Regulatory Limits to Corporate Sustainability: How Climate Change Law and Energy Reforms in Mexico May Impair Sustainability Practices in Mexican Firms

Antonio Lloret [1,2], Rogerio Domenge [1,2] and Mildred Castro-Hernández [2]

[1,] Instituto Tecnológico Autónomo de México

[2] ITAM Center of Energy and Natural Resources
  Mexico City, 01080 México
  antonio.lloret@itam.mx (A.LL.); domenge@itam.mx (R.D.); sgmil09@gmail.com (M.C.H)
  * Correspondence: antonio.lloret@itam.mx

Abstract: This paper challenges the assumption that "state-of-the-art" regulation aimed at curbing greenhouse gas emissions (GHG) by firms is the panacea that will force firms to face the impact of climate change and create conditions that promote sustainable corporations. We argue that, in fact, such regulation, when improperly implemented, may impair sustainability practices because it creates unintended consequences. This paper tackles the design and efficiency of the institutional framework chosen through the lenses of the analytical themes of fit, scale and interplay. Then, we model a systems dynamic approach to represent how public policy in the arenas of energy efficiency and GHG emissions reduction may interplay with competitive business outcomes and corporate sustainability schemes. We found, as a result of the institutional design chosen, that the system is dominated by negative feedback processes resulting in inefficient outcomes that would be better tackled by firms not being subject to the restrictions imposed by the new laws.

Keywords: systems dynamics; corporate sustainability; Mexico energy reform; institutional implementation

1. Introduction

Energy sustainability, as defined by the World Energy Council, is the balance between energy security, social equity, and environmental impact mitigation. This definition is aligned with the concept of sustainable development, which aims to find a balance between economic, environmental, and social systems. The development of energy schemes that are stable, affordable, and environmentally viable is not simple, and solutions to this problem are complex. The number of stakeholders involved is large and quite diverse; thus, any scheme to facilitate the balancing of these systems must consider that there are interconnections between the public and private productive sectors, governments, and regulators. Different institutional frameworks must consider the demands of society, of companies, and of governments, including societal environmental concerns.

Since December 2013, Mexico has carried out an ambitious transformation process intended to end state monopolies in its energy sector. The constitutional amendments establish new industry structures in oil, natural gas, and electricity. The aim was for competition to be introduced into the refined product and electricity markets, and for private investment to flow into various segments of these industries. The state would maintain ownership and control of subsoil hydrocarbon assets [13].

These reforms are positive for an emerging economy. Mexico's landmark energy sector reform has the potential to transform and to grow the economy, and to attract billions of dollars of investment. The proposed energy laws represent a major shift in Mexico's energy policy. The proposal to transform Mexico's energy sector will not only boost the country's oil and gas production, but also

significantly improve its economic growth prospects. Real GDP growth is forecast to rise by 3.0% in 2013 and 4.1% in 2014, compared to the 3.9% increase witnessed in 2012. [8]. The energy sector is a significant contributor to export revenue and an even more important contributor to government finances [9]. The expected growth, however, comes at a price: a trade-off between economic growth and environmental protection, as carbon dioxide emissions soar and pollution becomes a severe problem amid economic progress and industrialization. Businesses offering clean technologies will find growing opportunities as emergent economies work and invest to reduce environmental damage [10].

In December 2015, under the Paris Agreement, Mexico agreed on a Nationally Determined Contribution (NDC) that covers targets for both emissions of greenhouse gases (GHGs) and black carbon (BC). In its NDC, Mexico proposed to unconditionally reduce combined GHG and BC emissions by 25% below business-as-usual (BAU) levels in 2030. Mexico also proposed a 40% reduction of GHG and BC emissions by 2030, conditional on certain requirements for global agreement and international support. The GHG component of these targets translates to a reduction goal of 22% below BAU unconditionally, and 36% conditionally by 2030 (UN NDC Registry, 2015) [23].

While world leaders appreciate the Mexican contribution, it is too ambitious to be met. It does not seem to have a clear grounding in economic productivity and competition. No analysis has been published that supports the NDC goals while also taking into account the economic growth of the country, nor on the technological innovation needed, nor on the funding that will be necessary, and it unfortunately has triggered some clearly negative opinions from business leaders and industry experts.

2. New Policies, New Challenges for Firms

Energy reform will trigger the dynamic that will allow Mexico to have the variety and quantity of energy that the country will require to meet its needs, achieve surplus exports, and compete in international markets. Through the 2014–2028 National Energy Strategy (NES), clarity and direction for the operational model of the energy and environmental sector resulting from the reform is provided, although there are institutional hurdles to overcome. In what follows, we discuss how and why the current institutional schemes may impair the current sustainability practices of firms, using Young's 2002 analytical framework. We also describe best practices expected in a low-carbon economy by the World Business Council for Sustainable Development and relate these to the reform, including a broad analysis of what sustainable firms in Mexico are currently doing.

Young´s analytical framework, developed in 2002, aims to understand the interconnections between institutions and environmental change. We argue that energy reform has many virtues but that improper implementation undermines the benefits of current sustainable practices being used by firms. Young addresses the questions of causality, institutional performance, and design, and uses an analytical framework to discuss the expected outcomes of such an institutional scheme. Young argues that "*It is impossible to succeed in designing effective institutions without some understanding of the roles that these arrangements play as driving forces in the realm of human affairs*" (Young 2002); thus, he uses an analytical framework based on scientific questions and analytical domains of fit, scale and interplay to suggest what ought to be achieved with the current institutional arrangement. The problem of *fit* centers on the proposition that there is a close fit between ecosystems and the institutional scheme chosen. *Scale* deals with the levels at which phenomena occur in the dimensions of space and time, and determines whether the institutions designed will be sufficiently able to be scaled up or down to tackle inefficiencies. *Interplay* implies that other arrangements, both horizontally and vertically, will result in cross-scale interactions as a consequence of the politics of institutional design and management.

> *Causality: The reform and bylaws related to energy efficiency and climate change mitigation and adaptation stem from a consensus on what Mexico as a country ought to do as an emerging economy.*

In Mexico, as in other developing countries, changes in extreme weather events are being observed. The Intergovernmental Panel on Climate Change, in its latest report, has confirmed that the

climate change observed over the last 50 years is attributable to human activities, primarily the burning of fossil fuels and deforestation.

Mexico acknowledges that the attention of this phenomenon lies with all countries and states its commitment to this: its goal is to reduce 30% of its greenhouse gases or compounds of greenhouse gas (GHG) by 2020 with respect to the business-as-usual trend line. It is clear that the consumption of goods and services is on the rise, and that this brings not only greater production and consumption of energy, but also a consequent increase in GHG emissions, which in turn rests on a greater use of natural resources and environmental pollution.

Mexico's Climate Change Strategy is conditional on the National Energy Strategy. For firms, this implies the adaptation and mitigation of their GHG emissions, which is a major challenge for companies because they must identify and generate information on emissions, reduction targets, innovation and development, and strategies. To achieve this, the General Law on Climate Change (DOF, 2012) requires companies that generate more than 25,000 tons of carbon dioxide equivalent (CO_2e) to report this in the National Register of Emissions (RENE). This standard includes a series of fines and penalties for companies that do not comply with their obligations. However, it is not clear how firms would measure certain strategies, such as spinoff or operations, logistics and distribution schemes and subsidiaries, among others.

Performance: The public policy in place should ensure competitive energy costs as firms move towards a low-carbon economy with beneficial environmental effects.

The NES represents an opportunity to achieve the necessary consensus between the various sectors—social, academic, industrial, research actors, and all three levels of Government. As part of the NES, the National Emission Register (RENE) is a decision making instrument that registers all those public and private facilities that emit more than 25,000 tons of carbon dioxide equivalents. This instrument, will inform regulators about energy consumption and environmental impact that may shape public policy.

Design: The designed institutional infrastructure aims to maximize performance.

The Energy Constitutional Reform, published on December 20, 2013 (DOF, 2013 and 2014), has 23 articles that involve creating 11 laws and changing 12 existing laws. Table 1a below schematizes the numerous amendments and new regulations set in place that will require adaptation and mitigation actions which firms directly or indirectly will have to consider in their sustainability strategies.

Table 1. (**a**). Institutional Schemes.

Table 1a. Energy Reform and Related Institutions

	Law	Type of amende­ment	Objectives	Main agency involved	Sources
HYDROCARBONS					
1	Hydrocarbon´s Law	New Law	Private investment in exploration and production through assign­ments and contracts. Allocations for Pemex and four types of contract for other compa­nies. Set state-owned hydrocarbons in the subsurface. The National Hydrocarbons Com­mission (CNH) is responsible for signing contracts through interna­tional competitive bidding. Creation of the National Control Centre Natural Gas (CENAGAS). Establish mechanisms for transpar­ency and accountability.	Energy Min­istry	http://www.dof.gob.mx/nota_detalle.php?codigo=5355989&fecha=11/08/2014
2	Foreign Invest­ment Law	Amendement			
3	Mining Law				
4	Public and Pri­vate Associations Law				
Public Finance					
5	Hydrocarbons In­come and Fi­nance Law	New Law	Fiscal criteria for the extraction of hydrocarbons; The SHCP must de­fine variables in each project award. Establish royalty payments, remu­neration and other rights for as­signments and contracts. Creation of Mexican Petroleum Fund, which will receive all oil rev­enues, it will transfer to the treas­ury and to retain the remaining fund long-term savings.	Secretaría de Hacienda y Crédito Público (SHCP)	http://www.dof.gob.mx/nota_detalle.php?codigo=5355983&fecha=11/08/2014
6	Mexican Petro­leum Fund for Stabilization and Development Law				
7	Federal Rights Law	Amendement			
8	Fiscal Corrdina­tion Law				
9	Federal Budget and Fiscal Re­sponsibility Law	Amendement			http://www.dof.gob.mx/nota_detalle.php?codigo=5355984&fecha=11/08/2014
10	General Public Debt Law				
Electrical Sector					

11	Electricity Industry Law	New Law	Private participation in power generation a wholesale electricity market. Private investment in expanding and improving transmission networks. Creation of the National Center for Energy Control (CENACE) dispatch of energy to operate and optimize the national power grid. CFE will continue to provide electric service to residential users. Obligation to purchase energy certificate.	Energy Ministry	http://www.dof.gob.mx/nota_detalle.php?codigo=5355986&fecha=11/08/2014
12	Geotermic Industry Law				
13	Water Law	Amendement			
PRODUCTIVE STATE ENTERPRISES					
14	Mexican Oil Law	New Law	Pemex and CFE have autonomy of management, technical and budget. Mandate is to create economic value and maximize revenue. Pemex will partner with private, by tender organized by CNH. Pemex and CFE retain their assets but CENAGAS break CENACE and vertical integration of the energy sector. Regulators responsible for promoting competition and free access to transport infrastructure, storage and distribution of hydrocarbons and electricity. State enterprises should operate on an equal footing with private investors.	Energy Ministry	http://www.dof.gob.mx/nota_detalle.php?codigo=5355990&fecha=11/08/2014
15	Federal Electricity Comission Law				
16	Federal Law of Parastatal Entities	Amendement			
17	Acquisitions, Leases and Public Sector Services Law				
18	Public Works and Related Services Law				
INSTITUTIONS AND ORGANIZATIONS					
19	Energy Regulators Law	New Law	Secretariat responsible for determining the areas and timing for exploration and technical aspects of energy contracts. Ministry of Finance defines fiscal terms for each contract and compliance audits. The National Hydrocarbons Commission organizes bidding rounds to choose the operating companies, administers exploration and production contracts. National Agency for Industrial Safety and Environmental Protection is part of the Ministry of Environment. Regulates the safety and environmental protection in all activities of the sector.	Energy Ministry Environmental Ministry	http://www.dof.gob.mx/nota_detalle.php?codigo=5355987&fecha=11/08/2014
20	National Agency for Industrial Safety and Environmental Protection of the Oil Sector Law	Amendement			
21	Federal Public Administration Law				

CLIMATE CHANGE					
22	Energy Transition Law	New Law	Obligation for companies to acquire energy certificate, diplomas awarded by the CRE pursuant to the provisions of the Electricity Industry Law.	Energy Ministry	http://www.dof.gob.mx/nota_detalle.php?codigo=5421295&fecha=24/12/2015
23	Climate Change Law		Mitigation targets of compounds or greenhouse gases are set: 30% to 2030 compared to the trend line and 50% compared to 2000.	Environmental Ministry	http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC_130515.pdf

In addition, as of December 20, 2015, the Energy Transition Law came into effect. The new law establishes a minimum requirement of clean energy use through the so-called "Clean Energy Certificates", or renewable energy certificates. These "Clean Energy Certificates" are instruments issued by the Mexican Energy Regulatory Commission that evidence the generation of a specific amount of electric energy from clean energy sources. They are used to demonstrate compliance with clean energy consumption requirements as a portion of the total amount of energy consumed by the firm.

2.1. The Analytical Framework of Fit

Young argues that an institutional arrangement that performs perfectly well in dealing with one environmental problem may prove to be a dismal failure when used in an effort to solve other problems. The 23 complex enacted laws, in some cases, are modified to attend to new problems; however, the new regulations are not always clear about specific measures and do not create a roadmap to tackle the problems at hand.

Mexico's ambitious commitment has to come from several actors, including the government itself. With regards to firms, greenhouse gas reduction is targeted with a National Emission Register (RENE): the tool that will provide timely, reliable, and verifiable information for assessing sector GHG emissions nationwide, and indicate whether companies are becoming more efficient in energy terms. Factual data considers that emissions by all private sectors in the Mexican economy account for anywhere between 20–30% of total GHG emissions. A 30% reduction of the current trend line in firms will represent 10% of the total GHG emissions only in the best of cases, should the government not reduce other emission sources with public policy such as public energy production, transportation, agriculture, landfill, or land changes. This number seems to be disproportionate relative to a firm's emissions. If firms were to aim for this goal in such a short time, then resources already committed to certain sustainability practices will potentially have to be transferred to different activities simply to meet these goals, with the unintended consequences of fewer sustainability activities being undertaken by firms.

2.2. The Analytical Framework of Interplay

Institutions are interconnected at different levels, both vertically at cross scale interactions and horizontally at the same level. The proposed energy reform, along with the laws involved, creates a challenge regarding how the interdependencies will arise as a consequence of the politics of institutional design and management. Figures 1 and 2 depict the actors involved and the interplay schemes expected in the reform.

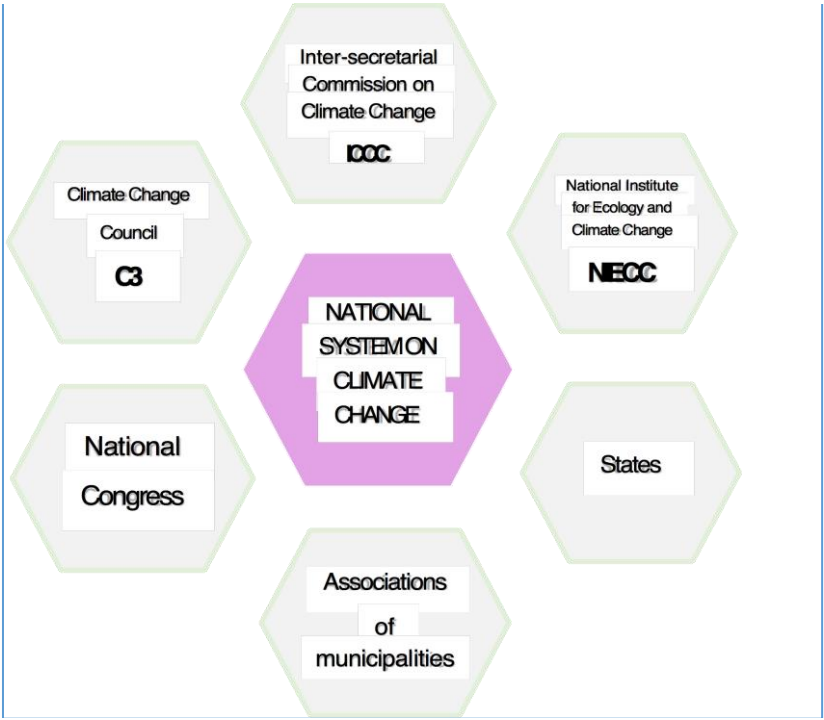



Figure 1. Institutional actors in the climate change system.

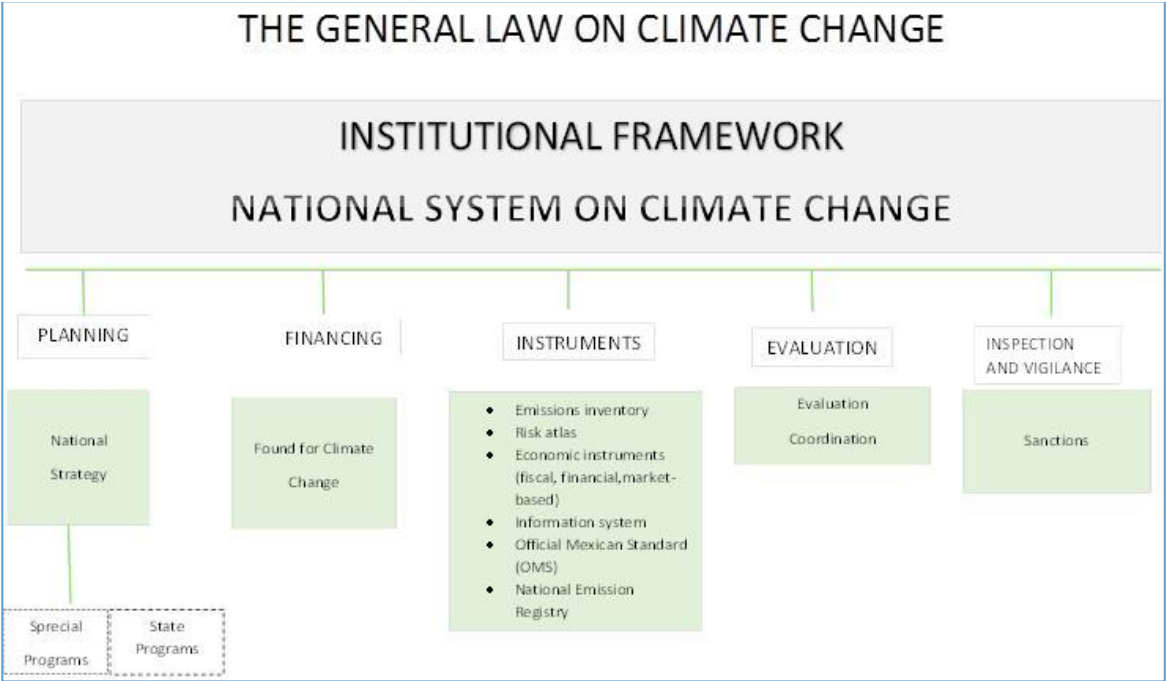



Figure 2. Climate change institutional scheme.

Although the energy sector is under federal jurisdiction, states and municipalities have responsibility for representing local interests, promoting opportunities for their people, and avoiding negative impacts on both society (considering the productive sectors) and ecosystems. Figure 3, below, shows how different institutions are arranged at the three levels of government.

Therefore, planning and coordination between the three levels of government and the private sector is required to prevent the most likely problems in the implementation of the reforms. The strategy should integrate international best practices, including sustainability objectives as well as competitive ones. For example, states should cooperate in implementing and monitoring standards through processes under their jurisdiction, without creating obstacles to business activities, while

also ensuring compliance with social and environmental standards. Planning should seek to develop policies to exploit opportunities that promote synergies between firms and their local activities. In Table 2 below, we analyze the likely impacts from the institutional interplay and link it to firms' outcomes.

It is expected that the upcoming implementation of the energy reform, with the consequent changes for the environment, will lead to gains in the productive sectors of Mexico. Most have anticipated costs, benefits and investments, but at the same time, they have to consider making adjustments to their business models in order to be more efficient and sustainable.

Figure 3. Interplay of climate change institutions.

Table 2. Energy reform interplay.

Table 2. Energy Reform Interplay	
Level	**Implications**
Federal Government	Criteria to reduce the risk of conflicts over land tenure: engage communities and owners in impact assessments; Criteria to clarify and guarantee the rights of consultation and consent to approve projects. Rule definition / criteria: a) ensure safe operations and environmental protection; b) rehabilitation in case of accidents; c) financial guarantees to cover liability in case of accidents (subject to the opinion of the SHCP). Regular activities across all stages of the project life. Specific criteria for exploration permits and production. HR policy of long-term planning and coordinating educational policies to improve employment opportunities for people in the future, considering tuition updated as the energy sector. Procedures for prior, free and informed to reach agreement or consent for projects consultation. SENER criteria for allocating resources including requirements for development projects in communities and localities where extractive projects take place.
State Government	Coordination and cooperation with the federal government in implementing and monitoring standards through processes under its jurisdiction, such as changes in land use or licenses or building permits. Contemplating criteria for granting representation to the different interests and reduce the risk of conflict over land tenure. Apart from the need to coordinate with federal authorities to give clarity to the processes of negotiation between companies and owners. Establish criteria of transparency, local permits and authorizations to productive projects. Establish criteria to prevent states commit public funds projects that increase the risk for public finances. Investments with public funds should have a well-defined social impact and be assigned to different productive activities. Productive sectors and identify opportunities for synergies in the regions and in collaboration with SENER and the Ministry of Economy in the strategies of industrial development and creation of productive chains. For example: establishing energy clusters; energy sector plans; Energy state agencies; promote international energy events; enterprise promotion and investor meetings with suppliers of goods and services; promote synergy between industry and the education system; etc. Promote with businesses, building communications and transportation infrastructure (roads modernize, develop plans for urban development with climate change criteria).
Local and firms	Adoption of best practices that include: a) criteria for protection, conservation, compensation and restoration of ecosystems, flora and fauna, environmental goods and services; b) sustainability objectives respect for human rights and community development; c) criteria for activities such as unconventional and deep-water oil; d) criteria for prevention and energy to damage during operations; e) promoting technological change and innovation to respond to the risks of spills, accidents and damages to the environment. Promoting human capital policies that take training opportunities under the consideration that the oil sector is suffering a shortage of oil and chemical engineers, scientists and workers, industrial and administrative technicians. Promotion certification activities, audit and verification.

2.3. The Analytical Framework of Scale

The concept of scale concerns the levels at which phenomena occur in the dimensions of space and time. The energy reform, grounded in the National Energy Strategy 2014–2027 and the National Strategy on Climate Change, aims to curb GHG emissions by 30% on average by 2025 Scale should be addressed from the technology and infrastructure perspectives, and yet, even with all these resources in place it is not clear whether the regulations will be capable of curbing emissions. The chances are that the institutional arrangement, unless properly enforced, will bring diminutive benefits in the short term.

3. Systems Dynamic Approach

In the next section, we schematize a systems dynamic approach based on Sterman (2002) to represent how public policy in the arenas of energy efficiency and GHG emissions reduction may interplay with competitive business outcomes and corporate sustainability schemes. We foresee that, as a result of the institutional design chosen, unintended consequences may occur should the system become dominated by negative feedback processes resulting in inefficient, worse, or unpredictable outcomes. With the newly approved energy reform, we can expect that implementation will come across difficult challenges and that the expected solution may find "side effects." The side effects, as we foresee, concern the fact that while trying to create a more energy efficient industry with fewer emissions, investment in other sustainable arenas will be reduced, having an overall effect that is worse than before. This is usually called policy resistance: the tendency for an intervention to be defeated by the system's response to the intervention itself (21).

The system as it is modeled creates feedback loops, a complicated map that helps explain all the decisions that have to be taken in a firm and which not only include the decisions taken by the firm, but the new restrictions imposed by the regulator. Policy resistance in such a situation may arise when the expectation of a stringent regulation may impair the overall goals laid out by the reform in the first place. The complexity of the number of decisions has to be simulated before decisions in policy are executed.

The complexity of the reform, not the reform in itself, is what may create policy resistance. The number of decisions that firms will be required to make will be complicated to balance, and when considering the analysis derived from the institutional arrangements through Young's analysis, we expect problems to be derived from the change in policies over time. The new regulations have taken time to see the light, and at times the rush of political terms is different to the times when decisions have to be made. This may affect the overall results. Another aspect is the amount of feedback involved in the decisions made by firms and the regulator. As an example of a single regulatory decision, the Energy Transition Law for firms to have a minimum amount of clean energy in their processes reduces their strategic investment in sustainable practices. To simulate such decision-making processes, we develop a model whose structure is outlined below.

4. Model Structure

Figure 4, below, shows the four loops that constitute the incentives caused by the required proportions of clean production and clean energy generation. Loops 4.a and 4.c are of the reinforcing loop type (positive loops) because they involve the development of the clean capacity of both the production and generation of energy from direct investments in these areas. The greater these proportions, the greater the incentives will be. The causal chain for Loop 4.a is as follows: the greater the strategic investment, the greater the investment in production capacity, the greater the clean production capacity construction, the greater the clean production capacity, the greater the clean to no-clean production capacity proportion, and the greater the incentives that finally increase the amount of strategic investment, which closes Loop 4.a. The causal chain for Loop 4.b is as follows: the larger the strategic investment, the larger the investment in energy production capacity, the larger the clean energy production capacity construction, the larger the clean energy production capacity, the larger the clean to non-clean energy production capacity proportion and the greater the incentives which ultimately increase strategic investment.

Loops 4.b and 4.d are of the balancing type (negative loops) since, by increasing the production capacities and the generation of non-clean energies, exogenous support incentives will decrease. The greater these proportions, the greater the incentives will be. The causal chain for Loop 4.b is as follows: the larger the strategic investment, the larger the investment in production capacity, the larger the clean production capacity construction, the larger the non-clean production capacity, the smaller the clean to non-clean production capacity proportion, and the lower the incentives that ultimately decrease the amount of strategic investment, which completes Loop 4.b. The causal chain for Loop 4.d is as follows: the higher the strategic investment, the higher the investment in energy production capacity, the higher the non-clean energy production capacity construction, the higher the non-clean

energy production capacity, the lower the clean to non-clean energy production capacity proportion, and finally the lower the strategic investment. Thus, to summarize, strategic investment in clean energy under the new law is an incentive-based strategy which means that, unless firms receive subsidies, few will invest out of their pocket directly to meet the new regulations.

(4.a Clean production capacity)   **(4.b Strategic investment)**

(4.c Clean energy production)   **(4.d Non clean energy production)**

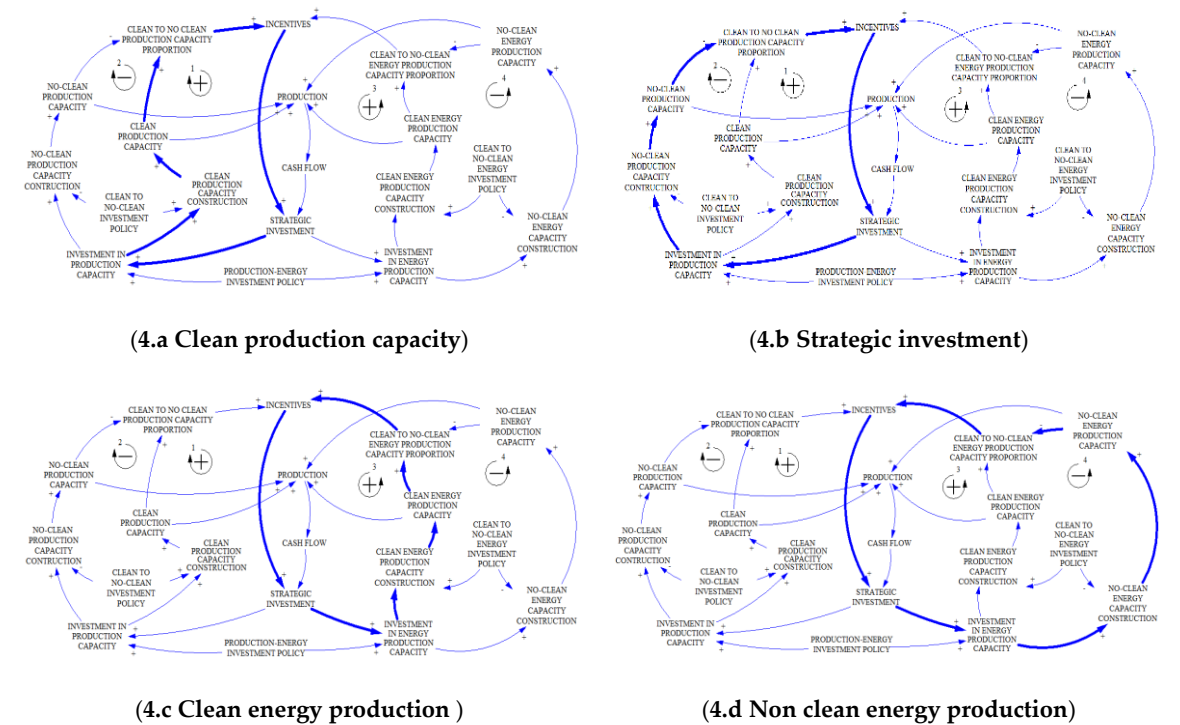



Figure 4. Investment incentives causal loop diagrams.

Figure 5, below, shows the four loops that determine the level of production. The four loops are of the reinforcing type since the greater the investment in each of the two production capacities (clean and non-clean) and the generation of energy (clean and not clean), the greater the production and, consequently, the cash flow available to increase the subsequent investment will be.

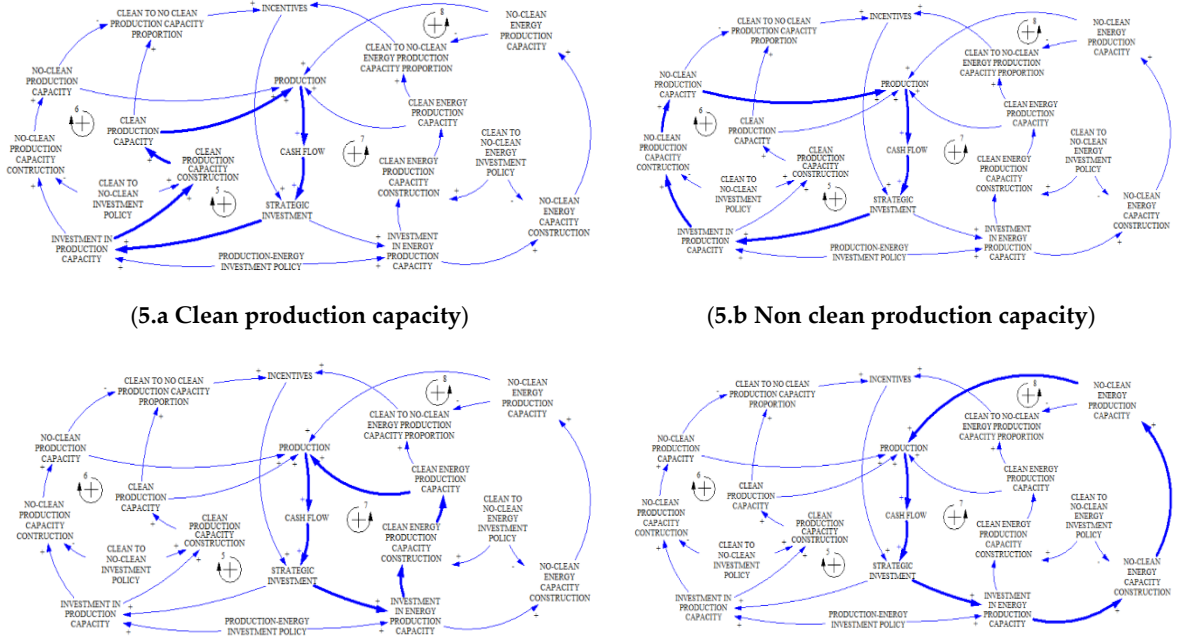
(5.a Clean production capacity)   **(5.b Non clean production capacity)**

(**5.c Clean energy production capacity**)   (**5.d Non clean energy production capacity**)

Figure 5. Resource investment causal loop diagrams.

When all these loops start to interact together, finding better solutions depends completely on the effects of the system, and these are unclear. In addition, we expect nonlinearity in the decisions taken by firms. In fact, when the reform aims at investment in firms' clean technology or energy investment, the effect on firms' competitiveness can be impacted, reducing the emissions or the need for cleaner technology as stated above, and the overall effect would be that firms will have to find other types of solutions that may impair their current sustainability efforts. As trade-offs by firms appear in the decisions involved, the firm will have to learn to slowly adapt and create new business models that in the short term may seem to be a solution, but that in the overall long term will be inefficient for reform.

5. Results

In this section two scenarios are analyzed: the imposed and the free. The imposed scenario is the one that follows regulations to meet the goals enacted by the government, whereas the free scenario allows firms to make their own decisions. The investment strategies for each of the two scenarios are shown in Table 3, below. The values of the investment proportions in production capacity and power generation, and their corresponding clean to non-clean proportions, are considered in the imposed scenario, based on the general guidelines of sustainable policy mentioned above. In the free scenario, new values of these decision variables are explored, whose impacts improve the KPIs.

Table 3. Scenario assumptions.

	Scenarios	
	Imposed	**Free**
% DESIRED ENERGY GENERATION CAPACITY TO PRODUCTION CAPACITY INVESTMENT	30%	55%
% DESIRED CLEAN TO NON-CLEAN ENERGY PRODUCTION INVESTMENT	20%	43%
% DESIRED CLEAN TO NOCLEAN PRODUCTION INVESTMENT	30%	62%

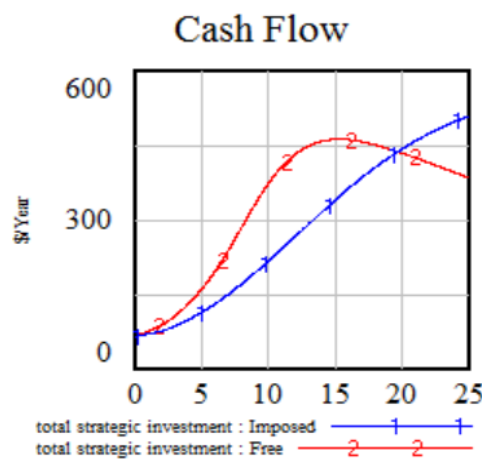
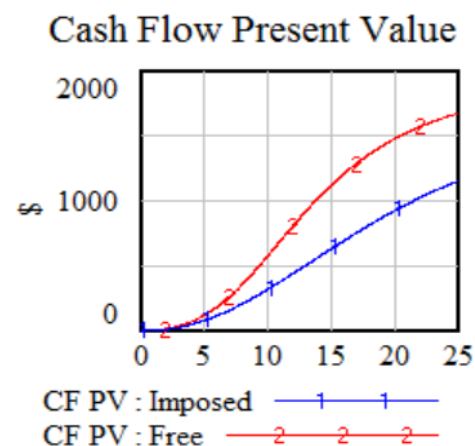
Table 4 shows the results obtained from the simulation of the model for each of the two scenarios.

Table 4. Scenario Key Performance Indicator (KPI).

	Scenarios	
	Imposed	**Free**

Clean to Non-Clean Production Capacity Increment	5.2 times	3.9 times
Clean to Non-Clean Energy Production Capacity Increment	1.5 times	1.3 times
ACCUMULATED TOTAL COST INDEX	679	613
ACCUMULATED TOTAL EMISSIONS INDEX	4251	3761
Commercial Energy Performance Certificates (CEPC) to total Energy Performance Certificates (EPC) proportion	23%	21%
Capacity to Production Capacity (CPC) to total Production Capacity (PC) proportion	43%	37%
PRESENT VALUE	1152	1675

The KPIs improve in the free scenario with respect to the imposed scenario. The present value is higher and the costs and emissions are lower. These values are achieved because the restrictions imposed on official policies are relaxed, which are not necessarily the most convenient methods for profitable and sustainable decision making.

Figure 6 shows the graphs for the main KPIs of the model: cash flow, cash flow present value, total cost, total cost present value, emissions and accumulated emissions, comparing their behavior over time, and corroborating the idea that the free scenario is more convenient than the imposed scenario.

(**6.a**) Cash Flow

(**6.b**) Cash Flow Present Value

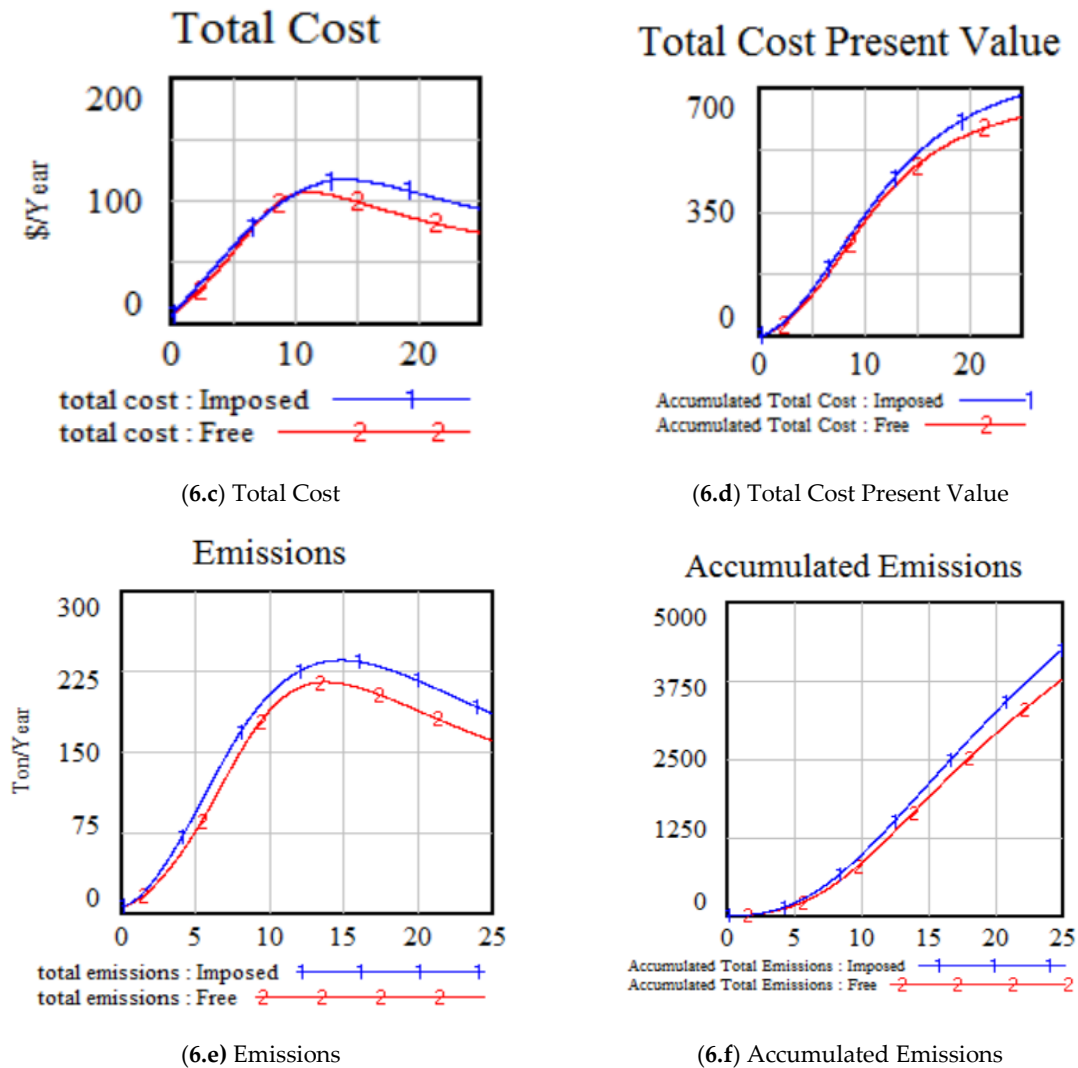



Figure 6. Results of the simulation model.

In all cases, the free scenario has a better outcome than the imposed scenario, suggesting that regulation will create unintended consequences.

6. Corporate Sustainability within the Energy Reform

Corporate sustainability derives from the broader sustainable development concept, and it is a construction parallel to Corporate Social Responsibility (13). We characterize corporate sustainability as the ability of firms to create reasonable economic success with well-executed strategies that consider economic, environmental, and social constraints, maintaining social equity, environmental integrity, and economic success.

Corporate sustainability within energy reform implies impacts both internally and externally in economic, social, and environmental terms. Knowing how and why these impacts are generated will allow firms to carry out strategies to undertake mitigation and adaptation strategies that will result in continuous improvements to improve environmental performance, focusing on the growing use of alternative fuels, reducing greenhouse gas emissions, and improving energy efficiency at the same time as maintaining their competitiveness.

For the case of many emerging economies, the idea is novel. In fact, in developed countries, the issue is at a mature stage regarding how and what to mitigate and adapt. In the case of Mexico, however, there are not as yet robust studies that can shed light on how, exactly, given the institutional infrastructure in place, companies will develop strategies and how the regulator should design public policies. The lack of factual information is perhaps one of the main hurdles in the implementation of public policies.

A literature review of the topic sheds some light, although the studies are too broad in scope: for example, some empirical studies have been conducted on environmental issues or environmental enforcement by adopting environmental management systems. Dasgupta et al., (2000) who studied the effects of regulation and management policies at the plant level in the adoption of environmental practices, concludes that factors such as market management systems and subsidizing by the regulator when there is weak regulation can be useful tools for implementing complementary best environmental practices. Ruiz-Arredondo et al., (2006) analyzed manufacturing enterprises in relation to the incentives to adopt subsidies, such as the Clean Industry Program ("National Environmental Audit Program"), the flagship program of voluntary regulation in Mexico. The authors analyzed a sample of 226 companies, and their study concluded that regulatory pressure (implementation of the standard) and receiving fines or prosecutions initiated, as a result, the adoption of practices of stronger environmental management. A broader study by Blackman et al., (2007) used a sample of companies in the Business Information System (SIEM) of the Ministry of Economy which received fines linked to PROFEPA (the Federal Attorney for Environmental Protection). Their study supports the results that the main driver of participation is the threat of regulatory sanctions. Their study found that plants that sell their products in foreign markets, which are government suppliers, are relatively large and in certain sectors and states are more likely to engage in environmental management programs. Montiel and Husted (2009) found, in the same sample as Blackman et al., (2007), that the early adoption of voluntary programs in Mexico is further explained by access to international markets and the possibility of obtaining relevant information regarding the industry associations to which they belong. Finally, Aigner & Lloret (2013) generated information on various aspects related to the adoption of practices of environmental sustainability and the responsibility for decision-making regarding environmental challenges. The study found that Mexican firms have numerous drivers to invest in environmental activities, and that these firms are investing at increasing rates, suggesting that firms are in an early adoption stage.

As the energy reform and climate change laws were designed and enacted, the position of most of the Chambers of Commerce in Mexico has been positive. Chambers such as the National Air Transportation Board and the Mexican Chamber of the Construction Industry consider that the reform can benefit their sectors in reducing the prices of their products, making them more internationally competitive. Companies will be able to sell their surplus generated electricity to third parties. Many industries expect that the energy reform will bring new investments to their companies and some are developing projects that will benefit from the energy reform, while some others are wary that the implementation stage and enforcement is still lacking. Among the chambers awaiting investments are the Mexican Chamber of Construction Industry (CMIC) Confederation of Industrial Chambers of the United Mexican States (CONCAMIN), National Association of Plastics Industries (ANIPAC) National Chamber of Sugar and Alcohol Industries (CNIAA), National Chamber of the Industry of the Iron and Steel (CANACERO), National Chamber of Fishing and Aquaculture Industries (CANAINPESCA) and the National Chamber of Industry Development and Promotion of Housing (CANADEVI). However, broadly speaking, the expectation is that energy efficiency will result in less use of natural resources, lower energy consumption, and a decrease in gas emissions or greenhouse compounds.

7. The Challenge

One has to appreciate the optimism that businesses are projecting towards the energy reform. The Business Coordinating Council (CCE) has expressed support for the agreements and commitments made by Mexico in the 21st Conference of the Parties to the UN Framework Convention on

Climate Change (COP21). The business sector is coming together around a set of priorities, and more ambitious and long-term goals, confirming an irreversible trend towards a low-carbon economy. However, goodwill is not enough. For a proper implementation of the reform, the regulators need reliable, verifiable and updated information, which currently is lacking—and even if it was proposing state-of-the-art regulation, the implementation is behind the reality of the challenge. The main instrument, the National Emission Register (RENE), must be complemented with a clear roadmap on what type of energy technologies will be implemented, by who, and when. In addition, what the carbon price should be and what financial instruments will be considered, and how these will be regulated, should be determined. At the current moment, there is no clarity about these factors.

A low-carbon economy needs mechanisms to facilitate the development of clean technology and the infrastructure to facilitate the development of a market for greenhouse gases and carbon, both of which are not ready yet. Firms and regulators need clear measurement, reports and verification of emissions. They need a framework for sector-specific actions, as well as a gradual increase in the development of new technologies. Successful adaptation depends in part on access to information and, in some sectors, the development of technology.

8. Conclusions

Energy reform is undoubtedly necessary to transform Mexico, but policy makers have yet to acknowledge one of its great hurdles: implementation itself constitutes a challenge in environmental and economic terms for many actors. Proper implementation of the energy reform in the public sector must harness the power of the business sector and encourage its alignment with the objectives of sustainability. However, if such institutional schemes do not incentivize better sustainable practices than the ones firms currently use, then the energy reform may in fact slow or reverse the growth of sustainable practices in the business sector.

Author Contributions: Conceptualization, Methodology, and Analysis Antonio Lloret; Formal Analysis, Programming Rogerio Domenge; Institutional Analysis, Mildred Castro-Hernández.

Funding: This research received no external funding.

Acknowledgments: The authors wish to acknowledge support by Asociación Mexicana de Cultura, AC for their support in this research.

Conflicts of Interest: The authors declare no conflict of interest.

References

1.   Aigner, D.J.; Lloret, A. Sustainability and Competitiveness in Mexico. *Manag. Res. Rev.* **2013**, *36*, 1252–1271, doi:10.1108/MRR-06-2013-0138.

2.   Blackman, A.; Lahiri, B.; Pizer, W.; Rivera-Planter, M.; Muñoz-Piña, C. *Voluntary Environmental Regulation in Developing Countries: Mexico's Clean Industry Program*; Resources for the Future: Washington, DC, USA, 2007.

3.   Dasgupta, S.; Hettige, H.; Wheeler, D. What Improves Environmental Compliance? Evidence from Mexican Industry. *J. Environ. Econ. Manag.* **2000**, *39*, 39–66, doi:10.1006/jeem.1999.1090.

4.   DOF. 20 de Diciembre de 2013. Decreto por el que se Reforman y Adicionan Diversas Disposiciones de la Constitución Política de los Estados Unidos Mexicanos, en Materia de Energía. Available online: http://www.diputados.gob.mx/LeyesBiblio/ref/dof/CPEUM_ref_212_20dic13.pdf (accessed on 29 December 2015).

5.   DOF. 11 de Agosto de 2014. Available online: http://www.dof.gob.mx/index.php?year=2014&month=08&day=11 (accessed on 29 October 2018).

6.   DOF. 6 de Junio de 2012. Ley General de Cambio Climático. Available online: http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC_130515.pdf (accessed on 28 December 2015).

7.   DOF. 24 de Diciembre de 2015. Decreto por el que se expide la Ley de Transición Energética. Available online: http://www.dof.gob.mx/nota_detalle.php?codigo=5421295&fecha=24/12/2015 (accessed on 30 December 2015

8.   Euromonitor Article, September 17, 2013.

9.   Euromonitor, *Unlocking the Energy Sector Could Transform the Mexican Economy*. Article, 6 February 2015.

10.   Emerging Focus: Emerging Market Economies Face Growing Environmental Problems. Euromonitor Article, 13 October 2015

11.   González, L. Reforma Energética Beneficiará a Industria Hasta 2016: Concamin. 2015. Available online: http://eleconomista.com.mx/industrias/2015/06/14/reforma-energetica-beneficiara-industria-hasta-2016-concamin (accessed on 6 October 2015).

12.   Hernández, A. Reforma Energética Traerá Inversiones por 10 mil mdd Anuales: Canacero. 2014. Available online: http://www.elfinanciero.com.mx/economia/reforma-energetica-atraera-inversiones-por-10mmdd-anuales-canacero.html (accessed on 7 October 2015).

13.   Lajous, A. *Mexican Energy Reform*; Center on Global Energy Policy, Columbia University: New York, NY, USA, 2014.

14.   Montiel, I. Corporate Social Responsibility and Corporate Sustainability: Separate Pasts, Common Futures. *Organ. Environ.* **2008**, *21*, 245–269, doi:10.1177/1086026608321329.

15.   Montiel, I.; Husted, B.W. The Adoption of Voluntary Environmental Management Programs in Mexico: First Movers as Institutional Entrepreneurs. *J. Bus. Ethics* **2009**, *88* (Suppl. 2), 349–363, doi:10.1007/s10551-009-0282-y.

16.   Perez-Batres, L.A.; Miller, V.V.; Pisani, M.J.; Henriques, I.; Renau-Sepulveda, J.A. Why Do Firms Engage in National Sustainability Programs and Transparent Sustainability Reporting? Evidence from Mexico's Clean Industry Program. *Manag. Int. Rev.* **2011**, *52*, 107–136, doi:10.1007/s11575-011-0098-8.

17.   PROMARNAT. *Plan de Desarrollo: Programa Sectorial de Medio Ambiente y Recursos Naturales Gobierno de la República Mexicana*; SEMARNAT: Mexico City, Mexico, 2013. Available online: http://www.conafor.gob.mx:8080/documentos/docs/8/5403PROGRAMA%20SECTORIAL%20DE%20MEDIO%20AMBIENTE%20Y%20RECURSOS%20NATURALES%202013-2018.pdf (accessed on 29 October 2018)

18.   SEMAR NAT. *Estrategia Nacional de Producción y Consumo Sustentable*; Secretaría de Medio Ambiente y Recursos Naturales: México City, México, 2013.

19.   SIPSE. Reforma Energética Reduciría Precios de Boletos de Avión. 2013. Available online: http://sipse.com/mexico/reforma-energetica-reduciria-precios-de-boletos-de-avion-48514.html   (accessed on 6 October 2015).

20.   Sterman, J.D. *Business Dynamics: Systems Thinking and Modeling for a Complex World*; Irwin/McGraw-Hill: Boston, MA, USA, 2000; Volume 19.

21.   Ruiz-Arredondo, J.; Rivera-Planter, M.; Muñoz-Piña, C. *Incentivos Económicos de las Empresas a Participar en Acuerdos Ambientales Voluntarios*; Instituto Nacional de Ecología: México City, México, 2006.

22.   Redacción Manufactura. 2014: El Impacto Industrial de la Reforma Energética. 2015. Available online: http://www.manufactura.mx/energia/2014/12/22/2014-el-impacto-industrial-de-la-reforma-energetica (accessed on 8 October 2015).

23.   UNFCCC. *Mexico Intended Nationally Determined Contributions*. Retrieved from http://www4.unfccc.int/ndcregistry/PublishedDocuments/Mexico First/MEXICO INDC 03.30.2015.pdf

24.   Valle, A. Reforma Energética Detonaría Construcción de 50 mil Casas en 2015. 2014. Available online: http://www.elfinanciero.com.mx/empresas/reforma-energetica-detonaria-construccion-de-vivienda-en-2015.html (accessed on 8 October 2015).

25.   Weyzig, F. Corporate Social Responsibility in Mexico. *Account. Bus. Public Interest* **2007**, *6*, 1–157.

26.   Young, O. *The Institutional Dimensions of Environmental Change: Fit, Interplay and Scale*; MIT Press: Cambridge, MA, USA, 2002.