U.S.-MEXICO FORUM 2025

ENERGY AND SUSTAINABILITY

UC San Diego
SCHOOL OF GLOBAL POLICY AND STRATEGY
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KEY RECOMMENDATIONS

Sustainability

- Accelerate the harmonization of energy efficiency standards.
- Reduce methane emissions in the oil and gas sector.
- Electric vehicles are an opportunity for job creation and regulatory harmonization.
- Create policy incentives for CCUS and green hydrogen.
- Better coordinate carbon pricing policies across the two countries.
- An Equitable Energy Transition

Hydrocarbons

- Collaborate on technological development and human capital to lower carbon and costs.
- Align health, environment, and safety regulations and standards in the oil and gas sector.
- Build and operate energy infrastructure with a focus on integrated markets.
- Oil companies themselves should cooperate directly to improve sustainability indicators.

Power, Gas, Renewables

- Develop clean energy, and resilient and sustainable infrastructure.
- Integrate new models for renewable power generation.
- Exchange lessons and tools on transmission planning.
- Leverage new models to finance transmission and distribution.
- Modernize the power grid.
- Fill gaps in gas pipeline networks and develop a secondary market for underutilized gas transmission capacity.
- Reinvent dynamic subnational cooperation in grid integration.

The world is in a transition to net-zero greenhouse gas emissions by 2050 that will change the way we use and produce energy and shape the sustainability of our planet. This paper addresses how Mexico and the United States can use their energy resources to deliver jobs, economic prosperity, and social justice at this transformational juncture in history. We examine three areas fundamental to the U.S.-Mexico energy relationship: sustainability; hydrocarbons; and gas, power, and renewables. Each section, for consistency, is organized around these themes: our interconnected and interdependent energy economies, the challenges and opportunities before us, and recommendations for action.

The focus on energy and sustainability reinforces a geographic reality: Mexico and the United States are inescapably interconnected. The economies of both nations are stronger together to meet national demands and to compete in international markets. Our potential is stronger when energy resources and technological capacity are aligned with infrastructure and investments that drive industrial competitiveness. In a world now dominated by a global energy transition, Mexico and the United States have the opportunity to use their linked energy ecosystem to redefine and underpin the foundations for their sustained prosperity.

A Global Transformation Reaches Mexico and the United States

The year 2020 was a pivot point for the global energy system. For decades, fossil fuels met about 80 percent of the world's primary energy demand. The global impact of COVID-19 – on economic growth, collapsing oil demand, lost lives, and the way we live and work – has forced countries around the world to assess how they will invest perhaps 15-25% of their GDP to rebuild their economies. The phrase "build back better" – a foundational premise for President Joseph Biden's Administration – encompasses the necessity to embrace change, confront the climate crisis, and build the infrastructure and economic incentives to create jobs while ensuring resilience and sustainability. In 2020, oil demand declined 10%, world energy demand fell 6%, but the world consumed 9% more wind and solar power.[1] The share of fossil fuels in the energy mix has begun an historic downward shift.

Globally, the path to net-zero will be filled with uncertainty, but the momentum has shifted and will touch most aspects of how every nation produces and consumes energy. Underpinning this shift have been commitments from about 125 nations around the world to net-zero emissions by 2050 (and 2060 for China). With the Biden Administration's pledge to net-zero by 2050 and carbon-free power sector by 2035, the share of global emissions in countries with net-zero pledges will be 66%.[2] In other words, two-thirds of the world's emissions will be in countries committed to reduce them to a net annual balance of 0. Yet, few of these countries have policies, laws, and regulations in place that will allow them to achieve this goal.

To succeed, countries across the world will enter a period of intense and accelerated legislative and regulatory activity, to create the frameworks that

1. *Wind and solar also includes geothermal and ocean power. Biomass includes biofuels and modern and traditional biomass. 2020 figures are preliminary estimates. IHS Markit The Energy Transition Moves Beyond Slow Motion: Implications for Oil- December 2020.*
2. *IHS Markit Post COVID-19 Scenarios and Net Zero Goals – November 2019.*

drive investment and innovation in order to make net-zero a reality. That period of action will jump into high gear in 2021, as nations prepare for COP-26, the 26th session of the UN Framework Convention on Climate Change, where countries will establish new commitments under the Paris Accord.

To be sure, climate change will be a central issue in the U.S.-Mexico relationship under the Biden Administration. President Biden has made climate change one of four priorities for his administration, the first U.S. president to do so. At home, Biden pledged to assess how climate penetrates all domestic investments, committing to ensure that all cities over 100,000 people have public transit systems, creating national infrastructure for electric vehicles, and banning new licenses for oil and gas production on public lands and waters. Mexico, as the largest U.S. trade partner and neighbor, could potentially benefit more from increased coordination with the United States to grasp the benefits of this transition than any other country in the world.

This paper explores areas for research and technology collaboration that could reduce emissions, and in the case of carbon capture and storage, also potentially extend the competitive lifespans of untapped hydrocarbon reserves in both countries. However, the converse of this dynamic is also a risk: both Mexico and the United States should expect that many countries, perhaps starting with Europe and extending to China with the world's largest carbon market, will impose cross-border tariffs on the goods of exporting nations that do not share their climate ambitions. At stake for Mexico and the United States is this challenge: can they adapt their energy systems to make them competitive, sustain growth, and create jobs in a global economy committed to eliminate net greenhouse gas emissions?

The answer depends on whether Mexico and the United States open the door for cooperation on energy transition. Much will depend on how the rule of law prevails in the energy relationship between the two countries. There have been disputes over private investment in renewables in Mexico and the rights of U.S. investors in the trade of refined products. Still, the United States-Mexico-Canada Agreement (USMCA) is now in force and provides a path forward to create transparent and predictable commercial relationships. No Party to the Agreement can modify its domestic legal framework or adopt measures in violation of its commitments under the USMCA without potentially facing claims under the general state to state or investor-state dispute settlement mechanisms. In addition, the reservations or exemptions to the energy obligations that each Party established in the Agreement, can only be modified in the future if they further liberalize; thus they cannot be made more restrictive. The administration of President Lopez Obrador may not accept this interpretation of the USMCA, and that could become an issue for both governments to address with urgency.

Mexico and the United States, with two of the most integrated manufacturing economies in the world, will remain inextricably intertwined as the global energy transition unfolds. And in turn, energy policies that foster cross-border integration of fossil fuels and renewable energy capacity can propel the global industrial competitiveness of both the United States and Mexico.

The transformation potential cuts across the energy spectrum. Not only have solar and wind costs dropped precipitously in the past decade – 80% for solar PV and 50% for onshore wind[3] – Mexico and the United States have geographic characteristics that make them first-in-class producers of renewable power. Even with the onset of peak oil demand, the decline rate of oil reservoirs combined with population growth and transportation demands in emerging economies suggest that the world will need by 2050 on the order of a new 45 MMb/d of oil.[4] Mexico and the United States have complementary fuel types and refining capabilities, and the potential for sharing technical innovation. These factors could facilitate greater integration of Mexican and U.S. energy systems, from upstream to refining, to achieve lower costs and higher productivity.

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Objectives that Guide Us

This paper takes a five-year perspective on the policies, regulations, investments, and goals that would allow the United States and Mexico to manage their joint interests in energy and sustainability. Choices made in the near term may affect projects and infrastructure that have 20-30 year lifespans. Hence the objectives that guide us must find a balance between near-term outcomes consistent with a course that will extend far beyond the scope of this paper. We highlight three goals:

Enhance the Energy Security of the United States and Mexico: This means that energy must be available, accessible, and affordable. Deepening the physical and market interconnections between Mexico and the United States will support energy markets that are more abundant, with lower costs.

Make the Production and Use of Energy Sustainable: This begins with the goal of reducing emissions but extends into business and political decision-making that will touch on every aspect of politics, commerce, and quality of life in both countries. Sustainability is fundamental to the "new competitiveness" in global markets, and to creating jobs that can thrive in this changing global context. Mexico and the United States should align their paths to achieve the Paris Agreement goals.

Create Jobs: The COVID-19 pandemic has touched every country in the world, causing a massive economic contraction that has left tens of millions out of work in Mexico and the United States. The energy sector must deliver jobs to support this recovery. In part, these jobs can come from investments in energy production and infrastructure. But cleaner energy produced at lower cost is necessary to consolidate an increasingly automated and digital industrial base that depends on electric power.

3. Since 2012 for solar and 2010 for wind. Prices for more than 1,000 tracked projects selected or short-listed in competitive auctions or tenders. IHS Markit Global Power and Renewables – October 2019.

4. Includes crude and condensate. IHS Markit Global Crude Oil Supply Analytics – 2nd Quarter 2020.

The Tools to Get Us There

Success on this course of integration will hinge on four factors:

Investment: The International Energy Agency (IEA) estimates that through 2050, the world must invest on the order of $3.5 trillion per year to transform its energy systems.[5] No energy producer today, not even the richest petrostate, can chart a successful future without private capital. For Mexico and the United States, the scale of investments needed in oil and gas production, connecting infrastructure, storage systems, and power generation require private capital.

Aligning U.S.-Mexico Energy Policy and Regulatory Goals: Regulatory quality will influence whether investments prove commercially sound, competitive, responsive to consumers and environmentally sustainable. These issues are especially acute for cross-border power trade, which is virtually non-existent. For two countries seeking to diversify supply chains away from China, the competitiveness of the U.S.-Mexican energy resource base is a natural foundation on which to build.

Research and Technology: The changing pace of technology is unprecedented, from the declining cost of renewables, to innovations in carbon capture and storage, to emerging battery technologies, to the commercial potential for hydrogen. As digitalization accelerates technology adoption, efficiency gains will reshape the competitiveness of fuels, oil fields, and generation plants.

Rule of Law and Legal Transparency: The USMCA introduced new rules of the game for Mexican and international private investors in the oil, gas, electricity, and renewable sectors. The U.S. and Mexican governments need to reach an understanding on how the USMCA incorporates Mexico's 2013-2014 Energy Reform. Disputes on this issue, including the independence of regulatory bodies, will deter both foreign and domestic energy investment.

Section I: Sustainability: Underpinning the Future of Energy

In terms of raw capacity, the United States and Mexico are a sustainable energy powerhouse. In 2019, the United States and Mexico got 60% more power per unit of capacity from its wind farms than China.[6] For solar photovoltaic, the United States and Mexico averaged about 50% greater efficiency turning their solar panels into power generation.[7] To be sure, China invests more in renewable energy – about $80 billion a year – than any country in the world. But even as China aspires to be the world's renewable energy powerhouse, Mexico and the United States have the capacity to convert the wind and sun more efficiently into electricity than even China.

The movement towards clean energy and reduction of emissions is not just about the environment, but also about industrial competitiveness, job creation, and social welfare. In the coming five years, the United States and Mexico have the opportunity to create a cleaner shared energy ecosystem, with ever cheaper technologies.

With the world transitioning to a new net-zero emissions reality, Mexico and the United States have a fundamental self-interest to align policies, laws, and regulations on energy and climate to reinforce the competitiveness of their massively integrated economies, and to bring affordable energy access to those outside that economic mainstream. Failure to shift profoundly the structure of energy and industry to a net-zero world will leave U.S.-Mexico supply chains from automobiles to electronics simply uncompetitive.

Interconnected and Interdependent

Since the Paris Agreement was adopted in 2015, there is a growing universal consensus around the goal of limiting global temperature rise to less than 2° C. By the end of 2021 and an expected new wave of climate action pledges at COP-26, nations will launch into a period of legislative and regulatory action to translate their climate aspirations into emissions reductions. Of the 1,900 pieces of climate legislation enacted globally in the last decade, carbon pricing mechanisms — carbon taxes or cap-and-trade systems — are among most popular. Over 40 countries worldwide have some form of price on carbon.[8] China will launch the world's biggest carbon pricing system in 2021.

Technological disruption toward renewable and low carbon energy is gaining momentum globally, as entrepreneurs seek to seize the $1.2 trillion opportunity that the International Energy Agency associates with meeting the Paris Agreement goals.[9] Innovation is driving the electrification of transport and increased investment in carbon capture, utilization, and storage (CCUS). Innovation is also accelerating the adoption of clean power, including batteries and hydrogen, smart grids, and other digital technologies to address solar and wind intermittency and improve energy efficiency.

Economic stimulus packages created in response to the COVID-19 pandemic are also accelerating policies to reduce CO2 emissions. Since the beginning of the pandemic, governments in G20 countries have committed

> *In terms of raw capacity, the United States and Mexico are a sustainable energy powerhouse. In 2019, the United States and Mexico got 60% more power per unit of capacity from its wind farms than China.*

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5. IEA/B20 joint statement on energy transitions. Press release – September 2020. https://www.b20saudiarabia.org.sa/wp-content/uploads/2020/09/B20-IEA-Jt-Stmt-on-Energy-Transitions-180920202.pdf

6. For 2019, IHS Markit estimates that the average capacity factor – the share of time that an onshore wind plant generates power – for the United States and Mexico was about 42.5%. For China it was 26%. (IHS Markit Global LCOE Dashboard, October 2020).

7. For 2019, IHS Markit estimates that the average capacity factor – the share of time that a solar photovoltaic plant generates power – for the United States and Mexico was about 27%. For China it was 18%. (IHS Markit Global LCOE Dashboard, October 2020).

8. World Bank, State and Trends of Carbon Pricing 2020- May 2020. https://openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf?sequence=4&isAllowed=y

9. Bloomberg Green, 3 Years and $3 Trillion Could Shift the Climate Change Narrative- June 2020. https://www.bloomberg.com/news/articles/2020-06-18/3-years-and-3-trillion-could-shift-the-climate-change-narrative

$448 billion to supporting different energy types through new or amended policies, including $167 billion for clean energy policies.[10] The European Union has enacted a green recovery strategy that will reduce by 2030 CO2 emissions 55% below those registered in 1990. A third of its $880 billion recovery plan is earmarked for climate measures. By contrast, stimulus policies in Mexico and the U.S. are primarily aimed at fossil fuels.

Opportunities and Challenges

Mexico and the U.S. are endowed with rich energy resources, both fossil and renewable. Due to the interdependent nature of their energy systems and of critical industrial sectors of their economies, such as transport and manufacturing, they face common interests in seizing the opportunities that the new global energy context presents to secure their competitiveness.

The Movement Toward Clean Energy: The transition to clean energy will entail challenges that Mexico and the United States can undertake together. Renewable power requires financing arrangements for high upfront capital costs. There are challenges arising from the need to manage the intermittency of solar and wind projects, issues of grid integration, and inadequate transmission grids. Tools already exist to manage intermittency and grid integration, including energy storage, grid management tools, smart grids, and ancillary services, but further work is needed to improve the related technologies and reduce costs. Improvement of existing transmission grids requires substantial new investment, obtaining rights of way, and management of community input and cost-sharing. These issues are discussed further in Section III below on power, gas, and renewables.

Oil and Gas "Peak Demand": Oil production is important to both countries, but rising global oil demand is no longer a certainty in light of the deep economic recession and declining oil demand brought on by the COVID-19 pandemic. Underlying this "peak demand" is a younger generation of consumers and institutional investors demanding low-carbon products, divestiture from fossil fuels, and disclosure of climate change risk.

Electrification of Transport: Mexico and the U.S. will face significant disruptions in critical industries, especially the automotive industry, given existing pressures to reduce emissions and transition towards electrification. BP, Ford, Exelon, National Grid, and Shell Oil Company launched the Coalition for a Better Business Environment to support the multi-state Transportation and Climate Initiative (TCI), aimed at cutting emissions in the transportation sector in the Northeast and Mid-Atlantic States. California Governor Gavin Newsom recently signed an executive order to ban sales of new cars with internal combustion engines in the state by 2035.

The U.S. and Mexico are behind China and Europe in the sales of electric vehicles (EVs). The global auto electrification trend could pose significant disruptions for Mexico and the U.S., in light of the intricate linkages in the North American supply chain. The motor and drivetrain in an EV are simpler and have fewer components than gasoline cars, meaning that vehicle electrification will make obsolete many vehicle parts and potentially the jobs associated with their production.

Mexico would be more affected by these changes than the U.S., due to the higher relevance of the auto industry in its economy and its dependence on access to the vast U.S. market. The industry is the largest contributor (25%) to Mexico's manufacturing GDP and contributes a third of total exports, while representing 12.5% of the U.S. manufacturing sector's gross output.

Carbon Capture, Utilization, and Storage (CCUS): CCUS will be a key technology for meeting net-zero emissions goals. It is the only technology to achieve deep emissions reductions from cement production and is the most cost-effective approach to reduce emissions in iron and steel and chemicals manufacturing. CCUS is also a critical tool to achieve deep decarbonization of the power sector, the highest emitting industrial sector.[11] The primary use for captured CO2 today is in the oil industry, injected into underground reservoirs to increase oil production. Both Mexico and the United States could benefit in the medium term from the deployment of CCUS technology in order to offset the impacts of existing emissions-heavy activities such as iron, steel and chemicals manufacturing, and the demands of international climate goals.

Access to Capital and Carbon Markets: Public pressure and increasing physical and legal risks from climate change are driving investments in sustainable energy systems. Sustainability will become increasingly central to Mexico's ability to attract investment in its energy sector. Many U.S. states, including California, Washington, and ten Eastern states that participate in the Regional Greenhouse Gas Initiative (RGGI), have successfully developed carbon pricing instruments for several industries. Similarly, Baja California, Tamaulipas, and Zacatecas, in Mexico, have adopted carbon taxes. The Mexican federal government has a carbon tax in place, and a nationwide Emissions Trading System is planned for 2023.

Nature-Based Solutions: Nature-based solutions, such as conservation or restoration of forests and mangroves, are becoming a popular option, particularly in the oil and airline industries, to reduce the cost of emissions mitigation. According to Forest Trends, in 2018, $296 million was spent buying the equivalent of 98 million tons of CO2 forest offsets in voluntary carbon markets, twice as much as in the previous year.[12] The key challenges are to ensure that only real, measurable and additional emission reductions are counted, and that the reductions are permanent.[13] Measuring the impacts of reforestation or forest conservation is difficult, given the long time required to ensure that CO2 emissions are absorbed.

A Just Energy Transition: Although a transition away from oil and other fossil fuels will be clearly beneficial to both countries on the whole, it will produce winners and losers. The United States and Mexico are both significant oil producers and although clean energy industries provide more jobs than fossil fuel industries, these jobs are likely not located in the same geographic areas. Additionally, energy makes up a higher portion of spending for lower income households and such households are likely to live in less energy-efficient homes. Furthermore, although the U.S. oil industry is larger, Mexico's industry plays a larger part in its economy, providing as much as 10% of government revenues in recent years, which is essential to funding social programs.

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10. IISD, Institute for Global Environmental Strategies, Oil Change International, ODI, Stockholm Environment Institute, Center on Global Energy Strategy – Columbia University. Data as of December 16, 2020. www.energypolicytracker.org

11. Dr. Julio Friedmann, Emeka Ochu and Jeffrey D. Brown, CGEP, Columbia University- April 28, 2020. IEA 2018.

12. The Economist, Cheap Cheats- September 17, 2020. https://www.economist.com/special-report/2020/09/17/cheap-cheats

13. Institute for Applied Ecology, How Additional is the Clean Development Mechanism - March 2016. https://ec.europa.eu/clima/sites/clima/files/ets/docs/clean_dev_mechanism_en.pdf

Key Recommendations

The energy transition will require policy to encourage deployment of existing technologies and further research and development on technical challenges we have yet to solve. Building on their strong history of cooperation on energy matters,[14] Mexico and the U.S. should create a Bilateral Task Force on Energy to address the full spectrum of energy issues from hydrocarbons to renewables to battery technology to the governing rules under the USMCA. The Task Force should offer in-depth analysis of the recommendations presented through this paper.

1. Accelerate the harmonization of energy efficiency standards

Increasing the ambition of previous collaborations would be a good start to a joint energy sustainability policy. For example, strengthening previous efforts to harmonize energy efficiency regulation, including standards for appliances and transport as well as building codes, would make compliance easier for companies that work on both sides of the border.

2. Reduce methane emissions in the oil and gas sector

Significant advances have been made in recent years in methane leak detection through the use of satellite technology, advanced mathematics, and geospatial data analysis. Many oil and gas operators employ a number of technologies to reduce methane emissions during well drilling, completion, and operation. Further, a group of private companies, NGOs, and academics have also entered into a rich debate around the merits of these new technologies and analytical methodologies for leak detection and monitoring. Mexico and the U.S. could evaluate these technologies and analytical methodologies with the goal of developing and implementing an effective, low-cost strategy to reduce methane emissions in oil and gas production and existing natural gas infrastructure.

3. Electric vehicles are an opportunity for job creation and regulatory harmonization

The shift toward EVs could offer significant opportunities for innovation, increased investments, and job creation. Mexico, for instance, possesses the world's largest reserves of lithium, which could become the basis for a new national industry focused on the production of EV batteries. By 2025, the global market for batteries could reach $300 billion annually.[15] The electrification of transport will require large-scale investments in infrastructure, such as converting gas stations into electric charge stations and grid fortification. The two countries should also harmonize vehicle standards, supporting the integrity of integrated North American supply chains.

4. Create policy incentives for CCUS and green hydrogen

Given the prevalence of fossil fuel-based power generation and heavy industries such as steel and cement that presently rely on fossil fuels, joint work to encourage CCUS, accelerate implementation and lower costs could help both countries reduce their emissions.

Green hydrogen, produced from the hydrolysis of water using renewable electricity, is another area for cooperation. Mexico and the U.S. both have potential for development of solar energy near existing industries, like refineries, with significant demand for hydrogen.

5. Better coordinate carbon pricing policies across the two countries

Carbon pricing is a critical tool to create transparency about the impact of carbon, send clear signals to industry and government on the scale and importance of mitigation strategies, and incentivize investment that captures or reduces CO_2 emissions. Still, pricing carbon has been difficult to advance politically since it increases costs in high-carbon-intensity industries like, steel, cement, glass, paper, and mining. In the United States, these industries coincide with battleground states that highly influence the outcome of presidential elections. Mexico would be particularly impacted in auto manufacturing and refining. Still, with carbon markets in the EU and China, the world is on a trajectory toward market-based prices on carbon.

Mexico and the United States are each country's leading trade partner, in part because of their integrated supply chains. The integration of the U.S. and Mexican industrial economies creates an imperative for both countries to improve their coordination on carbon pricing policies, from considering a joint approach to relevant border adjustment tariffs, to expanding carbon offsets, to national strategies on pricing carbon.

With the Biden Administration's commitment to net-zero emissions and a carbon-free power sector, combined with financial institutions increasingly focused on ESG (Environmental, Social, and Governance) investing, recognition in the U.S. of allowances and carbon credits in Mexico could allow for offset purchases that reduce corporate emissions profiles in the United States and channel capital back to Mexico that could be invested in innovation or to address social welfare needs in communities providing the offsets. Mexico could become an offset supplier from mangroves, REDD+ (Reducing Emissions from Deforestation and forest Degradation and related programs), land use, and agriculture for state/federal cap-and-trade programs.

6. An Equitable Energy Transition

The Unites States and Mexico should jointly develop programs, such as assistance with energy bills and in purchasing more energy efficient technology, to ease social dislocation that will inevitably come with the energy transition. Potential increases in electricity costs would be disproportionately harmful for lower income households and people who live in less energy-efficient homes. An equitable energy transition must also consider how to replace government revenues derived from fossil fuels, particularly in Mexico. Both countries can collaborate and share experiences in the development of job training programs and on redevelopment plans for fossil fuel-dependent areas on both sides of the border.

Section II: Hydrocarbons: Optimizing Competitiveness and Energy Security

The United States and Mexico are both major oil and gas producers with significant untapped potential. Global projections for a decline in oil demand present a massive challenge for both countries to remain competitive, secure investment, replace jobs fleeing from oil and gas, and compensate for revenue shortfalls from revenues and taxes. Oil producers today face a highly competitive global environment. Oil supply is abundant, with historic inventories having accumulated as demand collapsed during the

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14. U.S Department of Energy. https://www.energy.gov/ia/international-affairs-initiatives/north-american-energy-cooperation

15. Corporation Knights, The EV Revolution will take batteries but are they ethical- January 2020. https://www.corporateknights.com/channels/transportation/ev-revolution-needs-batteries-ethical-15795118/

COVID-19 pandemic. Meanwhile, the likely enactment of policy measures to fight climate change and invest in a greener economic recovery in many countries dampens the oil demand outlook. Most forecasts foresee demand declining gradually with the world still consuming tens of millions of barrels per day for decades to come. However, in a scenario where the ambitious goals of the Paris Agreement are reached, oil demand would have already peaked, and gas would do so by 2025, according to the International Energy Agency. In this scenario, by 2040 oil demand would drop by 45%. Meanwhile, natural gas, which is expected to replace higher emissions coal in the near and medium term, would see demand drop by only 3% by 2040.[16]

Under any demand scenario, competition will increase brutally for capital to develop the oil and gas resources that the world continues to need. ESG pressures and investors fears of commodity price volatility are driving energy investment to renewables or to other sectors like technology and pharmaceuticals. Mexico and the United States need to prepare for this reality: companies with the cheapest oil and the lowest emissions content will sell the marginal barrel of oil.

Interdependent and Interconnected

A Kansas City Southern train recently arrived at a warehouse in San Luis Potosi, loaded with fuels for Mexican consumers. The off-taker was a major international energy firm active in the Mexican market since 2015. Shortly thereafter, the product that had begun as oil in the U.S., converted and refined into fuel and shipped by rail hundreds of miles across the U.S.-Mexico border, would be pumped by Mexican consumers into their automobile tanks. It should be celebrated that we have come a long way towards a more integrated and truly interdependent energy market. Yet, as important as these cross-border connections have become for energy security and market stability, U.S.-Mexico energy integration needs to evolve along with changing global market conditions.

The United States and Mexico have highly integrated energy systems, among the most integrated of any two countries in the world. And the flow of oil, natural gas, and refined products between the two countries is growing. This trade has been facilitated by the build out of infrastructure, including oil and gas pipelines, rail lines, and storage facilities. Cross-border trade and investment have flourished in part thanks to government regulations and bilateral cooperation.

U.S. and Mexican oil production and refining complement each other because each country produces crude grades suited to the other county's refineries. Sour heavy crude, which accounts for 55% of Mexican production, is an ideal feedstock for some of the high conversion refineries in the U.S. Gulf Coast (USGC).[17] The light crude surplus in the U.S. would fit well with Mexican lack of deep conversion refineries. Despite declining gasoline demand in the U.S., USGC refineries have been able to maintain a high utilization rate by exporting gasoline to Mexico. And Mexico benefits from low cost and cleaner fuels from some of the world's most competitive refineries. These synergies create business opportunities, new investment flows, and job creation on both sides.

U.S. shale producers have also benefited from the ability to monetize gas by selling into the Mexican market. Mexican imports of natural gas from the U.S. by gas pipeline reached 5.1 billion cubic feet per day in 2019, compared to 4.8 bcfd in 2017 and 4.9 bcfd in 2018.[18] For Mexico, access to the cheapest gas in the world should improve competitiveness of Mexican manufacturers highly integrated with U.S. production chains.

Many companies have recently started to invest in Mexico's hydrocarbons sector, responding to the cross-border integrated business opportunities. American companies such as ExxonMobil, Chevron, Talos, Fieldwood, Murphy, Valero, Avant, Bulkmatic, among others, have E&P contracts and are importing, distributing, and commercializing refined products, and building terminals. Not only U.S. companies but also non-U.S. companies with business interests and operations in the U.S. are expanding into Mexico.

Challenges and Opportunities

In order to compete for a shrinking share of capital investment and market share, oil producers must look to cut costs, improve efficiencies, and reduce their direct and indirect emissions. The COVID-19 pandemic has sped up some of the changes expected from this energy transition. Oil demand — and prices — plummeted in March and April as lockdown measures were imposed around the world to contain the coronavirus outbreak. In early 2021, global demand and prices have still not recovered to pre-COVID levels, and the prospect of longer-term changes in consumer patterns, such as a permanent increase in teleworking, raise the possibility of softening oil demand in the long term. US Benchmark WTI dropped from $50/barrel in early February 2020 to below $20/barrel in April, and hovering in the range of $50/barrel in January 2021 after an extraordinary supply cut of 1 MMb/d by Saudi Arabia.[19] The International Energy Agency forecasts a gradual increase in demand as lockdown measures are eased, projecting that global oil demand will be 8.1 mb/d lower in 2020 and 5.7 million b/d lower in 2021 compared to 2019.[20]

Over the last decade, the United States has emerged as one of the world's largest oil and natural gas producers and indeed one of the main forces behind the increasing competition among global suppliers. U.S. crude oil production more than doubled from 5.5 million b/d in 2010 to 12.7 million b/d in February 2020,[21] with over 60% of crude output coming from shale last year.[22] Likewise, natural gas production rose by 62% over the past decade,[23] and by 2019 shale accounted for 75% of total U.S. dry gas production.[24]

However, U.S. shale output is highly sensitive to oil price fluctuations due in large part to its shorter production cycles. While conventional oil projects require large upfront

16. *IEA, The Oil and Gas Industry in Energy Transitions. Insights from IEA analysis. https://webstore.iea.org/download/direct/2935. 2020 edition of BP Energy Outlook 2050, http://www.bp.com/energyoutlook*

17. *Deer Park is an outstanding example of integration, this refinery is a 50-50 partnership between Shell and Pemex, 40-50% of its crude slate is Mexican heavy sour.*

18. *U.S. Natural Gas Exports by Country- August 31, 2020. https://www.eia.gov/dnav/ng/ng_move_expc_s1_a.htm*

19. *Statista, Weekly Brent, OPEC Basket, and Crude Oil Prices from December 30, 2019 to December 28, 2020. https://www.statista.com/statistics/326017/weekly-crude-oil-prices/*

20. *Oil Price, Will Oil Ever Recover to Pre-COVID Levels?- July 2020. https://oilprice.com/Energy/Crude-Oil/Will-Oil-Ever-Recover-To-Pre-COVID-Levels.html*

21. *U.S Energy Information Administration, December 2020. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M and https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus2&f=a*

22. *U.S energy Information Administration, Frequently Asked Questions- September 2020. https://www.eia.gov/tools/faqs/faq.php?id=847&t=6*

23. *U.S Energy Information Administration, Natural Gas Gross Withdrawals and Production- December 2020. https://www.eia.gov/dnav/ng/NG_PROD_SUM_A_EPG0_VGM_MMCF_A.htm*

24. *U.S energy Information Administration, Frequently Asked Questions- September 2020. https://www.eia.gov/tools/faqs/faq.php?id=907&t=8#:~:text=The%20U.S.%20Energy%20Information%20Administration,natural%20gas%20production%20in%202019*

capital investments and then ramp up output over several years — making it uneconomical to shut in production in response to short term price fluctuations — shale wells reach peak output in a matter of months and can be quickly closed down or restarted without major losses. As a result, many shale wells have been shut in since the oil price collapse early in 2020. The U.S. shale sector is also highly dependent on low interest financing, and dozens of companies that were highly leveraged have already declared bankruptcy in recent months. Continued investor appetite for financing the shale boom despite the sector's low returns is uncertain, putting ever greater pressure on operators to improve efficiency gains. The shale gas sector faces the additional challenge of inadequate infrastructure and insufficient demand. Huge volumes of natural gas, often associated gas from shale oil wells, are flared due to lack of markets. As a result, the export of piped gas to Mexico has become a critical outlet for U.S. shale gas.

In Mexico, more than 70 years of closing the hydrocarbons sector to private investment and competition limited its development to the financial, technical, and operating capabilities of its state company Pemex. Mexico undertook a comprehensive energy reform in December 2013, and investment quickly responded.[25] In 2018, the Mexican government shifted its energy policy to reinforce state control over the sector.

Mexico holds significant resources that could more than triple its current reserves but lacks financial, technical, and operating capacities to explore and develop them. Oil and gas production are declining and more complex resources, deepwater, and unconventional, have not been monetized. As a result, the Mexican state, as the owner of those resources, has not been able to reap the benefits even though Mexico remains highly dependent on the oil sector's contribution to the public budget to support economic growth. And as oil production has declined, so has the production of associated gas.

Mexican refining capacity, all owned by Pemex, falls short of demand due to a lack of residuum upgrading capacity to produce the yield of products consumed in Mexico (dominated by gasoline). In addition, refineries run at low utilization rates owing to lack of maintenance and funding and high operating costs. The current Mexican administration is building a new refinery (340,000 bd of processing capacity), which constrains maintenance, repairs, and upgrades in existing refineries given the limited resources of Pemex and the Mexican government. Mexico lacks sufficient and reliable refined products pipelines and storage facilities for reliable fuel markets. Fuel inventories in Mexico are less than five days of demand in some regions. By comparison, the United States and most European markets have fuel inventories on the order of one month of demand.

Key Recommendations

The market trends described above create business opportunities on both sides of the border. But while market forces will continue to be the main driver of energy integration, governments need to create a favorable environment for trade and investment. Going forward, if the United States and Mexico are to remain competitive in global oil markets and access affordable, clean and reliable energy, their governments should place more emphasis on modernizing energy infrastructure and instituting practices to make them more efficient, cost effective, and sustainable.

1. Collaborate on technological development and human capital to lower carbon and costs

As discussed earlier, improvements in technologies such as carbon capture and storage will be key to achieving zero carbon energy systems. The oil industry is continually expanding the deployment of advanced technologies, with digitalization and artificial intelligence widely used for many processes in exploration and production to improve efficiency and reduce costs. New technologies should be accompanied by constant training of personnel to effectively incorporate them. Both the United States and Mexico would benefit from partnerships among universities, government research institutions like the U.S. national labs and the Mexican Petroleum Institute (IMP), and regulatory agencies to advance technological innovation and professional growth of energy workforces. Both governments could also create rules for regional content and/or fiscal incentives which incentivize permanent training alliances among technology providers and companies.

2. Align health, environment, and safety regulations and standards in the oil and gas sector

Policymakers and regulators in both the U.S. and Mexico could learn from their counterparts through technical exchanges between organizations like Mexico's ASEA and the U.S. Bureau of Safety and Environmental Enforcement on reducing greenhouse gas emissions in the hydrocarbons sector. Mexico could improve air quality by adopting higher U.S. fuel quality standards. The two countries share a maritime border with oil projects on both sides of the Gulf of Mexico and should align safety and environmental management standards and share information on offshore regulation. In addition, both the United States and Mexico hold substantial unconventional oil and gas reserves but face concerns about environmental regulation of fracking, including related to methane leaks and water management. Thus, Mexico and the United States could increase collaboration on fracking regulation at the federal and/or state levels. Such cooperation has occurred under previous governments but needs to be reactivated and expanded.

3. Build and operate energy infrastructure with a focus on integrated markets

Mexican deepwater potential in the northern Gulf of Mexico could be developed more efficiently by leveraging the decades of experience on the U.S. deepwater side and building infrastructure to tie Mexican developments to existing U.S. infrastructure. Drilling equipment, support vessels and other equipment could be optimized if shared for the development of different assets. Infrastructure could be connected to existing pipelines flowing to refineries in the U.S. and gas pipelines to the Mexican market could be expanded. With companies and personnel working across the border, developing cross-border integrated businesses in a highly competitive environment will drive economic growth and efficiency gains in both countries. Improving conditions for refined products trade, for example by allowing long term import permits in Mexico, and improving customs processes on both sides of the border, will create capacity to move and store refined products, relieving fuel security concerns and lowering fuel logistics costs.

4. Oil companies themselves should cooperate directly to improve sustainability indicators

Oil companies are facing increasing pressure from investors and civil society to improve their sustainability indicators,

25. Today, there are 73 companies from around the world participating in exploration and production contracts, including 8 US companies. Mexican Government, Rondas Mexico- April 2019. https://rondasmexico.gob.mx/esp/cifras-relevantes/
With those contracts Mexico has widened significantly its financial, technical, and operational capacities to explore, appraise and develop hydrocarbon resources while risk has been diversified among many investors. Although it is still too early to see the full benefits of companies participating in the sector, private oil firms could contribute to 12% of total production by 2025. IHS Markit- December 2020.

providing an impetus for further action. U.S. investors are increasingly concerned about the risk of oil companies investing in stranded assets, and companies are under pressure to develop long-term strategies to embrace the transition away from fossil fuels. The direct emissions of Pemex alone are equivalent to some 5% of Mexico's total emissions. The state company lacks a strategy for diversifying its portfolio to include low emissions energy sources and mitigating the risk of stranded assets. U.S. oil companies and Pemex can collaborate through international initiatives such as the Oil and Gas Climate Initiative, of which Chevron, ExxonMobil, and Occidental are all members (Pemex recently withdrew but should rejoin).[26]

Section III: Power, Gas, Renewables: Cleaner and Cheaper Energy

The U.S. and Mexico have an enormous energy resource base to fuel industry and provide clean and reliable power to households. Abundant U.S. natural gas combined with substantial prospective resources south of the border in Mexico can be combined to consolidate a regional gas market to supply the world. In addition, high solar insolation as well as best-in-class wind resources in both the U.S. and Mexico, permit high capacity factor wind generation projects.

Mexico suffers from high electricity prices compared to the U.S. In addition, Mexico's industrial sector still relies on expensive and more polluting sources of energy. In the interconnected U.S-Mexico supply chains, these differentials undermine the competitiveness of our integrated industries.

Interconnected and Interdependent

Mexico is the largest importer of U.S. natural gas. The Mexican gas pipeline network supporting these imports, both cross-border and domestic, has grown enormously in the last few years. The CFE has been the main anchor shipper for new pipelines, which were planned to provide sources of gas for new power generation facilities and to open new markets, previously isolated, for natural gas access.

Currently, the utilization of Mexico's pipeline capacity is low, but this presents a unique opportunity to enhance the competitiveness of Mexican industry and strengthen the ties of U.S.-Mexican gas industries. Increased access to natural gas from the U.S. – sold at very low prices compared to gas prices in Europe or Asia – could benefit Mexican industries that use natural gas as a heat source, as well as businesses and consumers that buy gas-fired electricity. The USMCA could also help the U.S. and Mexico compete more effectively in export markets and provide low-cost products to Mexican consumers.

Further, the U.S. and Mexico could jointly build a natural gas export platform whereby natural gas is imported from the U.S. into Mexico through existing pipeline networks, liquefied at Mexican Pacific Coast facilities then exported to the growth economies of Asia.

The U.S. and Mexico also have a joint interest in taking advantage of new energy technologies related to renewable energy and grid management. The cost of electricity derived from solar and wind has dropped precipitously over the last decade to the point that electricity from utility-scale renewable sources is now cheaper in many cases than electricity from gas-fired generation. With energy storage and improved grid management, renewable energy can be reliable as well as low cost. As a result, generating capacity from wind and solar is now growing faster in the U.S. than from any other technology. Renewable energy will also be a cornerstone to the energy transition over the medium to long term as the electrification of our energy systems becomes more prevalent (internal combustion engine vehicles will likely be phased out in favor of electric vehicles — see the example of California mentioned above, new fuels can be produced with renewable energy — see hydrogen example above, and heating can be switched to power, as well).

Going forward, robust capacity for cross-border power trade will enhance U.S. and Mexican competitiveness in an increasingly electrified global economy. To realize that potential, both sides must contend with politics and policy to bring about increased integration between the U.S. and Mexican grids. U.S. regulators, state-level policymakers, federal authorities, and Mexico's state-owned enterprises all have important political constituencies that will need to participate in the discussion. To date, the amount of electricity traded between the two countries is minimal.

Challenges and Opportunities

Retiring Legacy Infrastructure: Mexico's legacy generation fleet is aging and inefficient, resulting in high electricity prices. According to the EIA, the average end-consumer tariff for industrial consumer in the U.S. was $6.8 US cents/KWh in 2019 with rates as low as $5.5 US cents/KWh in states like Texas.[27] In contrast, Mexican mid- and large-size industrials paid $12 US cents/KWh and $8.4 US cents/KWh respectively in 2019 according to Mexico's Energy Regulatory Commission, CRE.[28] Most Mexican households pay a subsidized price for electricity rather than full price, with the subsidies costing the Mexican government $3.9 billion in 2019.[29]

Even though Mexico has made significant strides in phasing out oil and coal generation, these fuels in 2019 still supplied 17% of total power.[30] According to the CRE, coal and fuel-oil generation costs in 2019 were $75/MWh and $104/MWh, respectively.[31] By contrast, between 2015 and 2018, Mexico carried out three clean energy auctions to contract new renewable (wind and solar) power and the related clean energy certificates (CELs), with the final auction producing bids averaging$20/MWh. The three auctions combined resulted in nearly 7 GW of wind and solar combined and commitments for nearly $9 billion in private investments.[32] The clean energy auctions, however, have now been indefinitely suspended.

Clean Energy and its Challenges: Although the clean energy auctions produced extremely low bid prices, Mexico has grave concerns regarding the variability of solar

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26. The Dialogue, Latin American State Oil companies and Climate Change: Decarbonization Strategies and Role in the Energy Transition- June 2020. https://www.thedialogue.org/analysis/latin-american-state-oil-companies-and-climate-change-decarbonization-strategies-and-role-in-the-energy-transition/

27. Energy Information Administration. Average Price of Electricity to Ultimate Customers. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_03

28. Final Basic Supply Rates 2019, CRE. Estimated National Average Rate. Mid-size industrial is the average of GDMTO and GDMTH and large-size industrial is the average of DIST and DIT. Exchange rate 19.26 MX$/US$. https://datos.gob.mx/busca/dataset/memorias-de-calculo-de-tarifas-de-suministro-basico/resource/b9d8d215-a9e1-43d5-89e3-00616a051b5a

29. Expenditure Budget of the Federation 2019. Subsidy for electricity rates. https://www.pef.hacienda.gob.mx/es/PEF2019/home

30. National Center for Energy Control. Energy Generated by Technology. https://www.cenace.gob.mx/Paginas/SIM/Reportes/EnergiaGeneradaTipoTec.aspx

31. CRE, Final Basic Supply Rates 2019, Estimated energy and generation costs 2019. https://datos.gob.mx/busca/dataset/memorias-de-calculo-de-tarifas-de-suministro-basico/resource/b9d8d215-a9e1-43d5-89e3-00616a051b5a

32. Estimated from results of the long-term power auctions carried out by Centro Nacional de Control de Energia (CENACE) between 2015 and 2017.

and wind projects, as well as issues of grid integration. California's experience also shows that there can be too much energy from solar projects during the afternoon hours, when production may exceed demand. Accordingly, the grid must have the capacity to absorb renewable power when it is available, or there must be alternatives to store it. Backup sources of generation need to be available in the case of variable generation shortfalls. It is also essential to integrate clean energy into transmission and distribution systems so as to ensure available capacity, reliability, and proper regulation of frequency and voltage. Given the goal of reaching net zero carbon emissions by 2050, these challenges can also be considered opportunities or trade-offs that governments such as those of Mexico and the United States should evaluate when considering how to manage potential renewable energy oversupplies. These options can include building out the grid to bring the supply to other loads, use the power to decarbonize non-power sector applications (e.g., transportation or industry), use the power to produce and sell zero carbon products like ammonia, hydrogen, other synthetic fuels, or use the excess power to operate CO2 removal equipment.[33]

Power Transmission Gaps: An extensive transmission grid can improve system reliability by making available generation resources from a wide geographical area and also reduce costs, since a system operator will be able to acquire electricity from the lowest cost provider for a specified time period over a large area. Transmission can also provide access to renewable resources that are geographically constrained, e.g. areas of steady high winds or undeveloped areas of intense insolation, and help to manage the intermittency of renewables. In both the United States and Mexico, extending and modernizing transmission infrastructure has been challenged on issues ranging from rights of way, social unrest and conflicts over cost-sharing. This issue in particular is one that represents a potential opportunity for close cooperation between the two countries given the significant challenge involved in expanding transmission lines.

Limited Cross-Border Electricity Trade: California and Baja California – where the U.S. and Mexican grids are interconnected and synchronized — demonstrate the sub-sovereign possibilities for collaboration and enhanced market development. But the example of Texas and northern Mexican — where the grids are not interconnected and are not synchronized — reminds us of the complexity that politics, policies, and state and federal regulations pose to the meshing of two distinct electric markets. However, assuming that those challenges could be overcome and greater integration attained, companies on both sides of the border could take advantage of the current infrastructure, diversity of load patterns between regions, and constantly changing prices to optimize their operations.

Gaps in Gas Pipeline Integration and Networks: Despite progress in the integration of the natural gas industries in Mexico and the U.S., local opposition, challenges to rights of way, and complicated regulatory processes have delayed the construction of gas pipelines in the United States and Mexico. In the U.S., gaps and delays in pipeline construction have contributed to significant increases in flaring and methane emissions which must be tackled in order to not offset the benefits of using gas to displace other pollutants fuels such as coal or oil. Delays in major gas pipelines in Mexico add to the gas production bottlenecks in the Permian Basin, mostly in West Texas. Such cross-border bottlenecks and more widespread delays in Mexico curtail or raise the costs of access to gas within Mexico.

Fuel Costs and Industrial Competitiveness: In Mexico, a transition towards a more open and integrated gas market with the U.S. will boost competitiveness of energy-intensive industries as well as promote economic development in states where there is limited or no access to natural gas. Historically, Mexico's industrial regions have had access to ample cheap energy; states like Guerrero, Oaxaca, and Chiapas have significant constraints in accessing cheap fuels and are reliant on such fuels as LPG, fuel oil (*combustoleo*), and diesel. In 2019, the average cost of natural gas in Mexico was below $3/mmbtu versus nearly $8/mmbtu for fuel oil and around $25/mmbtu for diesel.[34]

Key Recommendations

1. Develop clean energy, and resilient and sustainable infrastructure

The Biden Plan for a Clean Energy Revolution pledges "investments in clean energy and resilient and sustainable infrastructure [that] will drive an innovation boom that helps us achieve the vision of a hemisphere that is secure, middle class, and democratic from Canada to Chile."[35] The Mexican and U.S. governments should engage immediately on structuring this initiative for Mexico and potential ties to Central America. For Mexico, such a program can target gaps in transmission, grid development, and energy access and open opportunities for collaborative research. For Central America, access to power will be key to job creation and tackling deep-rooted issues on migration. Even if the U.S. provides only limited government funding, U.S. government engagement under the Biden plan could reduce investor risk and leverage investment from international development banks and private sources.

2. Integrate new models for renewable power generation

If Mexico can put in place a significant portfolio of renewable energy projects that provide low-cost, reliable electricity, it would be able to retire older power plants using fuel oil or diesel that generate electricity at high prices and create substantial pollution. The private sector has shown itself willing, through its response to the clean energy auctions, to invest in renewable energy projects based on long-term contracts. CFE has canceled the auctions because they left intermittency and grid integration to be managed by CFE, without compensation. One way to foster renewable energy would be to redesign the auction model in order to address these issues.

This would mean an auction process where the bid must include energy storage and other tools for managing intermittency and grid integration, to be provided or paid for by the bidder rather than CFE. Other tools may be necessary, including advanced wind and solar technologies that include regulation capability (frequency and voltage regulation), improved forecasting, fast-ramp conventional generation to meet shortfalls, and other ancillary services. Mexico may want to consult with the Public Service Company of Colorado, which conducted such an auction in 2017.

Another way to foster renewables would be to develop financing options that maintain CFE ownership of power

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33. Dr. Julio Friedmann, Melissa Lott CGEP, Colombia University- October 2020. https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/ElectricityOversupply_CGEP_Commentary_FINALr1.pdf

34. CRE, Final Basic Supply Rates 2019. Estimated and observed 2019 fuel prices. https://datos.gob.mx/busca/dataset/memorias-de-calculo-de-tarifas-de-suministro-basico/resource/b9d8d215-a9e1-43d5-89e3-00616a051b5a

35. The Biden Plan for a Clean Energy Revolution and Environmental Justice, https://joebiden.com/climate-plan/, Section III, Rally the Rest of the World to Address the Grave Climate Threat.

generation. Renewable energy requires large upfront capital expenses, and CFE may not have the capability to self-fund on the scale necessary. Yet, it may be possible to structure private "finance lease" structures for generation assets where CFE is the owner of selected new energy assets, meeting the state's requirement for energy sovereignty, while private sources provide the necessary funding, without ownership, and still obtain their required return.

3. Exchange lessons and tools on transmission planning

A reliable North American electric grid will help achieve significant efficiencies, cost savings, and security for the public and regulated entities which could ensure cheaper energy and boost competitiveness as well. Transmission planners on both sides of the border should compare planning strategies and tools, their decision processes, how they manage public input, their strategies for financing new transmission, and cost allocation strategies. On the U.S. side, regional transmission operators and independent system operators such as the Electric Reliability Council of Texas (ERCOT), the Southwest Power Pool (SPP), the Midcontinent Independent System Operator (MISO)), and the California Independent System Operator (CAISO) have experience with large-scale transmission projects, which have produced multiple benefits that together far exceed their costs. The U.S. Federal Energy Regulatory Commission (FERC) has regulatory expertise in "Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities," as reflected in its Order 1000.[36] On the Mexican side, CFE and CENACE have built and managed Mexico's transmission grid. A dialogue among these U.S. and Mexican parties on transmission issues could be fruitful for both sides.

4. Leverage new models to finance transmission and distribution

Economics and financing, market uncertainties, regulatory limits on cost recovery, and environmental and siting issues are key transmission fundamentals driving investment decisions in both cross-border and non-cross-border projects alike. The Mexican constitution requires the Mexican state to retain ownership of its transmission and distribution networks. However, subject to retention of ownership, the Mexican state, directly or through state-owned entities, may form associations or enter into contracts with private parties for the financing, installation, maintenance, management, operation, and expansion of infrastructure for the state to provide transmission and distribution services. Investor/operators in the U.S. may find opportunities in Mexican transmission and distribution infrastructure attractive, even if the Mexican state is the owner of that infrastructure, so long as there is a clear, firmly committed source of repayment for the infrastructure provided.

5. Modernize the power grid

As electrical systems become more complex with the addition of renewable energy and other distributed energy resources – energy efficiency, demand response, distributed renewable and clean generation, energy storage, and electric vehicles – grids need more capabilities. So-called "smart grids" permit two-way power flow and two-way information flow to improve the reliability, efficiency, and economics of system operations. Among other things, a smart grid will accommodate all generation and storage options; provide good power quality (through frequency and voltage regulation); optimize asset utilization; anticipate and respond to system disturbances (self-heal); and operate resiliently against attack and natural disaster.

6. Fill gaps in gas pipeline networks and develop a secondary market for underutilized gas transmission capacity

The foundation of a U.S.-Mexico open gas market has been laid, but the last mile is still pending. The first step is a coordinated strategy to connect gas supply with Mexican demand. The second is developing a secondary market where currently underutilized capacity is made available to other users with a potential two-fold effect: (1) it would allow CFE, the main offtaker of gas transportation contracts, to monetize the unused capacity and reduce its financial burden from the contracts; (2) it could foster new business models by allowing third parties access to gas through the purchase of capacity. This might include the joint LNG export platform from the Mexican Pacific coast, the displacement of more expensive and dirty fossil fuels in industry, and the opening of new markets in regions where access to cheap energy is limited. In each of these business areas, CFE would continue to have an important role.

7. Reinvent dynamic subnational cooperation in grid integration

For Baja California, there have been a series of recommendations on both sides of the border for CENACE to pursue participation in the WECC Energy Imbalance Market, subject to satisfying technical and operational requirements. Baja California would get grid access to the 15-minute and real-time market in the western interconnection.[37] This provides a tangible opportunity to address Baja California capacity shortfalls by taking advantage of cross-border trade with California where renewable energy has exceeded demand and been curtailed as a consequence.

With respect to northern Mexico and south of Texas, the lack of interconnection and synchronization between the ERCOT grid and the Mexican grid presents complex political and regulatory problems. The U.S. and Mexico could analyze these problems and potential solutions by means of a joint study group, including CFE and Mexican regulators on the Mexican side, and transmission operators and state and federal regulators on the U.S. side, perhaps with assistance from transmission specialists from academia and national laboratories or think tanks.

Conclusions

The integration of the U.S. and Mexican economies was crafted at a time when energy was a politically untouchable theme of cooperation. Clean energy was still a commercial aspiration. That world has changed, and the nature of the U.S.-Mexico economic and energy relationship needs to change with it to sustain industrial competitiveness, create jobs, and deliver affordable goods and services to U.S. and Mexican citizens.

As argued earlier, the imbalance between net-zero commitments and the lack of action plans by most countries to get there will lead to a period of intense legislation and regulation to correct the course. How Mexico and the United States collaborate on energy and climate policies and regulations in the next five years could shape their economic potential for decades.

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36. Order No. 1000 - Transmission Planning and Cost Allocation. Federal Energy Regulatory Commission- April 2015. https://www.ferc.gov/industries-data/electric/electric-transmission/order-no-1000-transmission-planning-and-cost

37. Baja California Energy Outlook 2020-2025, Institute of the Americas, January 2020. https://www.iamericas.org/wp-content/uploads/2020/02/Baja_Energy_Outlook_2020_2025.pdf

The energy transition before Mexico and the United States, and for that matter, the rest of the world, will have profound challenges. Ignoring these challenges will undermine economic competitiveness and most profoundly disadvantage the poor who have little resilience for economic dislocation. Seizing those challenges together, between Mexico and the United States, will create opportunities for both countries. Here are some of the most profound:

Jobs: The regulatory push toward an electric vehicle world is upon us. Mexico and the U.S. together need to restructure their supply chains and set the incentives now for investments to prepare for the future. Millions of jobs will depend on it. Renewable power should be part of that equation.

Justice and Equity: Renewable energies can help solve some of the logistical conundrums of fuel and infrastructure to bring electricity to Mexican communities without access. Consistent, sustainable power can spark entrepreneurship. It would revolutionize health care and access to medical care. It would expand educational prospects through lighting and the internet.

Carbon Markets and the Poor: Manufacturers, energy producers, and financial institutions all need to reduce emissions. Mexico has the forests and agricultural lands that can absorb carbon or reduce emissions from deforestation. Carbon markets can link the two, with sales of the offsets addressing social welfare for the poor. Even though much needs to be done to close gaps on monitoring and verification, the foundational connections exist.
Technology and Hydrocarbons: Mexico and the United States are major producers of hydrocarbons. They have a common stake in developing and sharing commercially viable technologies that would capture carbon, reduce emissions, and extend the lifespan of their oil and gas resources. This change alone would ease major dislocations of an energy transition.

Energy Efficiency and Consumers: Buildings account for 39% of global emissions,[38] with weather and power inefficiencies wasting fuel and increasing costs to households. Among the most exposed are the urban poor. Both Mexico and the U.S. can target scalable efficiency programs, led by cities, focused on household efficiency solutions for the urban poor.

Unlocking Investment: The world cannot function without power and energy. The infrastructure and energy base in both countries needs to be expanded and renewed, from grids to transmissions lines to retiring obsolete generation plants. This is the moment for compatible policies and regulations that unleash private investment seeking predictable returns and 0-emission assets.

The incoming Biden Administration and the Lopez Obrador Administration perhaps bring different perspectives on energy, but they share common objectives to create jobs and seek social justice for their citizens. Collaboration on a sustainable energy future can open surprising opportunities that will leave both countries stronger and more resilient — with the chance of fulfilling a promise to preserve our planet for future generations.

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38. IEA Global Status Report for Business and Construction 2019. Technology Report- December 2019. https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019

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