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AI and Data Center-Driven Demand for Green and Renewable Energy: Finance Needs and Activities in México

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ABSTRACT: The accelerating deployment of artificial intelligence (AI) systems and associated data center infrastructure across México is generating an unprecedented surge in electricity demand, fundamentally reshaping the country's energy landscape and creating acute pressure on its capacity to finance and deliver renewable energy at scale. The analysis reveals persistent misalignments between corporate clean energy commitments, investor risk appetites, and the regulatory environment. However, several structural catalysts—including nearshoring-driven industrial demand, revised clean energy certificates, and multilateral climate finance flows—suggest a conditional pathway toward renewable energy-financed data center ecosystems. The report concludes with policy recommendations directed at government regulators, private investors, and technology corporations operating in México's evolving energy market.

Keywords: *artificial intelligence, data centers, renewable energy finance, México, green bonds, power purchase agreements, nearshoring, energy transition*

INTRODUCTION

The intersection of two significant technological and economic changes, the worldwide proliferation of artificial intelligence technology, and the need to decarbonize the energy mix of individual countries will place México at the vanguard of an emerging dialogue on energy security, sustainability, and investment strategy. During the last ten years, the geographical positioning, competitive energy prices, and proximity to the United States have created favorable conditions for the inflow of significant foreign direct investments in the technology and manufacturing industries of México. The recent rise of the practice of nearshoring, which has been amplified by the US-Mexico-Canada Agreement, has further reinforced the appeal of México as an emerging hub for digital infrastructure (Mendieta & Torres, 2023). Concurrently, the worldwide proliferation of generative AI models, large language models, and cloud computing has created exponential growth rates in data center energy consumption worldwide, with the International

Energy Agency (IEA) estimating data centers could account for more than 4% of global electricity use by 2026 (IEA, 2024).

Under this context, México holds a unique place of interest. México has significant and extraordinary levels of renewable energy resources, including solar irradiance in the Sonoran and Chihuahuan deserts and wind energy in the Isthmus of Tehuantepec (IRENA, 2023). The development and implementation of renewable energy have been slowed down due to a series of changes in the energy policy and regulations introduced under the current administration of Mexican President López Obrador (2018-2024), which has systematically undermined the interest of independent power producers and strengthened the market dominance of state-owned enterprises CFE and Pemex (Elizondo Azuela et al., 2022). This has caused considerable uncertainty among investors at a time of increased global demand for clean energy data center infrastructure.
Under the current administration of Mexican President Claudia Sheinbaum (2024-2030), an energy engineer and climate change activist, there is evidence of a significant change in energy policy with a strong emphasis on renewable energy and digitalization as twin pillars of modernization (Sheinbaum-Pardo et al., 2024). Nevertheless, there are considerable legacies from the prior sexenio in terms of delays in clean energy certificate markets, litigation against foreign investors under USMCA Chapter 31, and financial difficulties faced by CFE.

Amidst these circumstances, this report poses a fundamental question: what are the financing necessities and mechanisms, and institutional conditions that are required to align electricity demand generated by AI and data centers growth with renewable energy supply in México? The paper seeks to investigate and analyze the nexus that connects AI and data centers growth, green and renewable energy finance, and institutional and regulatory conditions that influence and impact energy finance in México. Based on a thorough and systematic review of conceptual, theoretical, and empirical literature, and a documentary analysis of México's energy plans and finance instruments and tools, this paper's findings point to a structurally paradoxical situation wherein renewable resources are in abundance, yet investment in clean and renewable energy is still in short supply, a situation that is partly a result of policy and regulatory uncertainty that followed a series of policy reversals in 2018. The entry of hyperscale data centers of global technology giants Google, Microsoft, Amazon Web Services, and Meta into México's energy sector has heightened and increased interest in clean and renewable energy procurement.

The paper explores and analyzes power purchase agreement structures, green bonds, and blended finance instruments and tools, and the involvement of development finance institutions such as Nacional Financiera (Nafin) and Inter-American Development Bank (IDB) in filling this financing gap. Accordingly, this paper is structured as follows: first, a literature review section that provides a conceptual, theoretical, and empirical background to this paper's research problem and question; a methods section that provides a detailed account of this paper's methodology and design; a results analysis section that presents a detailed account of this paper's findings and results; a findings section that provides a detailed account of this paper's findings and results; a discussion section that provides a detailed account of this paper's findings and results in light of theory and policy; and finally, a conclusions section that provides a detailed account of this paper's conclusions and recommendations in light of findings and results. Throughout this paper, APA 7th Edition is used as a referencing and citation style.

CONCEPTUAL, THEORETICAL, AND EMPIRICAL LITERATURE REVIEW

Conceptual Framework: Green Energy Finance and Digital Infrastructure

The study is grounded on three main conceptual threads: the political economy of energy system transition, the economics of digital infrastructure investment, and the growing literature on climate finance in emerging markets. More broadly, "green finance" refers to "financial instruments, institutions, and flows that explicitly integrate environmental sustainability considerations into investment decisions" (Sachs et al., 2019). In the context of energy finance, this includes "green bonds," "sustainability-linked loans," "climate-aligned equity," and "blended finance" models that combine concessional public funds with private sector investment to reduce risks associated with investment in what are considered to be "higher-risk" markets (Bhattacharya et al., 2022).

Secondly, the "data center energy nexus" refers to the close relationship between digital infrastructure investment and electricity system planning (Avgerinou et al., 2017). While other industrial consumers of electricity have varied and unpredictable demand profiles, data centers operated by tech firms have unusually large and stable electricity demand profiles. Furthermore, data centers operated by tech firms have substantial influence over electricity procurement decisions and an explicit corporate commitment to sustainability that favors "green" energy sources. In this regard, tech firms like Google or Facebook represent unusual electricity consumers: large procurers of renewable energy and at the same time advocates of policies to ease renewable energy procurement.

A third conceptual thread is energy transition risks in emerging markets. For instance, Mazzucato and Semieniuk (2018) argue that private sector investors tend to prioritize risk-adjusted returns on investment and often overlook systemic benefits of energy transition. Emerging markets face additional risks associated with sovereign risk, currency risk, and regulatory risks, all of which are very relevant to the Mexican energy sector at present. In this regard, this study conceptualizes private and institutionalized green finance within a broader political economy framework that recognizes the critical role of the state in influencing investment conditions.

Theoretical Perspectives

The theoretical basis for this analysis is rooted in institutional economics, the political economy of energy governance, and corporate sustainability theories. From the institutional economics perspective, North's (1991) "rules of the game" approach to understanding how economies work provides insight into how changing regulations in Mexico's electricity markets create new investment conditions. For example, the constant tweaking of clean energy certificates and self-supply arrangements between 2019 and 2022 illustrates how unstable rules contribute to higher transaction costs for investors in renewable energy (Calderón et al., 2022).

Transition management is another perspective for understanding how energy markets evolve and is discussed in Rotmans and colleagues' (2001) and Geels' (2011) work. This perspective considers how niches (new players and technologies), sociotechnical regimes (the traditional players and technologies), and landscapes (macro-level forces) interact in shaping change in energy markets. For example, in Mexico's energy markets, AI-driven demand for data centers represents a niche effect that is challenging the traditional CFE-dominated sociotechnical regime by providing a credible and sizeable demand for renewable energy that CFE cannot supply in clean form.

Theory of corporate sustainability, based on Carroll (1991)'s pyramid and subsequent extensions, holds that firms have to balance economic, legal, ethical, and philanthropic demands. For tech companies with data centers in Mexico, this means balancing economic demands to reduce energy expenditures, legal demands under Mexican electricity laws, ethical demands to reach net-zero targets, and philanthropic demands to benefit host countries' sustainability. Torres-Reyna and Vásquez (2023) have shown that corporate renewable energy purchases are developing as a new form of corporate governance in Latin American electricity markets, with tech companies becoming de facto champions of electricity reform.

Under a climate finance approach, the concept of investment gap is key (UNCTAD, 2023). This is the idea that the investment required to scale up renewables to meet climate targets is larger than actual investments, which is due to market failures, institutional failures, and systemic failures. For Mexico, this investment gap is estimated to be between USD 15 billion and USD 30 billion annually until 2030, depending on assumptions (ClimateWorks Foundation, 2023).

Empirical Literature on Renewable Energy Finance in México

The body of empirical literature on renewable energy finance in Mexico is vast and growing, reflecting both the importance of Mexico in Latin American energy markets and the policy volatility of the last few years. Elizondo Azuela et al. (2022) provide a comprehensive overview of the Mexican journey to energy transition, detailing the systematic reversal of the 2013-2018 Energy Reform under López Obrador and assessing its effects. The authors calculate that renewables auctions cancelled or postponed between 2019 and 2022 resulted in USD 10 billion in lost investment and 8 GW in lost clean generation capacity.

Studies focused more closely on market dynamics by Wood Mackenzie (2023) and BloombergNEF (2024) identify nearshoring-driven demand from data centers as the primary driver of renewable energy procurement in Mexico in the short term. They identify power purchase agreements between tech companies and independent power producers as the primary financial mechanism for developing renewable projects under the current regime, with corporate PPAs acting in place of government-backed renewable energy auctions to act as a project finance mechanism.

Regarding data centers and energy demand, research is still in its infancy but is growing rapidly. According to the Mexican Association of Data Centers, "the data center infrastructure is set to grow by approximately 45% from 2021 to 2023, with hyperscale data center projects currently underway in Mexico City, Queretaro, and Monterrey" (MXDC, 2023). Data from IEA (2024) indicates that data centers in Mexico currently use 8 TWh of electricity, equivalent to 2.3% of national electricity demand. It is estimated that this demand may double or triple by 2030 if there is a high demand for AI services.

Research on green bonds and sustainable finance has exploded in Mexico after BBVA México launched the first corporate green bond in 2016. Currently, at the end of 2023, the accumulated issuance of green bonds is around USD 12 billion. Of this total, 60% is dedicated to the energy sector. Despite this positive growth, Villegas-Ortiz and Pérez-Campuzano (2022) highlight major issues of greenwashing. For instance, there is a lack of standardization regarding the verification of funds use. To solve this problem, the Mexican Taxonomy of Sustainable Finance was created in 2023 to establish a set of standardized definitions of what is considered "green" activity.

Investigations into the role of development finance institutions in shaping the renewable energy market in Mexico have also been made. Gallagher and Yuan (2017) examine the influence of China’s development banks in Latin American renewable energy projects, while Romero et al. (2022) evaluate the influence of IDB and World Bank Group development finance in shaping the Mexican renewable energy market. The common conclusion drawn by all studies is that MDBs are effective in risk mitigation strategies but not in funding projects directly.

Empirical literature on AI energy demand

Since Strubell et al. (2019) first estimated that a single large transformer model's training could consume as much carbon as five cars produce in their lifetime, researchers have refined their studies to include inference-based models, which are responsible for most of the in-use AI system's energy demand (Patterson et al., 2021). The IEA (2024) projects that AI-related global electricity demand, which encompasses both training and inference, is projected to increase from 100 TWh in 2023 to between 300 and 500 TWh by 2026.

For Latin America, studies are still in their infancy. Rojo-Gutiérrez et al. (2024) examine data center location decisions by hyperscale data center operators in Mexico, showing that proximity to urban demand centers, fiber connectivity, cooling water availability, and grid reliability are primary location drivers. They also show that clean energy procurement capability is increasingly a critical requirement for data center operators, particularly for tech companies with sustainability reporting expectations. The study of Google's announced data center in Queretaro (2023) and Microsoft's investments in Mexico City (2024) highlights how clean energy demand is driving a significant share of the spatial distribution of renewable energy investments in Mexico.

METHODS

Research design. The research design of this paper is a mixed-methods design that combines a thorough examination of documents with a structured examination of existing data. It is a suitable design for this paper since it seeks to identify renewable energy financing needs linked to AI-powered data center growth in Mexico and determine the rules, institutions, and markets that facilitate or hinder linking renewable energy financing needs to clean power.

Data sources. Primary sources of data include various official sources in Mexico, such as Secretaría de Energía (SENER), Comisión Reguladora de Energía (CRE), Comisión Nacional para el Uso Eficiente de la Energía (CONUEE), and Secretaría de Hacienda y Crédito Público (SHCP). Secondary sources of data include various reports from Wood Mackenzie, (2023) BloombergNEF, (2024) and International Renewable Energy Agency (IRENA), academic sources in Scopus, Web of Science, Google Scholar, and various reports from various development finance institutions such as IDB, World Bank Group, and NADB.

For AI and data center demand, the study relies on reports by the International Energy Agency (IEA), the Mexican Association of Data Centers (MXDC), (2023) and corporate sustainability reports by Google, Microsoft, Amazon Web Services, and Meta for their data centers in Mexico. Data on green bonds and sustainable finance instruments in Mexico is sourced from the Climate Bonds Initiative (CBI) and Green Finance Platform.

Analytical framework. The analysis is structured in three steps. First is regulatory mapping to identify the current regulatory framework for renewable energy investments and clean energy procurements in Mexico, with particular emphasis on relevant tools for data centers. Second is a review of the financing landscape to define the size, structure, and composition of green and renewable energy finance into Mexico, including key modalities and actors. Finally, scenario analysis is used to synthesize insights from regulatory and finance analysis to assess when AI-driven data center demand may serve as a potential catalyst to support acceleration of renewable energy investments.

There are also several methodological caveats. The authors are dependent on publicly available documentary evidence and therefore do not have access to private agreements between parties and financial arrangements. Due to the rapid development of AI tech and data centers, there is considerable uncertainty in any hard numbers. The cross-section approach does not allow us to see how changes in regulations and investments are interrelated.

ANALYSIS OF RESULTS

Regulatory Environment for Renewable Energy Finance. Mexico's renewable energy finance regulatory environment has undergone significant changes between 2019 and 2024, which have had significant impacts on renewable energy finance. The cornerstone of Mexico's 2013-2018 Energy Reform, the competitive wholesale electricity market (Mercado Eléctrico Mayorista, MEM), has notably been constrained by successive orders and legislative changes to regulations, which have privileged CFE dispatch, suspended auctions for clean energy certificates (CELs), and tightened self-supply contracts.

Under the Sheinbaum administration, there are signs of recalibration in regulations. For instance, in the National Energy Transition Strategy 2024-2030 (SENER, 2024), it is proposed that 40% of electricity generation should come from renewable sources by 2030, compared to about 27% in 2023. Solar and wind are identified as key renewable sources, with large-scale generation to be promoted via a mix of investment via CFE investment programs, private investment via CFE partnership models, and corporate procurement by large industrial consumers, such as data centers. The CEL market is being reactivated, although the methodology for calculating the clean generation attribute is currently under review in the electricity regulations arena, as of early 2025.

From a data center operator's point of view, there are opportunities and barriers in the current and evolving electricity regulations. For instance, under the Gran Consumidor category, large industrial consumers with demand in excess of 1 MW are allowed to negotiate bilateral supply contracts with qualified suppliers. This would include a PPA with renewable generators. One of the significant barriers to connecting renewable generation located in remote areas of northern Mexico to data center demand in central urban hubs is a significant investment in transmission infrastructure. In 2024, it was estimated that a sum of about USD 8 billion would be required to expand transmission infrastructure from 2024 to 2030 to accommodate renewable generation additions.

A major regulatory change of particular interest to data center operators is the proposed revision of the Official Standard NOM-ENER-007, which establishes requirements for energy efficiency in data centers and server rooms. Under the 2024 draft of the revision, new data center installations would be required to comply with minimum mandatory requirements for Power Usage Effectiveness (PUE) of 1.5 or better. This is a stricter requirement than the average data center efficiency ratings in Mexico, where the average data center operates at between 1.6 and 2.1 (CONUEE, 2024). This would encourage data center operators to adopt more efficient cooling and power distribution systems, thereby reducing their demand for electricity and hence easing some of the strain on renewable energy procurement. This would also bring data center energy efficiency practices in Mexico in line with global best practices, such as those employed in the EU and the USA, and would therefore facilitate the operations of multinational tech companies looking to establish standardized data center designs globally.

Power Purchase Agreements as the Main Financing Mechanism. Since the government auctions are not working effectively, the use of bilateral corporate PPAs has been the de facto first choice for financing renewable energy projects in Mexico. A PPA is an agreement between a renewable energy generator and an electricity user to define the terms of clean energy supply. A project's financial viability depends upon the creditworthiness of the off-taker of the PPA and the structural bankability of the contract (Wood Mackenzie, 2023).

Tech companies, which are data center hosts in Mexico, are identified to be attractive counterparties for PPAs, owing to their high creditworthiness, high electricity demand, and corporate commitment to 100% renewable energy sourcing, such as RE100. In 2023, Google announced its data center project in Querétaro, Mexico, amounting to 300 MW, along with solar and wind PPAs, to build multiple renewable energy projects in Sonora and Oaxaca (Rojo-Gutiérrez et al., 2024). Similarly, Microsoft's planned data center investments in the Mexico City metropolitan area are designed to secure solar energy via PPA contracts for solar projects in Aguascalientes and Jalisco (Microsoft, 2024).

The method of financing renewable sources of energy in Mexico, typically done via corporate PPAs, involves non-recourse project finance provided by banks and equity provided by renewable energy specialists. In this regard, BBVA México, Banorte, and Santander México have been the most active commercial bank lenders to renewable energy projects in Mexico. Multilateral institutions like IDB and IFC have also filled gaps in tenors and first-loss guarantees to help sustain these projects in environments that are typically tougher (IDB, 2023).

Green Bond Market Development. Mexico's green bond market has witnessed significant growth since the first sovereign green bond issue in 2020, which is considered one of the first sovereign bonds in Latin America. At present, total issuances in the Mexican green bond market stand at about 12 billion US dollars as of 2023 (Climate Bonds Initiative, 2024). The composition of these issuances reflects not only the significant financing gaps and limitations of the capital markets in Mexico but also their potential. At present, about 60 percent of these issuances are from the energy sector, followed by 20 percent from the real estate sector (green buildings) and 12 percent from transportation. Although still in their nascent stages, data center bonds are also a component of the green bond space in Mexico, with the 'Mexico Taxonomy for Sustainable Finance' (SHCP, 2023) specifically referencing high-efficiency data centers.

A few structural constraints exist in the Mexican green bond market, which impact the potential of the market to be scaled up for the financing of renewable energy. These include the relatively smaller demand for long-term energy debt compared to the global players tapped for the dollar-denominated international issues, the risks of currencies, and the reporting and verification processes, which, despite the new taxonomy, are not as robust as those in more developed markets such as Europe (Villegas-Ortiz & Pérez-Campuzano, 2022).

Despite the structural constraints, there are some bond issuances that are particularly relevant to the AI energy demand. For instance, the USD 500 million issuance of the development bank, Nacional Financiera (Nafin), in 2023, which targeted transmission upgrades, addresses the key challenge of the transmission bottleneck between the centers of demand and the renewable energy supply.

The IDB Lab has been assisting in the structuring of data center sustainability-linked loans, where the interest rate is linked to verifiable green performance metrics such as RE share, PUE, and WUE (IDB Lab, 2024).

Blended Finance and Development Finance Institutions. The concept of blended finance, or the targeted use of development finance to mobilize greater amounts of private finance for sustainable development, has been popularized by several actors involved in the Mexican market. Essentially, the concept of blended finance works by having governments or development finance institutions provide riskier capital tranches or first-loss risk to shift the risk profile of renewable energy investments to an attractive risk profile for commercial investors, thereby mobilizing capital that would otherwise not be invested (OECD, 2022).

In the case of the renewable energy market in Mexico, several actors have been involved in blended finance. NADB has mobilized USD 600 million for renewable energy and energy efficiency financing in the border region up to 2023, focusing strongly on solar energy for data center clients in the Monterrey-Saltillo data center corridor (NADB, 2023). The World Bank, via its IFC division, has developed a partial credit guarantee facility of up to USD 200 million for renewable energy financing in Mexico, allowing banks to extend tenors for renewable energy project debt beyond what would normally be commercially viable (IFC, 2024).

IDB Invest has been particularly active in the market, having delivered several direct equity and quasi-equity investments and blended finance facilities for renewable energy investments. Notable deals include the development of a facility for solar development in the states of Sonora and Chihuahua, targeting corporate off-takers such as data center clients via corporate PPAs, and the provision of technical assistance grants to CENACE for grid modernization studies to accommodate variable renewable energy (IDB Invest, 2023). Other actors, such as Germany-based DEG and France-based Proparco, have been involved in syndicated project financings for renewable energy investments in Mexico, tapping into the sustainability ecosystem of Europe to fund renewable energy investments in emerging markets.

Financing Gaps and Structural Barriers. Despite recent positive trends, there is indeed a financing gap. The best available data on this is from ClimateWorks Foundation (2023), developed with the Mexican Center for Climate and Environmental Law (CEMDA), who calculate that México is set to face an investment gap of USD 20–25 billion annually in renewable energy through 2030, compared to its current level of USD 5–6 billion annually. While part of this is down to thin financing, it is also affected by how regulatory uncertainty affects investment decisions.

If we focus on data centers, we find that there are additional structural barriers to investment that increase the investment gap. For example, there is a very tangible "last mile" problem of providing reliable electricity to data centers from renewable sources, especially when serving the Mexico City metropolitan area, where the majority of data center capacity is concentrated and where renewable energy procurement is undermined by the difficulty of providing reliable electricity to data centers. There is also an issue with land use. For example, in the wind-rich Isthmus of Tehuantepec region of Oaxaca, where there is great potential for wind farms, there has been an issue with indigenous consultation requirements that have slowed down data center projects (Carruthers, 2023).

Water scarcity is an additional layer of complexity to data center investment. Data centers require large amounts of water for cooling, and regions of México with the highest renewable energy potential – northern Sonora, Chihuahua, and Baja California – are also water-scarce regions. Addressing this complex set of issues – data center water demand and agricultural or municipal water demand – is an important ESG risk issue that requires not only technical solutions such as closed-loop water systems or drought-resistant landscaping but also coordination between energy regulators and water regulators who currently operate in separate policy bubbles.

Currency and macro risks also introduce another level of structural barriers to renewable finance in Mexico. In most renewable finance transactions in Mexico, dollars are used to finance the project and purchase technology, and then the sale of electricity to CFE or end-consumers is denominated in pesos. This creates a hedge requirement and thus increases finance costs. In 2023 and 2024, Mexico's peso depreciation due to increasing political uncertainty increased the costs of debt repayment in renewable energy finance by 8 to 12 percent, thus offsetting the benefits of declining solar panel costs (BloombergNEF, 2024). Developing a local-currency-denominated green bond, secured and actively promoted by multilateral guarantees and

Nafin and Banobras, is a key area of opportunity to develop a more robust renewable finance ecosystem in Mexico.

FINDINGS

Seven key findings capture the current state of renewable finance in Mexico driven by AI and data centers.

Finding 1: Real, Faster-Than-Expected Demand. Renewable demand in Mexico driven by data centers is growing faster than previously anticipated. MXDC (2023) estimates that announced data center capacity additions in 2024 to 2027 are 2,200 MW in total across all market segments, compared to 900 MW of installed capacity in 2023. This represents a near-three-fold increase in capacity additions in four years, or 15 to 18 TWh of electricity demand growth in 2027, equivalent to the electricity generated by three to four large combined cycle gas plants or five to six large 500 MW-sized utility-scale solar plants.

Finding 2: Corporate PPAs Fill in the Policy Gap. Renewable auctions are not being held in Mexico, and corporate PPAs are driving renewable finance in Mexico. Tech companies are emerging as the most creditworthy and significant corporate off takers of renewable PPAs due to favorable business and economics of doing business in Mexico. The announced corporate PPA pipeline in 2024 to 2026 is 3,500 MW of solar and wind capacity, or two years of all prior auction activity in the prior market design (BloombergNEF, 2024).

Finding 3: Transmission Is The Critical Bottleneck. The primary barrier to investment in renewable energy in México is transmission. This is a common point raised by both developers and corporate offtakers. The gap between where there is a surplus of renewables (northern and southern México) and where data center demand is highest (Mexico City, Queretaro, and Monterrey) requires significant investment in transmission to realize commercial synergies. CENACE's investment plan for 2024 highlights 47 transmission projects worth USD 8.1 billion for 2024-2030. As of early 2025, only USD 2.3 billion of that amount has been financed (CENACE, 2024).

Finding 4: The Green Bond Market Is Growing But Not Scaled Enough. The green bond market in México is one of the more developed in Latin America but still not at a scale to meet the investment gap created by AI-driven data centers. The market is issuing around USD 3-4 billion annually, of which USD 2 billion is for projects in the energy sector. This is still not sufficient to meet the estimated investment gap of USD 20-25 billion annually. While structural improvements in a taxonomy for sustainability, reporting, and peso-denominated instruments are critical to a well-functioning market, they are not sufficient to meet the investment gap.

Finding 5: Blended Finance Is Effective but Not Yet Widely Deployed. Interventions by development finance institutions have been successful in mobilizing private capital for the renewable energy sector of Mexico, with the mobilized amount of private capital for every dollar of public capital typically in the range of 2:1 to 5:1 for well-structured blended facilities. However, the total MDB financing amounts to only a small fraction of the total financing required for the renewable energy sector of México. This requires not only more MDB capital but also better coordination between bilateral and multilateral lenders to avoid duplication.

Finding 6: Regulatory Uncertainty Remains the Main Risk. Renewable energy investors and developers in México consistently rank regulatory uncertainty as their biggest risk, ahead of other project risks such as resource, construction, or financing risk (Wood Mackenzie, 2023). The policy reversals between 2019 and

2022 have created an institutional memory effect, which still affects risk perceptions, even though the new administration has taken steps to improve the regulatory environment.

Finding 7: Water-Energy Nexus Requires Integrated Planning. A water-energy nexus issue is arising in northern México, where water-intensive data centers are located in close proximity to solar and wind parks in a water-scarce environment. Existing energy strategies fail to account for this water-energy nexus issue. What is required is water-energy nexus planning, and this is a key institutional capacity that SENER, CONAGUA, and CENACE are required to develop together. The absence of institutional coordination is a threat to investment and also an opportunity for DFI's to provide technical assistance.

The water-energy nexus issue in México is underscored by CONAGUA's estimates in early 2024 that data centers in the Sonora-Chihuahua corridor could require 80 to 150 million cubic meters of water annually to cool data centers by 2030—a quantity of water equivalent to a half-million-person city's water usage. Modern data centers are moving to adiabatic and closed-loop cooling systems that significantly reduce water usage compared to older data centers that rely on water towers to cool computers. Adiabatic and closed-loop cooling require significant capital investment in data centers and are not yet mandated in current building and environmental codes in México. Existing environmental and building codes in México are not yet requiring adiabatic and closed-loop cooling in data centers, although ESG reporting is changing with TNFD's addition of water metrics to investment decisions, which will require future regulatory alignment even when current codes are not requiring water usage restrictions (TNFD, 2023).

DISCUSSION

This study points to the tensions and opportunities at the heart of México's energy transition in an era of AI-driven change. At its most fundamental level, it points to the tensions that highlight the structural challenge of converting private investment in tech infrastructure to support upgrades to public infrastructure in an era of uncertainty.

The emergence of tech giants as the principal consumers of renewable energy in México represents a major shift with unclear implications. On one level, it represents a major boost to demand for financing of projects in renewables not dependent on stable government policy support, given that corporate sustainability goals provide a stable level of demand even as policy continues to evolve. On another level, it represents a shift that potentially excludes other players from the renewables space as demand is concentrated among a few large players.

This is part of broader debates about energy transition in emerging markets, understood through the prism of political economy. If we understand this through Geels (2011)' transition management approach, data centers are clearly niche actors attempting to transition Mexico's energy system away from the status quo of CFE dominance through their pursuit of renewable energy. Yet again, this is only being achieved through market mechanisms and not through the more traditional state-led approach to energy transition in developing markets (Chang, 2019). What we see here is a hybrid transition, where market drivers are attempting to transition the market, yet state-level institutions are still playing catch-up. The end result is a seeming paradox whereby Mexico attracts large-scale renewable energy investments from international tech firms yet still struggles to keep the lights on for ordinary citizens.

This financing gap is revealing of a significant flaw in Mexico's current renewable finance system. The financial tools best suited to large-scale renewable investments are dominated by sophisticated international actors. The tools and financial vehicles available are not suited to meeting the needs of domestic-level infrastructure upgrades, smaller-scale renewable investments, and community-level energy initiatives. This, therefore, suggests that policy interventions aiming to strengthen access to clean energy finance, improving domestic financial markets, changing the remit of development banks, and extending mandatory clean energy procurement to more industrial users are necessary accompaniments to the market-driven transition already underway.

This water-energy nexus creates another dimension which has not been considered until now in renewable energy finance in Latin America. In water-scarce regions, data center cooling requirements become an environmental externality which, if not managed, can give rise to social conflicts which can jeopardize renewable project development and data center operations. The best example is Baja California in 2023, where data center water usage was allegedly diverting irrigation rights from farmers (CONAGUA, 2024). Water risk is increasingly being integrated into ESG analyses, and without effective water and energy policy and regulation, some of the high-value renewable sites in Mexico could progressively become unfinanceable.

Development finance institutions have emerged as key actors which have not yet realized their full potential. Development finance institutions, such as IDB, IFC, and NADB, have demonstrated their ability to mobilize private capital in an environment characterized by high levels of regulatory uncertainty through their creative and innovative financial tools, including partial credit guarantees, first-loss tranches, and technical assistance grants. However, DFI funding to Mexican renewable energy is still limited compared to the scale of need. For DFI finance to have more impact, institutional changes are necessary, including faster project approval processes and more flexible financial tools, and more engagement with local capital markets, including AFORES, which have over USD 200 billion under management but only allocate a minuscule portion to renewable energy.

Mexico’s green bond market is similar to those of other emerging markets and has similar strengths and weaknesses. While there has been significant growth in green bond issuance in Mexico, reaching USD 12 billion in total issuance, placing it in the top three in Latin America, there are still cause for concern regarding quality. For example, bank-dominated issuance is predominant, peso-denominated issues are rare, and verification of use of proceeds is applied unevenly. The Mexican Sustainability Taxonomy represents an important step forward in institutional development and can have significant positive impacts if implementation is strong, including verification through third parties and consequences under law.

Looking forward, the analysis presented in the study outlines three possible avenues for the future trajectory of AI-driven data center demand for renewable energy finance in Mexico. In the best possible scenario, the Mexican government, with President Sheinbaum at the helm, is able to implement the necessary regulatory reforms to revive the wholesale electricity market, speed up the permitting process for infrastructure construction, and increase the procurement targets for clean energy. Meanwhile, the development finance sector is also able to increase its investments to the point that local capital is also mobilized. In such a scenario, the demand for renewable energy finance for data centers has the potential to act as the catalyst for the energy transition process. The guarantee provided by tech companies through power purchase agreements has the potential to attract infrastructure finance on a grand scale.

In the most likely scenario, there are incremental improvements to the regulatory environment, reducing some of the risks faced by investors. However, investors are still cautious and do not regain full confidence. Investments are still made in data center renewables, but they are isolated from the rest of the energy transition process and do not spill over to other industrial sectors or to increasing energy access for households.

In the worst possible scenario, the regulatory environment remains volatile, and the problems faced by investors are still unresolved. In such a scenario, the tech companies may decide to look for alternative locations for their data centers in other Latin American countries such as Chile, Brazil, and Colombia, which are more favorable for renewable energy and also have more stable regulations and better water resources.

Another important factor is the distribution of the costs and benefits of the AI-driven renewable energy sector. The states with the highest potential for renewable energy are also the most socioeconomically disadvantaged, such as Oaxaca, Sonora, and Chihuahua, and are inhabited by indigenous communities whose land and consultation rights are often violated. The Social Impact Assessments conducted under the Hydrocarbons Regulation Law (LREH) and the General Law on Ecological Equilibrium are supposed to act as checks on such violations. However, there are examples such as the wind farms located on the Isthmus region of Oaxaca, which faced community opposition and were either cancelled or delayed (Carruthers, 2023).

Technology companies with ESG pledges on indigenous rights and supply chain due diligence, in line with the UN Guiding Principles on Business and Human Rights, are facing growing pressure from investors and civil society to uphold these pledges in their RE supply chains in Mexico, which presents governance problems the current regulatory framework isn't designed to address.

We should also consider the employment and economic development aspect of the data center expansion driven by AI. These data centers don't directly employ thousands, usually ranging from 200 to 500 permanent jobs, but their impact on the local supply chain and the wider labor market can be significant. Research on Google's data center in Queretaro, Mexico, found approximately 4,500 indirect jobs created during the construction phase and approximately 2,200 permanent indirect jobs during operations (ProMéxico, 2023). However, the labor demand for data centers requires specific and technical skills, such as electrical engineers, IT specialists, and facilities managers, which means the employment benefit isn't spread evenly across the local labor market unless targeted workforce development programs are put in place. Linking the economic development impact of data center investment with technical training programs on renewable energy, which could be co-funded with technology companies and development banks, could maximize the economic development impact of AI infrastructure on the host communities.

CONCLUSIONS

This analysis examines the role and impact of the financing requirements and activities related to AI and data center demand for green and RE energy in Mexico, and how these activities and requirements fit into the existing literature and scholarship on the subject. Through documentary analysis of the relevant data, the main conclusion drawn is that Mexico is at a critical moment in its energy transition, and AI data center investment could be the catalyst for the development of RE energy or a windfall for RE energy development that fails to meet the challenge of decarbonization.

The examination of the financing space in Mexico has indicated that, despite the availability of a wide range of financing instruments and actors in the renewable energy space, such as corporate PPAs, the emergence of the green bond market, facilities from DFI, and the development of the sustainability taxonomy, these financing solutions, when combined, are not substantial and integrated enough to address the financing requirements created by the rise of AI-demand and the need for an instant energy transition. The annual financing gap of USD 20-25 billion is ten times the current flow of sustainable finance into the energy space.

Regulation, which has been moving forward with the current administration, still has the vestiges of the 2018-2024 period, which negatively impact investor sentiment and the cost of capital for renewable energy investments. This will take time, and trust will need to be regained with consistent and clear policy and regulatory actions, and the development of investor protection mechanisms, which cannot be achieved in the short term.

Based on the analysis, the report makes the following policy recommendations: First, the Mexican government should accelerate the revival and reform of the CEL market, bringing data center operators and other large technology user groups into the fold as mandatory participants with clear obligations to buy clean energy certificates. Second, SENER and CENACE should design a specific planning framework for data centers and digital infrastructure, which would link the renewable energy buy with the transmission development planning, to ensure data center development does not put additional strains on the grid. Third, the SHCP and Banco de Mexico should establish regulatory incentives for AFORES to invest at least a certain percentage of assets under management in certified renewable energy infrastructure bonds, building on the existing domestic institutional investor base for green finance. Fourth, development finance institutions in Mexico should work together to establish a joint blended finance facility of at least USD 5 billion for 2025-2030, targeting transmission infrastructure, distributed renewables for industrial consumers, and community energy in areas targeted for large-scale development of renewables. Fifth, technology companies with data centers in Mexico should set and announce water usage efficiency targets alongside their RE buy obligations, and work proactively with CONAGUA and water basin authorities to establish water stewardship strategies to address water stress in the region.

A sixth set of recommendations involves the governance of the renewable energy supply chain in socially sensitive communities. Tech companies, development financial institutions, and the Mexican government must work together to establish a standardized Indigenous and Community Engagement Protocol for the supply of renewable energy to data center operations. This must be compatible with the United Nations Guiding Principles on Business and Human Rights and the ILO Convention 169. This must include free, prior, and informed consent, revenue sharing with the community, and monitoring.

A seventh set of recommendations involves the skills and labor required for the data centers and the renewable energy supply chain. The Secretaría de Educación Pública (SEP) and the Secretaría del Trabajo (STPS) must, in consultation with technology companies and renewable energy companies, establish a national curriculum for the training of technicians in the operation of renewable energy technology and data center operations. This would be done through the existing CONALEP and CBTIS vocational training network in the states with the highest concentrations of data center and renewable energy operations.

This study contributes to the existing literature on AI, digital infrastructure, and sustainable energy financing in the context of developing economies. This is the first analysis of the Mexican case in the context of an integrated regulatory, financial, and institutional framework. Future work could include comparative analysis with other Latin American countries, the development of models on the link between regulatory quality and the supply of renewable energy in the region, the impact of technology on energy access and equity in Mexico, and the efficiency gains of AI technology on the energy intensity of AI workloads as a moderating factor on energy demand forecasts. Future work could include longitudinal analysis on the impact of the Sheinbaum administration’s energy transition strategy on the energy sector from 2025 to 2030.

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