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Carbon Lock-In and Contradictions—Applied Guide to Academic Teaching of Mexico's Energy Transition

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Abstract: The energy sector plays an important role in Mexico's development trajectory. Mexico makes an interesting case study because it shows how difficult it is to reduce fossil energy dependence despite geographic and climatic conditions that favour renewable energy deployment and use. Resolving path dependencies and the related carbon lock-in are key to Mexico's sustainable energy transition. This applied teaching guide contemplates the use of a case-illustration typology to identify and discuss how the politics about carbon lock-in affects Mexico's sustainable energy transition. This methodology is an innovative endeavour that aims to apply the case study in classrooms with the intention to encourage discussions and solution-oriented approaches when tangible actions are identified by the educator and students. This methodology elevates the case study to a "living" case study that leads to recommended actions. The applied teaching guide allows educators, who are mostly researchers, to reflect on how Mexico's case study could be explained not only to promote the students' understanding of the challenges, but also to provide educators/researchers the skills on how to effectively disseminate knowledge. Mexico's carbon lock-in involves oil and oil-run power plants that are costly to build but relatively inexpensive to operate. To conclude, this case study identifies potential entry points for transitioning towards sustainable energy in Mexico—resources that can promote the use of clean energy despite carbon lock-in. For example, focusing on electrification—particularly the carbon-intensive sectors—can help Mexico transit towards sustainable energy despite institutional constraints. Complementing this case study is a teaching guide with recommendations for using Mexico's energy transition in courses on sustainability. By understanding how to explain the case study, the educator/researcher can better structure the complexity of the case study. This approach introduces a "learning activation framework" to identify emerging opportunities that can advance sustainable energy transitions in different cases of carbon lock-in. The framework also gives students a chance to help dismantle or cope with carbon lock-ins. Mexico's energy transition makes a valuable teaching example because its energy transition is part of a broader developmental goal. This teaching guide's systematic approach can maximise the students' learning experience.

Keywords: sustainable energy; renewable energies; energy transitions; transformation to sustainability; policy analysis; grass-root movements; indigenous communities

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1. Introduction: Mexico's Modernisation

> *"Electric power is everywhere present in unlimited quantities and can drive the world's machinery without the need of coal, oil, or any other fuel."* —Nikola Tesla.

Like most developing countries, Mexico must undergo multiple transitions on its developmental trajectory. One is political transition: The country is searching for ways to move from one-party politics towards inclusive and concordant democracy [1,2]. Since becoming independent from Spain in 1810, Mexico has seemed trapped in what Lauren Herget [1] calls an "internal tug-of-war between cosmopolitan modernity and rustic indigenousness." For decades, Mexican presidents have pursued political, social, and environmental sector reforms intended to modernise the country [3–5]. However, many of these reforms have been seen as further exacerbating social divisions or inequalities [6,7]. Furthermore, irrespective of political affiliation, all governments have preferred "*centre-periphery*" policymaking [8]. Policymakers seem to not recognise that effective policies require stakeholder consultation and deliberative processes involving the larger Mexican society [9,10].

Mexico's modernisation is a complex process that requires multiple coherent transitions and paradigm shifts [5,11]. The country must reach multiple, often contradictory, goals. For example, upgrading infrastructure while also making fiscal reforms can further increase the income gap between urban and rural regions [12], while improving Mexico's tax system invigorates its already inefficient "low-trust bureaucracy" [13]. Another major contradiction is that deploying clean, green energy creates new social injustices for indigenous communities [14]. The lack of substantial mechanisms for bottom-up participative and deliberation processes reinforces the contradictions. On one hand, this is because stakeholders, particularly representatives of marginalised communities, tend to channel their energy into participating in street protests rather than sharing their expert knowledge to help develop tangible solutions [15]. Their contributions appear merely rhetorical, which motivates policymakers to continue to exclude them [16]. On the other hand, policymakers often consider civil society groups unhelpful—particularly when decisions must be taken quickly. Thus, Alberto Olvera [7] contends, civil society is perceived as "unstable" and unfit for policy consultation. This "legitimacy-efficiency dilemma" is a huge impediment to Mexico's modernisation. Inefficient policy is likely to miss its target, whereas even the most efficient policy will be seen as intrusive if it lacks legitimacy. Another example of legitimacy vs. efficiency is Mexico's energy transition, in which the central government pursues its energy policy goals with minimal participation by non-state actors [17,18].

The energy sector plays an important role in Mexico's development trajectory because it can be both a driver and a barrier to modernisation. Talk about increasing energy security has further legitimised discourses and actors advocating more fossil-fuel extraction and use [19]. Mexico's abundant fossil and non-fossil energy sources allow it to not only cover its own energy demand but also to generate income through international trade. Mexico is one of the world's largest producers of petroleum and other liquid fuels [20]. In 2019, around 51 per cent of Mexican crude oil exports supplied about 9 per cent of the US crude oil imports [20]. Crude oil largely drives Mexico's economy—creating carbon lock-in that makes transitioning to alternative energy more difficult and expensive. Maturing fields have caused Mexican oil production to decline since its peak in 2004, with production in 2019 only half that of 2004. Mexico has to decide if it wants to continue to depend on oil or shift to more diversified energies.

Mexico makes an interesting case study on transitioning towards sustainable energy. It shows how difficult it is to reduce fossil energy dependence despite geographic and climatic conditions that favour renewable energy deployment and use. Why can the country not benefit from its huge potential for solar and wind power? Resolving path dependencies and the related carbon lock-in are key to Mexico's sustainable energy transition [21,22]. "Carbon lock-in" is an equilibrium in which certain carbon-intensive technological systems or practices persist over time, either "locking out" the potential for change or braking further movement towards low or zero carbon [23,24]. This equilibrium directly or indirectly hinders the deployment of low-carbon technologies, which either cost more upfront or cannot compete with the lower prices of high-carbon technologies. Examples of carbon lock-ins include technologies that may be costly to build, require much planning and necessitate state subsidies. Over time, they reinforce political, market, and social factors—

tax exemptions, infrastructure, research and development (R&D), and entrepreneurship—that inhibit flexibility and thwart efforts to move away from these technologies [24].

This case study aims to identify and discuss how carbon lock-in affects Mexico's sustainable energy transition. Carbon lock-in not only increases the costs of Mexico's climate mitigation strategies [25,26], but also reinforces existing social inequalities, for example, as a result of the resource curse [27,28]. Mexico's carbon lock-in involves oil and oil-run power plants that are costly to build but relatively inexpensive to operate. The whole world is hooked on burning fossil fuels, which in 2015 produced roughly 80 per cent of global energy [29]. Like many countries, large state subsidies for oil reduce funding available for renewables like wind or geothermal. Scant research on renewable energies due to lack of funding also inhibits public and private investment. The Mexican government plans to invest USD 83.5 billion in power generation between 2018 and 2032 [30]. However, its efforts to stop fuel shortages could also make renewable energy more viable. On 27 December 2018, President Andrés Manuel López Obrador declared war on *huachicol* (gasoline theft) [31]. However, the wish to improve Mexico's energy supply might induce policymakers to accept short-term inconveniences related to the deployment of renewable energies.

This case study identifies potential entry points for transitioning towards sustainable energy in Mexico—resources that can promote the use of clean energy despite carbon lock-in. For example, focusing on electrification—particularly of the carbon-intensive sectors—can help Mexico transition towards sustainable energy despite institutional constraints. Decarbonising its electricity sector might help Mexico move closer to its greenhouse gas (GHG) emission targets—for example, by complementing its electrification agenda with structural changes in energy-intensive sectors like transport and industry [32]. The decarbonisation of Mexico's electricity sector could be fostered through decentralisation and liberalisation, as well as through public and private investments [4,33]. Decarbonising electricity complements consumers' growing preference for clean and green energy, especially in urban areas [34]. However, the administration of President López Obrador is pushing for more state control over energy markets [35]. Mexico is an example of an energy transition driven by nationalistic policy, with limited diversification and societal or end-user participation [35,36]. Mexico's modernisation agenda helps explain the dynamics of its energy transition and the path dependencies limiting its scope and pace. It is necessary to get a brief idea of Mexico's current energy system—supply and demand—and the framework that serves as the blueprint for the government's energy transition plan, as well as examine the different types of carbon lock-in.

Complementing this case study is a teaching guide with recommendations for using Mexico's energy transition in courses on sustainability. It introduces a "learning activation framework" to help students reflect on the phenomena caused by carbon lock-in and apply their knowledge to specific contexts. The framework also uses a stakeholder mind map to help students understand the dynamics and complexity of joint decision-making processes. Since conflict thresholds exist in every sustainable energy transition, it is also necessary to understand negotiating and collaborative processes. The learning action framework teaches students to identify emerging opportunities and entry points that can advance sustainable energy transitions in different cases of carbon lock-in. Finally, the framework also gives students a chance to create "carbon lock-in blasters" to help dismantle or manage carbon lock-ins.

2. Mexico's Energy System: Data and Indicators

The United States of Mexico is a Central American country with a surface area of 1,964,375 km^2. Although Mexico is a G20 member, has the world's fifteenth largest economy by nominal GDP, and the eleventh largest by purchasing power parity (ppp), it is considered a "developing country" and ranked 74th on the Human Development Index [37]. Table 1 shows that 80.4 per cent of the population lives in congested urban areas. Urban planning is urgently needed to solve problems caused by traffic congestion, air pollution, high income inequality and food costs, as well as difficult logistics and mobility issues. Mexico's Gini coefficient of 45.4 puts it in the group of very unequal countries because it depends heavily on natural resource exports like oil [27,38]. Exacerbating all these challenges is Mexican migration, mostly to the United States. Its negative migration rate (−0.5 per 1000 people) robs the country of human capital needed for its development.

Table 1. Mexican energy statistics.

Characteristics	Mexico
Population (2019)	127,500,000
Size (km^2)	1,964,375 km^2
Urban population	80.4%
Gross national income (GNI) per capita (2019), Atlas method (current USD)	USD 9480
Gross domestic product (GDP) (2019)	USD 1.27 trillion
GDP per capita (2020)	USD 8069.1
Gini coefficient (2018)	45.4
Total power generation (2020)	317,200 GWh
Total power generation, by energy source (2020)	a. Fossil fuels: 80% (combined cycle, thermoelectric and coal-fired) b. Hydroelectric: 7% c. Wind: 5% d. Geothermal: 2% e. Photovoltaic/solar: 3%
Total power capacity (2020)	87.89 GW
Total power capacity, by energy source (2020)	a. Fossil fuels: 67% (combined cycle, thermoelectric and coal-fired) b. Hydroelectric: 15% c. Wind: 8% d. Geothermal: 1% e. Photovoltaic/solar: 7% f. Nuclear: 3%
Final energy consumption (2018)	2.34 PW
Renewable energies share of primary energy consumption (2019)	8.9%
Nuclear energy share in electricity generation mix (2020)	3.2%
Energy intensity per capita (MMBtu/person) (2018)	63.29
Energy independence (2021)	83%
Electricity production (TWh) (2019)	331 TWh
Installed capacity (TWh) (2019)	465 megawatts (MW)
Electricity consumption per capita (2019)	2200 kWh
Population's access to electricity (2018)	100%
People directly employed in the RE sector and top 2 RE technologies	97,900 (incl. 23,800 in wind energy and 23,300 solar)
CO2 emissions (metric tons per capita) (2020)	3.5
Emission reduction obligation/target	22% GHG (51% of black carbon)
Investment in clean energy (2019)	USD 4.3 billion
Total investment in power generation for 2018–2032 (2018)	USD 83.5 billion
R&D expenditure in 2020 (% of GDP)	0.3%
Net migration rate (per 1000 people) (2020)	−0.5

Sources: IEA, 2000; IRENA, 2021; WB, 2021a; Statista, 2020; BMWi, 2020; SENER, 2018; UNDP, 2020.

Mexico's energy supply exhibits significant contradictions. It depends on crude oil despite having abundant access to renewable energies. Mexico has the world's third largest solar potential, but in 2020, the share of solar energy in energy mix was relatively low—just 3 per cent of its total power generation or 7 per cent of total power capacity [39,40].

Mexico lags far behind other countries in deploying renewable sources to produce clean and green energy. More than 80 per cent of the country's energy production depends on hydrocarbons [20], which are mostly imported, thus jeopardising Mexico's energy sovereignty [41].

In 2019, according to the Secretaría de Energía [42], Mexico had 80 gigawatts (GW) of installed generation capacity, including fossil fuel (66%) and hydroelectricity (15%). Fossil resources provide 92 per cent of primary energy in Mexico. Figure 1 shows that in 2019 around 43 per cent of Mexico's primary energy came from oil, 42 from natural gas and 7 from coal. Hydroelectric plants contribute 3 per cent of total primary energy, renewables 4 and nuclear 1.

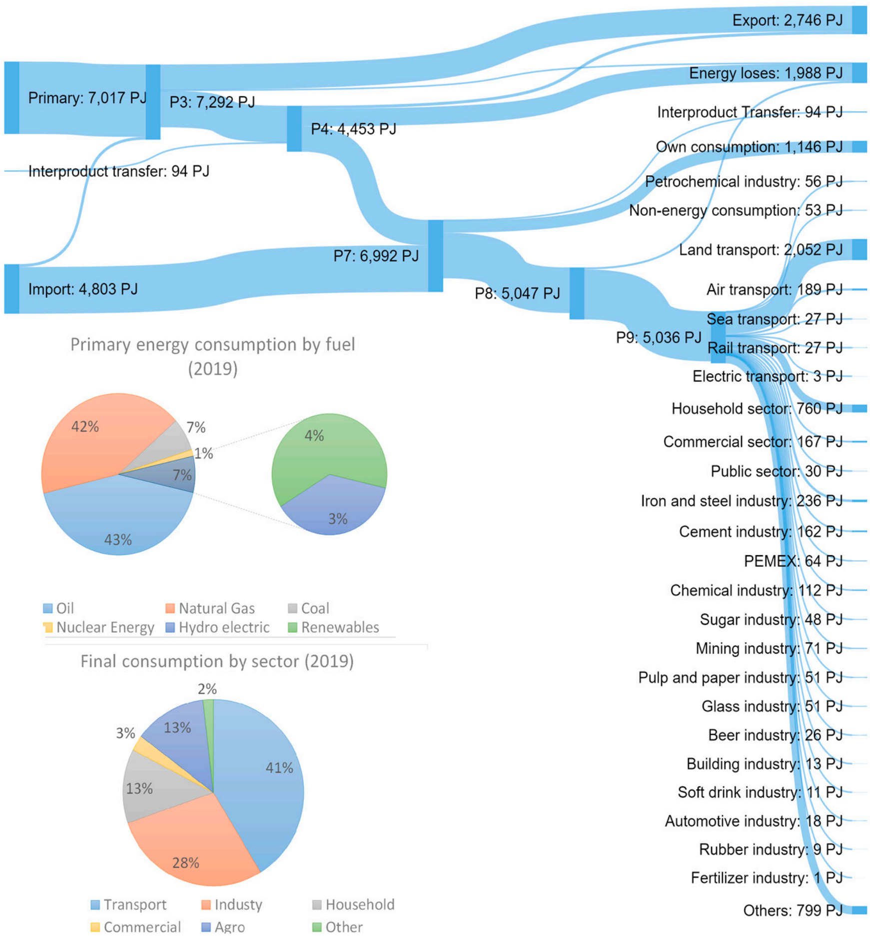
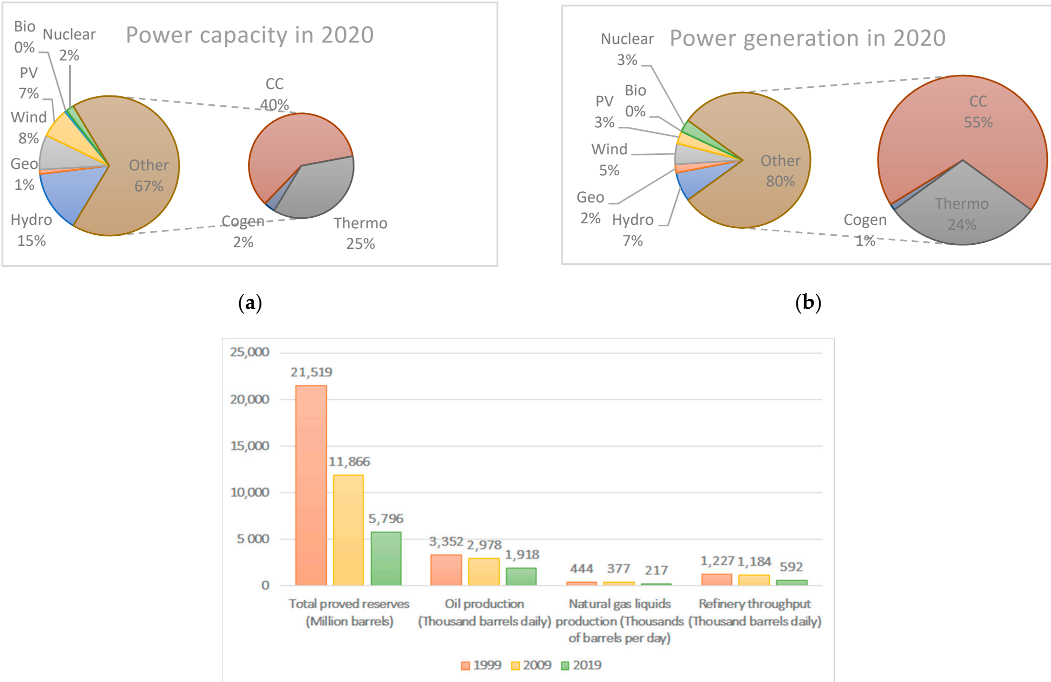


Figure 1. Mexico's energy flow and final consumption (2019). Source: Adapted by the authors using SENER data [40,42].

In 2020, Mexico's total power generation was 317,200 GWh [40,42], 80 per cent of which was generated by fossil fuels (combined cycle, thermoelectric, and coal-fired). Hydroelectric, wind, geothermal, and photovoltaic sources accounted for 7, 5, 2, and 3 per cent, respectively. That same year, Mexico's total power capacity was 87.89 GW—around 67 per cent from fossil fuels (combined cycle, thermoelectric and coal-fired), with hydroelectric, wind, geothermal, and photovoltaic capacities 15, 8, 1, and 7 per cent, respectively (Table 1, Figure 2). SENER [43,44] predicted that by the first quarter of 2021, 31 per cent of Mexico's installed capacity would come from renewable energies produced and consumed in Mexico. That share is increasing as more people use electricity generated by solar, wind, and geothermal sources [39]. In 2019, power plants using fossil fuels provided 73 per cent of Mexico's electricity [45]. Over the past decade, with natural gas becoming less expensive and more available, it has been increasingly used to generate electricity. Renewable energy provides just 10 per cent of the country's electricity [20].



(**a**) (**b**)

(**c**)

Figure 2. Mexico's power: (**a**) power capacity in 2020, (**b**) power generation in 2020, (**c**) proven oil reserves, oil production, natural gas liquids production, and refinery throughput, Source: Adapted by the authors using BP data [45].

Crude oil is Mexico's dominant energy supply source. In 2019, its total proved oil reserves were 5796 million barrels, 0.3 per cent of the world's total. The ratio of proved reserves/oil production (R/P) is 8.3. However, oil production has fallen by an average 4.6 per cent annually due to maturing oil fields and delayed investments in new fields. Oil consumption decreased from 92.7 in 2007 to 74.9 Mt in 2019. Transportation represents around 61 per cent of demand, followed by power plants (12%) and industry (11%) [46].

This brief overview of Mexico's energy system shows that it can achieve its modernisation goals through domestic energy sources. Mexico's demographic and economic conditions are also generally favourable for transitioning towards sustainable energy. To make the most of its potential, however, Mexico must escape carbon lock-in.

3. Carbon Lock-In Hinders Mexico's Sustainable Energy Transition

Many developing countries aspire to develop sustainably [47,48]. The SDGs can provide the roadmap for multiple transitions [10,49]. However, path dependencies and related carbon lock-ins not only destroy political will but also increase the costs of change [50,51]. It is also argued that sustainable energy transitions should accept fossil-based technologies in the name of convenience [52]. However, being receptive to fossil energy technologies could be a euphemism for "being resigned." This should not be allowed to "kill the argument" but instead serve as an invitation for students to assess the direct and indirect costs and benefits of both fossil and renewable energy sources.

The discussion should focus on how oil and gas companies are responding: looking at where they do business and how they are rethinking their business models in a decarbonising world [53]. Fossil fuels play an important role in energy transitions, particularly in developing countries. As Scott Foster and David Elzinga argue [54], the engagement of the broadest possible group of stakeholders is needed to address the issue of sustainable energy. Ignoring the role played by fossil fuels guarantees negative economic and social effects. For example, increased costs for private households may disproportionately burden the poor [55,56]. Foster and Elzinga contend that developing countries like Mexico and

Indonesia have large untapped fossil fuel resources that they can use to develop their economies and that before they have viable alternatives in place, pressure to abandon their resources is unhelpful.

Adding lock-ins to the discussion can be challenging, especially because it is conceptual and difficult to measure. The temporal component of lock-ins further complicates the discussion by blaming earlier generations who made convenient decisions at the expense of present and future generations [57,58]. For example, at the turn of the 20th century there were breakthroughs in electric vehicle technologies in Hungary, the Netherlands, Germany, and the United States [59]. At that time, costs for petrol-driven and electric vehicles were comparable. However, after Ford was able to mass-produce Model Ts, making the car more affordable, and following the discovery of crude oil in Texas, the fate of electric cars was sealed because the latter could no longer compete on cost. The competitive advantage of fossil fuels was defined by technological innovation, particularly in mass production and by infrastructures that define demand [59]. Carbon lock-in sustains the competitive advantage of fossil fuels, while their environmental and societal costs are ignored.

Another problem is that it is difficult to quantify and attribute the costs of carbon lock-in [24,29], yet there are logical errors in the current conceptualisation. For example, ensuring energy security requires reducing a country's dependence on imported fossil energies [60]. However, the concept of energy security is influenced by the current geopolitical climate, and it is easy to manipulate the real costs of dependence [60]. Often the costs of dismantling carbon lock-ins are shown as the direct costs of transitioning to sustainable energy [61,62]: The costs of diversifying the energy supply are combined with the costs of promoting renewable energy, but the costs of importing fossil fuels are left out [63]. This misleading practice distorts the public debate about sustainable energy: Diversification is needed because of the dominance of fossil fuels [64]. Technologies like carbon capture and storage (CCS) that can reduce fossil-fuel emissions are conveniently defined as "climate protection measures" although they are actually reinforcing the dominance of fossil fuels [65].

The next sections discuss the different types of carbon lock-in that Mexico needs to address.

3.1. Governance and Institutional Lock-In

Current developments in Mexico show how institutional carbon lock-in can shape choices and limit the actions of government and state institutions, and how institutional choices sustain the competitive advantage of fossil-fuel technologies, inhibiting public and private investment in clean energy [24,66]. However, it should be emphasised that institutional lock-in is "an intended feature of institutional design, not an unintended by-product of systemic forces" [29]. Institutional lock-in is deliberate. The Mexican government is actively seeking to reinforce a status quo trajectory that favours its state-owned companies, "Petróleos Mexicanos" (PEMEX) and "Comisión Federal de Electricidad" (CFE). The Mexican president has claimed that the previous government had been "ruining" PEMEX and CFE by bringing more actors into the energy market and fostering shifts in the demand for renewable energies [67]. In fact, the new government intentionally sought to prevent a new type of institutional lock-in that favours renewables over fossil energy.

President López Obrador, who took power in 2018, began to revise Mexico's energy transition—most likely more motivated by politics than economics in light of the warnings about how his new law could have a "harmful ripple effect" on industries that had invested in clean energy, not to mention the potential loss of more than 17,000 jobs. His new administration may also have considered that the political cost of dismantling the structures that ensure the oil sector's competitive advantage was too high. Its new policies and course of action, such as revising the country's Electricity Act (Ley de la Industria Electrica), are perceived as an "equivocal threat" to efforts to make Mexico's policies for achieving energy security compatible with its emission reduction goals [34,68,69]. For example, under the reforms, the CFE is no longer obliged to buy renewable energy through auctions. Private clean-energy companies cannot compete with non-renewable energy companies. As a result, investment in renewables has dropped. CFE announced its intention to participate in the Clean Energy Certificates (CELs) market, lowering their price and discouraging development of new clean energy projects. During the COVID-19 pandemic, pre-operational testing of renewables was also halted [70]. Mexico's renewable capacity mainly comes from CFE hydroelectric plants, legacy contracts, or bilateral contracts between CFE and private companies signed before the energy reform, and installed capacity from long-term renewable energy auctions in 2015, 2016, and 2017 [71]. By late 2020, installed capacity was 30 per cent but the amount of renewable energy generated hovered around just 20 per cent [72]. Several local and international trade bodies and groups like the Global Wind Energy Council and Global Solar Council, as well as the International Renewable Energy Agency (IRENA), say that Mexico's new government is undoing years of progress on transitioning to clean energy resources [69].

A regulatory framework from 2013/2014 had been the basis for Mexico's energy transition [73]. However, because the 2013 energy reform had been executed from the top down with limited public consultation, there was minimal political resistance when President López Obrador undid Mexico's 2015 Energy Transition Law. In addition, PEMEX and CFE were able to create their own narratives regarding the energy transition—in which they are considered the "good guys." With the ruling political party, players like PEMEX and CFE, who benefit from the existing economic, social, and cultural arrangements that favour a carbon-intensive trajectory, are coordinating efforts to structure institutional rules, norms, and constraints to their advantage [29]. They also seek to reduce the leverage of those who would benefit from an alternative trajectory. For example, the new reforms focus on boosting the oil sector's productivity instead of diversifying Mexico's energy mix.

In late 2018, as soon as the new administration took power, it immediately cancelled Mexico's fourth long-term clean energy action as well as tenders for two transmission lines, which would have fostered the deployment of renewable energy. Auctions for medium-term, capacity, and transmission rights were also cancelled, and existing power purchase agreements (PPAs) were subjected to review by the country's energy regulator [74]. The new energy policy not only multiplied the costs of clean energy generation facilities for wheeling and distribution charges, but also ended all pre-operative testing for variable electricity generation projects. Instead, it granted preferential grid access to conventionally generated electricity [74]. The new government also modified the country's electricity dispatch mechanism to give priority to CFE power plants—regardless of the cost of fuels. The Electricity Industry Law introduced in March 2021 [75] hinders the production of renewable electricity [76], while the Hydrocarbon Law introduced on 4 May 2021 [77] empowers the state to revoke permission to individuals if the government considers them an "imminent danger", a "national security problem", an "energy security problem", or a "national economy risk"—all undefined terms [78]. It is feared that the government will use the ambiguity to limit the deployment of renewables [79]. The new uncertainty regarding existing and planned renewable energy projects has already led to a significant decrease in investment in Mexican renewables [74].

This development does, however, have a positive aspect: The conflict between the fossil-fuel and renewables trajectories has brought about tangible efforts to reduce inefficiencies in fossil energies. The recurring major electricity outages of the last few years—such as the one in February 2021 that affected almost five million residents in Northern Mexico—have provided proponents of clean energy with political capital. To undercut them, the government has blamed the United States and the "oil thieves" who steal the equivalent of 1145 truckloads of oil from PEMEX every day—the equivalent of around USD 7.4 billion in lost revenue since 2016 [31]. In late 2018, a strategy to curb the theft of hydrocarbons was implemented because of dramatic energy shortages in 16 of the 31 Mexican states [31].

To address the decline in oil production, the government accelerated construction of the "Dos Bocas" refinery, which began in July 2019. Experts argue that expected production output of Dos Bocas cannot justify the USD 8.9 billion to construct this refinery. The maximum cost of construction should only have been USD 1.2 billion for it to be profitable [80]. The amount the refinery is supposed to process is only at 173,000 thousand barrels of petrol and 125,000 barrels of diesel each day, which is not enough to justify the high costs of construction [81]. In addition, although this refinery is expected to create 23,000 direct and 110,000 indirect jobs, it is preventing the creation of thousands of jobs in the renewable energy sector. Further cementing Mexico's future dependence on oil is the May 2021 decision of PEMEX to buy the Deer Park refinery in Texas for USD 596 million [82]. The Dos Bocas and the Deer Park projects are hotly contested because of the high investment costs, slow construction, problems regarding the site, its environmental impact, and its incompatibility with the renewable energy transition [83]. At the beginning of the COVID-19 pandemic, a "Confiabilidad" was decreed to promote the production and use of gas and coal because of intermittency issues regarding the generation of electricity using renewables [84–86].

Escaping Mexico's institutional carbon lock-in is challenging but not impossible—even in the current political climate. Despite the barriers to clean energy transition presented by institutional lock-in, institutional change can still occur from the bottom up by policy entrepreneurs in business and industry directly or indirectly promoting carbon-reducing policies [87,88]. In addition, in a globalised world, technological breakthroughs achieved in a few countries can support sustainable energy transitions in others. Incremental learning can continue to reduce the costs of deploying renewables until it becomes an opportunity cost for those dependent on fossil energy. For example, technological innovations in wind or solar energy in other countries can open new windows of opportunity for renewables in Mexico. In addition, at the global level, the "greening" of the World Trade Organization (WTO) and international development aid, along with World Bank Green Bonds, can build new institutional and technological lock-ins favouring renewables that may stimulate a rethink by future Mexican administrations [89,90]. A bottom-up approach might help make Mexico's energy transition 2.0 more resistant to political backlash.

3.2. Infrastructural and Technological Lock-In

Infrastructures and energy technologies often lock societies into carbon-intensive emission pathways because of the length of time before investments pay off [29]. Oil and gas extraction projects are usually not only capital intensive but also require many years of planning, exploration, and development [91], and once the projects have been explored, appraised, and developed, revenues are likely to be lucrative. Because such projects ensure energy security, most receive huge financial support and guarantees from the state, which becomes a stakeholder in the projects. When Mexico's oil production declined, it was said to be time for the country to stop producing crude oil. As mentioned, the previous administration had begun to plan, explore, and develop renewables but the López Obrador rolled back the reforms and started to reinforce existing carbon lock-ins, invoking the COVID-19 pandemic as justification [79].

Mexico's transition towards sustainable energy is undermined by the government expanding its fossil-fuel burning energy infrastructure. The operating conditions, fuel type/quality, and physical specifications generally mean that infrastructures are only modified slightly during their lifetimes, thus making it difficult to adopt new and cleaner renewable energy technologies [29]. Without making more ambitious efforts and revising its goals for national energy efficiency, Mexico is sure to fall short of its target of producing 35 per cent of its energy from renewable sources by 2024 and 43 per cent by 2030 [43,92]. Some experts, however, are not discouraged by the new development in Mexico [93,94]: Claudia Viridiana Diezmartínez [93] writes that by investing in energy storage, Mexico will be able to diminish the effects of the technological lock-in that favour fossil energy. However, financial incentives are needed to accelerate investment.

Other experts see new opportunities for moving away from energy-related infrastructure based on demand, as well as technological lock-in, by radically decarbonising sectors whose energy demands drive CO_2 emissions—like the transport sector, responsible for 41 per cent of Mexico's total energy consumption [92,95]. In Mexico, 26 to 30 per cent of the total CO_2-eq emissions come from transport [96], which primarily uses petrol and diesel. Mexico has 50,594,282 automotive units, of which 35,270,440 are cars, 638,171 are passenger buses, and 10,834,877 are trucks [97]. To model the decarbonisation scenario, Jorge Islas-Samperio et al. [98] developed a baseline for transportation and compared it with the implementation of 21 mitigation measures. They concluded that Mexico's transport sector can be decarbonised using measures such as traffic optimisation, vehicle energy efficiency, and modal shifts from private internal combustion engine (ICE) vehicles in (bus) rapid transport, as well as by switching from fossil to biofuels or using electric vehicles.

However, decarbonising energy-intensive sectors such as transport and industry require reducing emissions from electricity generation [32]. Electrifying Mexico's transport sector can help the country manage its energy transition if sufficient charging stations are deployed. Mexico now has approximately 1500 electric stations, around 70 per cent public and 30 per cent private. Half of all the charging stations are in Mexico City, Nuevo León, and Aguascalientes. Most of them are free and located in shopping malls; private stations charge USD 4 or less for a full recharge [99]. Deploying this infrastructure will promote technological change in mobility. Because Mexico's existing infrastructure and technological carbon lock-in focuses on the supply side, private sector engagement can drive the deployment of charging infrastructures for electric vehicles [98].

3.3. Behavioural Lock-In

Behavioural lock-in limits the scope and pace of the energy transition and *any* transition towards sustainability. This type of lock-in is neither inherently helpful nor inherently harmful to climate protection efforts [100]: Depending on the technology, a lock-in can both promote and hinder climate protection. Behavioural lock-in refers to social practices, cultural norms, values, and habits that hinder the following:

(1) the deliberation and persuasion processes needed to mobilise behavioural change;
(2) the internalisation of negative externalities which, for example, allow polluters to pay rather than modify their behaviour;
(3) learning from past performance and situations to establish context cues that trigger certain behaviours (e.g., turning off lights because of the knowledge of high electricity costs) [29,101,102].

Since a sustainable energy transition is complex and uncertain, behavioural carbon lock-in must be absent in order for individual and collective decision-making to be made in accordance with principles of sustainability.

Behavioural lock-in also refers to structures that allow humans to interact despite uncertainties by making human interactions predictable [103,104]. Habits minimise uncertainty, contingencies and the amount of cognitive effort needed to make a timely decision [100,105]. Energy transition requires stakeholders to exchange experiences and knowledge about (un)sustainable practices. For example, learning about the costs and benefits of cooperating or interacting with peers is key to establishing sustainable practices [106,107]. The various types of behavioural lock-ins include culture, information, and education that establish rewards or sanctions mechanisms—raising the cost of alternatives and negatively impacting alternative practices, norms, and habits [108,109]. In Mexico's modernisation project, changemakers are often confronted with behavioural lock-in that is particularly difficult to overcome because it involves multiple layers and levels of persuasion and bargaining [110,111].

The lack of proper management of collective conflicts in Mexico is its most significant behavioural lock-in. This creates a huge barrier for Mexico's sustainable energy transition because of the need for a minimum quality of democratic deliberation, as expressed in SDG 16 (peace, justice, and strong institutions) of the 2030 Agenda for Sustainable Development. Mexico's democratic structures conflate various conflicts [2,11,112]. Alberto Olvera [7,113] criticises the "over-politicisation" of specific issues such as energy security. The state monopolises the public sphere to such an extent that politically powerful actors are able to mould public opinion and further profit from old unequal practices and traditions based on dependence, such as clientelism, corporatism, and patrimonialism. This limits the scope and quality of public discourse in Mexico—which is needed to stimulate discussion that can ultimately dismantle behavioural (carbon) lock-in.

Public discourse is key to Mexico's energy transition, because through it, behavioural lock-in can be revised if needed. Mexico's lack of public discourse mirrors its exclusionary centre/periphery decision-making structure [9]. This absence is attributed to Mexico's colonial past, when a small but powerful elite politically, socially, and economically disenfranchised most of the population, particularly indigenous communities [7,114]. It sustains the high level of political violence in Mexico, because of the "winner-takes-all" implications of elections and political positions [115,116]. The lack of formal channels to effectively participate and express political views is seen as encouraging violence towards politicians—causing Mexican legislators to evade consultations [9,117]. For their part, advocacy groups are reluctant to cooperate with state agencies that they perceive as authoritarian and corrupt [112,118].

At the same time, even if given the chance, societal groups cannot always participate in public discourse because making informed contributions requires access to knowledge. Mexican civil society representatives' lack of technical expertise is seen as a major hindrance to including them in technical consultations [16]. Without properly understanding the technical issues, their participation in consultations is limited to "rhetoric" that is not expected to involve constructive debate or produce solutions [11,118]. The lack of technical expertise among civil society groups can partly be attributed to the absence of public discourse. The lack of substantial interactions and partnerships between universities and research institutions and civil society groups limits the latter's opportunity to apply technical knowledge. Universities and research institutions have difficulty fulfilling their social mandate due to lack of funding, state-sponsored violence, organised crime, and the constant "criminalisation" of provocative students and professors [119,120].

Successfully managing conflicts related to Mexico's energy transition requires credible facilitators between the parties. In theory and practice, these facilitators include churches, NGOs, and the scientific community [6,121]. But in Mexico, these "traditional" facilitators are not deemed able to function as bridges between multiple interests [6]. Furthermore, Mexico's transition to sustainable energy and its transformation towards sustainability require deeper understanding of governance, along with recognition of the importance of networks and the private sector (business and civil society) for developing and implementing policy goals.

4. Teaching Guide: Learning from Mexico's Energy Transition

This case study on energy transition involves a country that has to overcome many contradictions in order to modernise. Mexico's energy policy success depends on its progress on other policy goals, particularly those regarding climate protection. To make energy security compatible with climate protection, Mexico must identify, conceptualise, and resolve various types of carbon lock-in. This case study emphasises the need to understand infrastructure and technological, institutional, and behavioural lock-ins. This focus can help future leaders learn about and propagate what is needed to address the complexities and uncertainties of transitioning to sustainable energy. The Mexican case study can help to teach students about carbon lock-ins and how they influence sustainable energy transitions. The case study can also stimulate dialogue on topics driving academic debate over sustainable energy:

- Why should oil-producing countries like Mexico move away from fossil energy?
- Does oil have a place in a sustainable energy system?
- Is a country's energy system inevitably a political issue? If so, is a genuine liberalised energy market possible?

These three questions can initiate a critical and open assessment of energy transition based on Mexico's case. The learning activation framework presents an innovative, solutions-oriented approach to assessing Mexico's transition towards sustainable energy.

4.1. Methodology to Prepare a Guidelines for Using the Case Study

A case study is a method of learning about a complex situation; it is based on a comprehensive understanding of said situation which is obtained through its description and analysis and is taken as a set within its context. That is, it involves a comprehensive understanding, extensive description, and analysis of a situation as a whole and within its context. A case-illustration typology is used and this deals with a situation that goes beyond decision-making, in which a real problem and the solution adopted, considering the context, are analysed. This allows the group to learn about the way in which a certain organisation or professional has made a decision, as well as its success.

This teaching guide introduces a framework to involve students. It can help transform situations into experience, develop analytical tools from that, and apply them to other situations and contexts, as explained in Figure 3.

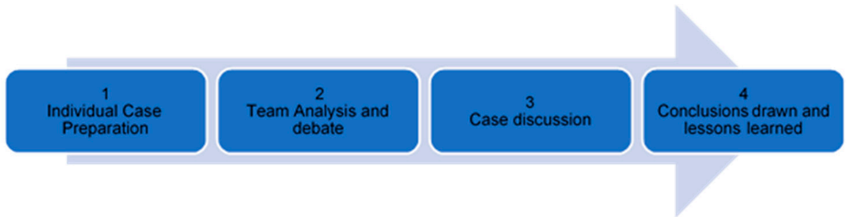


Figure 3. Steps to develop a case method learning situation. Authors' own elaboration.

4.1.1. Teaching Objectives and Target Audience: Inspiring Future Changemakers

Without understanding carbon lock-ins, students who might well lead the country one day may think that it is impossible to eliminate them. If they are daunted by the high costs or stakes of eliminating the factors that establish and maintain carbon lock-in, they could even become spoilers of a sustainable energy transition. Students should be taught that preferring fossil fuels over renewables merely because they are used by current infrastructures, technologies, institutions, and social practices is not a viable long-term strategy: The problems created by unsustainable practices will just be passed on to future generations. Not only is carbon lock-in especially costly for future generations, it is also an unfair burden. Policymakers must not use carbon lock-in to justify inaction.

Mexico's energy transition is an excellent case study for a course linking transformative knowledge on sustainability with the professional skills needed to understand the complexities involved in a sustainable transition. It provides useful ways to enhance students' assessment and judgement skills. The contradictions elaborated here reflect the perspectives of multiple stakeholders. Students should weigh different interests, perspectives, and value systems based on the premise that all stakeholders are legitimate. Students need to learn to solve problems and formulate priorities using not only their "moral compass" but also evidence and reason. They must not merely understand the technical complexity of issues but also develop empathy regarding the social equity implications of a particular course of action. This case study can help make students more "politically savvy" and aware of power contexts and structures. It helps them develop courage and conviction to make popular and unpopular decisions regarding all kinds of problems.

Evidence-based policymaking requires reconciling ideological or political worldviews with scientific reasoning. This case study can help improve students' leadership skills by highlighting their sense of accountability. Although Mexico's public sector is the main driver of its energy transition, its success depends on the public sector forging genuine partnerships with business, industry, and civil society. The dilemmas and contradictions confronting Mexico show the complexity of the necessary transitions. Students should be helped to identify and conceptualise various trajectories and express how they impact or are affected by a sustainable energy transition. Students must not only be knowledgeable about the technical, social, political, economic, and ecological aspects of the energy transition, but also be able to debate in a healthy and constructive manner. For this, they need transdisciplinary professional training. Some students can be expected to be well informed on the economic aspects of the energy transition, while others might provide important insights regarding governance. Students are expected to be passionate about certain topics and respect the passion of others.

The case study also helps educators enhance their own skills. These include ensuring that not only the loudest and most extroverted but also the introverted students share their views. Educators are recommended to apply the Socratic method to stimulate critical debate [122]—encouraging cooperative argument by asking provocative questions and presenting theses. Questions should be formulated holistically by linking the key issues of energy transition. Educators can decide the amount of time and effort to spend on the case study. Some might decide to focus on one carbon lock-in and discuss whether challenges are confronting their home countries, while others focus on governance aspects of energy transitions.

4.1.2. Teaching Approach and Strategy: Linking Reflection with Interactions and Actions

This guide introduces the "learning activation approach" which helps educators to facilitate the learning process. Students begin by considering the three different types of carbon lock-ins that are undermining or delaying Mexico's transition towards sustainable energy. Figure 4 shows how a given carbon lock-in can be taught. The three parts of this approach—reflection, interaction, and action—reflect the pedagogical objectives.

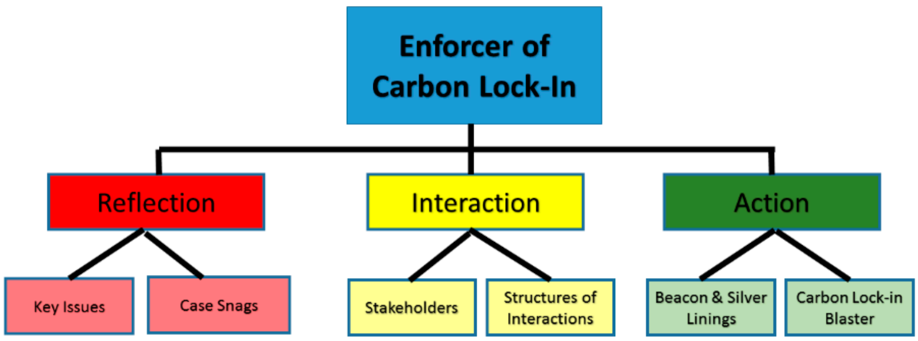


Figure 4. The learning activation framework: Mexico's carbon lock-in. Source: Authors (CC by 2.0).

The learning activation framework first identifies the factors that establish, maintain, and reproduce one or more types of carbon lock-in and then elaborates their "enforcers" and provides examples. The reflection part allows students to independently explore innovative ways of addressing the three types of carbon lock-in. The key issues discussed in Mexico's energy transition are intended to stimulate critical thinking. Case snags are issues that require further research and debate. Energy transition case snags often focus on trade-offs and co-benefits as well as negative or positive externalities. Interaction focuses on the processes of stakeholder bargaining and joint decision-making. Understanding stakeholders' motivations and preferences, as well as the structures available for them to interact, helps students develop appropriate facilitation strategies. Deeper understanding of the structures and processes of collective decision-making and cooperation can reduce the cost of making decisions (in terms of time and effort), allowing more attention to be given to the actual issues [123–125].

The last part of the learning activation framework is to explore the specific things—both institutional and personal—that can help achieve an equitable and sustainable energy transition? The action part of the learning activation approach includes two steps:

(1) Students should be taught to identify how the transition towards sustainable energy can be advanced despite unhelpful government policies. The case study gives examples of positive aspects: Can students think of other reasons or see any indications that clean energy can assert itself?

(2) Students should identify additional actions needed to further dismantle carbon lock-in. Educators encourage students to think up "carbon lock-in blasters"—events or

tools that can help sustainability lock-in become more competitive. The educators should aim to establish from the students creative and innovative ways to deal with the problems of the lock-ins mentioned in the case study and discuss whether these ideas can be applied in their own countries.

4.2. Case Analysis: Learning from Mexico's Energy Transition

Table A1 summarises various types of lock-in and key issues. The learning activation framework starts by identifying the factors that establish, maintain, and reproduce carbon lock-in. Educators can decide whether students should focus on Mexico's energy transition or on their home countries, using the Mexican case study as the reference point. Factors enforcing carbon lock-in include:

- Resource endowment effect: Factors that influence product layout. The geophysical location, climatic conditions and availability of certain fossil resources influence coal, oil, metal, and mining development levels, which critically affect the product layout of the carbon-intensive industry [126].
- Scale effect: Demand increases along with supply because consumer prices decrease, leading to more emissions [127].
- Structural effect: How energy supply influences energy demand and vice versa. When fossil fuel dominates the energy consumption structure, it is difficult to implement fundamental changes to the energy system [127].
- Governance effect: Volatile and unpredictable policymaking sustain carbon lock-in, as does limited participation because one government's energy policy framework is likely be tossed out by the following administration.
- Market effect: Investment capital for carbon-intensive energy technologies sustains carbon lock-in. FDI is greening, so increased FDI improves environmental regulation and contributes to clean energy development through the introduction and absorption of advanced technology [127].
- Technological effect: Sustaining carbon lock-in requires the best technology available. The profitability of fossil-based energy technologies is defined by the tax regime, operational costs, upfront costs, consumer income level, and competitive access to raw materials [127].

Educators can divide the students into groups and have each group choose an "enforcer of carbon lock-in" and identify the key issues (Appendix A) for escaping carbon lock-in. Escaping infrastructure and institutional carbon lock-in requires strategies for dealing with the energy supply monopoly (by coping with or ending it). Another issue is affordability. Reducing energy prices in a clean energy scenario or developing mechanisms to internalise negative externalities of fossil-based energies can dismantle behavioural carbon lock-in. Students should elaborate a key issue of their choice in an essay.

The next step is to identify case snags, which are formulated like the following sample questions.

- If fossil-based energy technologies like coal and oil are no longer profitable, what should be done with the stranded assets—the fossil fuel resources that would go unused as a result of climate protection measures or changing demand [128]. Should developing countries like Mexico be compensated for their stranded assets?
- Is privatising energy sectors suitable and feasible, especially in developing countries? How is capacity building for smaller players key to a genuine liberalisation of the energy market?
- Is market concentration in power generation inevitable? Should there be more diversity amongst energy supply providers?
- How does the energy sector monopoly hinder the transition towards sustainable energy? How can smaller players break state-led monopoly?
- Which cultural factors are inhibiting this transition in Mexico or in the students' home countries?

- How can public procurement help advance clean energy deployment in Mexico or in their countries?
- Will consumers pay higher premiums for sustainable energy? If yes, how can this be justified?
- Is it possible to differentiate political from economic interests?

The next part of the learning activation framework uses a stakeholder mind map to teach how to get an overview of the different stakeholders and their interactions. Students must understand that power relations between stakeholders can both sustain and eliminate carbon lock-in, and that the power asymmetry between stakeholders is constantly changing. Weaker actors can assume more powerful positions by strategising [129,130]. Students should make a stakeholder mind map of the energy sector in Mexico or in their home country, focusing on one key issue related to carbon lock-in and visualising the relationships. This mind map of the constellation of the relations between stakeholders should answer the following questions:

- Which actors would like to escape from carbon lock-in?
- Which ones are likely opposing all attempts to escape from carbon lock-in?
- Which frameworks or platforms are used for undertaking dialogue with the groups? Who organises these? Is there a third-party mediator?
- Are there emerging leaders on both sides? Who champions the transition towards sustainable energy? Who defends the carbon-intensive status quo?
- How are non-state actors engaged in the dialogue?
- How are subnational actors, including cities and urban clusters, involved in energy policy planning and implementation? Do they compete with or complement the national government?

When drafting the stakeholder mind map, it is important to define the conflict cleavages amongst stakeholders. Appendix A shows examples of conflict thresholds: public vs. private sectors, state-owned vs. private energy providers, domestic vs. foreign investors, energy transition leaders and spoilers, power asymmetry, stakeholder coalitions and "unholy alliances", and non-state and subnational actors. Students can discuss the structures and processes used in stakeholder bargaining. Which regulatory, economic, or legal frameworks (e.g., the World Trade Organization (WTO), the European common energy market, and the Southeast Asian energy market) exist for resolving stakeholder disputes?

The last part of the learning activation framework examines actions that can help dismantle the carbon lock-in. Taking account of silver linings, students are encouraged to resolve their key issue by first identifying an entry point. Does any development or silver lining encourage optimism? Despite setbacks in Mexico's transition towards sustainable energy, the situation is not hopeless. Electrifying the transport sector could be an entry point to sustainable energy. The learning activation framework aims to help students identify emerging opportunities that may need just a little nudge to materialise.

The next step is more ambitious: Students are requested to develop carbon lock-in blasters—policy instruments or bottom-up actions (e.g., explaining the facts and shaming and blaming) that can enhance entry points. Again, using the transport sector as an example, students can develop policy instruments to accelerate its electrification. An inventory of public transport companies could provide insight into the transport sector in Mexico or in students' home countries. How many are there? Are they private or state-owned—or private entities that depend on government subsidies? Students can develop plans to increase public transport companies' competitiveness.

5. Conclusions

Mexico's energy transition cannot be separated from its broader modernisation agenda. It is both a dependent and an independent variable in Mexico's democratisation, economic development, and social cohesion. The importance of Mexico's energy sector makes it prone to politicisation, which can make transitioning towards clean, green, reliable, efficient, affordable, inclusive, and equitable energy more difficult and uncertain. Mexico's usual top-down policymaking reflects a political culture characterised by centre-periphery politics that limit substantial public debate on important issues. Centre-periphery politics reflects the significant inequality between urban and rural regions in terms of influence in policymaking. Public debate is about exchanging perspectives, which can help to make the energy transition more legitimate and efficient. Mexico must resolve its challenges with governing human interactions, humans, and the environment.

Compared with some other countries, Mexico's energy system has greater potential to become sustainable. The country not only has abundant access to fossil fuel sources but to renewables as well. It could cover its energy demand through domestic sources. It attracts foreign direct investment (FDI), while access to the North American energy market provides additional opportunities. Mexico's young population drives economic growth as well as innovation and democratisation. However, Mexico cannot take advantage of these potentials without coming to terms with its colonial past. It must find ways to make its modernisation goals compatible with the aspirations of all parts of society, especially with its indigenous communities, and adopt a more inclusive way of governing.

For Mexico to successfully transition to sustainable energies, various types of carbon lock-in must be dismantled: They inhibit the establishment of practices, structures, and institutions that could support the deployment of renewable energy and instigate fundamental changes in Mexicans' consumption behaviour. Carbon lock-in prevents the establishment of a different lock-in that could facilitate a more sustainable pathway for Mexico's energy transition. Despite current setbacks for its energy transition, however, entry points and opportunities are emerging that could move Mexico closer to sustainable energy. As these entry points are largely demand driven, they give new impulses on how to govern energy transitions. They offer new bottom-up and participative approaches that can also support Mexico's democratisation.

Mexico's energy transition must help the country achieve its commitments to curbing climate change—although the current administration seems to have prioritised its energy security goals at the expense of climate protection. With increasing global connectivity and the momentum to address climate change growing worldwide, Mexico cannot afford to take a backseat after hosting the climate negotiations in Cancun. Mexico's role in those negotiations made it possible to achieve results that are key to the success of the Paris Climate Agreement. Furthermore, Mexico was the first developing country to submit a climate action plan. Mexico cannot afford to ruin its own reputation. It must get back on track to reach its own mitigation goals.

Give the students additional reading and reference materials. Comparing Mexico with other countries experiencing similar challenges has empirical value. Be sure to highlight the connection between theory and practice. The Mexican case study presents case snags to help identify issues that can be studied more closely. For example, discussing efforts to decouple emissions from energy demand or economic growth can reveal emerging debates on degrowth or sufficiency.

The case study also shows how important it is for students to broaden their perspectives on various issues. Educators should conclude with a feedback round in which students (preferably in smaller groups) answer the following questions:

1. What connection have I had to the energy issue? Has learning about Mexico's energy transition help me discover others?
2. Have I learned something new that vindicated or changed any of my views?
3. Did learning about Mexico's energy transition lead me to better understand the challenges of energy transition in my home country?
4. Did I discover something from the Mexican case study that can be applied at home?
5. Are there other important key issues that should be discussed in greater detail?
6. Have I learned anything important from my classmates?

Mexico's energy transition makes a valuable teaching example because its energy transition is part of a broader developmental goal. This teaching guide's systematic approach can maximise the students' learning experience. By reflecting, interacting, and acting, they become part of the energy transition. As they project the challenges and solutions to their own situations, some might even become stakeholders ... That is the point!

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Abbreviations

The following abbreviations are used in this manuscript:

BMWi	Federal Ministry of Economics and Technology (Germany)
BP	British Petroleum
CCS	Carbon Capture and Storage (CCS)
CELs	Clean Energy Certificates
CFE	Comisión Federal de Electricidad
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gross National Income
GW	Gigawatt
GWh	Gigawatt per hour
ICE	Internal Combustion Engine
IEA	International Energy Agency
IRENA	International Renewable Energy Council
MMBtu	Million British thermal units
MW	Megawatt
PEMEX	Petróleos Mexicanos
PJ	Petajoule
PPAs	Power Purchase Agreements
PPP	Purchasing Power Parity
R&D	Research and Development
SDG 16	Sustainable Development Goal 16
SENER	Secretaría de Energía (Mexico)
TWh	Terawatt per hour
WB	World Bank
WTO	World Trade Organisation

Appendix A

Table A1. Carbon lock-in in Mexico's energy transition—The Learning Activation Approach.

Enforcers of Carbon Lock-In	Reflection		Interaction		Action	
	Key Issues	**Case Snags**	**Stakeholders**	**Structures and Processes**	**Silver Linings**	**Carbon Lock-In "Blaster"**
Resource endowment effect: product layout, geophysical location Scale effect: average unit cost declines as production increases Structural effect: industry standards, upfront costs Governance effect: rough government transitions, negative externalities Market effect: market factors, capital market, FDI Technological effects: R&D, FDI (access to foreign investors)	Monopoly of state-owned energy companies; indigenous knowledge; best practices in energy-sector investment; carbon trade; affordable energy; FDI for clean energy; energy standardisation; income inequality	Stranded assets; double monopoly markup; energy company ownership; voluntary energy-related standards; public procurement; compensation for developing countries escaping carbon lock-in; prospects for employment and livelihoods	Conflict thresholds (public vs. private sectors, state-owned vs. private energy providers, domestic vs. foreign investors; energy transition leaders and spoilers; power asymmetry; stakeholder coalitions and "unholy alliances"; non-state and subnational actors)	Establish independent accounting system; WTO framework; private networks; national development planning; bi- and multilateral trade	Clean energy investments; R&D from increased FDI; greening of international development assistance; diminished information asymmetry through digitalisation; public transport electrification; better educated populations; leapfrogging; economic growth; US government change	Compensating stranded assets; privatising unbundling and energy generation; internalising externalities in planning and investment (location, timing and matching); reducing transaction costs (asset- specific investment, contract costs) resulting from information asymmetry; integrating transmission companies; liberalising retail; selling power generation and distribution utilities; carbon tax and trade; trading electricity; shaming through labelling (e.g., as "climate pariah")

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