

Pemex and the Energy Transition: Timely Responses to Growing Threats

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Key messages

- An energy transition that progressively phases out fossil fuels is needed to avoid climate catastrophe. Nonetheless, such a transition will harm oil-producing countries and their state-owned businesses, such as Mexico and Pemex. In the International Energy Agency's Announced Pledges Scenario, an estimated USD 10 billion of Pemex investments would not break even. This would harm Mexican society: government revenue would fall, and Mexican businesses in the oil industry, such as those in the states of Campeche and Tabasco, would suffer.

- The energy transition is increasingly likely to result in a progressive and lasting decrease in global demand for oil. Although Mexico's domestic oil market is significant, were Pemex to produce only to meet domestic demand, this would not sufficiently protect it or Mexico from the fall in global export demand.

- The energy transition may exacerbate what is already a difficult financial situation for Pemex. It is the world's most indebted state oil company, with high costs in its refinery system, its labor and pension commitments, and several upstream projects. These challenges weaken the company's position *vis-à-vis* the impacts of the energy transition.

- Oil extraction in Mexico has decreased over time. Despite substantial government financial support, Pemex has been unable to reverse the significant downward trend, and this is unlikely to radically change.

- Without sufficient profits, Pemex's debt will grow. Its creditors have thus far been willing to loan it money, expecting continued government support. However, as more creditors worry about energy transition risk and decarbonize their investments, such willingness to lend is reducing. Interest rates are already rising for Pemex and likely also to increase for the Mexican government. This trend will make debt costs prohibitive for the company, trigger a spiraling of financial problems and increase the costs of government support.

Summary of recommendations

We propose **three actions and points of discussion focus** for Pemex, the Mexican government and policy-makers:

1. **Recognize and evaluate energy transition risk.** Although Pemex has begun to recognize such risk, it can do much more by publishing its risk assessment. Pemex can thereby facilitate public scrutiny and foster a more informed public debate. Pemex should evaluate the financial impact of different oil and carbon price scenarios and, at a minimum, (i) use multiple price scenarios rather than a single assumption; (ii) use metrics to evaluate the financial feasibility of future investments and publish its findings and assumptions; and (iii) put its assessment findings to effective use in its investment decisions.

2. **Mitigate risk with a resilient business plan.** Pemex should redirect its investments toward more resilient strategies, focusing on projects with greater returns and evaluating the feasibility of different diversification options. This may include investments in renewable technologies and other low-carbon activities if they align with company capacities. Pemex and Mexico's Federal Electricity Commission should build a coordinated vision that can support the domestic energy transition and strategies to mitigate transition risk.

3. **Ensure state-level oversight.** The Mexican state, as the sole owner of Pemex, is responsible for setting objectives and decision-making processes within the company and ensuring their respective fulfillment and efficacy. In that regard, different state agencies must transform if they are to oversee transition risk. The Energy Secretariat, which must lead the country's energy transition planning, should improve its risk management and build synergy among state-owned businesses in the sector. The Treasury Secretariat should consider the conditions required to transfer public funds to Pemex. And the energy regulators should consider transition risk when it comes to approving new projects and setting targets.

Introduction

The global energy transition is necessary to avoid the worst impacts of the climate crisis. However, it also brings risks for fossil fuel producer countries and national oil companies (NOCs), such as Mexico and Petróleos Mexicanos (Pemex). The International Energy Agency (IEA) estimates that if governments around the world meet the climate commitments they have set, global demand for crude oil will drop by half by 2050.[1] This won't be sufficient to meet the targets in the Paris Agreement, but it is concerning for oil companies and oil-producing governments.

The energy transition comes at a time when Pemex already faces challenges. Its oil production has fallen by nearly half since 2010. As a result, Mexico is today a net importer of oil products. To boost its "energy sovereignty" as defined by the Andrés Manuel López Obrador administration, and to ensure a diversified and secure oil supply, Pemex has invested significant resources in its national refinery system. The company also carries important financial labor liabilities linked to funds committed to its workers' pensions. Considered the most deeply indebted oil company in the world,[2] Pemex stays afloat because of substantial government support. Pemex's debt exceeds USD 100 billion, equivalent to 5.6 percent of Mexico's gross domestic product (GDP) for 2023.[3]

On top of this, a significant portion of the government's revenue comes from oil revenue. In 2023, oil revenue accounted for 15 percent of its total budgeted income. Of this total, 10 percentage points (MXN 736.56 billion) came from Pemex revenue. If we include the contribution Pemex makes to the Mexican Oil Fund, Pemex's contribution to the country's 2023 budget revenue is 22 percent.[4, 5] Nonetheless, as this report will explain, Pemex itself has reabsorbed a large portion of this contribution through financial support from the government.

These factors put Pemex in a difficult bind in facing the global energy transition. The response from Pemex and the government will be crucial for the sustainability of this state-owned enterprise. The response will equally be critical for Mexico's public finances,[6] its energy security, and the 520,000 people Pemex and its associated industries employ—especially in states like Campeche and Tabasco, where Pemex extracts most of its oil (50 percent and 41 percent of total company production respectively).[7]

The decisions Mexico's new government makes around Pemex will be pivotal, as will be proposals for how the company can face the enormous challenges ahead, including the energy transition risks the new administration

1 International Energy Agency, *World Energy Outlook, 2023,* www.iea.org/reports/world-energy-outlook-2023.
2 The Economist, "Pemex is the world's most indebted oil company," 12 October 2023, www.economist.com/the-americas/2023/10/12/pemex-is-the-worlds-most-indebted- oil-company.
3 IMCO, *Pemex en la mira: Análisis de resultados al cuarto trimestre de 2023 (Pemex under the microscope: Analysis of fourth quarter results, 2023)*, 28 February 2024, imco.org.mx/wp-content/uploads/2024/02/REPORTE_ PEMEX_4T2023_28Feb2024.pdf.
4 NRGI estimates based on Bank of Mexico Economic Information System and Center for Economic and Budget Research (Centro de Investigación Económica y Presupuestaria, CIEP) calculations of Pemex's average contributions to the FME, 98% from 2015 to 2020, used to estimate 2022 contributions: Banxico, "Ingresos Presupuestales del Sector Público," www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=9&accion=consultarCuadro&idCuadro=CG8&locale=es.
5 Joel Tonatiuh Vásquez Pérez, "Ingresos y transferencias del Fondo Mexicano de Petróleo," CIEP, 5 May 2020, ciep.mx/ingresos-y-transferencias-del-fondo-mexicano-del-petroleo/.
6 Pemex and the development of Mexico overall are closely linked. Although oil revenue for the federal government has fallen since 2014, the oil company's performance continues to heavily influence the sustainability of the public finances: México Evalúa, "5 evidencias sobre las finanzas públicas: Anual 2022," *Números de Erario*, 1 March 2023, numerosdeerario.mexicoevalua.org/2023/03/01/5-evidencias-sobre-las-finanzas-publicas-anual- 2022%EF%BF%BC/.
7 *Energía Hoy*, "Actividad de PEMEX impulsa a Tabasco y estados del sur," 21 April 2023, energiahoy.com/2023/04/21/actividad-de-pemex-impulsa-a-tabasco-y-estados-del-sur/#:~:text=Las%20inversiones%20petroleras%20en%20Tabasco,Estad%C3%ADstica%20y%20Geograf%C3%ADa%20(Inegi).

faces. Mexico's change of government in October 2024 represents an opportunity for citizens to demand a commitment from their political leaders to focus on the challenges Pemex faces in the context of the transition and on progress toward the country's energy and decarbonization goals.

This report contributes to an understanding of the current situation and recommends three main focuses of discussion and action for Pemex, the Mexican government and policy-makers.[8]



Oil platform, Sonda de Campeche, Mexico. Armando Salgado/NRGI

8 This report was developed based on a working session in Mexico held from 25 to 27 April 2023 with 35 participants from the energy sector and climate organizations. A joint scenario exercise was conducted to discuss implications of the energy transition for Pemex and Mexico. Input from this discussion refined our preliminary analysis, and this report presents a summary of those ideas: NRGI, *Pemex y la transición energética: Análisis de escenarios para la toma de decisiones*, March 2024, resourcegovernance.org/sites/default/files/2024-03/Memoria_Pemex%20y%20la%20transición%20energética.pdf.

1. Pemex, Mexico and global energy transition risk

1.1 The energy transition's impacts for Mexico

Financial threats to oil assets

In a previous report, NRGI reviewed the oil and gas exploration and production projects in which Pemex could invest in the next 10 years.[9] We analyzed the break-even prices for each project, based on data from Rystad Energy consultants, and compared these figures with estimated prices under the three IEA energy transition scenarios:[10]

- **Net Zero Emissions (NZE) Scenario,** in which the global economy emits net zero emissions by the year 2050. The global energy transition is moving quickly.
- **Announced Pledges Scenario (APS),** in which governments keep their climate promises, regardless of whether they are enshrined in legislation or policy, with corresponding impacts for the energy sector. The energy transition is moderate.
- **Stated Policies Scenario (STEPS),** in which governments do not implement new climate and energy transition policies, but rather continue along the lines of policies currently in force, and the energy transition is slow.[11]

For each of these scenarios, we estimated an average oil price for the period from 2023 to 2040. The result was USD 20 per barrel in the NZE scenario, USD 45 under the APS and USD 56 under STEPS.[12]

Figure 1 shows that most of the possible investments Pemex could make in the coming decade would be profitable under the APS. Nonetheless, USD 9.5 billion (MXN 163 million) of Pemex's capital could be oriented toward projects with higher costs that would not be profitable under this scenario. Pemex comes eleventh in the list of state-owned oil companies with the highest exposure to transition risk out of 58 companies we analyzed. If the company pursues objectives limited to maximizing production only, it may be forced to invest in high-cost projects that would be unprofitable in the context of a rapid global energy transition.

9 David Manley, Andrea Furnaro and Patrick Heller, *Riskier Bets, Smaller Pockets*, NRGI, January 2024, resourcegovernance.org/es/publications/riskier-bets-smaller-pockets-national-oil-companies-public-money-energytransition.
10 We defined the break-even price as the necessary price for an oil project to generate sufficient revenue to cover project costs, taxes and other government payments, plus a minimum profit margin sufficient to justify the investment. There is no universal number for the minimum expected return for investors, but we assume a rate of return of 10% per year (nominal) on capital invested.
11 IEA, *World Energy Outlook* 2023.
12 For a full description of our method, see Manley, Furnaro and Heller, *Riskier Bets, Smaller Pockets*.

Figure 1. Value of Pemex oil and gas exploration and production investments that break even in each IEA scenario

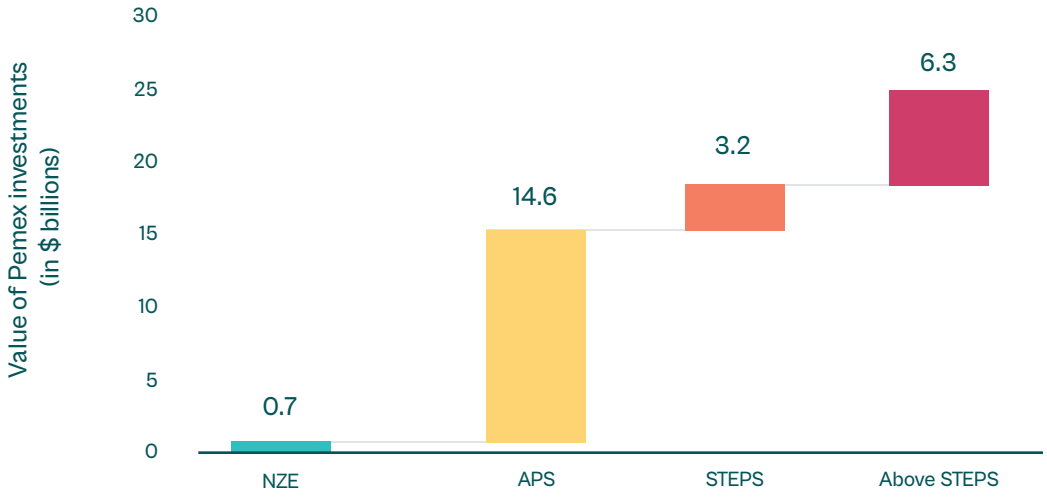


Table 1 shows the main oil projects Pemex could develop during the next decade that would not break even under the NZE scenario. These could be new projects or the expansion of projects currently in production. For each project, we estimated whether it would break even under the APS. According to our calculations, none of the projects in the Pemex 10-year investment portfolio would break even under the NZE scenario.

Some new projects that could be developed have relatively low break-even prices. So from a purely economic standpoint, it would make more sense for Pemex to develop these projects rather than expand currently existing initiatives that have higher break-even prices. This is a particularly problematic situation in the context of IEA declarations that leave little space in the global carbon budget for new oil projects.[13]

13 IEA, *Net Zero by 2050*, May 2021, www.iea.org/reports/net-zero-by-2050.

Table 1. Main oil investment projects[14]

Project	Status[15]	Oil reserves (Millions barrels)	Capital expenditure, current value (Millions USD)	Oil break-even price (USD/barrel)	Reach break-even point under APS?
Kante	Planned for development	_	872	146	No
Uchukil	Planned for development	11	936	90	No
Aceite Terciario del Golfo	In production	11,624	183,028	80	No
Pankiwi Shale	Planned for development	26	1,570	74	No
Maxochitl Shale	Planned for development	18	1,138	74	No
Integral Ek-Balam	In production	6,703	59,291	74	No
Tsimin-Xux	In production	5,044	66,537	53	No
Unidad de Negocio Integral Abkatún-Pol-Chuc	In production	68,774	200,442	52	No
Jujo-Tecominoacan	In production	16,164	44,802	51	No
Crudo Ligero Marino	Planned for development	_	5,543	46	Yes
Aceite Terciario del Golfo	Planned for development	37	1,336	44	Yes
Trion	Planned for development	3,392	33,985	43	Yes
Proyecto Ku-Maloob-Zaap	In production	129,983	448,057	38	Yes

14 Rystad Energy UCube, consulted 30 January 2024.
15 Projects "planned for development" correspond to new (greenfield) projects, while projects "in production" correspond to the expansion of currently operational projects.

Table 1. (continued)

Project	Status	Oil reserves (Millions barrels)	Capital expenditure, current value (millions USD)	Oil break-even price (USD/barrel)	Reach break-even point under APS?
Poza Rica	In production	47,904	50,686	36	Yes
Pit	Planned for development	1,812	28,485	35	Yes
Antonio J. Bermudez	In production	55,159	122,371	35	Yes
Integral Yaxché-Xanab	In production	5,059	81,647	35	Yes
Delta del Grijalva	In production	17,330	45,201	32	Yes
Zama	Planned for development	2,889	20,653	29	Yes
Ogarrio-Sánchez Magallanes	In production	19,678	51,063	28	Yes

Effect on Pemex payments to the government

According to calculations by Mexico's Center for Economic and Budget Research (Centro de Investigación Económica y Presupuestaria, CIEP), from 2015 to 2018, for every MXN 1 Pemex received from the national treasury, it contributed MXN 5.7 in return. From 2019 to 2023, that figure dropped to MXN 1.4. And from 2021 to 2023, Pemex's tax contributions were less than the support it received from the federal government.[16, 17]

In a fast energy transition scenario, Pemex's payments to the national treasury may reduce further. We do not have an estimate of the impact on government revenue if global oil demand falls according to the APS. However, in the NZE scenario, government revenue from oil exploration and production falls by 84 percent, according to analysis by Carbon Tracker.[18] This analysis also shows that the company's contribution to total government revenue could decrease from 18 percent to 3 percent. If the government needs to continue providing financial support to Pemex, this would result in substantial payments from the government.

Overall, as we will argue in Chapter 3, the economic and political costs to the government of continued support for Pemex could become unsustainable.

16 César Augusto Rivera de Jesús, "Apoyos fiscales y patrimoniales a Pemex," CIEP, 17 October 2023, ciep.mx/wp-content/uploads/2023/10/Apoyos_fiscales_y_patrimoniales_Renta_petrolera_neta.pdf.
17 Alejandra Macías Sánchez, Ricardo Cantú Calderón and César Augusto Rivera de Jesús, *La importancia fiscal de PEMEX: Hacia la era post-petróleo*, CIEP, 28 September 2023, ciep.mx/wp-content/uploads/2023/07/La_brecha_fiscal_post_petroleo_28sep23.pdf.
18 Mike Coffin and Andrew Grant, *Beyond Petrostates: The Urgent Need to Reduce Dependence on Oil in the Energy Transition,* Carbon Tracker, 3 May 2023, carbontracker.org/reports/petrostates-energy-transition-report.

Jobs at risk

Pemex is one of the largest employers in Mexico, with 117,000 direct employees and approximately 400,000 indirect jobs.[19, 20] As the energy transition accelerates, the company will launch fewer oil projects, and there will be fewer jobs for employees at Pemex and in other oil companies and associated industries. This will be especially the case in oil-rich parts of Mexico, such as Campeche, Tabasco and Veracruz, which accounted for 50 percent, 41 percent and 5.9 percent of the country's total hydrocarbon production respectively in 2022.[21]

Uncertain impacts on energy security

It is not entirely clear how the global energy transition will affect energy security in Mexico. (The IEA defines energy security as the "uninterrupted availability of energy sources at an affordable price.")[22] If governments uphold their climate commitments, the IEA expects the price of oil to drop to USD 60 dollars per barrel in 2050, and the price of natural gas may fall to USD 2 per million thermal units.[23] Refinery costs in the United States may also fall, where demand for gasoline has already peaked, and refineries may find themselves with surplus capacity. This decrease in prices might have an advantage for some importer countries such as Mexico. But this dynamic would also deepen Mexico's dependence on imports, which could affect its energy sovereignty or independence—that is, Mexico's capacity to meet its energy consumption needs by exploiting its own resources.[24]

A reduction in global prices will not necessarily mean a corresponding fall in Mexico's costs of oil and gas production. As we will see in Chapter 3, falling demand, falling prices, and the corresponding retreat of many investors from a business with shrinking profits and negative climate change impacts may make access to capital difficult for the country's oil industry, again reducing its energy security.

Mexico's energy security will also be affected by the availability of alternative energy sources, such as renewable energy. Several renewable technologies already have potential to produce cheaper energy than oil and gas for electricity and transport in Mexico,[25] although their feasibility may be conditioned by regulatory and institutional challenges. Renewable energy technologies offer advantages in terms of energy sovereignty. This is because, even though Mexico needs—at least initially—to import the technology, it would depend less on external energy sources and imports and be less vulnerable to fluctuating oil prices.[26]

19 Michael Lynch, *El Futuro del Petróleo en México: entendiendo el Valor Económico del Nuevo Modelo Energético*, EPRINC, January 2019, eprinc.org/wp-content/uploads/2019/01/Mexicos-Petroleum-Future-Espa--ol-1.28.19.pdf.
20 Diana Nava, "Pemex elevará su número de empleados a su nivel más alto desde 2017", *Expansión*, September 18, 2023, expansion.mx/empresas/2023/09/18/pemex-elevara-numero-de-empleados-nivel-mas-alto.
21 Efraín Mariano, "Campeche lidera producción nacional de hidrocarburos con el 50%", *Energy and Commerce*, February 1, 2023, energyandcommerce.com.mx/campeche-lidera-produccion-nacional-de-hidrocarburos-con-el-50/#:~:text=De%20esa%20plataforma%2C%20el%20estado,5.9%25%20(111%2C600%20barriles).
22 IEA, "Emergency response and energy security," 3 August 2023, www.iea.org/about/emergency-response-and-energy-security.
23 IEA, *The Oil and Gas Industry in Net Zero Transitions*, February 2024, iea.blob.core.windows.net/assets/f065ae5e-94ed-4fcb-8f17-8ceffde8bdd2/TheOilandGasIndustryinNetZeroTransitions.pdf.
24 Diario Oficial de la Federación, *Programa Sectorial Derivado Del Plan Nacional De Desarrollo 2019-2024*, 8 July 2020, www.dof.gob.mx/nota_detalle.php?codigo=5596374&fecha=08/07/2020#gsc.tab=0.
25 Pedro Hancevic, Héctor Núñez and Juan Rosellón, "Mexico's Energy Prospects: Gains from Renewable Sources over a Fossil Fuel-Dominated Environment," *Economics of Energy & Environmental Policy*, 11(2), 2022, www.proquest.com/openview/d83669073b5bc8fa3191417ecb643e95/1?cbl=2069346&pq-origsite=gscholar&parentSessionId=pih1QItPqeXWg%2BB77gZZgAFlL0M4Jk%2FA3lUs102P2kU%3D.
26 Saidi Flores Sánchez, Miguel Alejandro Flores Segovia and Luis Carlos Rodríguez López, "Estimating a national energy security index in Mexico: A quantitative approach and public policy implications," *Energy Strategy Reviews*, 45, 101019, 2023, doi.org/10.1016/j.esr.2022.101019.

1.2 Likelihood of a permanent fall in global oil demand

Although our impact estimates are based on IEA scenarios, nobody can predict whether the future will turn out as these scenarios suggest. Yet there is growing probability of a rapid energy transition, and thus an accelerated fall in global demand for oil.

Despite the recent unprecedented profits generated by the oil industry, the global energy transition has picked up speed. Several organizations, including the IEA, project global demand for oil to reach its peak this decade.[27] In the Organisation for Economic Co-operation and Development countries, fossil fuel consumption peaked in 2005.[28] Analysts have estimated that oil demand in China will peak in 2024.[29]

It is difficult to know whether global oil demand will flatline or collapse after this peak. The speed of the transition to electric vehicles (EVs) will be a key factor. Road vehicles use nearly half the world's crude oil production. This makes cars the most important market to consider in any assessment of future oil demand.[30] The sale of new EVs is growing exponentially, gradually displacing internal combustion vehicles. In the past, the growth of many new successful technologies has followed an S-curve: the new technology begins with barely perceptible growth, then it reaches a phase of exponential growth that begins to fade once the market is saturated. In the U.S., technologies such as landline telephones, mobile phones and televisions followed this trend.[31]

In 2023, EV sales grew by 35 percent compared to 2022, which expanded the share of EVs in global vehicle sales from 14 percent to 18 percent.[32] Moreover, global production capacity for EV batteries will soon be sufficient to meet projected world demand in 2030 under the NZE scenario.[33] New EV sales are projected to cover from 62 percent to 86 percent of the market by 2030.[34]

In terms of oil demand, the key figure is not the sale of new EVs, but rather the total number of internal combustion vehicles used. The current growth of EVs has displaced only 1.5 million barrels per day (Mbd) of oil demand, about 3 percent of the fuel demand for road vehicles.[35]

27 BloombergNEF, *Electric Vehicle Outlook 2024*, about.bnef.com/electric-vehicle-outlook.
28 Kingsmill Bond, *Decline and Fall: The size and Vulnerability of the Fossil Fuel System*, Carbon Tracker, 2020.
29 Liu Lican, "China may have reached peak petrol station," *China Dialogue*, 7 December 2023, chinadialogue.net/en/transport/china- may-have-reached-peak-petrol-station.
30 IEA, *Oil total final consumption by sector*, 1971-2018, 27 August 2020, www.iea.org/data-and-statistics/charts/oil-total- final-consumption-by-sector-1971-2018.
31 Our World in Data, "Share of United States households using specific technologies," ourworldindata.org/grapher/ technology-adoption-by-households-in-the-united-states.
32 IEA, *Global EV Outlook 2023*.
33 IEA, *Net Zero Roadmap: A Global Pathway to Keep the 1.5°C Goal in Reach*, September 2023, www.iea.org/reports/net- zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach.
34 The Rocky Mountain Institute calculates a range of 62% to 86% if EVs follow the S-curve trend: Kingsmill Bond et al., "X-Change: Cars, The end of the ICE age", Rocky Mountain Institute, 28 November 2023, rmi.org/ insight/x-change-cars/.
35 BloombergNEF, *Electric Vehicle Outlook 2024*.

Nonetheless, BloombergNEF projects an "Economic Transition" scenario (the most likely) in which 50 percent of the world's passenger vehicles will be electric by 2040.[36]

One of the most important uses for crude oil, in addition to road vehicle fuel, is to produce petrochemicals, accounting for about 12 percent of crude oil use, such as in plastic production. This need could address a small proportion of Pemex's financial problems.[37] The IEA projects that petrochemicals demand will grow significantly, becoming the largest driver of world oil use and adding nearly 7 Mbd by 2050.[38] However, current global oil consumption is around 100 Mbd, and according to the IEA APS, total demand—including for petrochemicals—will fall by 55 Mbd by 2050.[39] Clearly, a 7 Mbd increase in oil demand for petrochemical production will be insufficient to offset the overall decrease.



Ciudad Pemex. Gas processing plant. Armando Salgado/NRGI

36 BloombergNEF, *Electric Vehicle Outlook 2024*.
37 Adrian Duhalt, "The Petrochemical Arm of Pemex: A Tale of Boom and Bust," Baker Institute, 14 May 2020, www.bakerinstitute.org/ research/ petrochemical-arm-pemex-tale-boom-and-bust
38 IEA, *The Future of Petrochemicals*, October 2018, www.iea.org/reports/the-future-of-petrochemicals.
39 IEA, *World Energy Outlook 2023.*

1.3 Limited protection from a domestic market focus

Although Mexico is an important oil consumer, with domestic demand that could mitigate the effects of falling international demand, what happens to the global oil market is of high importance for Pemex. Focusing on the domestic market, therefore, as the previous administration's self-sufficiency policy outlined, will not necessarily reduce exposure to the transition risk. To understand this dynamic, it is helpful to consider the Mexican oil market in three segments.

Figure 2. Oil exports, domestic sales and imports



Pemex produced 1.62 Mbd of oil in 2022 and exported 60 percent of this production (USD 32 billion in crude oil and USD 6 billion in petroleum-based products).[40] Also in 2022, Mexico consumed 1.9 Mbd,[41] while the country imported USD 43billion in refined oil (plus $30bn in plastics) more than its petroleum exports.[42]

A global decrease in oil prices affects the three elements of the equation: exports, domestic sales and imports. Lower crude oil prices result in a fall in the value of exports and in revenue for Pemex. The price Mexicans pay to import fuel also falls.

The value of Pemex's sales in the domestic market may also drop, because the current formula in Mexico to calculate gasoline and diesel prices includes the Houston Waterborne USGC (U.S. Gulf Cost) gasoline indicator metric in its constituent factors.[43] In this case, the Secretariat of the Treasury and Public Credit (Secretaría de Hacienda y Crédito Público, SHCP) averages gasoline spot market prices of the 10 previous days, using Platts US Marketscan data.[44]

The government could unhitch domestic fuel prices from this reference price in a move to protect Pemex from falling global prices. The political cost of such a shift might be high, however, as fuel costs account for a significant portion of total household spending in Mexico.[45]

An energy transition in Mexico would lead to a reduction in domestic demand for gasoline and diesel. It is not clear how quickly EV use will grow in Mexico. A report from the Mexican Climate Initiative (Iniciativa Climatica de Mexico, ICM) projects that EVs will account for only 11 percent of the total vehicle fleet in the country by 2050.[46] According to the Mexican Automobile Industry Association (Asociación Mexicana de la Industria Automotriz, AMIA), the transition toward EVs may be slow in Mexico, due to the lack of government stimuli.[47, 48] There is a lack of charging stations and clean energy, and EV prices are still high for the general population in Mexico.[49, 50]

Other analysts assert that Mexico's transition to EVs could come sooner than expected. The country's geographical location near the U.S. and its well-developed auto industry and workforce are advantages.[51] Recent investments from the U.S. to produce EVs in Mexico, such as from Chevrolet, Ford and Tesla, could accelerate this process if the government acts to ensure that a large share of EVs produced in the country sell to the domestic market.[52] Growing availability of lower cost EVs and more affordable renewable energy could also accelerate the transition, regardless of government policy.[53]

40 INEGI, "Exportación e Importación: Balanza de productos petroleros," 11 March 2024, www.inegi.org.mx/app/tabulados/default.html?nc=821&idrt=8&opc=t; Comisión Nacional de Hidrocarburos, "Tablero de producción de petróleo y gas," 2022, produccion.hidrocarburos.gob.mx/.
41 Energy Institute, *Statistical Review of World Energy* (2024), www.energyinst.org/statistical-review
42 Observatory of Economic Complexity (2024), accessed 6 November, 2024. oec.world/en/profile/country/mex.
43 For more on how fuel prices are set in Mexico, see Gobierno de México, Comisión Reguladora de Energía, 2016, www.dof.gob.mx/ nota_detalle.php?codigo=5424775&fecha=09/02/2016#gsc.tab=0.
44 Platts US Marketscan is an independent provider of data and reference prices for raw materials and energy markets
45 León A. Martínez, "Mexicanos, los que gastan la mayor parte de sus sueldos en gasoline al año," *El Economista*, 11 July 2018, www.eleconomista.com.mx/empresas/Mexicanos-los-que-gastan-la-mayor-parte-de-sus-sueldos-en-gasolina-al-ano--20180711-0036.html.
46 ICM and Carbon Trust, *Rutas Sectoriales de Descarbonización para México al 2030 y proyecciones a 2050*, 2020. www. iniciativaclimatica.org/wp-content/uploads/2021/03/PresupuestoCarbono_DOC-POL.pdf.
47 Tzuara de Luna, "México Atrae Inversiones para fabricar autos eléctricos, pero no para producir baterías," *Expansión*, 4 August 2023, expansion.mx/empresas/2023/08/04/mexico-no-desarrolla-la-proveeduria-esencial-de-electricos.
48 AMIA, "Transición a la electromovilidad en México," 10 March 2022. amia.com.mx/wp-content/uploads/2022/03/ electromovilidad28022022-V2.pdf.
49 Naela Hernández, "Estos son los retos que México debe atender para transitar hacia los autos eléctricos", *El CEO*, 17 October 2023, elceo.com/negocios/estos-son-los-retos-que-mexico-debe-atender-para-transitar-a-los-autos-electricos.
50 AMIA, "Transición a la electromovilidad en México."
51 Tzuara de Luna, "México Atrae Inversiones para fabricar autos eléctricos, pero no para producir baterías."
52 Fernando Navarrete, "México 'se pone las pilas': producción de autos eléctricos acelera 36%," *El Financiero*, 7 February 2024, www.elfinanciero.com.mx/empresas/2024/02/07/mexico-se-pone-las-pilas-produccion-de-autos-electricos-acelera-36/#:~:text=La%20 producci%C3%B3n%20de%20veh%C3%ADculos%20el%C3%A9ctricos,tecnolog%C3%ADa%20producidos%20en%20el%202022.
53 Carbon Tracker, *Driving Change: How electric vehicles can rise in the Global South*, November 2023, carbontracker.org/reports/ electric-vehicles-in-the-global-south.

2. The energy transition and the current crisis

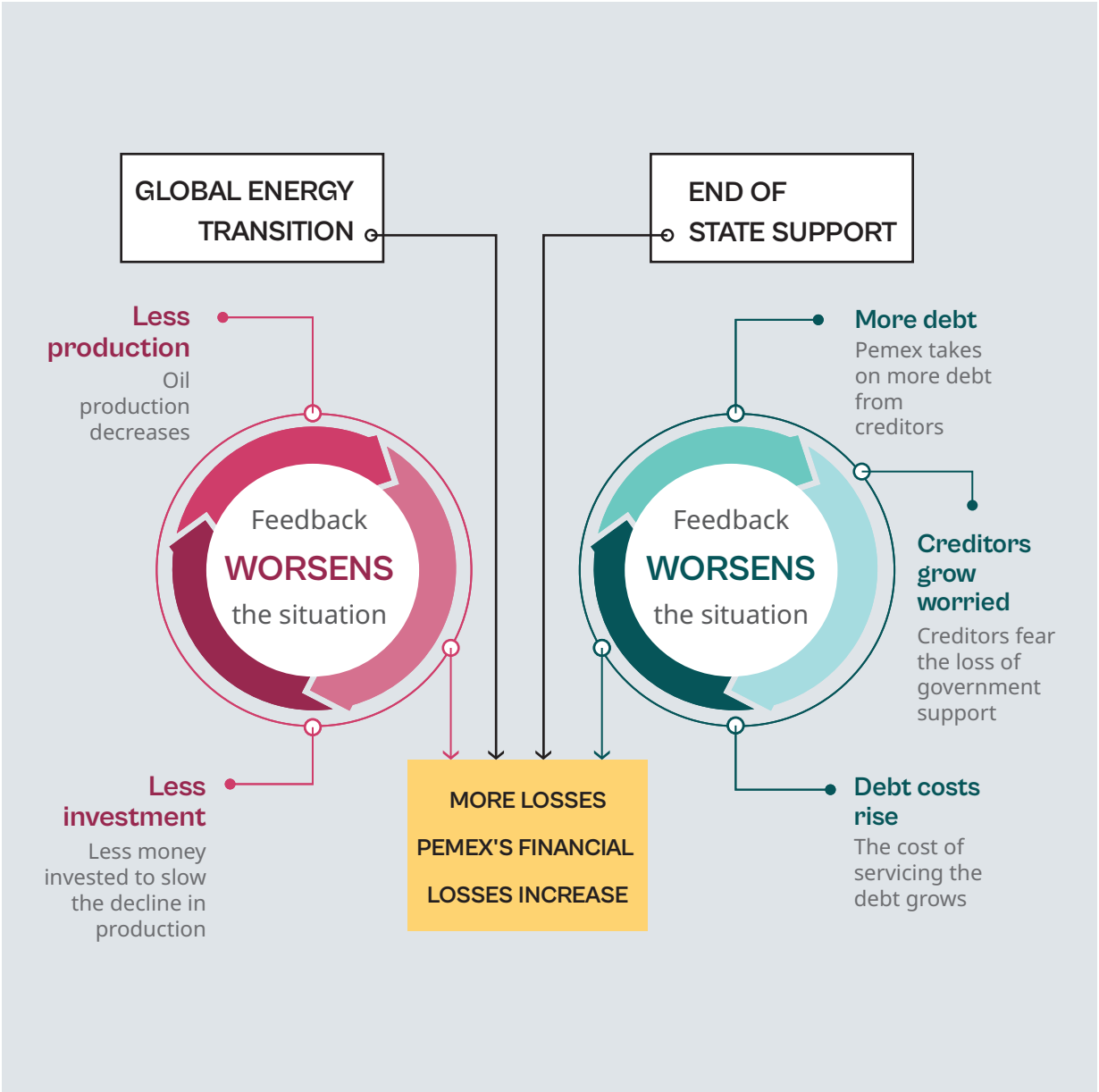
Pemex faces a challenging financial situation. The Mexican government has guaranteed Pemex's debt and bailed out the company to prevent its collapse. But the global energy transition could exacerbate the situation. If not managed effectively, the situation could spiral out of control and lead to greater financial problems and unemployment in Mexico.

At least two effects could combine in a feedback loop to accelerate the financial crisis facing Pemex. The first is a cycle involving the decrease in the company's oil production and its spending on high-cost projects. These factors will result in Pemex having less capital to develop more oil resources. The second effect is a cycle in which the company's rising financial losses lead to greater debt and a growing need for government support. Crucially, these two cycles interact so that one feeds into the other, leading to the possibility of a sudden collapse in Pemex and even in the state's finances.

Currently, government support for Pemex keeps these two cycles from spiraling out of control. There is rising concern among the company's creditors regarding transition risks, which could destabilize the system. This concern could intensify, even in advance of any major fall in global demand for oil, especially if creditors' expectations about Pemex's financial solvency and government support deteriorate. Pemex's rising cost of debt suggests this effect may already be in play. Additionally, the government may reduce its support if it faces a budget crisis or changes course in its approach to the transition risks or its willingness to accept the political cost associated with supporting the company.

The unpredictable speed of any changes in the situation complicates the challenge for the government. Our intention in this report is to alert decision-makers to the uncertainties arising from this combination of effects, including the additional challenges associated with the global energy transition. The risk is that the current crisis may transform into a much greater one, at unexpected speed, taking both the government and the company's creditors by surprise. Figure 3 summarizes this process.

Figure 3. How can the energy transition deepen the current crisis?



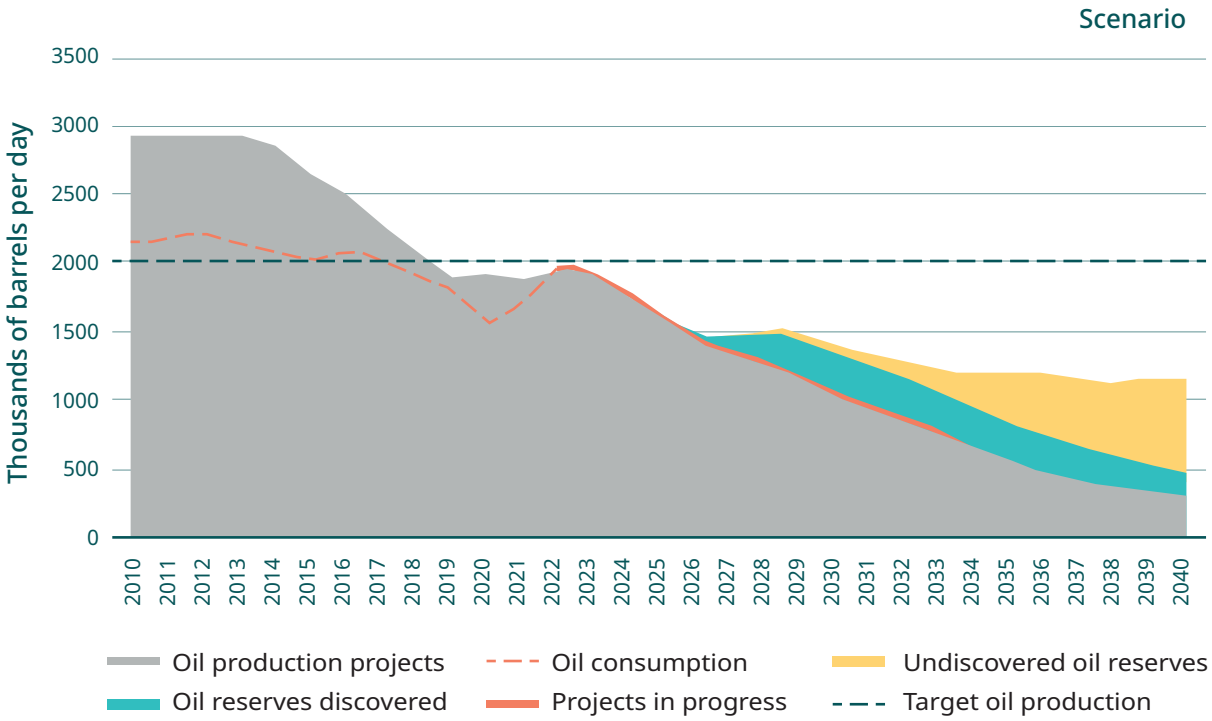
2.1 Cycle 1: Less production and fewer investments

In the first of the two feedback effects, Pemex faces challenges arising from its declining oil production, the high cost of its refinery program and high labor (pension) liabilities. Reduced future oil demand would worsen Pemex's current losses.

Falling production despite government targets

Mexico's oil production has been decreasing since 2010, as Figure 4 shows. The government aims to produce 2 Mbd, but scenarios such as that published by Rystad Energy, and some scenarios from Mexico's National Hydrocarbons Commission (Comisión Nacional de Hidrocarburos, CNH), suggest that this target will be difficult to hit. Even if Pemex or other companies find new oil fields, production will continue to fall under Rystad Energy's main production scenario.

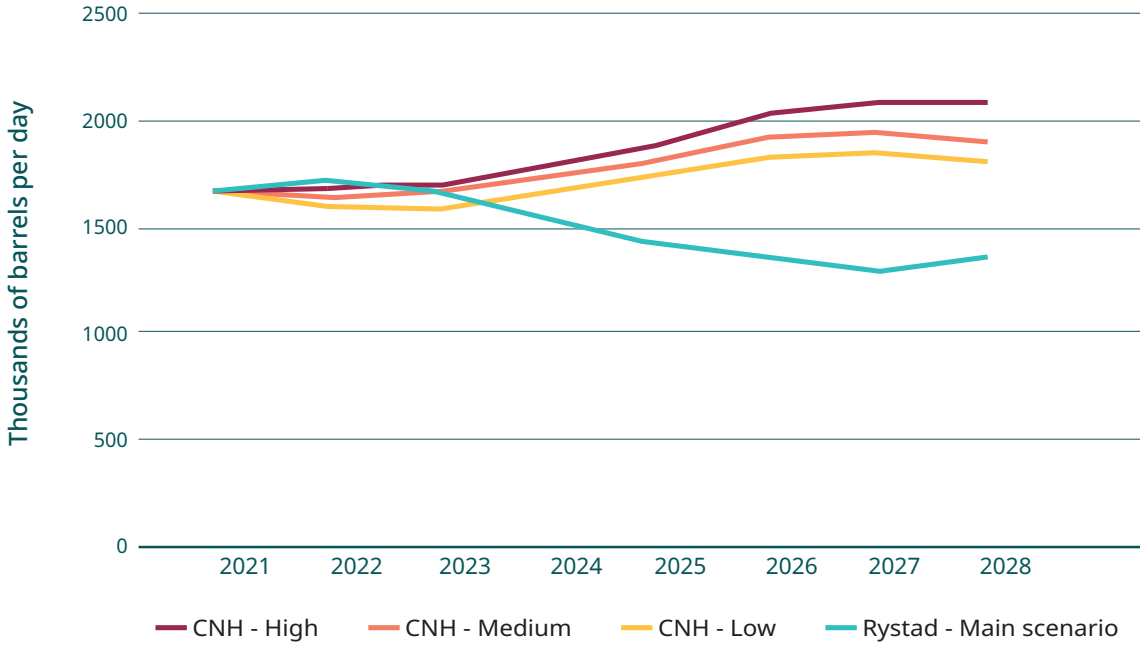
Figure 4. Historic and projected production and consumption for Mexico[54]



54 Based on data from Rystad Energy and Energy Institute, *2023 Energy Institute Statistical Review of World Energy*, 2023, www.energyinst.org/statistical-review. Rystad Energy is an independent provider of oil and gas information. It predicts the availability of new discoveries, based on the knowledge of existing reserves and the trajectory of previous production in countries with similar geographies (the "growth curve").

Figure 5 shows that, even under the Rystad scenario that assumes high global oil demand in line with Organization of the Petroleum Exporting Countries projections, Mexico's oil production continues to fall. Only the CNH scenarios show production growth.[55] The most optimistic CNH scenario depends on increased production under private contracts, which seems improbable, given that many private companies such as Shell and BP have revoked their contracts and closed operations in Mexico. For this scenario to be realized, several investors with a high risk appetite would have to continue investing in Mexico, which currently seems unlikely.[56, 57]

Figure 5. Mexican oil production scenarios, CNH and Rystad Energy (2021–2028)[58, 59]



55 CNH, "Nota metodológica para la estimación de la producción prospectiva de petróleo y gas natural," 2021, hidrocarburos.gob.mx/ media/4822/nota-metodol%C3%B3gica-prospectiva.pdf.
56 Héctor Usla, "Shell renuncia a contratos petroleros en México tras quedarse sin `recursos comerciales´," *El Financiero*, 18 May 2023, www.elfinanciero.com.mx/economia/2023/05/18/shell-renuncia-a-contratos-petroleros-en-mexico-tras-quedarse-sin-recursos- comerciales.
57 Arturo Solís, "Exclusiva: BP abandona el negocio de exploración de petróleo y gas en México," Bloomberg Línea, 15 August 2022, www.bloomberglinea.com/2022/08/15/exclusiva-bp-abandona-el-negocio-de-exploracion-de-petroleo-y-gas-en-mexico.
58 Rystad Energy Dashboard, "E&P Energy Transition Risk"; Rystad Energy Ucube.
59 CNH, "Prospectiva de Producción 2022-2028," 2022, hidrocarburos.gob.mx/media/5452/reporte-prospectiva-3er-trim-2022.pdf.

Slowing investments to reverse decline

Mexico's oil production has fallen since 2013, as Figure 4 shows. As we mention above, although the government seeks to produce 2 Mbd, industry scenarios indicate non-achievement of this goal. Even if Pemex or other companies find new oil fields, production will continue to fall, according to Rystad Energy's scenario.

High cost of refineries

Before 2022, Mexico had six refineries with a combined capacity of 1.6 Mbd of crude oil. From 2019 to 2023, Pemex racked up net losses of USD 50 billion, 70 percent of which arose from the refining operations of Pemex Industrial Transformation (Pemex Transformación Industrial). This means a loss of USD 34 dollars per barrel of crude oil the refineries process.[60]

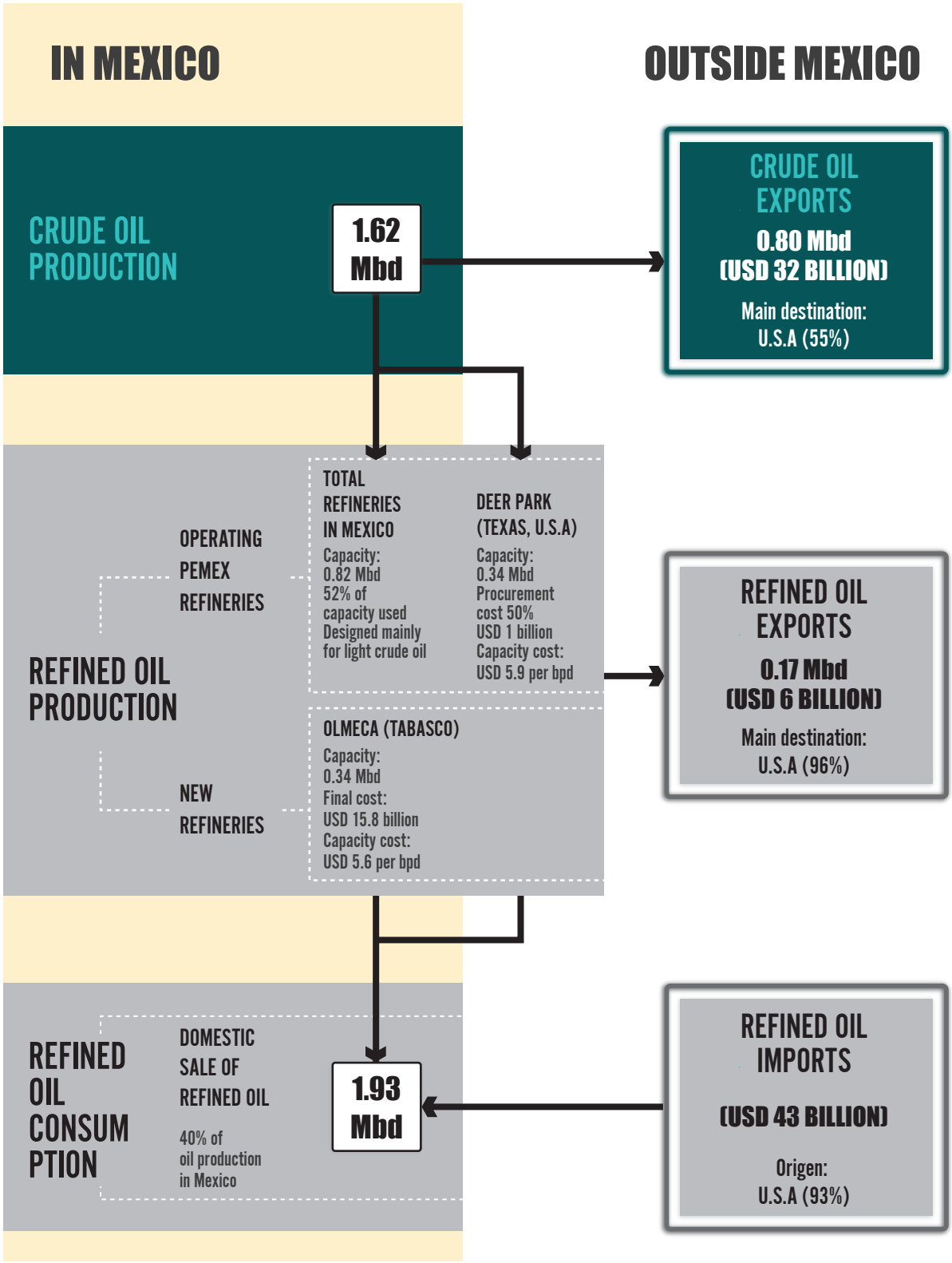
To understand why Pemex finds itself in this position, it is helpful to appreciate the current flows of crude and refined oil, as Figure 6 illustrates.



Distribution plant, Pajaritos, Coatzacoalcos. Armando Salgado/NRGI

60 Gabriel Quadri de la Torre, "El derrumbe de Pemex," El Economista, 14 March 2024, www.eleconomista.com.mx/opinion/El- derrumbe-de-Pemex-20240314-0132.html#.

Figure 6. Crude and refined oil flow in the Mexican oil system[61, 62, 63, 64]



61 Observatory of Economic Complexity, *Mexico, 2022*, oec.world/en/profile/country/mex.
62 Energy Institute, *2023 Energy Institute Statistical Review of World Energy*, www.energyinst.org/statistical-review.
63 Diana Nava, "¿Cuánto ha costado la refinería de Dos Bocas? Rocío Nahle responde," *Expansión*, 11 November 2023, expansion.mx/empresas/2023/11/11/cuanto-ha-costado-dos-bocas-rocio-nahle.
64 Robert Brelsford, "Pemex completes purchase of Deer Park refinery" ("Pemex complete compra de la refinería Deer Park"), *Oil & Gas Journal*, 21 January 2022, www.ogj.com/refining-processing/article/14224049/pemex-completes-purchase-of-deer-park-refinery.

Pemex's refineries, built from 1950 to 1979, have prioritized low costs over efficiency and failed to invest enough in maintenance and technology renewal.[65] As a result, utilization rates fell from approximately 88 percent from 1980 to 2008 to just 38 percent in 2020, although they rose back to 52 percent in 2022.[66]

The disparity between the type of crude oil produced in Pemex wells (heavy sour crude) and the oil these low-complexity and relatively inflexible refineries can process (light sweet crude), combined with low margins in the refinery sector, makes profitability difficult. Ensuring the refineries can adapt to the heavy sour crude Mexico produces has been a challenge. Prior to 1995, most of Mexico's crude oil production was regular and light. But the Cantarell project produced heavy oil from 1978 and reached its maximum production in 2004. The Ku-Maloob-Zaap project then replaced Cantarell and produced extra heavy crude oil. Ku-Maloob-Zaap production peaked in 2018, and Rystad Energy projects that it will rapidly tail off from 2030 to 2040. According to the central Rystad scenario, regular and light crude oil will once again represent most of Mexico's crude oil production by early 2030, although at much lower volumes than current production.[67]

The increasing extraction of heavy crude oil from Mexican wells presents another problem. Refineries produce a large quantity of fuel oil when processing this low-complexity oil. For example, in 2021 Pemex produced more fuel oil than gasoline for the first time.[68] Fuel oil pollutes more than gasoline and is thus less desirable and trades at a lower price compared to other products. To sell it, Pemex has offered discounts to Mexico's Federal Electricity Commission (Comisión Federal de Electricidad, CFE) plants, leading to greater pollution.[69]

Pemex has recently invested in two more refineries. In 2022, it acquired the remaining half of the Deer Park refinery in the U.S., which it owned in a joint venture with Shell. With a capacity of 0.34 Mbd, this refinery was designed mainly to process heavy crude oil. Pemex paid nearly USD 1.2 billion for this acquisition.[70] This works out as a cost of USD 6 per barrel per day.

The second refinery is Olmeca, also known as Dos Bocas. It has a 0.34 Mbd capacity and is designed to refine heavy crude.[71] Pemex expects the combined capacity of this refinery system to reach 1.8 Mbd.[72] A study conducted prior to construction of this refinery shows that Pemex will recover the investment cost of Olmeca in only 2 percent of scenarios.[73] The costs of this project, which is behind schedule, have risen significantly from a budget of MXN 1.37 billion (USD 8 billion)[74] to between USD 15.6 and 16 billion, according to government estimates.[75] Costs at the Olmeca refinery could be USD 56 per barrel per day, almost 10 times higher than at Deer Park.[76]

In total these two projects cost the government an amount equivalent to 90 percent of Pemex's

65 Francisco José Barnés de Castro, "Sistema Nacional de Refinación," OCE, 2022, energia.org.mx/wp-content/uploads/2022/03_SistemaNacionalRefinaciónFBarnesPrimeraParte.pdf.
66 Data from the Ministry of Energy National Energy Balance: SENER, *Balance Nacional de Energía 2018*, 2019, www.gob. mx/cms/uploads/attachment/file/528054/Balance_Nacional_de_Energ_a_2018.pdf; Energy Institute, *2023 Energy Institute Statistical Review of World Energy*.
67 NRGI calculations based on Rystad Energy UCube data.
68 Jesús Carrillo, Diego Díaz, Sonia Mancera, Oscar Ocampo and Montserrat Ramiro, *La Energía que Queremos: Infraestructura, regulación y Estado de derecho para un sector energético que detone la competitividad de México*, September 2022, imco.org.mx/wp-content/uploads/2022/09/La-energia-que-queremos_Documento.pdf.
69 Barnés de Castro, "Sistema Nacional de Refinación."
70 Luis Miguel González, "¿Por qué Dos Bocas no es Deer Park?" *El Economista*, 5 January 2024.
71 Secretaría de Energía, "El Gobierno de México anuncia el Plan Nacional de Refinación que asegurará el acceso a la energía y al desarrollo equilibrado," 9 December 2018, www.gob.mx/sener/en/articulos/el-gobierno-de-mexico-anuncia-el-plan-de-produccion-de-combustibles-que-asegurara-el-acceso-a-la-energia-y-al-desarrollo-equilibrado#:~:text=En%20Dos%20Bocas%2C%20 Tabasco%2C%20se,barriles%20de%20petróleo%20por%20día.
72 NS Energy, "The Dos Bocas refinery project," 14 April 2020, www.nsenergybusiness.com/projects/dos-bocas-refinery-project.
73 IMCO, *Diagnóstico IMCO: Refinería Dos Bocas*, April 2019, imco.org.mx/diagnostico-imco-refineria-dos-bocas.
74 "Refinería de Dos bocas: Este fue el presupuesto inicial y lo que finalmente puede llegar a costar," *El Financiero*, 23 June 2023, www.elfinanciero.com.mx/nacional/2022/06/23/refineria-de-dos-bocas-este-fue-el-presupuesto-inicial-y-lo-que-finalmente-puede- llegar-costar.
75 Nava, "¿Cuánto ha costado la refinería de Dos Bocas? Rocío Nahle responde."
76 The need to pay for oil in USD and the US capacity to stop dollar payments through its banking system may be a greater security issue. But this is the case for all countries as long as the global economy runs on USD.

annual budget from 2018 to 2022,[77] without a solid analysis to demonstrate when this investment may be recovered, especially in the case of the Olmeca refinery.

Half of Mexico's current crude oil exports go to the U.S., where there is ample refinery capacity for heavy sour crude. Mexico exports heavy sour crude oil and then imports refined oil products. This type of trade is common in oil-producing countries, as refineries tend to require specific types or mixes of crude oil that they cannot always easily obtain in the country. For example, in 2022, Brazil exported USD 43 billion worth of crude oil and imported USD 9 billion of crude to use in its own refineries. The same year, the U.S. exported USD 118 billion of crude oil, principally WTI (West Texas Intermediate) sweet light crude, and imported USD 199 billion of crude oil, including Maya heavy crude from Mexico.[78]

Facing a possible drop in production and a change in the type of crude oil Mexico produces, and given the challenge of high domestic refinery costs, using the international market to balance the types of crude with the demand for refined oil could be a good way of building in flexibility. Pemex should pay commercial costs and the average margin of USD 10 per barrel that U.S. refineries charge. By virtue of owning the Deer Park refinery, part of these rates brings financial returns for Pemex.

High labor (pension) liabilities

Pensions account for another important cost area for Pemex. By late 2022, Pemex's total pension liability reached MXN 1.31 trillion, accounting for 32 percent of all company liabilities.[79] Although this amount is 5.6 percent lower than in 2021, it remains an important liability for the company.

Investments in high-cost exploration and production projects

As we have noted, Pemex is in the process of spending almost USD 10 billion on projects that will not be profitable under the IEA's plausible APS. If Pemex completes these investments, it could scale up production, but it runs the risk of not obtaining sufficient profit and compounding losses. These projects include the Ek-Balam field, in which the company has invested heavily in recent years and plans to continue investing.[80]

77 García, Karol. "En refinación, gobierno de AMLO ha gastado cerca de 90% del presupuesto anual de Pemex," El Economista, 02 September 2022, www.eleconomista.com.mx/empresas/En-refinacion-gobierno-de-AMLO-ha-gastado-cerca-de-90-del-presupuesto-anual-de-Pemex-20220901-0141.html
78 OEC, "Which countries import crude petroleum? (2022)," oec.world/en/visualize/tree_map/hs92/import/show/all/52709/2022.
79 Diego Díaz Pérez, "Pemex en la mira: análisis de resultados al cuarto trimestre de 2022," IMCO, 28 February 2023, imco.org.mx/ wp-content/uploads/2023/02/Pemex-en-la-mira_4T2022.pdf.
80 Gerardo Can Dzib, "Campo Ek-Balam, la gran apuesta de Pemex en la Sonda de Campeche," *PorEsto!*, 25 September 2022, www.poresto.net/campeche/2022/9/25/campo-ek-balam-la-gran-apuesta-de-pemex-en-la-sonda-de-campeche-353421.html.

2.2 Cycle 2: Creditor confidence and the cost of debt

In the second cycle, Pemex's losses force the company to take on more debt. Creditors' anticipation of losses triggers a debt spiral in which they—already concerned about Pemex's capacity to meet its obligations and the potential loss of government financial support—raise interest rates on the company's debt. This in turn results in further losses for Pemex.

This spiral also affects the government. Concerned that Pemex's losses may become unsustainable and even make interest rates higher for Mexico's own sovereign debt, the government might scale back its support to the company, as it would be too expensive.

If the government and the creditors anticipate this spiral and react by withdrawing their support and raising interest rates respectively, or if creditors simply refuse to loan at any rate, they may unintentionally cause the situation to spin even further out of control. It is thus essential to chart a clear path to generate value for all stakeholders: Pemex, the government and the creditors.

Pemex is already heavily indebted.[81] The company's debt accounted for 8 percent of Mexico's GDP and 17 percent of its sovereign debt in 2021.[82] That year, Pemex's interest payments, commissions and debt amortization reached their highest point in the last 32 years, equivalent to one-fifth of Mexico's total financial cost of public debt.

Continued government support offers some security to creditors, but this cost may become untenable for Mexican society and for the government. Creditors have anticipated precisely this scenario, which is why they have already begun to demand a higher interest rate on loans to Pemex. If this trend continues, it will lead to deeper financial losses.[83]

In fact, as a signal of the weakening credibility of state support, Pemex's corporate debt has become more costly than the government's own sovereign debt. In 2024, this difference reached nearly five percentage points.[84] These costs can further complicate the company's capacity to invest to increase production.

The increased cost of Pemex's debt, above the sovereign debt rates, suggests investors are concerned about possible changes in government support and how these could affect Pemex's profitability. These concerns will mount if creditors are asked to accept cancellations or reductions in the total amount of their loans, or if the government puts Pemex on a path of controlled decline. When designing its next bailout, the government must be aware of how investors will react, given their status as important stakeholders in the system.

The government's willingness to continue to support Pemex may weaken for different reasons. As losses mount, as described above under the first cycle, the government will receive less tax revenue, and other Pemex payments will decline. Currently, as we describe above, the government transfers more funds to Pemex than it receives from the company, according to CIEP estimates, making the company's net contribution to Mexico negative from 2021 to 2023.[85]

As Pemex receives more government financial support, the government will have fewer resources available to fund other policies. This may come to affect essential social policies, and the government may be forced to stop financing Pemex entirely at the risk of losing popularity.

81 In 2019, Pemex was considered the most indebted NOC of the world: The Economist, "Pemex is the world's most indebted oil company."
82 IMCO, "Estados financieros 2021 de Pemex y CFE," 3 March 2022, imco.org.mx/estados-financieros-2021-de-pemex-y-cfe.
83 Héctor Ulsa, "Moody´s ´zarandea´ a Pemex: Rebajo su calificación y la deja a un paso de riesgo sustancial," El Financiero, 9 February 2024, www.elfinanciero.com.mx/economia/2024/02/09/moodys-zarandea-a-pemex-rebaja-su-calificacion-y-la-deja-a-un-paso-de- riesgo-sustancial.
84 Michael O'Boyle, Maria Elena Vizcaino and Scott Squires, "CEO de Pemex critica a Moody's; hace eco de alcistas de bonos," Bloomberg, 28 February 2024, www.bloomberg.com/news/articles/2024-02-28/ceo-de-pemex-critica-a-moody-s-hace-eco-de-alcistas-de-bonos.
85 Macías Sánchez, Rivera De Jesús and Cantú Calderón, *La importancia fiscal de Pemex: Hacia la era post-petróleo*.

3. Risk mitigation strategies

3.1 Recognize and evaluate energy transition risk

Recognizing the risk the energy transition brings is the first step Pemex and the Mexican government must take to mitigate it. In its Business Plan for 2023–2027, Pemex recognizes for the first time risks related to decarbonization, including the shrinking market for crude oil and petroleum products. In the same document, it also admits that climate change could lead to some physical risks for its infrastructure.[86] Pemex's Sustainability Plan, published in March 2024, refers to the transition risk as one of the most significant risks the company faces.[87]

The description of this risk and its component factors in the Sustainability Plan is important progress, but the way Pemex has recognized transition risk thus far has been relatively general, especially compared to the degree of recognition other NOCs show.[88] It is therefore striking that the company opted to omit the final section of its Business Plan for 2023–2027, entitled "Strategic Risks and Risk Scenarios." Pemex justifies this omission by citing the need to safeguard strategic information from possible competitors. Nonetheless, as NRGI has argued in other studies, given that NOCs are administrators of much of the wealth of their respective countries and face the risk of a rapid energy transition, transparency about their perspectives and plans is essential to allow public scrutiny on the part of policy-makers, investors and citizens.

The next step Pemex must take to mitigate the transition risk is to undertake a rigorous scenario analysis. Many oil companies use such analysis to assess the different financial impacts of possible pathways through the transition. This means considering the economic feasibility of new projects as well as of existing operations under different scenarios.

Some NOCs already publish their application of scenario analysis to evaluate transition risk, including Ecopetrol (Colombia), Pertamina (Indonesia), Petrobras (Brazil) and PTT (Thailand). Petrobras is notable as one of the few NOCs to use a rapid transition strategy—its "resilience scenario"—which assumes a long-term value of USD 35 dollars per barrel of crude oil. According to Petrobras, this price aligns with scenarios compatible with the Paris Agreement. Even so, Petrobras may be overestimating this price: the IEA calculates that an oil price aligned with Paris objectives would be USD 24 dollars per barrel.[89, 90, 91]

86 Pemex, *Business Plan 2023-2027*, December 2022, www.pemex.com/acerca/plan-de-negocios/Documents/business_ plan_2023-2027.pdf.
87 *Pemex, Plan de Sostenibilidad*, March 2024, www.pemex.com/acerca/plan-de-sostenibilidad/Documents/plan_sostenibilidad_pemex. pdf.
88 Andrea Furnaro and David Manley, *Enfrentando el futuro: lo que dicen las empresas petroleras estatales sobre la transición energética*, NRGI, January 2024, resourcegovernance.org/es/publications/enfrentando-el-futuro-lo-que-dicen-las-empresas- petroleras-estatales-sobre-la.
89 Petrobras, *Annual Report and Form 20-F 2022*, api.mziq.com/mzfilemanager/v2/d/25fdf098-34f5-4608-b7fa- 17d60b2de47d/23f48cb9-9972-be78-2996-b3a79b5c351c?origin=1.
90 IEA, *World Energy Outlook 2022*, www.iea.org/reports/world-energy-outlook-2022.
91 IEA, *World Energy Outlook 2021*, www.iea.org/reports/world-energy-outlook-2021.

In its recent Sustainability Plan, Pemex describes the use of three transition scenarios based on a methodology developed by S&P. However, these demand scenarios do not include price estimates; nor do they measure the potential effects of the company's investments. The plan indicates only that "Pemex has conducted an assessment of the financial impact of these risk factors, and it considers that the potential impact on long-term revenue will be significant,"[92] but offers no further details.

To ensure its scenario analysis effectively mitigates the risk, at a minimum Pemex must:

1. Consider uncertainty, using several pricing scenarios rather than just one. The speed of the global energy transition brings fundamental uncertainty for Pemex. Although the transition is already under way, it is impossible to predict its speed. The general speed and scope of future changes in oil prices offer a wide range of possible futures for Pemex and the Mexican economy. Given this range, Pemex must evaluate decisions based on a range of oil price scenarios and not only one. Pemex may follow the example of many other companies and use oil price scenarios built by other organizations as a reference, such as those from the IEA or the International Renewable Energy Agency.[93]

2. Use metrics to assess the financial feasibility of its investments and publish the findings and assumptions. Once it has established oil price scenarios, Pemex should assess the possible impact of each scenario for its investment portfolio. There are several methodologies for this type of analysis. Two related approaches include:

Break-even price point analysis. This analysis is based on calculating the break-even price of different projects, to evaluate the feasibility of each under different scenarios. The analysis helps identify projects that fail to break even if future oil demand falls under the more rapid transition scenarios. NRGI has conducted such comparative analysis for different NOCs, based on the NZE scenario and the APS.[94] Shell has reported using this type of analysis; it tests its portfolio each year under different scenarios, including prolonged periods of low oil prices. Shell also classifies the break-even prices of its assets in its upstream and integrated gas businesses, to assess resilience in the face of low oil and gas prices.[95]

Discounted cash flow analysis. This assessment calculates the present cash flow value under each scenario, to determine the profitability of different investments. A recent IEA report presents this approach to calculate the possible value at risk for NOCs and their respective governments, through an analysis of the net present value (NPV) in the three main IEA scenarios.[96, 97] Petrobras also analyzes the impact on NPV of its company portfolio based on international scenarios, considering the effect of the assumed oil and carbon prices in the periods studied.[98] Other companies that perform similar assessments based on carbon pricing scenarios include Eni and Equinor.[99]

92 Pemex, *Plan de Sostenibilidad*.
93 Barbara Davidson and Rob Schuwerk, *Still Flying Blind: The Absence of Climate Risk in Financial Reporting*, Carbon Tracker, October 2022, carbontracker.org/reports/still-flying-blind-the-absence-of-climate-risk-in-financial-reporting.
94 David Manley, Andrea Furnaro and Patrick Heller, *Apuestas más arriesgadas, bolsillos más pequeños: Cómo están gastando el dinero público las empresas petroleras estatales en medio de la transición energética*, NRGI, January 2024, resourcegovernance. org/sites/default/files/2024-03/NRGI_Apuestas%20más%20arriesgadas_bolsillos%20más%20pequeños_ESP.pdf.
95 Shell, *Our progress towards net zero: Energy transition progress report 2022*, reports.shell.com/energy-transition-progress-report/2022/_assets/downloads/shell-energy-transition- progress-report-2022.pdf.
96 IEA, *The Oil and Gas Industry in Net Zero Transitions*.
97 For an academic example applied in the case of ExxonMobil, see Drew Riedl, "The magnitude of energy transition risk embedded in fossil fuel company valuations," *Heliyon*, 7(11), e08400, 2021, doi.org/10.1016/j.heliyon.2021.e08400.
98 Petrobras, *Climate Change Supplement*, 2021, api.mziq.com/mzfilemanager/v2/d/25fdf098-34f5-4608-b7fa-17d60b2de47d/82b69c0b- 4a43-b921-1d5c-2f53bd5bc196?origin=2.
99 World Business Council for Sustainable Development, *Climate-related financial disclosure by oil and gas companies: implementing the TCFD recommendations*, July 2018, docs.wbcsd.org/2018/07/Climate_related_financial_disclosure_by_oil_and_gas_companies.pdf.

Another important measure is to disclose greenhouse gas (GHG) emissions for each project. This goes beyond simple environmental responsibility; it also offers an opportunity to gain a critical view of the projects. More GHG-intensive projects are more exposed to the risk of becoming stranded assets as countries implement and enforce stricter national and international climate policies.[100]

Based on recommendations from Carbon Tracker and the Task Force on Climate-related Financial Disclosures, Table 2 presents a summary of the main domains of scenario analysis Pemex should consider. The details different oil companies disclose in these domains vary. Equinor, for example, publishes an average break-even price for future investments, but not a detailed list of break-even prices for each project.[101] Petrobras publishes the percentage of NPV of investments at risk under each scenario, but it does not indicate which are the riskiest projects.[102] At a minimum, it is important for companies to specify which dimensions they use in their risk analysis, even if they do not disclose the concrete parameters or results.

By publishing these methodological dimensions, each company's main stakeholders—investors, governments (in the case of NOCs), business partners, climate organizations and the community at large—can have the information they need to undertake a detailed review of, and possibly speak out against, investments that fail to align with climate, economic or social objectives.

Table 2. Main methodological dimensions in transition risk scenario analysis[103,104]

Parameters/assumptions	Options for analysis	Business impacts/effects
• Price of raw materials or key products • Carbon price • Discount rate • Energy demand and mix • Macroeconomic variables (GDP, employment rate, etc.) • Demographic variables • Energy efficiency • Geographic adaptation to transitio vimpact • Changes in technology • Changes in policy • Timeline of possible impacts • Asset lifecycle • Refinery margins • Provisions for asset decommissioning	• Scenario selection • Time horizons • Alignment with Nationally Determined Contribution scenarios • Methodology changes from prior assessments	• Profit • Costs • Revenue • Assets • Capital allocation/ investments • Timeline of development costs, revenue and profit • Company responses

100 Daniel Kaufmann and Robert Pitman, "Extractive Company Disclosure of Project-Level Greenhouse Gas Emissions is Critical," NRGI, 1 May 2023, resourcegovernance.org/articles/extractive-company-disclosure-project-level-greenhouse-gas- emissions-critical.
101 Equinor, "Equinor CDP Climate Change Questionnaire 2019," July 2019, www.equinor.com/content/dam/statoil/documents/ sustainability-reports/equinor-cdp-response-2019.pdf.
102 Petrobras, *Climate Change Supplement*, 2021.
103 Davidson and Schuwerk, *Still Flying Blind*.
104 TCFD, *Recommendations of the Task Force on Climate-related Financial Disclosure*, June 2017, assets.bbhub.io/company/ sites/60/2021/10/FINAL-2017-TCFD-Report.pdf.

3. Apply the analysis findings effectively in investment decisions. A recent Carbon Tracker study highlighted the difference between simply referring to a transition risk analysis in oil company sustainability reports and making effective use of such analysis in reporting and financial decision-making.[105] In other words, oil companies must ensure their financial statements align with their other reports, disclosing the assumptions and parameters used and offering a sensitivity analysis of possible implications and a decline analysis of the impact of the transition on its asset values.

3.2 Mitigate risk through a resilient business plan

Mitigating transition risk implies redirecting future investments toward more resilient strategies. Defining the most appropriate business plan requires careful analysis of the benefits and problems arising from each different option. We offer below three recommendations to help define these mitigation strategies.

Pursue value, not volume

Based on the analysis above, it seems improbable that Pemex could significantly reverse the downward trend in oil production. It is therefore essential to define the optimal size for Pemex both in a slow transition scenario and under a rapid transition. The most practical strategy to reduce risk exposure is to concentrate investments in projects with higher expected returns, prioritizing value of investment over volume of production.[106] In this regard, projects such as Kante, Uchukil, Pankiwi Shale and Maxochitl Shale are particularly costly.

Some international oil companies (IOCs) are already following this strategy. They have limited their expansion plans and sold off projects that would not bring high returns under an accelerated energy transition scenario. Many of these companies have also reduced exploration.[107, 108, 109]

This strategy is less common among NOCs. Some such companies, especially in the Middle East, have less expensive reserves than non-state IOCs, or their governments order them to continue to maximize production.

Many NOCs have relatively costly projects that today pursue volume over value, with the goal of accelerating production before the world begins to slow its demand for their oil. In Ghana, for example, some decision-makers consider this strategy could reduce the risk of stranded assets to their NOC, which plans to acquire several projects that IOCs are selling off in the country.[110]

Oil projects need an average of 7.5 years to move from discovery to the production stage, however.[111] As a result of this timeframe, prioritization of volume over value is more appropriate for oil fields that are already producing and can rapidly generate additional volume, rather than for new projects. Pemex should consider this before deciding to invest in greenfield projects and costly initiatives such as Kante, Uchukil, Pankiwi Shale and Maxochitl Shale.

105 Davidson and Schuwerk, *Still Flying Blind*.
106 EY, *From volume to value: the transformation of National Oil Companies*, 2017, assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/oil-and-gas/ey-noc-transformation.pdf?download.
107 IEA, *The Oil and Gas Industry in Net Zero Transitions*.
108 See the BP strategy to let go of its highest-polluting assets:"BP update on strategic progress," 8 February 2022, www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-update-on-strategic-progress.html.
109 Energy Council, *Capital Discipline: Revitalizing Confidence and Attracting Investors to the Oil & Gas Sector*, January 2024, energycouncil.com/articles/capital-discipline-revitalizing-confidence-and-attracting-investors-to-oil-gas-sector.
110 Joy Business, "GNPC seeks Parliament's approval to buy a 37% stake in Aker Energy's oil block," 3 August 2021, www.myjoyonline.com/ gnpc-seeks-parliament-approval-to-purchase-37-stake-in-aker-energys-oil-block.
111 David Mihalyi and Thomas Scurfield, "How did Africa's prospective petroleum producers fall victim to the resource curse?" World Bank, 2020, openknowledge.worldbank.org/bitstream/handle/10986/34470/How-Did-Africa-39-s-Prospective-Petroleum-Producers- Fall-Victim-to-the-Presource-Curse.pdf.

Reduce operational emissions

Pemex's reduction of the greenhouse gasses from its operations is a crucial strategy to improve its environmental, social and governance performance and in turn, as some studies have shown, its capacity to access capital.[112]

The most obvious strategy is to prioritize projects that reduce the company's carbon intensity in the short term. According to a McKinsey study, oil companies can reduce between 40 percent and 50 percent of the emissions from their operations and bring down costs by using proven technologies.[113] Pemex included in its recent Sustainability Plan key strategies to reduce emissions as a way of adding value to the business:[114] for example, the capture of currently flared natural gas, cogeneration, energy efficiency and incorporating renewable energies.

Although the company's Sustainability Plan represents an important step forward, several stakeholders consider it insufficient in terms of taking advantage of the economic opportunities of reducing operations emissions. For example, the plan does not include clear financing strategies that could help to assess the proposals' feasibility.[115] Stakeholders have also argued that the plan is not ambitious enough, as it uses 2020 as the base year for calculating emissions reduction, which was a particularly low-emissions year given the economic effects of the Covid pandemic. Nor is there clarity regarding the validity of the financial commitments the plan indicates, as these initiatives were not enshrined in the Pemex Business Plan.

Evaluate the feasibility of diversification options

A relevant strategy to mitigate transition risk in the oil industry is to diversify activities. At a workshop NRGI organized in April 2023, oil sector experts and climate change organizations agreed that more information is urgently needed about the technical and financial feasibility of different diversification strategies for Pemex. Lines of business that require evaluation include petrochemicals, biofuels, hydrogen, green ammonia, efficient cogeneration, geothermal energy and offshore wind energy. For each of these options, analysis should consider the role for Pemex in the business ownership structure, and whether the company should participate in joint ventures and with an operator.

In the case of petrochemicals, some NOCs such as Sonotrach (Algeria)[116] have begun to reinforce their investments in the sector. Pemex could follow this example,[117] although it should not consider petrochemicals to be entirely a "safe haven" from the energy transition. With so many NOCs considering a similar strategy, there is a chance of overinvestment and surplus supply of petrochemicals, compared to relatively limited expectations of their capacity to counteract a possible drop in demand for oil, as described in section 1.2.[118, 119]

Other oil companies are investing in low-carbon energy projects.[120] Aramco (Saudi Arabia), for example, wants to become an "integrated energy and chemical company" and is investing in renewable energies, hydrogen, carbon capture and utilization, and biofuels.[121]

112 Oil and gas projects with low carbon emissions are more likely to receive financing than those with higher emissions; Tom Ellacott, "Oil and gas companies will recalibrate strategies in 2023," Wood Mackenzie, 14 December 2022, www.woodmac.com/news/opinion/ oil-and-gas-companies-will-recalibrate-strategies-2023-outlook/.
113 McKinsey Sustainability, "Decarbonize and create value: How incumbents can tackle the steep challenge," 24 October 2023, www.mckinsey. com/capabilities/sustainability/our-insights/decarbonize-and-create-value-how-incumbents-can-tackle-the-steep-challenge.
114 Pemex, *Plan de Sostenibilidad*.
115 El Universal, "Pemex's sustainable strategy is unviable, say experts" ("Inviable, estrategia sostenible de Pemex: expertos"), 19 March 2024.
116 Hana Saada, "Sonatrach: $11 billion allocated to the development of petrochemical industries for 2022-2026," *DZ Breaking*, 12 August 2022, www.dzbreaking.com/2022/08/12/sonatrach-11-billion-usd-allocated-to-development-of-petrochemical-industries- for-2022-2026.
117 Adrian Duhalt, *The Petrochemical Arm of Pemex: A tale of Boom and Bust*, Baker Institute, May 2020, www.bakerinstitute.org/ research/petrochemical-arm-pemex-tale-boom-and-bust.
118 IEA, *The Oil and Gas Industry in Energy Transitions*, 2020, iea.blob.core.windows.net/assets/4315f4ed-5cb2- 4264-b0ee-2054fd34c118/The_Oil_and_Gas_Industry_in_Energy_Transitions.pdf.
119 In the Announced Pledges Scenario, the use of oil as a source of plastics grows by 0.6 Mbd until 2030 and only drops slightly until 2050: IEA, *The Oil and Gas Industry in Net Zero Transitions: World Energy Outlook Special Report*, November 2023. iea.blob.core.windows.net/assets/a6e9b926- 2349-4bee-856e-4997aab5399f/TheOilandGasIndustryinNetZeroTransitions.pdf.
120 Alex Dewar, Randolph Bell, Reed Blakemore and David W. Yellen, *Leading Oil and Gas into a Net-Zero World*, Atlantic Council, March 2023, www.atlanticcouncil.org/in-depth-research-reports/report/leading-oil-and-gas-into-a-net-zero-world.
121 Mauricio Cárdenas and Luisa Palacios, "National Oil Companies and the Energy Transition: Ecopetrol's Acquisition of an Electricity Transmission Company," Center on Global Energy Policy, August 2021, www.energypolicy.columbia.edu/research/ commentary/national-oil-companies-and-energy-transition-ecopetrols-acquisition-electric-transmission-company.

For Pemex, as for any NOC, this strategy makes sense if the company has sufficient capacity. NOCs that play a leadership role in the energy sector in their country can lead investments in renewable energy; but they become little more than an obstacle if they lack the requisite financial, institutional and technical capacity.[122] In Mexico, the state company with the legal mandate and technical capacity to venture into renewable energy is the Federal Electricity Commission (Comisión Federal de Electricidad, CFE). Both Pemex and the CFE can play an important role by achieving net zero emissions in the energy sector and leading progress in the national energy transition. To that end, they will need to build a coordinated and integrated vision, strategy and action plan defining each company's contribution.



Pemex petrochemical plant in Morelos, Mexico. Armando Salgado/NRGI

122 NRGI and International Institute for Sustainable Development, National Oil Companies and Climate Change: Insights for Advocates, November 2021, resourcegovernance.org/sites/ default/files/documents/national_oil_companies_and_climate_change_insights_for_advocates.pdf.

3.3 Ensure the Mexican state's oversight of transition risk

Given that Pemex's influence and impacts go beyond its internal management, to promote better mitigation plans for the transition risk it is essential that the different stakeholders accept responsibility. The Mexican state, as Pemex's sole proprietor, bears important responsibility for company policy including setting objectives, establishing decision-making processes, and ensuring accountability and compliance.

Different state entities, including the Secretariat of the Treasury and Public Credit (Secretaría de Hacienda y Crédito Público, SHCP) and the Energy Secretariat (Secretaría de Energia), along with the Congress and the Superior Audit Office of the Federation (Auditoría Superior de la Federación, ASF), all play a crucial role in setting and supervising such policy.[123] These institutions must also undergo transformation to be able to incorporate and oversee energy transition risk for Pemex. We propose three key changes here.

The Energy Secretariat must take on an energy transition planning role

The Energy Secretariat, charged with shaping energy policy for the Mexican government, must play a fundamental role in focusing on energy transition risk, leading strategic planning to accelerate the country's transition and ensuring improved transition risk management in the oil sector. This role means seeking synergy among state-owned businesses linked to the energy transition, including Pemex, the CFE and the newly established state lithium mining company LitioMX.

In this context, The Energy Secretariat should clarify Pemex's role as an energy provider and in energy access and security within the broader timeline of the energy transition, which includes the expansion of renewable energies in the country's energy grid. This clarity is crucial to ensure cooperation and efficient resource use between these state-owned businesses.

123 México Evalúa, *Mapa de Vigilancia del Estado sobre sus empresas productivas*, September, 2020. www.mexicoevalua.org/mapa-de-vigilancia-del-estado-sobre-sus-empresas-productivas/.

The Secretariat of the Treasury should review the conditions under which Pemex receives public resources

Because of the important financial support the government has given Pemex, the SHCP, as the institution responsible for providing this support, should present a convincing argument to justify the continuity of this policy. It has not yet presented such an argument.

From January 2019 to June 2023, the Mexican government directly transferred over MXN 1.32 trillion to Pemex.[124] Through official statements, the SHCP has explained this spending as part of the government's efforts to improve the company's financial situation and scale up its production capacity.[125, 126] However, these transfers are public resources that could be allocated to priority areas and services such as healthcare and education.

In addition to direct transfers, Pemex has received tax benefits that have reduced revenue flows the state might have used in other ways, such as in funding the country's 32 federal entities (31 states and the capital, Mexico City). The SHCP recently recognized such impacts by disclosing that the most recent reduction in shared utility rights (derecho de utilidad compartida, DUC), from 40 percent to 30 percent, will reduce the resources the government can channel to Mexico's state and Mexico City administrations.[127] The Center for Economic and Budget Research (CIEP) estimates that tax benefits awarded to Pemex, particularly with the reduction in DUC, reached MXN 800 billion from 2016 to 2024.[128]

With the transition risk this report describes and Pemex's financial situation, government financial support to the company without accountability risks becoming the norm. Although energy reforms passed in 2013 stipulate that transfers to Pemex should occur only under extraordinary conditions, these transfers continue at the government's discretion.[129] The SHCP should review the justifications and conditions relating to this support, in the interest of fiscal responsibility and transparency in public resource management.

Moreover, the SHCP should incorporate conditions regarding transition risk—publication of scenario analyses and mitigation plans, for example—and Pemex's energy transition plans aligned with Mexico's Nationally Determined Contribution as components of any justification for transferring public funds to Pemex.

124 IMCO, Apoyos del Gobierno Federal a Pemex, September 12, 2023. imco.org.mx/apoyos-del-gobierno-federal-a-pemex/.
125 See for example the SHCP statement in September 2019 on the new capital contribution to Pemex of USD 5 billion: "This action is part of the government's efforts to strengthen the financial stability of Pemex and improve its profitability and strategic contributions to the Mexican economy in the long term." Gobierno de México, "Anuncio de aportación patrimonial a PEMEX," 11 September 2019, www.gob.mx/cms/uploads/attachment/file/492433/SHCP_084_espa_ol.pdf.
126 Another example is the Decree DOF:19/02/2021 awarding tax benefits to Pemex: SEGOB, DECRETO por el que se otorgan beneficios fiscales a los contribuyentes que se indican, 19 February 2021, www.dof.gob.mx/nota_detalle.php?codigo=5611907&fecha=19/02/2021#gsc.tab=0.
127 Ulises Juárez, "Reducción del DUC de Pemex impactará en participación de recursos a los estados, reconoce Hacienda," *Energía a Debate*, 25 October 2023, energiaadebate.com/reduccion-del-duc-de-pemex-impactara-en-participacion-de-recursos-a-los-estados- reconoce-hacienda/.
128 Rivera de Jesús, "Apoyos fiscales y patrimoniales a Pemex."
129 México Evalúa, *Mapa de Vigilancia del Estado sobre sus empresas productivas.*

Implementation of the property policy and the role of Congress and the Superior Auditor Office

Studies have uncovered issues in the enforcement of the property policy for Mexico's productive state enterprises (*empresas productivas del estado, EPEs*) since its creation in 2013.[130] In particular, Congress has a significant oversight role as one of the state's main representatives as owner of *EPEs*. However, Congress has not taken sufficient action to uphold the responsibilities of its role, which includes monitoring Pemex's annual reports, overseeing progress toward objectives and determining assessment criteria for company governance bodies. These responsibilities are even more important in the context of Pemex's current financial situation and the consequences of the energy transition, and this underscore the necessity of aligning decision-making with the state's overall interests.

Pemex's production targets should consider transition risk (with a role for the energy regulator)

The Mexican government should reevaluate Pemex's ambitious production targets, which pose risks by requiring the company to invest in loss-making exploration and production activities. In the context of the global energy transition, it is essential to align production targets with realistic expectations for the market and the government's climate and environmental commitments. A balanced approach that prioritizes economic feasibility and environmental sustainability could lead to a better mitigation strategy for transition risk for Pemex and the Mexican economy.

From a regulatory standpoint, the CNH as the technical regulatory body for hydrocarbon exploration and production can verify transition risk as part of its analysis of any new project or already operational ventures. In this, the CNH should recognize the time needed to develop new oil fields, consider scenarios such as the NZE and APS, and set prospects and production targets accordingly.

130 México Evalúa, *Mapa de Vigilancia del Estado sobre sus empresas productivas*.

4. Conclusions

Pemex faces a host of challenges. A decline in production, which is likely to continue, high costs, recent investments in unprofitable ventures such as refineries, high debt and dependence on government support have combined to generate a crisis that affects the company and Mexico's public finances.

This puts Pemex in a difficult position to respond to energy transition challenge. This report has described how the transition could transform the company's current difficulties into a deeper crisis. If governments around the world enforce their current climate policies—the IEA Announced Pledges Scenario—approximately USD 10 billion in Pemex assets will fail to break even.

Pemex's crisis is nothing new; it has caused headaches for decision- and policy-makers for several decades. Three mechanisms have kept the system stable: the high price of oil that has generated sufficient resources to sustain the company; the financial support the government has provided to cover Pemex's debt on different occasions; and creditors' trust that this financial support will continue.

As the energy transition continues, these three factors could change radically: oil prices could drop; the government could limit its financing to support Pemex; and creditors could lose faith in the stability of the state guarantee and grow concerned about the risk that company assets may fail.

If Pemex does not consider the risks related to the energy transition, there is a high probability of an economic crisis. This crisis could harm Mexico's public finances, employment rates and energy security.

The decisions Mexico's new administration makes about Pemex will be crucial. So far, however, public debate has not adequately considered several key issues about Pemex's future. There are at least three fundamental questions. For the first two questions, this report's analysis offers important initial guidelines. For the third question, more detailed analysis of regional and local aspects is urgently needed.

How can the Mexican government and Pemex address the investment decisions already made, especially those that appear economically questionable and in many cases environmentally questionable as well? Refineries are a particularly prominent example in this regard.[131]

What strategies can the government and Pemex implement to avoid other commitments highly exposed to transition risk?

How can the government safeguard Pemex workers and the communities and regions that depend on the oil sector, such as Campeche, Tabasco and Veracruz, and what strategies can bring about timely commitment and action to advance a just transition?

131 IMCO, *Diagnóstico IMCO: refinería Dos Bocas.*

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