



2040 AGENDA: TRANSFORMING MEXICO

Mexican Association of Hydrocarbon Companies

Executive Summary

Mexico City

March 14th, 2018

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MEXICAN ASSOCIATION OF HYDROCARBON COMPANIES

Presentation

In each country, the performance of the energy sector puts its national development model to the test. Although it is always tempting to seek the symptoms of the present in the immediate context, in reality, the productive infrastructure of today depends on what was conceived, planned and began to develop decades ago. In the energy sector, the current results are the product of the actions taken two decades ago. In Mexico, only 2 percent of the accumulated historical production comes from oil fields that started production in the last 25 years.

It is for this reason that this study by the Mexican Association of Hydrocarbons Companies sets its focus on the horizon of 2040's Mexico. The energy results of the future and their impact on our economy will depend on the decisions we make in the present. By the year 2040, today's active reservoirs will decrease their production by 85 percent. Then, in order to build the future, we must begin to discover, develop and take advantage of our energy potential as quickly as possible.

The New Mexican Energy Model, naturally diverse, has the enormous virtue of guaranteeing that the future does not depend on a single centralized vision, which can be right or wrong. On the contrary, it allows many ideas, technologies and points of view—despite being different—to coexist, compete and collaborate in the building of a common course.

Thinking about that common course is the spirit that powers our *2040 Agenda: Transforming Mexico*. This is an effort built from the industry, but that incorporates voices of experts and authorities to reflect on our past and our present, but above all, to identify the keys to build the best possible future.

For a long time, the Mexican oil sector has been a source of strength and pride for Mexico and Mexicans. It must continue to be that, therefore, and in accordance with the projections available from the International Energy Agency, we must maintain the course and pace with an appropriate implementation of the Energy Reform. This will not only solve the challenges we have inherited from the previous model, but above all, it will help us add a trillion dollars to our economy in 2040. The goal is within our reach. It depends on the sector

regulation and operation following four principles: perseverance, competition, transparency and commitment to knowledge.

Following these principles with discipline is the best way to learn from an extraordinary national oil past and project today's opportunities in a global market with a deep attachment to transparency. It is, above all, the essential bridge to advance in sustainability and face a future of accelerated technological transformation.

Mexico finally has a framework of adequate public policies to make the global oil landscape play in its favor in the next two decades and to manage to enhance the national productive infrastructure for much longer.

We are confident that, with the right decisions, the energy sector of 2040's Mexico will speak well of the national development model that this generation supported and that all those who come will benefit from.

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Executive summary

Contemporary economies derive a significant part of their total value from the production and consumption of hydrocarbons and their derivatives. In large producing countries such as Mexico, they play an important role in tax collection and investment. In the main consuming countries, among which Mexico is rapidly placing itself, they are the basis of its productive activity. In this sense, Mexico creates value for its economy from the production of hydrocarbons, while obtaining basic consumables from them, from electricity and fuels to petrochemicals and new materials, essential for its competitiveness and economic prosperity.

Moreover, the influence of hydrocarbons will remain for a significant period, not only in Mexico, but throughout the world. In fact, practically all energy prospects—regardless of their private, governmental or academic origin—agree that hydrocarbons will continue to be the starting point for the bulk of economic activities around the world, at least until the year 2040, to which most of these studies span.

This is due to a profound technological transformation in the sector. Although other energy sources, particularly renewables, have undergone major technological changes in recent years and benefit from growth rates that are sometimes double-digit rates, hydrocarbon sector technologies are also vigorous and profound. In addition, the starting base for renewables is still small, compared to the starting base for hydrocarbons.

The above does not mean that the hydrocarbons sector is a drag on the planet's sustainability, on the contrary, hydrocarbons are helping to successfully face many of the current challenges. The rapid development of natural gas in recent years is one of the main variables that explain lower levels of greenhouse gas emissions. Carbon capture technologies are maturing at great speed and new petrochemical processes, better fuels and the development of new materials are helping to reduce the emissions and consumption of vehicles, not only in the lightweight fleet, but in the vehicle fleet as a whole.

This should not be surprising. Despite existing since the second half of the 19th century, hydrocarbons have played a central role in all technological revolutions since then. Today, at the dawn of the third decade of the 21st century, the hydrocarbon industry is characterized as one of the most intensive in the use of computing capabilities, as it operates at great marine depths with robots and autonomous vehicles, and uses advanced data analytics management processes, automation, sensors and advanced manufacturing. That is why, in recent years, old predictions that saw an imminent decline have been reversed. What has happened is the opposite. Today, hydrocarbons are driving deep economic transformations across the planet.

Despite their great success, the reality is that, it is necessary to develop all kinds of energy resources in today's world, due to the inescapable link between the success of an energy sector and that of the economy it serves. World economic growth and its demands make produced energy a valuable and indispensable consumable good. It is a symbiotic relationship, but it does not mean that both parties move in tandem. The Mexican energy sector has been, in many times, the engine of the economy and, in others, it has also become a burden.

Thinking back in history, the Mexican oil sector first burst as a great engine of growth; then, it lagged behind the economy, and later passed it again. In recent decades, the energy sector stagnated to the point of declining, while the economy continued to point upwards slowly but consistently. An important gap was opened between the two that made a consistent and sustained development model impossible.

The creation of the New Mexican Energy Model set the objective of reuniting what was separated and solving a pressing structural crisis in our sector. Likewise, it was proposed to catapult the entire energy sector as a whole—including, above all, the dominant hydrocarbon subsector—from its current lagged position with regard to the national economy, towards a leading position, returning it to its historic role of national economic growth driver.

In recent years, good news of the opening of the Mexican energy sector, characterized by record levels of investment announcements, the massive entry of new competitors and a strong commitment to knowledge, have made us forget that the news was always bad until recently.

Only five years ago, we still experienced the so-called critical alerts, that is, the interruption of the natural gas supply that paralyzed industries and drove other productive sectors away, such as the automotive or electronic sectors. In the last decade, we have lost more than one million barrels of production, in addition to having to divest reserves. Even in the context of healthy growth in energy demand, it was impossible to accompany it with strategic investments, despite record levels in Pemex's budgets, while various energy subsidies drowned public finances, and our polluting emissions increased.

The foregoing reflects a structural crisis, derived from our previous energy model, which was unable to keep pace with an economy that quickly industrialized and a population that began to demand more and more energy. The contradiction between an open and diversified economy, and a monopolistic and concentrated energy sector, in the midst of a profound technological transformation, is the root cause of our still significant energy challenges.

Fortunately, these are no longer structural challenges, as the New Energy Model has solved this contradiction and the large investments and new rules have hindered deterioration. On the one hand, Mexico no longer suffers critical alerts and, on the other, new discoveries will help fortify current production levels, and the emergence of multiple stakeholders investing not only along the hydrocarbons chain, but also in the energy sector as a whole, allows us to forecast a growing contribution of the sector to the Mexican economy.

Despite the considerable improvement in the energy scenario and the future landscape, reversing decades of delay requires repeating what we have been doing in recent years, for much longer. With perseverance, we need to attract and develop even more competitors, specializing the energy sector in various areas.

That is only possible if we are guided by a strong commitment to transparency, such as the one that has characterized the New Mexican Energy Model. Furthermore, it requires a solid commitment to knowledge, as exemplified in the spectacular creation of knowledge following the seismic surveys of the last three years that has allowed us to multiply the knowledge we had of the subsoil before the Reform by four.

Consequently, the New Mexican Energy Model is an ambitious goal, both for the potential there is and the historical evidence, and there are reasons to think that it is achievable under the right conditions. It is difficult to think that a single player could achieve this, but if the effort is collective and it takes advantage of national and global strengths, then it becomes much more viable.

It is not the same to leave all the responsibility to a single company and finance it with the public treasury, than to count on it and an endless number of other investors who risk their capital, without the nation taking risks. Also, each participant of the New Model is a creator of knowledge and new perspectives that result in the development of value, where we previously did not see it. Therefore, many forces perhaps working in different, but coordinated directions, largely thanks to the design of public policies from the authority, make the goal become affordable.

This spirit of recognizing the strength of collaboration and plurality also encourages this document. Instead of reflecting the perspective of a single player, it reflects a collective voice. It is a reflection that incorporates the ideas and proposals of independent authorities

and experts, in addition to the ideas and proposals of the almost 50 companies that make up the Mexican Association of Hydrocarbons Companies (Amexhi). Throughout fifteen months of analysis and interviews with experts, and having four discussion roundtables as well, Amexhi sought to compile the knowledge, experience and vision of a plural group of leaders of the Mexican energy sector in one place.

In order to give meaning and coherence to all this information wealth, the document is organized as follows:

The first chapter is a historical reflection. Rather than narrating the oil history of Mexico, a task that belongs to historians, the chapter describes it by analyzing the interconnection between the sector and the rest of the economy. That is, instead of selecting a historical moment as a starting point, it covers the entire Mexican oil history, since it was sought to use oil as a fuel and raw material for the industrial development of the country, more or less, since the last third of the XIX century, to this day. In that regard, we do not revisit the uses of hydrocarbons in pre-Columbian Mexico or its role in shipbuilding during the Colony.

The perspective that emerges from this approach is one in which the economic and energy models, initially deeply interconnected in their orientation, eventually dislocated.

This is a story whose annals highlight the role of knowledge, in its origins, in the creation of Pemex and, above all, following the sixties, with the use of science to carry out the great discoveries of the southeast, on and offshore. It is also a story of contrasts, especially when the energy sector could not be reformed and modernized at the same speed as the rest of the economy.

In particular, the chapter highlights the irruption of financial challenges, frequently resolved with debt and assuming the entire risk through the State, which at various times led to financial crises, especially when oil prices experienced their inevitable corrections. Thus, it reflects the constant search of our country for a model that guarantees the property of the Nation, but that does not build heavy slabs for future generations, or causes crises that erode what has been advanced.

The second chapter of this *2040 Agenda: Transforming Mexico* analyzes the conception and construction of the 2013 energy reform. This reform is the result of a long debate that spanned for three decades, in which the country sought to find solutions to a growing energy problem derived from the inconsistency between an open economy and a closed energy sector.

The first part details the sense of urgency that Mexico faced, caused by its internal needs: on the one hand, a declining oil production and dwindling reserves, and, on the other, an increasing energy demand by both the various industries and the consumers. Moreover, this situation on the supply and demand side has aggravated public finances, both by way of indebtedness and by the growing subsidies that sought to alleviate this situation. In fact,

despite record investments in Pemex, its results were limited before the immensity of the challenge. After all, a large economy like the Mexico's could not depend on a single provider of energy resources, so increasing implementation capacity became central.

There was also a sense of urgency based on the need to take advantage of Mexico's oil resources in the coming decades, while their global demand continues to grow. The rapid technological transformation worldwide, and particularly in the hydrocarbon world, demanded a significant increase in national energy capabilities in order to keep the pace.

The construction of the scaffolding for the New Energy Model had the benefit of relying on a large stock of energy openings throughout the world and on large quantum leaps in knowledge, from the engineering of institutions to behavioral economics.

In this sense, there is full acknowledgement that the complete opening of the energy sector not only involved letting encumbrances go, which sounds easy, but also building institutions and processes that meet the needs. The chapter details the main characteristics of the New Model: transparency, the rule of law, competition, competitiveness and dialogue between the government and other stakeholders.

The third chapter of this Agenda focuses on the vision towards the year 2040 and the benefits of the New Energy Model. Thus, one of the main pillars of the reform is the opening to new players that allow to take advantage of the oil potential of the industry, as well as to meet the growing energy demands of a country with one of the largest growth and industrialization processes. Consequently, this chapter points out the three great benefits derived from the Reform: the benefits that the Mexican State will obtain as the owner of the oil wealth, the benefits for the industry and the consumers, and the benefits on the generalized competitiveness in the country with a multiplier effect.

It should be noted that this chapter makes use of multiple documents and studies prepared on the Mexican energy sector, in particular the *Mexico Energy Outlook 2017*, published by the International Energy Agency, one of the world's leading organizations of the energy sector. From this report, the 2040 vision has been completed by presenting production, growth and investment scenarios with a view to the medium term.

If Mexico is constant in the building of competitive markets and a knowledge-based economy with full attachment to transparency and accountability, by 2040 its current production could grow by up to 40 percent and add more than a trillion dollars to its GDP.

This will not happen automatically. At the end of the projection period, the difference between good decisions and bad decisions could be equal to 4 percent of the national GDP. Bad decisions and lack of continuity could reduce the economic and oil production factor; and there would also be an opportunity cost of 1.6 times the total budget of the Secretariat of Social Development, 1.4 times the budget of the Secretariat of Health and 0.6 times the budget

of the Secretariat of Public Education in the next 20 years. Thus, the contrast between keeping the energy sector in tune with an open economy and a return to the past leads to two very different Mexico's in the year 2040.

The fourth chapter explains the need for a New Energy Model and the reasons that motivated this document. It briefly describes the national projections and needs for the year 2040, from the demographic, social, economic, and technological point of view.

Today, Mexico has managed to position itself among the main industrialized powers, and there are studies that show that, in a couple of decades, our economy could be among the top ten in the world. In order to achieve this type of development, it is necessary to create ecosystems that disseminate and extrapolate the potential of the energy reform.

Derived from the approaches of economist Ricardo Hausmann and physicist César Hidalgo, of Harvard and MIT, respectively, the Mexican energy sector must transform itself into a complex economy that, beyond consolidating itself as a producer focused on a primary good, allows reliable production and accessible energy for the development and welfare of the population. This will result in the creation of parallel industries, in symbiosis with the energy industry, that will contribute to the multiplier effect and, above all, create more knowledge and national growth and development capabilities.

As part of the reflection on substantive reasons, the chapter also analyzes the concept of energy security. In principle, the importance of achieving an optimal level of energy security is related to the growing integration of energy value chains in the region: an energy-integrated North America that can stand up to the world and, secondly, the growing energy demand from our population. However, it is necessary to find a balance between cost and security, in order to enhance economic prosperity.

Another fundamental aspect is sustainability. The New Mexican Energy Model represents the most significant effort in the development of renewable energy sources and, in the last two years, we have seen a significant increase in the contracts signed by the photovoltaic and wind industry.

On the other hand, it is also clear that the hydrocarbon industry is an essential force to generate greater sustainability. The New Model gives way to the investment and development of new technologies that allow the reduction of greenhouse gas emissions, as well as other innovative technologies that make hydrocarbon extraction and production processes more efficient and less polluting.

A greater availability of gas, better energy efficiency practices, prices without subsidy distortions, as well as new venting technologies, carbon capture and better petrochemicals, fuels, and new materials are an important contribution to a more sustainable model. They also

boost regional development, community participation and transparency rules emanating from a system of checks and balances and accountability mechanisms.

In the fifth chapter, a cash cut is made and essential principles and proposals for the good performance of the Mexican energy sector are identified. It is recognized that much progress has been made in a few years. Our energy sector is much more dynamic today. Regulatory quality and transparency have advanced decisively. Our country has managed to attract large investments, knowledge and technology. However, there is much to be done. The challenges of the energy sector are still significant, and an expanding economy, young population, and rapid technological change make it necessary to stay on the current path.

To that end, we have identified four principles that the implementation of the energy reform should follow. These are the key between achieving the high scenario outlined by the International Energy Agency or returning to a model with insufficient answers for 21st Century Mexico. These principles are perseverance, competition, transparency and knowledge.

All of them affect the strengthening of the institutional architecture, the construction of an ecosystem of competitors, the leverage of the country's international competitiveness and the consolidation of a knowledge-based economy.

Each axis or principle has a detailed explanation of its implications, as well as a description of the actions that Mexico can implement in the oil industry to achieve the 2040 vision.

Furthermore, while our analysis concludes that the reform has many virtues, although it requires time to mature and give the expected results, by approaching the industry, authorities and experts, we have identified a series of actions or proposals that would allow the achievement of better results. The chapter mentions them in their entirety, abounding in their reasons and, in the end, it highlights ten proposals whose importance is substance.

These ten proposals to enhance the New Energy Model deserve particular attention. These include conducting bidding rounds every year, in order not to lose the accumulated knowledge and reverse the lags that still undermine our energy sector. We also emphasize the importance of increasing inter-agency coordination, in order to give greater capacity and execution speed to the sector, noting however the importance of not putting autonomy at risk, as well as the checks and balances of the different regulators and authorities of the sector. We also believe that empowering the ASEA and developing a digital regulatory compliance platform can be powerful tools for the future.

We believe above all that the New Mexican Energy Model presents a series of elements worth emulating in other areas of the Mexican economic activity, particularly in the development of infrastructure. While the energy sector already has the same orientation as the rest of the economy, the development of infrastructure in Mexico requires a profound

transformation to create more competition, increase its implementation capacity, develop more transparency and attract knowledge. Without an infrastructure sector capable of keeping the pace of an energy sector and economy in deep transformation, the results will be meager, and the bottlenecks plentiful.

We believe that Pemex can continue to be strengthened, generating better conditions so that it can fully utilize the powerful tools that the Reform grants it, seeking partners, reducing its fiscal burden, improving the quality of its financing, and its implementation capacity. We must also strengthen the legal and physical certainty of investments, develop our unconventional resources in order to create greater regional development and consolidate knowledge in the decision making within the Mexican energy sector.

Altogether, this document draws a road map towards the year 2040, guided by an oil sector that shares the economic vision of the rest of the country: openness, competitiveness, transparency and knowledge. By outlining the principles and policies that could rebuild the national and international leadership of our energy sector, we trust that the New Model, born in 2013, will be a catalyst for multiple growth routes and wellbeing for the Mexico of the future, a Mexico where everyone with good ideas to promote growth and national wellbeing has enough energy to make them a reality.

FOUR ESSENTIAL PRINCIPLES:

Consistency: This is an essential element in a sector that is so risk-intensive and calls for consistency in vision, interpretation (legal certainty) and processes.

Transparency: Transparency guarantees that information can be consulted by the industry and by citizens. The accountability that transparency enables also interconnects with the other principles: it makes the functioning of institutions predictable based on the legal certainty that points out responsibilities, establishes goals, prevents abuse and maintains the procedures by which the daily task is developed within the standards.

Competition: The New Mexican Energy Model has an even floor of competition among all players. Thus, the country now has a diversity of stakeholders independent from the federal administration and with capabilities to expand investment, diversify risks and create collective efficiency parameters, in the pursuit of their own interests.

Knowledge: The energy reform is a knowledge-based reform. It involves attracting the knowledge and technology of the entire world through the New Mexican Energy Model to benefit the development of the energy sector, and therefore of our economy and society. It also involves substantial investments in the training of Mexican human capital, as well as in research and development to be carried out in the country.

TEN PROPOSALS TO ENHANCE THE NEW MEXICAN ENERGY MODEL

1. **Annual Rounds:** Consolidate a system of annual rounds with predictable dates, and independent from the political or price cycles, based solely on the Five-Year Technical Plans and the nomination system.
2. **Inter-agency Coordination:** Deepen the coordination mechanisms between the different regulatory agencies and State secretariats, in order to have higher levels of effectiveness in the execution of programs. Deepen the interaction through the Energy Sector Coordination Council and place special emphasis on the imminent needs in terms of infrastructure.
3. **Regulatory Autonomy:** Provide autonomy to the ASEA and charter its decision-making powers, in terms similar to those that characterize the other regulators of the sector, to promote a long-term State vision. Grant greater budgetary autonomy to all regulators.
4. **Digital Platform:** Create a single digital platform for the fulfillment of regulatory and contractual obligations, as well as simplification thereof, without undermining the checks and balances between regulatory agents. Special emphasis should be given to the cost-recovery mechanisms of the contracts.
5. **Elimination of Entrance Barriers:** A fundamental principle to consolidate greater competition. It is essential to move forward in terms of access and infrastructure development, public consultations and impact assessments, and improving the bankability and stability of contracts.
6. **Drive the development of Pemex:** Create better conditions for it to hold alliances, thus reducing its fiscal burden and risks, while improving its financing and implementation capacity, by having more partners.
7. **Certainty:** Strengthen the legal certainty of investments, guaranteeing access to arbitration mechanisms for dispute resolution, both in laws and treaties. Guarantee the physical security of the workers, the assets, and the communities where the sector is developed.
8. **Unconventional Resources:** Develop unconventional resources, with the same zeal as conventional ones have been developed, recognizing the need to find contractual terms that allow competing in North America, advancing in the availability of seismic information, and promoting regulations and dialogue that give certainty to communities and operators.

9. **Knowledge-based Economy:** Consolidate the integration of information at the CNIH; sustain, and preferably, deepen the scholarship, internship, certification and research programs of the energy sector, always placing them at the center of the planning and the solution of new challenges.
10. **Public Service Career Plan:** Create a career plan system within the institutions responsible for managing energy policy, placing merit and knowledge at the heart of their professional development. Provide ongoing training programs and clear paths for professional development and the management of their careers.



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