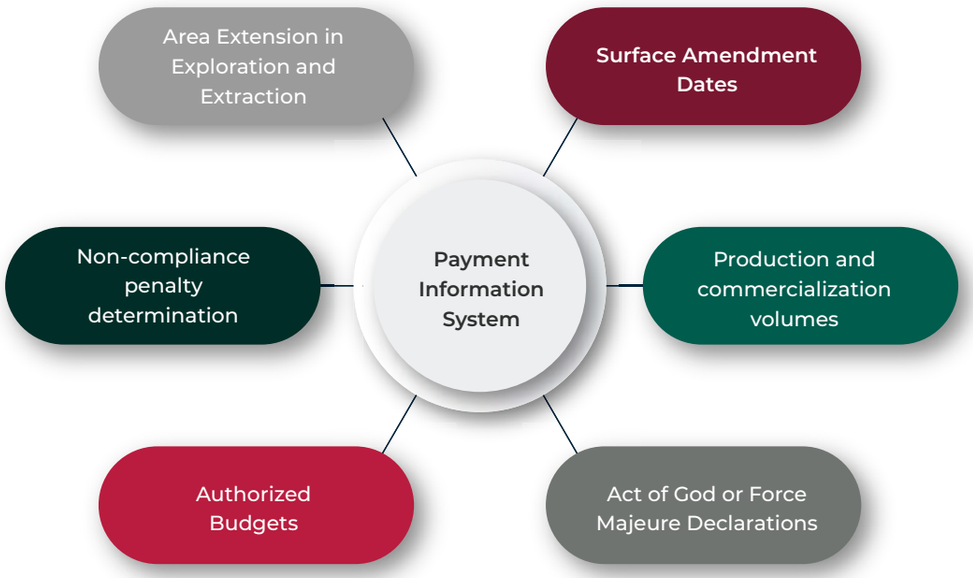
Oil and Gas Industry Professional Certification Program for students and recent graduates

Internship, Technical Conference and Field Visit Programs

Supplier Development Program

Entitlement and Contract Administration (2019-2024)

Through the Payment Information System, CNH provides data for consideration calculation:



Safeguard of:

78
Current Unlimited**Corporate Guarantees**

109
Current limited**Corporate Guarantees** in the amount of:

$198,995,000,000
US$

31
Current **Performance Guarantees**

in the amount of

$468,791,067.21
US$

Legal Unit

Oversight of Legal compliance in

412
Entitlements

112
Contracts*

Regulatory Improvement

10
New Guidelines

16
Amendments

Preparation of

48
Sanctioning and Contentious Procedures

Drafts for Agreements and Resolutions issued by the Governing Body

* 104 current contracts

Executive Secretariat

2,560
Agreements issued by the Governing Body

554
Governing Body Sessions

Preparation, execution and drafting of corresponding proceedings

The Governing Body holds sessions **twice** per week, with an average of **10 items** per meeting.

415
Hearings and Work Meetings

held by the Commissioners and CNH Areas with **62** national and international regulated companies

Around
658
Governing Body
session hours

National Hydrocarbons Information Center

Digital information Management

21

Petabytes

of reservoir, geophysical and well information, amounting to more than

105,011

million

eBooks

Physical Sample Safeguard

One Core Center in Hidalgo and one in Yucatán

Housing more than

9

millon

rock samples from the Mexican subsoil from

17

thousand wells

Economic Evaluation

738

Analyses

determining each oil project's economic viability

Information Dissemination

2

Core Centers

11

Technology tools

20

Statistical Reports

Information from

2,135 **municipalities** in **32** **states** totaling an area of **2.7** **million** km^2

and representing **53 %*** of Mexico

***** Considering seismic datasets, potential methods, ARES with acquisition and data reprocessing. Total surface includes the exclusive economic zone and continental surface.

Administration and Finances

(2019-2024)

Proprietary Fees and Levies

4,007.9

MM MXN$

Total amount for the term

Contribution to Federal Government Expenditure

989.2

MM MXN$

Total per term

Other State Revenue

262

MM US$

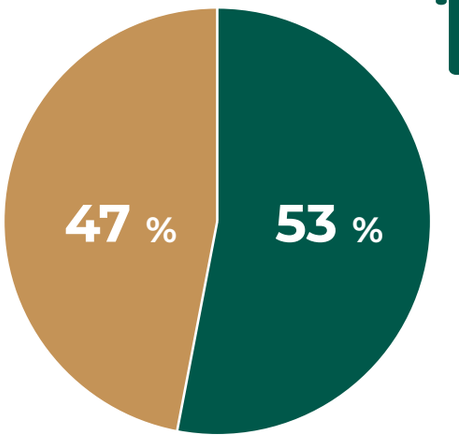
Oil Billing VAT

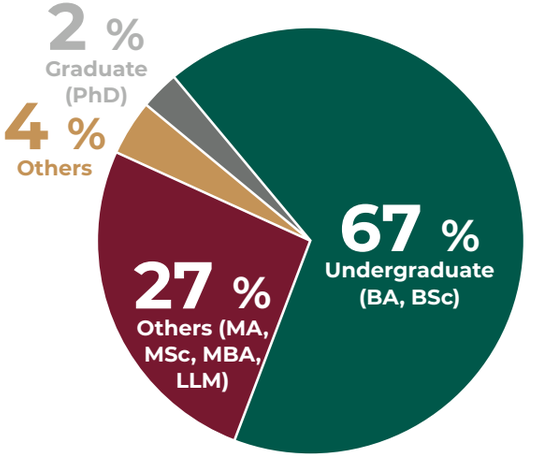
27,951

MM MXN$

375

Public Servants working in CNH





Industry Icons: Carlos A. Garibaldi

The role of natural gas in energy transitions in Latin America and the Caribbean

By **Carlos A. Garibaldi**
Association of Oil, Gas and Renewable Energy Companies of Latin America and the Caribbean (ARPEL)

ARPEL is a non-profit association for companies and institutions in the oil, gas and renewable energy sector in Latin America and the Caribbean. Founded in 1965 as a vehicle for cooperation and mutual assistance among companies in the sector, ARPEL's main purpose is actively contributing to the integration and competitive growth of the industry and sustainable energy development in the region. Its members operate in more than 30 countries in Latin America and the Caribbean and include national and international Operators, technology, goods and services suppliers for the value chain, and national and international institutions in the industry.

Gas addresses two major problems plaguing our region: climate change and energy poverty. It emits 50% fewer environmental pollutants than coal and 25% less than liquid fuels. In many countries in our region, gas provides non-interruptible support for hydroelectric, solar and wind energy. It is also a natural input for producing fertilizers, which are mostly imported into our region.

Gas has been a vector of socioeconomic development in countries such as Argentina, Bolivia, Peru, Colombia, and Trinidad and Tobago. However, many people in our region still cook with firewood or animal waste, with the consequent ecological, environmental and sanitary effects.

Natural gas is thus the ideal fuel for energy transitions due to its lower emissions, availability and low cost, proven technology and socioeconomic benefits. Therefore, natural gas will continue to play a key role in the conceivable future. Countries with gas resources facing energy poverty (especially those without access to clean cooking) have the opportunity to accelerate their development.

THE CASE OF GREEN HYDROGEN IN URUGUAY | CNH GAZETTE

ANCAP integrates offshore energy projects for a responsible energy transition in Uruguay[1]

By **Emily Smith Llinás,**
Latin America and Caribbean Region Director (AAPG)

The **American Association of Petroleum Geologists** (AAPG) is one of the largest trade associations in the petroleum industry. It has more than 39,000 members from 129 countries and its mission is to advance the science of geology, especially as it relates to petroleum, natural gas, other subsurface fluids, and mineral resources to promote the development of exploration technology, in an economically and environmentally sound manner. Since its founding in 1917, it has been a pillar of the world scientific community.

Administración Nacional de Combustibles, Alcohol y Pórtland (ANCAP) is a Uruguayan public company charged, by law of 1931, with exploiting and administering the monopoly of national alcohol and fuel, portland cement, as well as importing, refining and selling petroleum derivatives.

Based on the experience it gained in hydrocarbon exploration and extraction, ANCAP has set its sights on renewable energies and is currently expanding its portfolio to include offshore green hydrogen production.

Additionally, ANCAP is preparing to host the AAPG Latin America and Caribbean Energy Summit 2024, to be held in Punta del Este, Uruguay, on November 19-21. The Summit will promote best practices for sustainable development and energy transition.

Uruguay, population 3.4 million, is a small country with big ambition – becoming a regional leader in providing reliable, sustainable and affordable energy.

Surrounded by Brazil, Argentina and the Atlantic Ocean, the 176,215 square kilometer country has the second smallest area of any country in South America, but the highest per capita income.

Uruguay's geographical location, energy mix and favorable fiscal terms make the country the perfect laboratory for developing strategies to meet the demand for hydrocarbons while transitioning to renewable energies.

Alejandro Stipanicic, president of ANCAP, Uruguay's national energy company, described the organization's efforts to lead a "responsible energy transition," striking a balance between sustainability, energy security and affordability:

> ***ANCAP is fulfilling its present-day mission of delivering the required quality fuels to the local market at the lowest possible cost, while also taking care of the future, leading the energy transition in Uruguay to position it as a reliable and valuable energy supplier worldwide. Today we import fossil fuels, tomorrow we will export our wind and sun.***

Investment climate

A World Bank report published in September 2023 credits Uruguay's sound macroeconomic management and favorable external conditions with supporting an economic expansion that has lasted for two decades, except for a brief recession induced by the COVID-19 pandemic in 2020.

The same report detailed robust economic growth coming out of the pandemic and noted that prudent fiscal management has helped Uruguay enjoy one of the lowest sovereign spreads in the region.

1 This is an updated version of an article published in the AAPG Explorer magazine in January 2024.

Hydrocarbon potential

Potential investors in the energy sector seek more than sound economic terms; they also seek resource potential.

While the exploratory wells drilled in 1976 have oil inclusions and gas shows, there has not yet been a commercial discovery. Bruno Conti, geologist and energy transition specialist at ANCAP, explained that, although Uruguayan basins have frontier status and represent high geological risk, they provide an opportunity highlighted by recent discoveries on the other side of the Atlantic.

He described how the Graff and Venus oil discoveries by Shell and TotalEnergies in 2022 caught the attention of supermajors, independent and small energy companies who flocked to the Orange Basin, a frontier area straddling the maritime boundary of Namibia and South Africa.

> ***Discoveries in the Orange Basin revealed a hidden prospectivity, not only for offshore Namibia, but for all the South Atlantic segment, particularly the offshore basins of Uruguay, which represent Orange's conjugate margin. Strong analogies between these basins can be observed in the petroleum systems, related to the presence of an Aptian source rock, responsible for the Venus accumulation, and the development of similar play types.***

Open Uruguay Round

For the past sixteen years, ANCAP has worked actively to attract investment by offering hydrocarbon exploration and extraction acreage.

The Open Uruguay Round, in place since 2019, allows companies to qualify and submit offers for offshore areas at any time, functioning as two rounds per year.

Pablo Gristo, chief of E&P at ANCAP, reported more than $US 1200 million spent on hydrocarbon exploration in Uruguayan basins, with financial risk incurred by international oil companies and service companies through multiclient agreements[2]. Even with the investment, Uruguayan offshore basins remain underexplored:

> ***Despite the significant amount of data available – 41,000 km of 2D seismic, 41,000 km² of 3D seismic and 13,500 km² of 3D controlled source electromagnetic (CSEM), among others – there is little well information (only three exploratory wells drilled in an area above 120,000 km²).***

Between 2012 and 2016, the most intense period of exploratory activity in the offshore of Uruguay took place, involving the acquisition of several 2D and 3D seismic campaigns and the drilling of an exploratory well in ultra-deep waters. The exploratory activity slowed down after 2016, subsequently entering a period of inactivity.

The story began to change in 2022 when oil companies showed renewed interest and submitted new bids for offshore areas. To date, all seven areas offered for exploration and potential production in Uruguay's offshore basins have been awarded through the Open Uruguay Round, with contracts already signed between operators and ANCAP.

A contract signed in May 2022 awarded Area OFF-1 to CEG. In December 2023, contracts for Areas OFF-2 and OFF-7 were signed with Shell, while YPF secured Area OFF-5, and APA obtained Area OFF-6.

In February 2024, a consortium between APA and Shell signed for Area OFF-4, followed by CEG signing for Area OFF-3 in March.

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2 Editor's note: Mexico implemented a multiclient system to stimulate exploration through Exploration and Surface Reconnaissance Authorizations (ARES).

Finally, in September 2024, ANCAP's board of directors approved the entrance of Chevron as operator, with a 60 percent stake in Area OFF-1 and CEG remaining as non-operating partner with 40 percent.

Alejandro Stipanicic described the bid round results as a "historic milestone" for Uruguay, noting that for the first time in the country's history, all offshore areas will have contracts in force. Pablo Gristo offers the following perspective:

> ***The oil industry has a renewed interest for the exploration offshore Uruguay, due to recent discoveries in Namibia, but undoubtedly this success also arises from the country's reputation and prestige for democratic, economic, and legal stability, as well as its unquestionable adherence to contracts and commitments made.***

Committed exploratory work for the four years exploration period has a nominal value of 129 MM US $, which includes seismic acquisition and reprocessing and, most significantly, a deep water exploratory well expected to be drilled by APA in Area OFF-6.

Long-term benefits

Gristo attributes the recent bid round success to ANCAP's commitment to supporting secure and sustainable investments in energy projects:

> ***APA, Shell CEG and YPF materialized their interest in Uruguay and the exploratory period for the awarded offshore blocks begins, within the framework of the responsible energy transition strategy promoted by ANCAP.***

He noted that results from exploratory efforts will provide benefits both for the operators and the Uruguayan people.

> ***Uruguay will be able to take advantage of its resources in a sustainable way, providing opportunities for investors and respecting contracts, while using income generated from resources beneficial to its population. We may not have the greatest, or the cheapest resources, but it has a combination of factors that make it the best country to invest in energy projects that are capital intensive and require stability in the very long term.***

Advances in renewable energies

ANCAP teams also work to enhance the company's portfolio in renewable energies.

Unlike other energy companies that separate traditional exploration and production from renewable energies projects, ANCAP integrates both divisions into a single working unit.

In 2008, Uruguay's political parties unanimously approved the 2005-2030 Energy Policy Strategy, which established long-term strategies and guidelines for energy diversification, the incorporation of renewable energies, and improved energy efficiency.

Santiago Ferro, ANCAP's energy transition manager, leads the company's E&P business as well as the renewable energy projects:

> ***Uruguay has large potential for energy transition and as a and exporter of renewable energy because of its combination of wind, solar, hydroelectric and biomass resources, that far exceed the national demand for energy. As a result of the implementation of this national strategy, Uruguay has achieved almost complete decarbonization of electricity generation, the first stage of our energy transformation.***

The share of renewables in Uruguay's electricity generation mix varies depending on the climate in any given year. In 2022 renewables comprised 91 percent of the mix (32 percent wind, 3 percent solar, 17 percent biomass, 39 percent hydroelectric), but, on average, electrical power represents just 21 percent of Uruguay's total energy consumption.

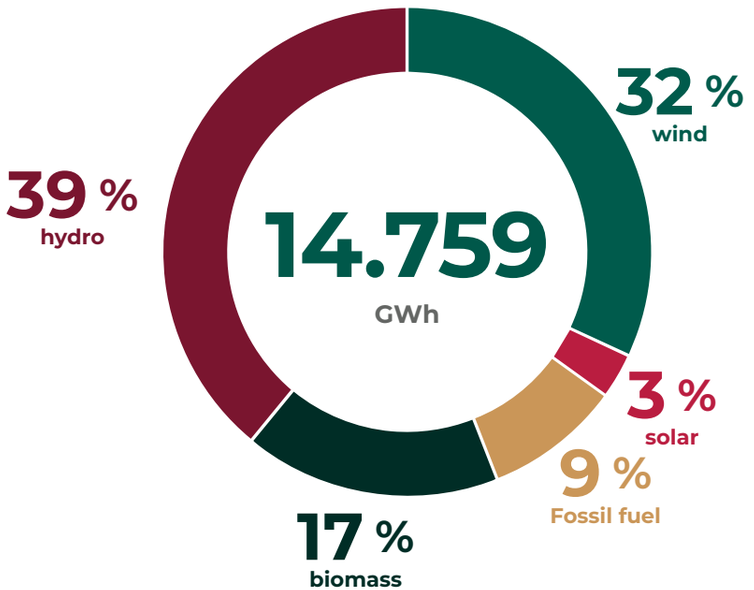


Chart. Energy Balance Report. Uruguay's Ministry of Industry, Energy and Mining (MIEM), July 2023

Santiago Ferro noted that decarbonizing the electrical system in just 10 years provides Uruguay with a proven track record and leaves the country in a strong position to attract foreign investment in renewable energies.

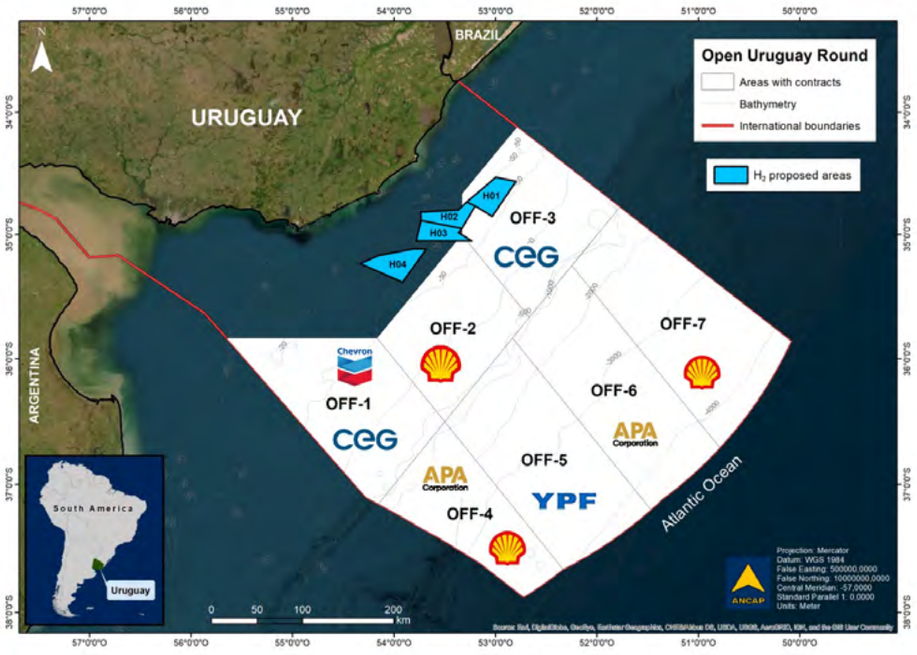
With the first stage of the energy transition —electrical power generation— complete, the country now has other opportunities to decarbonize. Uruguay has consolidated the industrial use of biomass, blending biofuels in diesel oil and gasoline, and is setting its sights on hydrogen. Ferro noted:

> ***The stage is set for a second energy transition, in which the country takes advantage of its natural resources, to position itself as a producer of green hydrogen (GH_2) and its derivatives. ANCAP's long-term objective is to become an exporter of GH_2, taking into consideration the global demand of low carbon energy and the fact that GH_2 is considered the most relevant energy vector for those hard-to-abate sectors (heavy industry and heavy-duty transport), where decarbonization through electrification is quite complex or technically unfeasible.***

Green Hydrogen Offshore Project

In 2023, Uruguay published *The Green Hydrogen Roadmap*, which includes elements needed to support GH_2 development in Uruguay: innovation, regulation, investment promotion, capacity building, international cooperation, infrastructure and logistics, including the hydrogen production from offshore energy projects.

The next important step for ANCAP is the *H2U Offshore Round,* offering offshore areas to produce GH_2 and/or derivatives from renewable energy and for energy companies to carry out feasibility studies and the potential installation of infrastructure.



Map. Offshore Energy Map with E&P blocks in place and proposed H2 blocks in light blue. By ANCAP

ANCAP presented the *H2U Offshore Round* to Uruguay's Ministry of Energy, who is reviewing the proposed bidding terms and a contract model. The model must be approved by the country's Executive Branch to be implemented. The bidding round is expected to be officially launched in early 2025.

Santiago Ferro leverages experience and best practices from hydrocarbon bid rounds to design the hydrogen offshore round.

> ***The H2U Offshore Round accomplishes the most valued factors by energy companies participating in a bidding round: transparency in the process of decision-making and a clear and predictable schedule. The proposed system works similarly to the E&P Uruguay Round, with comparable bidding terms and several analogies in the contract model.***

Attractive place for investment

Ferro said recent interest in the offshore blocks provide the impetus Uruguay needs to move forward with a long-term transition strategy.

> ***Energy transition is a major transformation of a global system that would take decades, and fossil resources will have a role to play during this period, and possibly afterwards. Renewable resources will continue to displace the use of fossil fuels, and at the same time, exploration and production of oil and gas will need to continue at a fair path to compensate for natural declining worldwide reserves. Our country could play a key role in this matter due to the high interest in exploration associated with the recent discoveries offshore Namibia.***

> *ANCAP continues to promote hydrocarbon exploration with an industry eager for new resources. The recent discoveries in Namibia and the direct analogies with the offshore basins of Uruguay show a promising future for E&P activities in future years. Uruguay was able to attract billions of dollars of investment in exploration in the past decade and is trying to extrapolate this capacity to attract investment in the H2U Offshore Round.*

Ferro noted that the exploration and eventual production of hydrocarbons does not imply a setback in the energy transition.

"Natural gas could provide an excellent low-carbon, dispatchable backup to intermittent renewable energy. For its part, the eventual production of oil and gas must be supported with carbon capture and storage projects that help reduce CO_2 emissions," he said, adding that ANCAP continually looks for successful models to serve as examples.

> *Uruguay could be inspired by the resource management carried out by other countries, such as Norway, and create a sovereign fund with part of the income from the oil industry, to invest in renewable energy and green hydrogen projects, further promoting the second phase of the energy transition.*

For additional information about the Uruguay Open Round visit *https://exploracionyproduccion.ancap.com.uy*
For information on the H2U Offshore Round visit *https://www.ancap.com.uy/hidrogeno*
To learn about the Energy Summit visit *https://energysummit.aapg.org/2024/*

By **Jesús Edoardo Rodríguez Pecina**
Society of Petroleum Engineers (SPE), Mexico Section

Applied Methodology for future oilfield production facility development in synergy with existing infrastructure

Coautors
Erika Patricia Mulato Enríquez *(Pemex Exploration and Production, SPRMNE)*
Gerardo Herrera Camilo *(IPM)*
Octavio Flores Lima *(IPM)*

SPE is a professional organization that brings together more than 127,000 engineers, scientists, managers and academia members in the upstream segment of the hydrocarbon sector. It collects, disseminates and exchanges technical knowledge concerning the exploration, development and production of oil and gas resources and related technologies to meet the world's energy needs in a safe and sustainable manner.

This methodology provides technical support for PEMEX specialists to make the best decision regarding proper oilfield management. This methodology is based on PEMEX's Operational Guide for Transportation Network Simulation and has a flow chart (See Figure 1) describing actions to perform in a punctual and summarized manner. A simulation model built and updated in the Petroleum Experts GAP® simulator can be generated under this premise. There are many simulators in the market, but their use also largely depends on the current needs of Pemex Exploración y Producción.

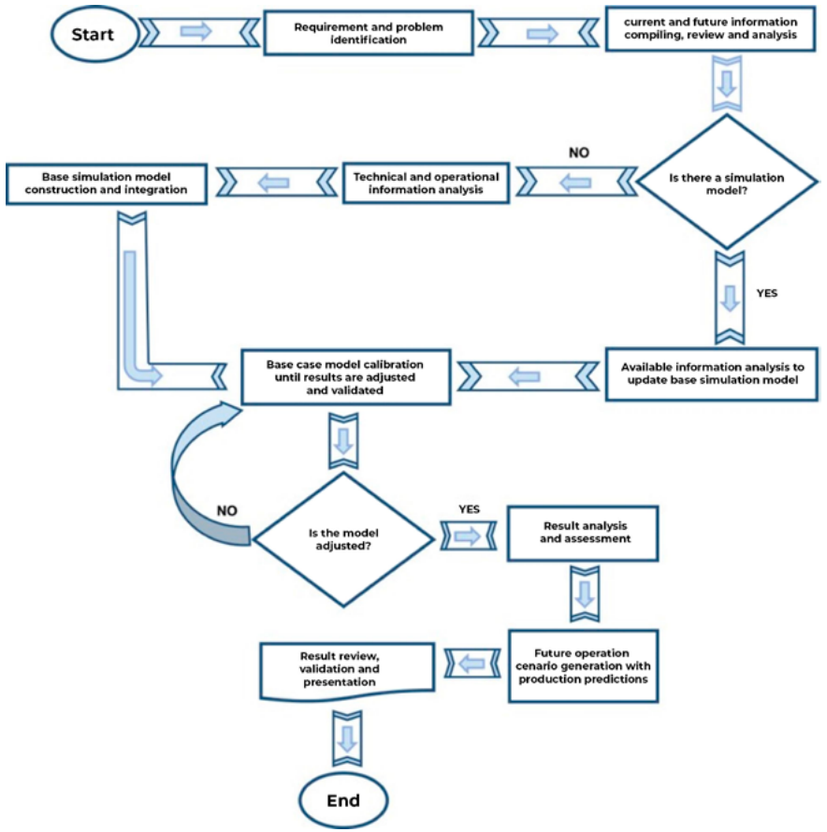


Figure 1

Target oilfields and specific challenges

Analyzed fields are located 130 km from Ciudad del Carmen, Campeche, in the Gulf of Mexico. They produce extra-heavy crude oil with densities ranging from 9° to 13° API. Exploitation will be performed through the Artificial Electrocentrifugal Pumping System by diluting crude at surface with light oil from an adjacent field (See Figure 2).

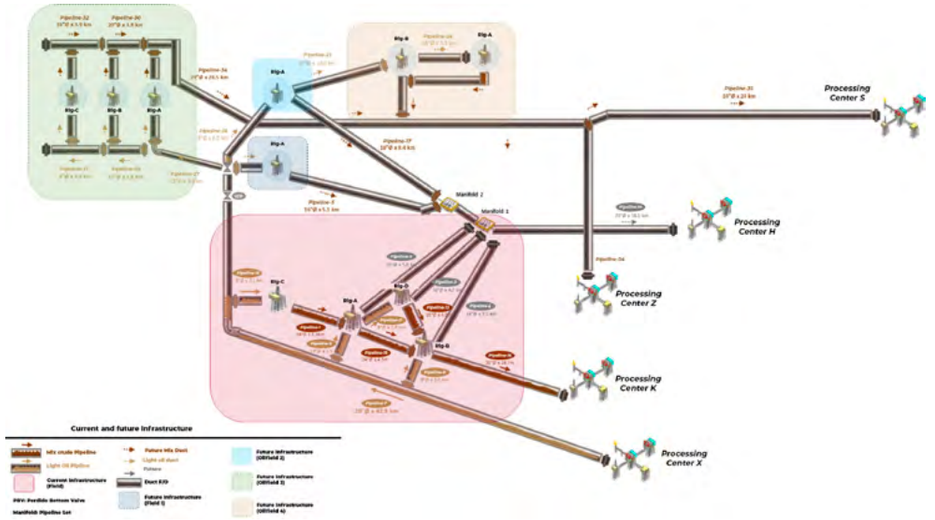


Figure 2

Table 1. *General description of development oilfields*

Oilfield	API Quality	Development Plan
Oilfield 1	13.1°	1 drilling rig
Oilfield 2	9.8°	1 drilling rig
Oilfield 3	8.6°	3 drilling rigs
Oilfield 4	10.8°	2 drilling rigs
Oilfield 5	10.1°	4 currently operating drilling rigs

These oilfields produce highly viscous, extra-heavy oil with very low API density, which has problems flowing naturally. This is their biggest challenge, making its PVT analysis and thermodynamic characterization difficult.

In surface facilities and pipelines, viscous fluids such as these, which are handled at low speeds, may generate accumulations and water may eventually spring in the reservoir and cause corrosion phenomena, directly impacting on pipeline mechanical integrity.

Another challenge, which today is seen as a considerable one for PEMEX regarding extra-heavy oil transportation, is hydrocarbon transfer to a Processing Center for disposal if there is no diluent oil or surface pumping equipment.

Simulated future operating scenarios

Simulation with forecasts allows predicting the future effects of the system's operation. It was therefore possible to evaluate ideal operating conditions through simulations. Likewise, some of the adverse conditions of Field 5 during its productive life were simulated, such as the lack of on-surface multiphase pumping equipment and light diluent oil, which directly impact on the system pressure and the estimated production. All these simulations allowed to determine pipeline pre-design pressures and pumping equipment.

Thus, PEMEX will have technical support for the user bases and engineering of the pipelines and surface lines to construction and commissioning of future fields(Fields 1 to 4). (See Figure 3).

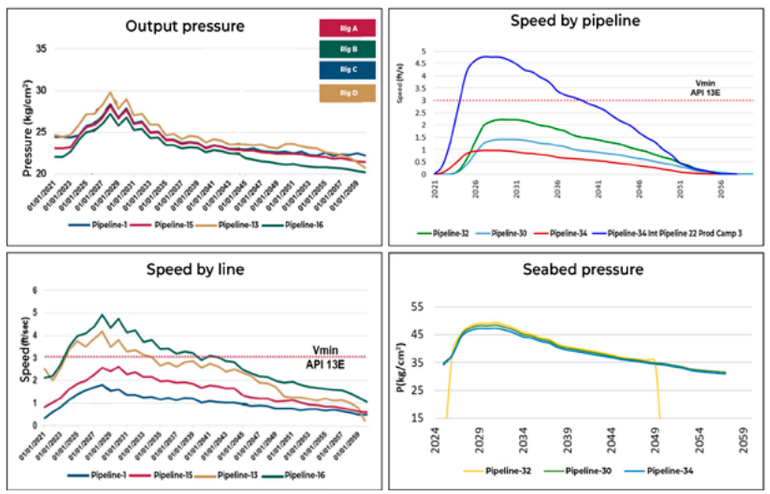


Figure 3

Benefits for PEMEX

This model can include or exclude well and material balance models, proving its versatility. Although there are many simulators in the market, choice depends on the specific needs of Pemex Exploración y Producción (PEP). The generation of the model allows this Production Asset to guarantee flow in involved oilfields, in addition to strengthening field exploitation strategies for future production management to identify, before starting operation, areas of opportunity, improvement and key focal points such as:

- Daily oil production monitoring based on well operating conditions to avoid production deferrals due to well outputs.
- Provision of optimal production management models and alternatives (evaluation of operating conditions).
- Evaluation of operating scenarios that defer or increase production to ensure technical feasibility.
- Teamwork that complements and strengthens the technical competence of the specialists in the different areas.
- Reduced time for decision-making in production management.
- Skill acquisition by PEMEX personnel in the use of simulation tools.

References

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- API 14E. American Petroleum Institute. 1991, reaffirmed, January 2013. Recommended Practice for Design and Installation of Offshore Production Platforms Piping Systems.

Unraveling a hidden treasure

By **Astrid Perales Natto**
Mexican Petroleum Institute (IMP)

The **Mexican Petroleum Institute** is a research center dedicated to the creation of competitive and valuable solutions for the national and international oil industry, as a result of scientific research, through the development, assimilation and transfer of technology, focused on solving specific problems. It provides technological services and products for Engineering, Exploration and Production, as well as specialized training.

Sedimentological studies on exploration well cores are essential to better understand geological formation characteristics and potential, as this is essential for the oil industry.

Therefore, a group of IMP specialists, led by José Gregorio Martínez Osorio, MSc, has conducted studies on geological porosity controls in well cores of the Wilcox Formation in the Perdido Area, in deep waters of the Gulf of Mexico.

These studies are aimed at evaluating porosity, determining its quality as a reservoir rock and analyzing factors affecting it, by either preserving or destroying it. This methodology can also be applied in other oil provinces in the country.

To achieve these ends, a three-stage work plan was designed: detailed well core description, petrographic and diagenetic (chemical, physical and biological changes transforming sediments into sedimentary rock) thin section analysis, and pore environment study. Each step has been crucial to better understand the internal dynamics of the Wilcox formation.

This formation, considered the main producer in the Perdido Area, is known for its hydrocarbon storage capacity both in Mexico and the U.S. area of the Gulf of Mexico, as it holds vast oil and natural gas reserves, hence its great importance.

A meticulous analysis of sediment origin and distribution, as well as the porosity of these rocks, provided a comprehensive view of their structure and petroleum potential.

Its composition includes limited extension sandstone bodies characterized by turbidite lobe facies, sandstone channels, and siltstone sediments (silt particle accumulations, lying in size between sand and clay), which are dispersed throughout the basin.

This paper focuses on sedimentological studies conducted on exploration well cores penetrated the Wilcox Formation in the Perdido Area subsoil.

José Gregorio Martínez Osorio, MSc

Methodology

The implemented methodology for the sedimentological study of the Wilcox Formation initially focused on sandstone granulometric and compositional analysis (Figure 1). The granulometric analysis is intended to determine the distribution of sedimentary particle sizes in a sample, while the compositional analysis identifies sandstone mineralogical components. Using the point counting method, it was possible to determine granulometry and sample composition.

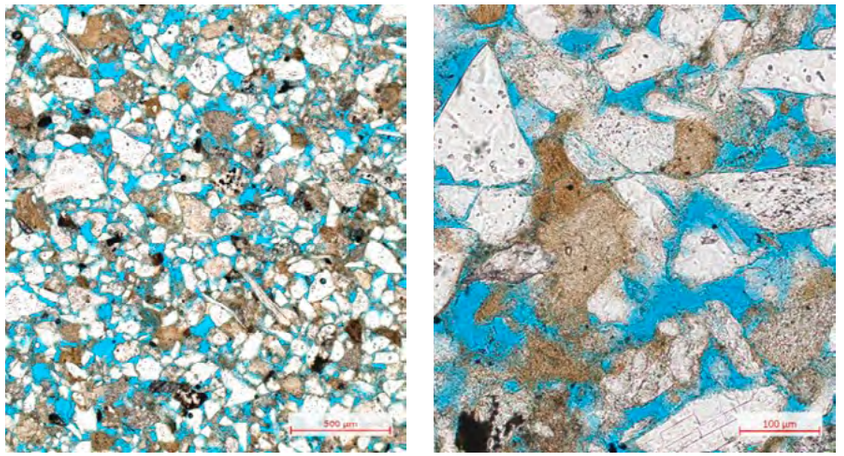


Figure 1. *Photomicrographs of highly porous sandstones of the Wilcox Formation.*

This step was followed by an exhaustive microfacies analysis (identification and description of the microscopic characteristics of sediments), which revealed a diversity of textures and compositions, underlining the complexity of the studied sediments.

Subsequently, attention was directed towards diagenesis (a set of key processes in porosity evolution that determine the generation and/or destruction of the porous medium in rocks). Finally, a porosity analysis was performed, employing two methods: traditional point counting and image analysis using the Image J® freeware (Figures 2a and 2b).

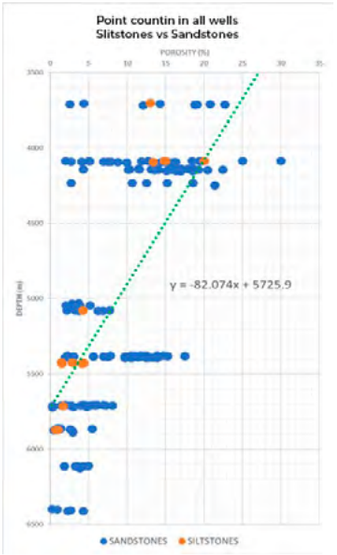


Figure 2a. *Porosity diagrams determined by point counting*

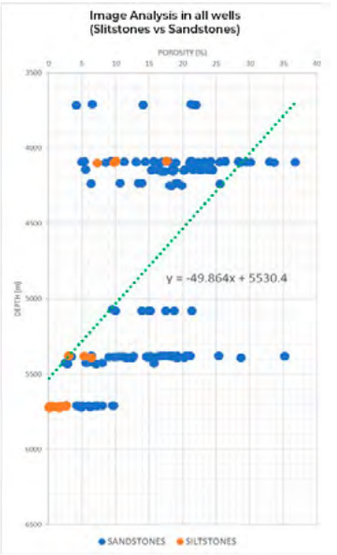


Figure 2b. *Porosity diagrams determined by image analysis.*

Studied area

The area subjected to this study is located in the territorial waters of the Gulf of Mexico, within Deep Waters of the Mexican Exclusive Economic Zone (EEZ), strategically located in the geological province of the Perdido Fold Belt, south of Alaminos Canyon and northeast of the Gulf of Mexico, off the coast of Matamoros, Tamaulipas (Figure 3). The Wilcox Formation is a geological testimony of the region's sedimentary history.

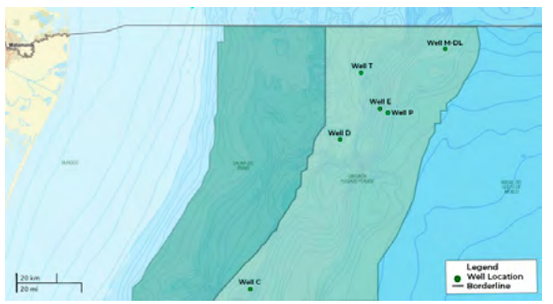


Figura 3. *Área de estudio en aguas profundas del Golfo de México*

The Perdido Area sedimentary column sits on a Precambrian basement with igneous intrusive bodies more than 635 million years old. Overlying this basement are layers of Triassic and Lower Jurassic evaporite and carbonate facies, a Middle Jurassic to Upper Cretaceous carbonate sequence and a strong Cenozoic clastic sequence with sandstones, siltstones and shales, including the Wilcox Formation.

This formation is characterized by a complex stratigraphic succession (sequential arrangement of sedimentary rock layers) with variable porosity and permeability. Deposited in a bathyal paleoenvironment (between 1,000 and 4,000 meters deep), it reveals a depositational history in an ancient turbiditic deep marine environment, with channel and amalgamated distal sandstone intercalations, constituting an excellent oil reservoir. These sediments originate from the Houston delta and the Rio Grande or Rio Bravo into the deep Gulf of Mexico.

Results

In the course of this study, 14 well cores were described, focusing on lithofacies (rock composition, texture and structure). Through microscopic analysis of samples, microfacies were defined and diagenesis was examined.

Porosity of the Wilcox Formation is controlled primarily by clay and compaction. Fine sandstones and coarse siltstones have storage potential, with porosity decreasing as clay proportion increases.

Diagenesis does not drastically affect porosity, except for compaction, which depends on burial depth. Shallow cores maintain good porosities (10 %-35 %), while deep cores have high compaction and low porosity (<5 %).

Processes such as dissolution or fracturing are not sufficiently representative to impact reservoir quality. Unstable grain cementing and hydrolyzing have a negligible impact.

This study, analyzing 14 well cores and 342 thin sections, took place in CNH's National Core Center facilities, and determined the petrographic, diagenetic and sedimentological properties of the reservoir in the Gulf of Mexico.

Thin horizons of fine grain sandstone ripple marks in M-DL Well's N1

Dark brown sand ripple thin intervals with hydrocaron impregnation Core 1, Well T.

Fine to medium grain sand facies with ripples. Core 3, Well T

Benefits

The Wilcox Formation is the most important deepwater play in Deep Waters of the Gulf of Mexico due to geologic-sedimentologic factors.

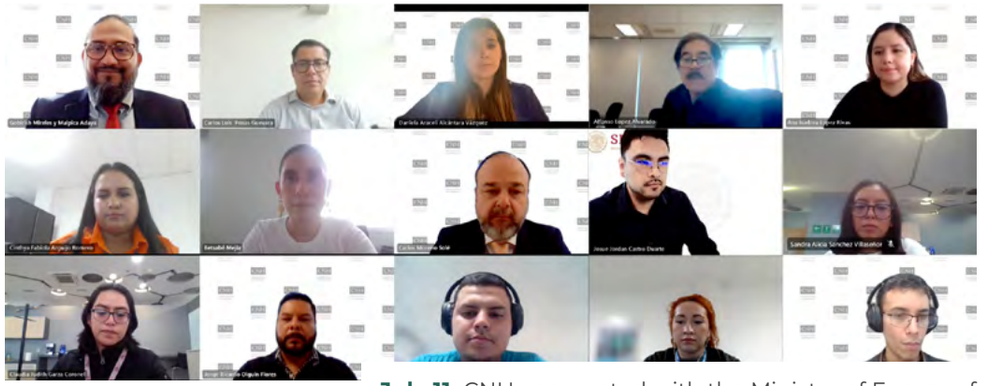
For the oil industry, characterizing and evaluating porosity in well cores enables reservoir storage potential. Sedimentological, petrographic and diagenetic characterization defines the geological factors that determine porosity evolution. Evaluating high-quality reservoir rock and prospective resources validates active petroleum systems, providing essential information for planning and guiding exploration and exploitation in oilfields managed by PEMEX and other operators.

For IMP, this involves developing advanced technological solutions in sedimentology and reflects the diversity of research conducted by the Specialized Exploration Department. The stratigraphic and sedimentary modeling studies of which this methodology is a part of are available to PEMEX and other operators, thus providing useful and indispensable tools for energy resource exploration.

Meetings and Workshops

July 1. Dr. Georgina María de la Luz González Sánchez, from the Autonomous University of Mexico City, delivered a presentation on *The Importance of Technology and ICTs in institutions* to National Hydrocarbons Information Center collaborators.

July 4. The President Commissioner, Agustín Díaz Lastra, participated in the **2nd Forum for Supplier Promotion and Strengthening**, organized by the Veracruz Energy Agency and the Government of Veracruz.



July 11. CNH cooperated with the Ministry of Energy of Mexico and the Mexican Agency for International Development Cooperation in delivering a technical workshop for the Ministry of Energy of Honduras.

July 5. CNH presided over the **3rd ARIAE Upstream Working Group Meeting** on Hydrocarbon Metering. In addition to CNH, this Working Group is composed of different agencies and institutions such as the National Hydrocarbons Agency (ANH) of Bolivia, the National Agency of Petroleum, Natural Gas and Biofuels (ANP) of Brazil, and the Supervisory Agency of Investment in Energy and Mining (OSINERGMIN) of Peru.

July 17. The President Commissioner attended the signing of the Collaboration Agreement between the Autonomous University of Tamaulipas and Woodside Mexico.

CNH Talent: Sharing Knowledge

CNH Talent: Sharing Knowledge is a conference series created to promote knowledge exchange among members of the CNH Community.

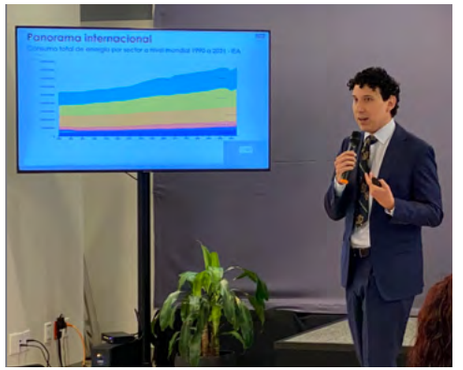
These conferences take place in CNH's Dr. Edgar René Rangel Germán Auditorium and are delivered by our specialized staff.

July 5. Machine Learning Technique Application for the prediction of low permeability reservoir properties. Edgar Eloy Medina Martinez, Director of Contract Exploration Plan Rulings.

July 26. Nearshoring in Mexico. Héctor Moreira Rodríguez, Commissioner. (Hybrid).

August 2. The importance of the Integrated Production System in Hydrocarbon Operation and Management. Horacio Andrés Ortega Benavides, Reservoir Director. (Hybrid)

August 16. Micropaleontology as a tool for geological operation. Mainoel Guaipy Barragán Ávila, Technical Director of Core Center Operation, Hidalgo. (Hybrid).



August 30. CNIH's role in energy transition. José David Treviño Bocanegra, Director of User Services. (Hybrid).

September 6. Understanding the Mexican Energy System. Héctor Moreira Rodríguez, Commisioner.

September 13. The international oil market, structure and dynamics. Brief essay. Salvador Ortuño Arzate, Commissioner.

September 27. Investment Project Assessment and Personal Finance. Juan José Reyes Ramírez, Expenditure and Investment Supervision Director

Hybrid conferences were held as a preventive measure in response to the increase of COVID-19 cases, thus prioritizing the health and safety of the participants, the speakers and the technical staff.

In the upcoming months, another seven conferences will be held and will cover reserve quantification and consolidation, reservoir characterization, well drilling and completion, regulatory excellence, among other relevant topics.

CNH at the National Petroleum Convention (CNP)

The **2024 National Petroleum Convention**, organized by the AMEXHI, took place on September 12 at the IMAX Screen of Papalote Museo del Niño, Mexico City.

The eighth edition of the CNP consisted of five round tables and three plenary conferences, which brought together representatives of federal government authorities, regulatory bodies, state governments, academia, industry chambers, opinion leaders and international experts.

Creating opportunities for women in the energy sector

Alessandra Testoni, Sustainability Director at Eni Mexico and leader of AMEXHI's Gender Subcommittee, moderated the panel on gender equity in the energy sector, with Patricia Zorrilla, Head of CNH's Unit for Technical Administration of Entitlements and Contracts, Valentina Olvera, Vice President of AMEXHI, Laura Josefina Chong, Head of the Legal Affairs Unit of ASEA, and Senator Rocío Abreu as panelists.

Patricia Zorrilla emphasized the importance of promoting the participation of women in decision-making, while creating equal opportunities for career growth.

Is Mexico still an oil and gas power?

Merlin Cochran, General Director of AMEXHI, moderated the round table discussion, attended by Rodrigo Hernández, Head of CNH's Technical Unit of Exploration and its Supervision, Claudia Pessagno, Research Director at S&P Global Commodity Insights, Vinicio Suro, Vice President of Hokchi Energy, Fluvio Ruiz, Oil Sector Analyst, and Francisco Noyola, Mexico Vice.

Plenary Conference

CNH's President Commissioner, Agustín Díaz Lastra, made the following remarks:

For some decades, hydrocarbon policies were primarily oriented toward extraction at the expense of exploration. Of course, while revenue in the hydrocarbon industry comes directly from extraction, this activity is based on, and derives from, substantial, prolonged and sustained exploration efforts. Consequently, despite its prevalence, this policy is not the most rational even more so when our country has reached the stage of maturity in hydrocarbon exploitation.

Just six years ago, a responsible discipline was re-established to replenish one hundred percent of the reserves extracted annually, which has been achieved with great effort, but not through explicit and effective planning. Even so, constant restitution means a definitive stimulus to exploration, since it implies the obligation to larger budget allocation.

If I may be allowed the epistemological analogy, with all due proportion, the same thing happened with the magnificent Greek concept of *logics*, which first required the fundamental, profound, prolific, brilliant notion of *logos*.

As we know, reestablishing extracted volumes from reserves requires investment and high-level professional and technological work. Geological information is also needed to define and estimate Prospective or Potential Resources, before any degree of probability can be assigned to these resources. Such investments facilitate the remaining exploratory, extractive and development works, with their corresponding budgetary and financial requirements. In due course, the Reserves consolidated and reported by the National Hydrocarbons Commission reflect exploration results of all oil operators in Mexico.

Notwithstanding the preceding, Potential Resources are still not duly or explicitly considered in public policy or Business Plans. At any rate, they are very scarcely found in annual budgets. Hydrocarbon exploration is like the root that, from the ground, allows a tree to produce fruit. Exploration is by no means a necessary evil; on the contrary, it is a true asset, although neglected and poorly understood.

Considering that data allowing Prospective Resource volume estimation is the first link in the hydrocarbon value chain, I hereby offer some reflections on the importance of their proper inclusion in our energy sector's planning, and consequently, in the national —nationalist— planning system.

Budget approval procedures for public investment projects necessarily contain probabilistic analyses that allow for monetary value calculation and thus foresee investment recovery, to analyze the amount of resources allocated to both extraction and exploration, since they are considered to be productive activities. In other words, budget allocations are subjected to "competing" for monetary returns, resulting in the relegation of medium-term exploration projects to shorter extraction terms.

Likewise, budgets generally follow an eligibility regime to opt for maximum value among possible investments. This is an impeccable logic when it comes to fund provision for public benefit.

These logics give preference to so much sought after short-term income to pay for other activities of all kinds (which, by the way, are always on the increase), and make exploration extremely vulnerable, since its success cannot be included in a probabilistic model.

However, the fact that the practical materiality of extraction intrinsically requires prior discovery of an oil formation is overlooked. If I may use the analogy, Columbus took extreme risk to search for a possible new route and ended up discovering an entire continent. One cannot just set out looking for a Cantarell, for example. One basically explores for hydrocarbons and suddenly discovers a source rock brimming with oil and gas, occasionally in enormous volumes and, more often than not, in smaller dimensions.

Consequently, budgetary resources do not reach the required magnitude to have a positive and sustained impact on our Prospective Resources. That is to say: they must be discovered to be converted from Potential into Reserves, whether Contingent or Possible -and when applicable, into Probable- and finally, into Proven and available for extraction.

From the hydrocarbon industry's own perspective, investments in extraction undoubtedly provide higher income than short-term investments, not only in extraction itself, but also in previous exploration. As a result, investments in exploration as a whole, as a *sine qua non* to extract hydrocarbons, do provide returns on the allocated budget, even if it materializes at oil and gas extraction.

Therefore, the lack of planning in an exploration activity portfolio means that additional discovered volumes tend to be inconsistent and insufficient for the hydrocarbon industry's correct, safe, healthy development in the medium and long term.

It should also be considered that exploration activities have been primarily oriented to what the Mexican industry has called *backyard exploration*, that is: prospective location to drill exploration wells in areas very close to already established reservoirs and available infrastructure.

In addition to the scarce annual investments destined to Prospective Resource exploration, we must consider that Mexico is no longer in an initial stage of large hydrocarbon discoveries. After more than a century of extraction, during which about half of the recently estimated total Prospective Resource volume has been extracted, we find ourselves in an inverse trend to the one that prevailed until the 1970s, when Mexico was discovering and starting to extract oil and gas from large reservoirs.

Namely, while this strategy may have been convenient in the short term, it is insufficient and risky for a horizon longer than a couple of years, due to the constant decline in our mature fields. It has provided fair results thus far, but it cannot be repeated for too long as the only exploration strategy.

In other words, it should be recognized that the budget for Prospective Resources must be allocated on the deterministic assumption that there are scientific indications of hydrocarbon existence, without any probability

yet being assigned. While systematic and sustained studies will generate material results, it is not foreseeable when a probabilistic model can be designed for a more accurate business case.

If Mexico's oil companies produce 1.8 million barrels per day, even with low and, in some years, null investment in exploration, it is not unreasonable to foresee what a true Strategic Exploration Program could deliver around the second half of the 2030s.

In my opinion, what is most needed to guarantee fuel sufficiency in Mexico is inter-institutional government planning so that the country's highest authorities make the best possible decisions for a 2030 horizon and beyond.

An alternative for replenishing extracted volumes could be establishing a minimum multi-year exploration project portfolio with fixed budget amounts, linked to annually extracted volumes.

If hydrocarbon extraction quantities turn out to be directly proportional to exploration, we can consequently conclude that investments in exploration should be calculated as a directly proportional function to extracted volumes, at least in the current stage of Mexico's hydrocarbon industry (2025-2030).

That said, the latest prospective resource estimate reaches 112.9 billion barrels of crude oil equivalent. Some 24 billion barrels are expected to be found in deep waters -under water depths greater than 500 meters- another 15 billion in shallow waters and 74 billion in onshore fields, the latter including shale gas. Consequently, it is convenient to completely characterize Mexico's potential resources to determine the best exploration and extraction public policies.

Due to all the above, it is advisable to continue working on exploration, whether the reserve classification of discovered and extracted resources is authorized or not.

The lack of continuity in Prospective Resource studies implies that a five-year wait period would be needed to allocate budgetary funds to discover commercially extractable hydrocarbons if in the future we opt for deep water or unconventional extraction. In other words, right timing is a critical factor to maximizing long-term hydrocarbon value as established by the law.

In scientific terms, there are two ways to solve a problem: by resolution, when reality is changed towards the desired objective, as has been and is the case of the need to extract hydrocarbons from the subsoil, or by dissolution, when the objectives must be adjusted to reality. This is the case of inexorable hydrocarbon depletion, since we can reasonably influence the manner and rate at which they are depleted.

In the same vein, while the intervention of petroleum engineers and other necessary professions has been valuable and decisive during the problem-solving phase of hydrocarbon extraction to satisfy the urgent energy demand of Mexicans, active and harmonized participation of all specialists, together with planners and administrators, is invaluable and essential now that we will have to face the future stage of depletion of our fossil resources.

As for the protection of our natural environment, allow me some very simple reflections. When we extract hydrocarbons, the environment is practically unaffected, since unfortunate polluting events are so scandalously remarkable that all operators take extreme measures to prevent and avoid accidents in the hydrocarbon industry.

In contrast, no one damages their reputation or is blamed for starting the internal combustion engine in their car, thus releasing carbon dioxide into the atmosphere, except when an environmental contingency has already been caused. In other words, environmental problems are actually not generated by hydrocarbon exploration or extraction, which leads to prevention while using fuels in our subsequent activities. Even so, of course, migration to clean and renewable sources is unavoidable.

Considerable funds are needed for the indispensable migration to clean and renewable energies as well as for primary energy source substitution to permanently solve the problem of future depletion. We can take advantage of our current remaining hydrocarbon resources as a financing source without having to resort to excessive loans, so long as we implement proper planning.

In other words, hydrocarbons can certainly continue to support our country's public finances for a certain period, as they have done for decades. On the other hand, lack of planning in the earlier times of large reservoir discovery has been very costly for Mexico in many aspects. Moreover, at the present stage, lack of planning in the hydrocarbon industry would surely prove disastrous for those past discoveries, since their depletion is getting closer.

It is therefore advisable to plan strategically for the upcoming decline of current fields and, at the same time, to intensify additional reservoir exploration. We cannot fail to consider that good exploration results are one of the pillars for improving any oil company's debt profile as is the case of Petróleos Mexicanos, our national company.

These are the last opportunities to develop a timely plan to achieve objectives and results in anticipation of an emergency which may happen in less time than expected. Keeping the current extraction rate will even be more difficult to achieve each year. There is enough potential to timely regain control of our future.

I am fully confident that our Federal Government will continue to lead the hydrocarbon industry along paths of certainty and improvement in all aspects, as we have seen over the last six years. The National Hydrocarbons Commission remains attentive to meeting any requirement.

Agustín Díaz Lastra
Mexico City, September 12, 2024

Collaboration Agreements

The National Hydrocarbons Commission has extensive experience in interinstitutional collaboration. Collaboration Agreements signed by CNH are an instance thereof. Their aim is to maintain outreach efforts with relevant national and international institutions, governments and stakeholders.

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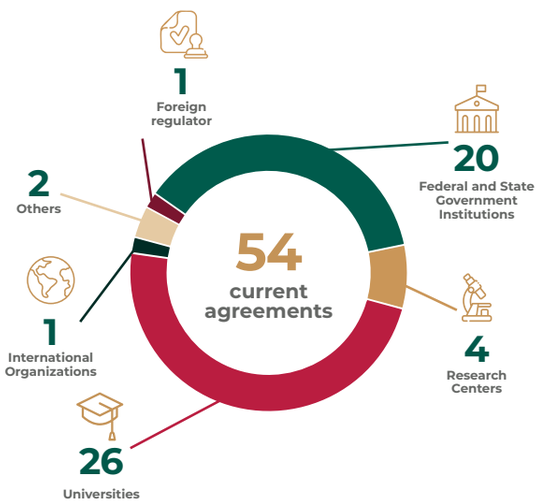
Agreements

2010 to present with

- Federal and State Government Institutions
- Universities
- Research Centers
- National and International Regulatory Agencies
- International Organizations

Focusing mainly on:

- Regulation
- Information
- Local Content
- Training



In 2024, CNH has entered into

12
Agreements

No	Institutions	Date
1	Veracruz State Energy Agency	Jan-19
2	International Centre of Excellence on Sustainable Resource Management (ICESRM)	Feb-7
3	Technical Petroleum and Energy Institute	Feb-28
4	Mexican Bar Association	Mar-1
5	Autonomous Carmen University	Mar-6
6	Technical Mining University of Zimapán	Mar-26
7	National Metrology Center	Apr-3
8	Technological Institute of Higher Studies of the Carboniferous Region	Apr-8
9	University of Houston	Jul-8
10	University of Houston (Specific Agreement)	Jul-8
11	Bureau of Ocean Energy Management (BOEM)	Jul-15
12	Ciudad Madero Institute of Technology	Jul-16

In the third quarter of 2024, the CNH signed the following agreements:

Jul-15. Collaboration Agreement with the Bureau of Ocean Energy Management.

Jul-8. Collaboration Agreement and Specific Agreement with the University of Houston.

Jul-16. Collaboration Agreement with the Ciudad Madero Institute of Technology.

Browse the Agreements entered into by CNH and Government Institutions,Organizations and Academic Institutions to establish the basis for cooperation on diverse matters.
https://cnh.gob.mx/informacion/convenios

Best Practices in Hydrocarbon Metering

Mexico, through CNH, chairs ARIAE's **Upstream Working Group (UWG)** comprised of Brazil, Bolivia, Mexico and Peru. Dialog during the **3rd UWG Meeting** focused on best practices in hydrocarbon metering implemented by Bolivia, Brazil and Mexico.

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Founded in March 2000, ARIAE provides a communication forum for member organizations and promotes knowledge exchange on energy regulation, regulatory harmonization, personnel training and education, and cooperation in activities of common interest.

The UWG discusses and exchanges knowledge and experience on hydrocarbon exploration and extraction. Among other issues, dialog in the UWG explores best practices in exploration incentives, risk studies in upstream activities, contractual regimes, among others.

CNH – National Hydrocarbons Commission – Mexico

Legal Framework
- *Hydrocarbons Law*
- *Hydrocarbons Revenue Law*
- *Law of Coordinated Regulatory Bodies in Energy Matters*
- *Internal Regulations of the National Hydrocarbons Commission*
- *Technical Guidelines on Hydrocarbon Metering (Guidelines)*
- *Technical Provisions for the Use of Associated Petroleum Gas (Provisions)*

Responsible area

Directorate-General of Production Metering and Commercialization (DGPMC)

Regulatory best practices
- Benchmarking of international standards. (see *Guidelines*, Annex 2. Normative References: NOM and API, AGA and ISO international standards, among other standards organizations).

Hydrocarbon Metering in the Value Chain
- Metering starts at the wellhead and ends when hydrocarbons reach the Metering Point.
- Metering Points are hydrocarbon delivery and inspection points.

Technical Opinions
- CNH's DGPMC issues Technical Opinions on metering for all EDPs and for TrPrs, ApPr, and EPs where production tests lasting more than 60 days are performed.
- 662 Technical Opinions have been issued regarding Plans and Plans from 2018 to 2024.

Gas venting and flaring records
- The *Provisions* establish a minimum target of 98% used gas volume.
- The Provisions determine several technical elements, procedures and criteria for approving gas utilization programs.

Regulatory improvement
- Technical Opinions are issued more expeditiously: procedures were reduced by 33% (see 5th amendment to the *Guidelines*, published in the Official Gazette on Nov 27, 2023).

ANH – National Hydrocarbons Agency – Bolivia

Legal Framework
- Regulation of Technical and Safety Standards for Hydrocarbon Exploration and/or Exploitation Activities (*Regulation*), approved by Supreme Decree 5114.
- Supreme Decrees 4935 and 4936.

Other authorities involved
- Ministry of Hydrocarbons and Energy
- *Yacimientos Petrolíferos Fiscales* Bolivianos (YPFB): metering and control

Regulatory best practices
- Metering and control in Bolivia follow, among others, the API, AST, ISO, and AGA standards *(see Regulation).*

Hydrocarbon Metering in the Value Chain
- Metering in the Value Chain starts at wellhead up to gaseous or liquid hydrocarbon commercialization.
- Private Operators hand over hydrocarbons to the State at Safekeeping Points (or *city gate* for gas), where hydrocarbon volume and quality are metered.
- ANH is in charge of commercialization and performs continuous, online and real-time metering.
- ANH's B-SISA system meters commercialization through nearly 3,000 transactions per second.

Gas venting and flaring records
- The *Supreme Decrees* establish efficiency measures for the use of gas (either conservation or sustainable use) in exploration and exploitation.
- At the annual or semi-annual request of licensees, YPFB audits the oil service contracts before the Ministry of Hydrocarbons and Energy, which approves or rejects such request.

ANP – National Agency of Petroleum, Natural Gas and Biofuels – Brazil

Legal Framework
- Law N° 9.478/97 (Petroleum Law)
- Decree N° 2.705/1998
- Technical Measurement Regulations - ANP/ Inmetro Joint Resolution n° 1/2013 (Regulation).
- Resolution ANP N° 806/2020 (Resolution)

Responsible area

Auditing Hub for Oil and Natural Gas Production Metering (NFP)

Other authorities involved

National Institute of Metrology, Quality and Technology (Inmetro)

Regulatory best practices
- In the absence of Brazilian legislation on the matter, standards by organizations authorized by ANP and Inmetro, such as AGA, ASTM, ISO, API, DTI, and CEN may be used (see Regulation) .

Hydrocarbon Metering in the Value Chain
- Fiscal Metering Points are those used to compute royalty aggregation. They must be located before storage in transportation facilities such as tankers and pipelines.
- Metering should be unitized immediately after separation facilities to stabilize oil and to ensure liquid separation in the natural gas stream.

Metering System Inspection
- NFP performs about 60 inspections per year (considering audits to metering system location).
- Inspection is complemented by validating the volumes declared by Operators and by analyzing the metering system.

Gas venting and flaring records
- Oil and Non-Associated Petroleum Gas Flaring is prohibited, except for safety, emergency, testing or well clean-up reasons. Limits vary from 96 to 98.5%, depending on the type of unit (see Resolution).
- To validate production, NFP uses production closure equations (addition or subtraction of metering points) to obtain the total quantity of hydrocarbons extracted at each production facility.

Notes:
Click on regulatory instruments to read them.
See terms and units of measure at the beginning of this gazette.

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