

Financing Technological Improvements and Firm Competitive Advantage Through the Kyoto Protocol's Clean Development Mechanism (CDM): A Latin American Example

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ABSTRACT. For nations of the global south there has been an overall dismissal of emissions reduction practices surrounding global warming, and perhaps rightfully so. Developed countries have been identified as the primary contributor towards the climate change issue, and many countries perceive that the curbing of emissions will lead to the stagnation of economic growth and prosperity. For developing nations, embracing emission reductions or carbon emission offsets appear to make little

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sense if in fact such actions would result in the economic contraction expected. However, we suggest that the climate change issue, although perceived as an obstacle to growth and prosperity, holds several strategic competitive advantages for first movers. Three factors are discussed regarding first mover advantage and we use the energy industry of the Latin American and Caribbean (LAC) region as our example.

RESUMEN. Para las naciones del sur global, ha habido un rechazo general, quizás apropiado, de la reducción de las prácticas relativas a las emisiones sobre el calentamiento global. Se ha identificado que los países desarrollados son los principales contribuyentes al tema del cambio climático, y muchos países perciben que el acto de frenar las emisiones llevará al estancamiento del crecimiento económico y la prosperidad. Para los países desarrollados, parece tener poco sentido común abrazar la causa de reducir las emisiones o compensar las emisiones de carbono si, de hecho, estas acciones resultarán en la esperada contracción de la economía. Sin embargo, sugerimos que, a pesar de percibirse como un obstáculo contra el crecimiento y la prosperidad, el tema del cambio climático ofrece varias ventajas competitivas para los que den el primer paso. Se discuten tres factores respecto a la ventaja para el que tome la iniciativa, y usamos la industria energética de la región latinoamericana y caribeña (LAC), para ilustrar nuestro ejemplo.

RESUMO. As nações do sul do globo terrestre têm verificado um retrocesso geral, conveniente, nas práticas de redução de emissão de gases que envolvem o aquecimento da terra. Os países desenvolvidos são os que mais contribuem para o fenômeno da mudança climática, e muitos países entendem que a diminuição das emissões conduzirão à estagnação da prosperidade e do crescimento econômico. Para as nações em desenvolvimento, adotar a redução das emissões ou compensar a emissão do gás carbônico não parece fazer muito sentido, se tais ações, de fato, resultarem na retração econômica esperada. Sugerimos, contudo, que o tema da mudança climática, embora seja considerado um obstáculo ao crescimento e à prosperidade, ofereça diversas vantagens competitivas estratégicas para os que tomarem esta iniciativa. Três fatores são discutidos em relação à vantagem daqueles que derem o primeiro passo, e usamos, como exemplo, a indústria energética das regiões da América Latina e do Caribe. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2005 by The Haworth Press, Inc. All rights reserved.]

KEYWORDS. Climate change, strategy, competitive advantage

In the last decade, Global Warming has become a legitimate issue. From pre-industrial times to today, anthropogenic emissions are said to have increased the tropospheric concentrations of greenhouse gases (GHG), i.e., carbon dioxide (CO₂) and methane, by 28% and 112%, respectively (Carbon Dioxide Information Analysis Center, 2001). For this reason, many nations have confirmed and agreed that their respective emissions may be contributing to the potential warming of the climate, and they have already started to take action. Following the 155 country ratification of the Framework Convention on Climate Change (FCCC) at the Earth Summit in Rio de Janeiro, the Kyoto Protocol was forged in 1997 to bind signatory nations to emission reduction targets. Once the protocol was ratified by 50 of the 156 participating nations, or 55% of global carbon emissions, a global contract would come into effect, thereby limiting each of the developed nations' GHG emissions. As of April 2005, 150 nations have ratified, accepted, accessed or approved the protocol, making Kyoto¹ the primary global pact addressing the climate change issue and binding signatory countries to emissions controls and reduction.

As a means of assisting participating countries and their respective industry in reducing carbon emissions, flexible mechanisms were added to the Kyoto Protocol. These mechanisms provide participating nations and their respective industry a degree of discretion to utilize market forces in their efforts to reduce emissions and be in compliance with the protocol. Despite their initial political strategy of lobbying regulatory regimes to keep from imposing emission reducing policies, the business sectors in these nations are experimenting with such mechanisms nonetheless. In preparation for a limit on emissions, some firms in the global north have taken one of two different strategies for managing the climate change issue: innovation or compensation (Kolk and Pinske, 2005). In the first instance, innovation is a strategy that seeks to add to the organization's assets and competencies through research and development. The strategy is to seek to stake a competitive position in the future by adding to the organization's asset base through technological change. In the latter situation, compensatory action involves the use of carbon trading systems, whereby organizations experiment with emission limits and offsets or credits that are offered on carbon markets. For many organizations, these strategies are voluntary until such a time as their governing authorities establish limits. But the adoption of voluntary reductions is on the rise, even in the US, where the current administration refuses to participate in the Kyoto protocol (Hoffman, 2005). Although several carbon trading markets have been piloted over

the last few years, we are now witnessing the emergence of sizeable markets that not only cross industry and country boundaries, but have incredible economic potential (Baron, 2000). The European Emissions Trading System, set to open this year (2005), is expected to operate among 15 participating countries and their respective industry (Victor and House, 2004). The point is that the strategic behaviors of innovation and compensation are an indicator of activities in response to the Kyoto protocol, climate change and a carbon constrained future, and many firms are experimenting with these mechanisms.

BP, Royal Dutch Shell, TransAlta Utilities, Duke Energy and Nike are but a small sample of a much larger list of enterprising companies² from the industrialized world seeking to strategically reduce their emissions and pilot sequestration projects in anticipation of carbon restraints. However, the carbon trading market is confined to Annex B nations. Annex B nations are those that have a defined emissions reduction plan under the terms of the protocol; they are nations that are primarily developed or in transition. In other words, participants of carbon trading are confined to the industrialized north. Yet, despite this omission of non-Annex B nations, or developing nations, we believe that there are significant strategic opportunities for firms of the global south (Painuly, 2001). However, part of the problem of getting organizations of the global south to recognize this environmental issue (climate change) as a credible strategic opportunity will be the removal of a few perceived barriers. We believe that these barriers function as a veil, covering or disguising the opportunities as unsupportable, economically poor investments. In this paper, we discuss these barriers in brief, provide a brief literature review of first mover advantages with respect to the natural environment, and then provide an example of how a mechanism under the climate change issue can result in a competitive opportunity.

Barriers to the Adoption of the Climate Change Issue

For many developed and developing nations, embracing emission reductions is considered an economic setback. The costs associated with mitigating global warming are staggering. The U.S. Council of Economic Advisors has estimated that the cost for the U.S. economy to reduce its emissions by 20% by the year 2100 would be approximately \$US 3 trillion (Levy, 1997). Likewise, the Canadian market expense to lower emissions in line with Kyoto prescriptions is projected to potentially impact its economy by as much as \$44 billion (Donnelly 2000).³

For the most part, global warming has been identified as a developed country issue, even though the climate change issue is a global problem. Hence, carbon emission reduction for developing countries and their respective industries makes little sense if in fact such actions would result in economic contraction. On top of that, non-Annex B countries, those in developing status, are exempt from participating in emissions trading, further alienating this segment of the world. In light of this, we discuss three specific phenomena that we believe have turned organizations of the global south away from seeking opportunities within the climate change issue: environmental orientation, climate change contribution and industry isomorphism. These factors are briefly discussed using the energy industry of the Latin American and Caribbean (LAC) region as our example.

First, with respect to protecting the environment, among all of the different stakeholders that influence managerial decision making, regulators have been highlighted as being the most effective. Regulatory enforcement for industry compliance with legislation that protects the environment is considered an effective means of controlling firm and executive behavior (Henriques & Sadorsky, 1996); it is especially effective where there is a trade-off between profits and protection of the environment. However, for the climate change issue, this regulatory influence would be borne out of public policies that recognize the importance of the natural environment and which emphasize its protection and preservation. In the global south, with respect to climate change and the environment, this is questionable. Being that the energy sector is one of the primary emitters of GHGs, few countries in the global south have environmental legislation specifically targeted to this sector, and what environmental legislation there is, is poorly enforced (Reinsch & Tissot, 1995). In Latin America, for example, environmental regulations often conflict with energy sector laws, which then creates confusion and conflicting goals (Barrera-Hernandez, Lucas, McCoy and McCready, 2000). Often the results are regulatory incentives that favor growth and production over environmental concerns, resulting in policy decisions that dismiss environmental protection and perhaps the adoption of emissions reductions. Since the climate change issue is associated with environmental activities, there would be an overall administrative emphasis on enhancing energy output over pollution abatement or emissions reducing technologies/practices, indicating that their environmental orientation is slighted and that protecting the environment is considered a hindrance to development and growth.

There is also the issue of government support for the climate change issue. With respect to that issue, and any projects surrounding its mitigation, countries, on an individual basis, must establish a definition for sustainable development and also clarify what would constitute as a verifiable emissions reducing project. Countries that are willing to participate in CDM projects must, as a requisite, establish a carbon baseline, a monitoring plan and additionality of carbon projects. There is reliance upon governing authorities before organizations can participate and potentially take advantage of CDM opportunities.

Second, and tied to the first, there is also the issue of the LAC region's contribution to the climate change issue. The LAC's electricity sector emits approximately 230,000 gigagrams (Gg) of CO₂. This represents approximately 21% of the total CO₂ emitted by the region (Pistonesi, Rodriguez Padilla and Chávez, 2000). This is a considerable percentage, but it is a small fraction of the approximately 6,000,000 Gg the U.S.A emits per year, or the 14,212,000 Gg (Zittel and Treber, 2000) emitted by the developed nations as a whole. On an allocation of contribution basis, there is no reason to expect the region to consider legislative policies or financial expenditures to support a reduction in emissions that could consequently impede energy growth or development.

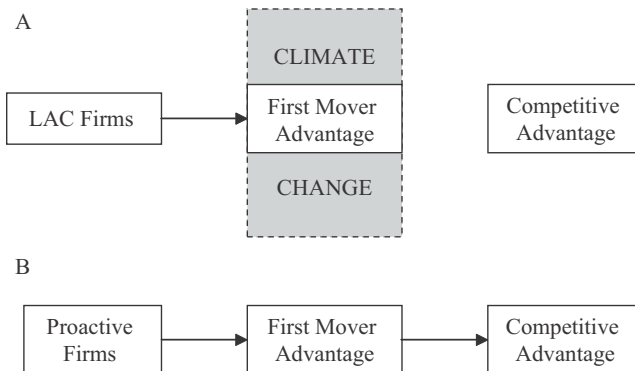
Finally, with respect to individual firms, it is unusual for one firm to be more proactive than its peers with regards to environmental performance. Most regional utilities in the energy sector tend to mirror one another. This phenomenon is a result of the institutional forces that exist within an industry. Tacit norms, values and beliefs developed by the people in the industry and the surrounding region act to encourage organizations to conform to particular behaviors and not to engage in new or unusual tactics. The result is a perception that conformance means easier access to resources and ultimately survival (Kondra & Hinings, 1998). This then creates risk averse behavior and imitation, or what is termed institutional isomorphism (Meyer & Rowan, 1977). In the LAC region, the institutional forces of some industries induce managers to perceive the implementation of environmental technologies⁴ as an unnecessary cost to their operations (Porter and van der Linde, 1995a; 1995b). This then invokes a classic "race to the bottom" mindset with respect to environmental initiatives and competition (Scherer and Smid, 2000). In line with governing body priorities, these organizations will seek energy growth or other more common or recognizable industry opportunities over pollution abatement or environmental initiatives, since these would not be considered a priority or strategically advantageous.

Without regulatory incentives, constant pressure to maintain the status quo and a rejection of any responsibility regarding the climate change issue, there will be a global warming disassociation. It is this perceived veil which we believe keeps organizations and their respective executives from identifying or even considering competitive opportunities involving the global warming subject. Figure 1 demonstrates how these factors alter the perception of climate change as being a developed country issue and an obstacle to economic prosperity. However, moving past these barriers to seize the opportunities, organizations must reconcile their indifference to investments in the natural environment and the perception that these investments are deleterious.

THE ENVIRONMENT IN STRATEGY

For many years there was a prevalent belief that corporate investment in environmental protection would harm the financial position of the firm. The primary mindset was that investing in the environment was a cost with no return. More importantly, investing in the natural environment was not a means for optimizing shareholder wealth. Expecting that shareholders were unimpressed with environment investments, corporations shied away from any type of significant investment in the environment or even advertised such if one was made. Over time,

FIGURE 1. First Mover Advantage



however, some firms accepted being environmentally responsible. Through significant regulatory enforcement and high stakeholder expectations, some firms developed capabilities to improve on their performance for managing both their environmental impacts and the stakeholders involved. Yet many other firms delayed or resisted the environmental revolution, maintaining the view that there was a fixed trade-off between investing in the environment and that of achieving optimal economic performance.

A specific stream of literature focused on the motives for managing the natural environment. Some cited financial reasons for “green” behavior and attempted to legitimize this behavior through the analysis of abnormal returns on the stock market (Hamilton, 1995; Jones et al., 1994), and through enhanced shareholder value (Dasgupta, Hettige and Wheeler, 1997; Dierickx and Cool, 1989; Russo and Fouts, 1997; Klassen and McLaughlin, 1996). Others identified subjective reasons that were firm specific, such as reputation and public acceptance (Marziliano, 1998; Kinkead, 1999; Kanter, 1999; Leiss, 2000). The point is that there were specific strategic reasons for engaging in environmental issues and these were not simply in response to risks. Both Sharma and Vredenburg’s (1998) and Porter and van der Linde’s (1995a) assessment of proactive and reactive firms found that proactive organizations foresaw improved environmental performance as a means to gain a competitive advantage over their competitors. The natural environment was not seen as a threat but rather as an opportunity. In other words, there was a growing environmental market consisting of the sustainable development kind where investing in the natural environment was a legitimate strategic option. As Hart (1997) pointed out in his paper “Beyond Greening,” sustainable development is not only a strategic option, but it will also constitute one of the biggest opportunities in the history of commerce.

Therefore, with respect to strategy, an element required for the forming of a corporate strategy is the recognition of what is shaping the competitive field so that the firm can stake a position that is less vulnerable to attack from head to head opponents (Porter, 1979). The recognition of where the corporation stands within its market, and with respect to the natural environment, will allow the organization to devise a strategy that may enable it to defend itself and to potentially exploit areas that may yield a competitive advantage, even if that competitive advantage is within the environmental arena. Hence, identifying the prevailing view of the fixed trade-off between the ecological and the economical approach, and attempting to converge the two through innovation and

resource productivity in forming a corporate strategy may bring about new market opportunities and a resulting competitive advantage (Porter and van der Linde, 1995a). The precept is that environmental improvements may pose an economic and competitive opportunity. However, they will only be available to those firms that are able to recognize and implement the environmentally conscious principles associated with the adoption of the climate change issue. In line with Hart (1997), there is considerable potential within the natural environment and sustainable development for competitive opportunities; organizations must recognize that environmental opportunities might actually become a major source of revenue growth. The movement towards a perspective that encompasses environmental management as a core strategic position is the first step towards the attainment of a competitive edge (Hart, 1997; IFAC, 1998). This, we believe, is definitely the case with the climate change issue. The next step is the acquisition of resources.

Prospector's Early Mover Advantage

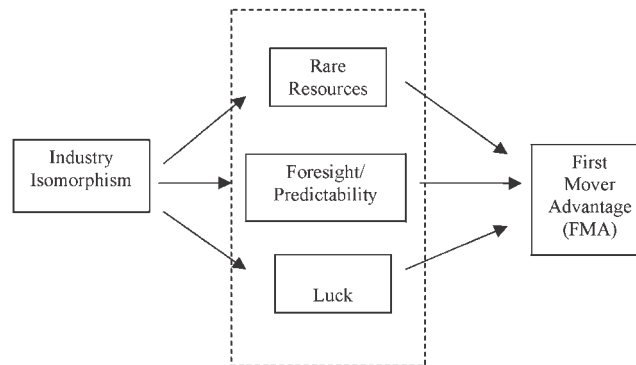
The attainment of a competitive advantage is generally accomplished through the exploitation of either a resource or position in the market. In order to do this, the organization must develop or acquire an asset or capability that is capable of increasing the organization's value. Once this is achieved, the organization's competitors (those without the asset or capability) will recognize their competitive disadvantage and attempt to negate or neutralize the advantage—either that or remain at a competitive disadvantage, which would be deleterious to the longevity of the organization and would demonstrate strategic incompetence. Hence, competitors will attempt to mimic or substitute the competitive advantage. This is another form of industry isomorphism (the term “iso” meaning equal, and “morph” indicating change). Accordingly, for an organization that acquires an advantage, if the advantage or the resource that generated it is not so easily copied or negated, then it becomes a sustainable competitive advantage.

There are several scenarios for the development of a sustainable competitive advantage or first mover opportunity. For instance, an unequal distribution of information and/or resource(s) may provide a first mover an opportunity or competitive advantage. The asymmetrical distribution of such information has the potential to result in a competitive advantage if the holding firm is able to use the information to create value for the firm. Since it is asymmetrical, the information is not equally distributed and therefore is not in the possession of competitors.

In this paper, we provide such information that is considered to be beneficial and which may lead to a competitive advantage. We also believe that the information provided here could convince executives to see the potential opportunities associated with global warming, to look past the barriers we have just listed, and to take the advantage. However, information alone would be insufficient without action. Using the resource-based view of the firm, a first mover advantage occurs when one of three conditions exists: resource rarity, predictability or luck (Lieberman and Montgomery, 1988; Barney, 1991) (see Figure 2).

In the first condition, a rare resource indicates a resource that is uncommon, valuable and non-substitutable (Barney, 1991). Resources may be tangible, physical and quantifiable assets, or intangible assets that are difficult to quantify or measure, especially on the balance sheet. Hence, these resources can range from physical assets (Dierickx and Cool, 1989; Hall, 1992; Coyne, 1986), such as technological leadership or strategic location, to special contracts with key customers, an organization's reputation or even its intellectual capital. The point is that the resource, in whatever form it takes, must add value to or benefit the firm either in the present or in the future. However, the worth of the resource is also determined by its distribution or unequal distribution. If in fact the resource adds value to the organization and is also inaccessible to competing firms, then that resource's value increases considerably. Having a value added resource that is rare allows the firm to exploit that resource for a sustained amount of time; that is, if competitors cannot find a substitute. If other competing firms do not have access to the

FIGURE 2. Industry Asymmetry



valuable resource and cannot find a substitute to replace it because it is considered non-substitutable, which thus effectually negates the competitive advantage, then the resource's value will not only increase but will also provide the firm with a sustainable competitive advantage.

The next two plausible conditions for the advent of a first mover advantage are luck and predictability. By chance, a firm may come across information or a resource that can be used by the firm to gain a benefit. If the firm holding the resource did not purposely acquire or develop it, then such would simply be good fortune, and it would be continued good fortune if that firm's competitors were unable to acquire the resource. However, as a strategy, relying on luck to compete against competitors is a recipe for failure. Predictability, the ability to foresee the future, entails opportunistic circumstances in which an organization makes the necessary changes to achieve a competitive advantage. In this condition, access to information that pertains to a certain future is as unlikely to be successful as is having luck for a strategy. Of course, both conditions are plausible, but they are really outside of the realm that management executives are responsible for with respect to crafting and executing a strategy.

With respect to the energy industry in the Latin American and Caribbean region, the opportunities for developing a competitive advantage via the acquisition of a rare resource are limited. Research and development and the advent of new technologies are not as common as what would be observed in developed nations (Porter and Stern, 2001) because of the capital intensity required for this type of activity.⁵ Given that firms of the energy industry have isomorphic tendencies, as we have already discussed, it is unlikely that significant efforts are being made to create or discover new firm technologies for the sake of competition. The implication is that if a first mover opportunity were to arise for firms of the global south, technological advancement would not necessarily be it. We actually suggest that energy utilities are not competing with one another for market share as much as they are competing for survival. Most utilities that are fortunate enough to be connected to their nation's primary electricity grid are focused on reliability and power rates and not on competition per se.

The Ecuadorian electrical sector serves as an example. The generating capability of its industry has been plagued by mandatory brownouts which are cycled through the country at different times of the year. Severe droughts in the region have had a direct affect on hydro producers. The subsequent undersupply of water necessary for electricity generation has increased the gap between supply and demand. This in turn has

placed a larger strain on the thermo, diesel or coal generators as they try to meet the region's shortfall.⁶ Since many of these generators are outdated and in need of replacement (INECEL, 1993), the spiral continues, with survival being a foremost concern. The industry is focusing on meeting the country's demand and remaining reliable. With a struggling economy and a desperate need for growth, competition is more or less based on survival of the fittest.

There is also the issue of increased competition from foreign investment. The electricity sector of the LAC region has seen a continual stream of privatization, which has thus increased competition in the region. The increase in demand and the lack of capital have created a thirst for new investment. The past decade has witnessed the privatization of many electric sectors in the LAC region. Markets that were completely controlled by the state are now racing towards a free market system. Chile has privatized its utilities; Colombia has established a mix between a free market and state controlled system, and other countries such as Venezuela, Ecuador, Brazil and Mexico are now allowing the participation of private corporations (Pistonesi, Rodriguez Padilla and Chávez, 2000). However, this influx of multinational enterprises could prove deleterious for local firms. If most local utilities are unable to upgrade and compete against the new entrants due to the capital required and the stigma of isomorphism generated within the industry, as we have mentioned, then not only will local LAC firms fall to a competitive disadvantage, but they will not survive at all. For this reason, and what we have argued thus far, we believe that the flexible mechanisms within the Kyoto protocol will be absolutely advantageous for organizations of the global south. These mechanisms will provide an avenue for the transfer of rare resources such as newer technologies and/or organizational capacities. Organizations that begin to engage climate change offices (with their respective governing authorities) and seek ways to participate in identifying emissions reductions increase the probability of participating in a CDM and of ultimately attaining a rare resource to become a first mover with respect to their local competition. This is the first mover advantage opportunity available through CDMs of the Kyoto Protocol.

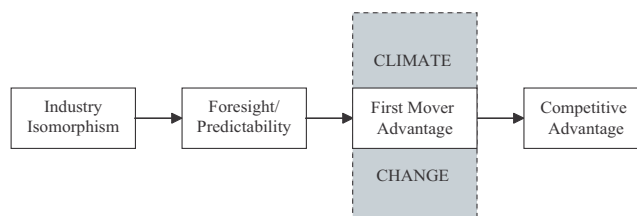
WHAT DOES IT LOOK LIKE?

The Kyoto protocol outlines potential means for reducing global greenhouse gas emissions. One such instrument is the Clean Development

Mechanism (CDM).⁷ The CDM is a process that facilitates the transfer of technology and/or capabilities between developed and developing countries. Outlined in Article 12, the CDM was proposed to enable Annex B parties that are subject to emission limits to invest in developing countries or non-Annex B parties and, in exchange, receive emission credits to apply to their own quota. Although the framework and procedure for the CDM is still at an early stage, the latest agreement reached by the Conference of the Parties' (COP) Marrakesh Accord and Declaration⁸ has brought the CDM closer to reality. The opportunity to be one of the first organizations or companies to participate in and be a recipient of a technological capability and/or capital from a developed country remains wide open. The clean development mechanism enables an Annex B nation to transfer technology to a non-Annex B nation and ultimately receive emissions credits. These credits can then be applied to the organization's quota or sold on the carbon market. The recipient of the technology, a firm within a non-Annex B country, will have received a technology upgrade. Simply put, an LAC firm that participates in a CDM will increase its opportunity to realize new technologies, potentially attract additional capital, gain advanced practices and improve its environmental conditions. This need not be a complicated undertaking for the local LAC region firm. GHG emissions reduction can occur by simple pollution control or pollution prevention strategies. A study conducted by five US Department of Energy (DOE) laboratories determined that numerous cost-effective energy-efficient technologies remain underutilized and that if feasible ways were found to implement these carbon reducing methods, the energy savings produced would roughly equal or exceed the costs required to implement the technology or program/policy. If in fact cost-effective energy efficient technology is so underutilized, then a technological transfer would be both simple and instantly impacting. The impending emissions-constrained future and the prospect of the CDM would facilitate a retrofit or upgrade of an LAC region utility by a firm from an Annex B nation (see Figure 3).

In 2000, the electricity generated in the LAC was close to 960,000 GWh; 63% of the generation was hydroelectricity, with the rest coming primarily from aging thermo-power plants (OLADE, 2002). These aging plants have been further strained with the recent droughts in the area. Because of the lack of rainfall, hydroelectric plants have been unable to meet the electricity demand. This has brought about not only power rationing but reforms in the sector in order to reduce hydro-power's share and increase thermoelectric generation using fossil fuels such as coal, oil derivatives and natural gas (IEA, 2001). The projected

FIGURE 3. LAC Industry Asymmetry



increase in emissions is inevitable; however, the CDM may assist in facilitating the implementation of cleaner technologies. If we consider that natural gas is the least carbon intensive fossil fuel, the idea of refitting a coal-based power plant to burn natural gas is very attractive.⁹ Refitting existing power plants with circulating fluidized bed (CFB) boilers or integrating a gas turbine to form a combined cycle can be more cost effective than building new power plants. In fact, refitting can increase capacity and improve plant efficiency (IEA, 2000). Currently, in the LAC region there are several coal-based power plants located in countries such as Argentina, Brazil, Colombia and Mexico, which could benefit from such a retrofit.

For example,¹⁰ suppose a 200 MW power plant is working at full capacity 300 days/year. Using coal, this plant emits approximately 1,440,000 tons/year of CO₂. If the plant is retrofitted and switched to natural gas, the emissions will be reduced to 864,000 tons/year. That is a difference of about 576,000 tons/year. The difference can either be assumed by a firm in an Annex B country or sold on an emissions trading market. Estimates vary, with some speculating that carbon will have a trade value of \$US 7 per ton. In this example, the marketable carbon credit would be worth just over \$US 4 million per year.

The evaluation of any plant for retrofitting includes a wide range of business aspects, such as load growth forecasts, financial parameters, environmental regulations and so on. Such an analysis has to be determined separately for each plant (IEA, 2000). The economic analysis to change the technology per se, where there is an increase of both capital cost and fuel switching,¹¹ must be contrasted with the savings due to lower O&M costs, the improved efficiency with the new fuel and, indirectly, with the social and environmental benefits. Regardless the cost-benefit analysis of the technological improvement, our argument is

that as soon as this generator changes to a cleaner technology, it has an additional asset to trade: 576,000 tons of CO₂ “sequestered” or avoided.¹²

The business opportunity is not only for coal-based plants but also for fossil fuel generators in general. Simply lowering the heat rates of these plants will result in greater efficiency (i.e., less fuel burned per electricity produced) and lower carbon emissions. Improved maintenance (either low cost or no cost) could reduce heating rates by as much as 5% (Interlaboratory Working Group, 1997). For a 200 MW plant working 330 days/year, this could mean yearly CO₂ emissions reductions of 72,000 tons for a coal-based plant, 57,600 for an oil-based plant and 43,200 for a gas-powered plant.

With respect to increasing the generating capacity in the region, renewables should be considered such as wind farm, biomass or small hydropower projects, as these will be able to take advantage of CDM and emissions reductions trading. “Peñas Blancas,” a hydropower plant (35.4 MW of capacity) in Costa Rica, has been operating since September, 2002. In an energy deficient region, developments of new plants or projects are being constructed to pilot opportunities within the Clean Development Mechanism. By avoiding the installation of a fossil fueled generating station and implementing renewables, the plant is expected to avoid emitting approximately 800,000 tons of CO₂ (800,000 CERs¹³) over a 10-year period. The project’s facilitators, the Costa Rican Electricity Institute (ICE) and the Government of Holland, anticipate that this will represent an additional income of approximately 3 million 600 thousand Euros if they were to acquire 4.5 Euros/CER on the carbon market. Even though this amount only represents about 10% of the total cost of the plant, it is still a significant amount and serves to send a positive signal to financiers.¹⁴

Other emissions reducing projects involving the innovation and involvement of firms from the global south remain wide open (Donnelly, 2000). They may be as unusual as providing opportunities for farmers of the global south to change the feed of their cattle,¹⁵ or contributing solutions for the deforestation of the Amazon forest. Estimates suggest that the deforestation rate over the next three decades, resulting in subsequent emissions and a decrease in sequestration, will negate any reducing activities brought about by standards set in the Kyoto protocol (Carvalho et al., 2004). In other words, organizations of the developed countries are exploring ways to manage the impending limit on emissions though the investment in emissions reducing programs of non-Annex B countries via the clean development mechanism. In support of

this and as an indication of this venture trend, many governments have established climate change offices, with some going as far as developing CDM programs. For instance, the Spanish government has pledged €200 million towards their CDM program, pushing total European government commitment to over one billion Euros (Michaelowa, 2005). On the other side of the equation, some governments of Annex B and non-Annex B nations have taken the initiative to assess carbon resources and the areas for potential investments. Brazil¹⁶, Cuba¹⁷ and India are a sampling of this growing list. Even Central and South American government support for CDMs is on the rise. As of 2003, 13 countries have established CDM offices, with many of these having identified projects and 9 of them having approved some.¹⁸

FINAL WORDS

Because technology is constantly changing, the new paradigm for global competitiveness requires organizations to have the ability to innovate rapidly (Porter and Van der Linde, 1995a). Many firms in developing countries do not have the resources available to compete at this level. The paradigm of bringing environmental improvements and competitiveness together (Hart, 1997; Porter and Van der Linde, 1995a) through environmental technologies to create and expand market demand, change production costs and make firms more attractive to investors and communities alike (Shrivastava, 1995) has yet to be experienced in the LAC region. Some countries of the North have sought to establish competitive advantages on an international scale through research and development in environmental technologies. Shrivastava (1995) has predicted that these technologies will impact the competitiveness of many industries and countries with the global south destined to lag behind. If it were not for the advent of Kyoto and the soon-to-be first movers of the global south, the energy industry would falter. The entrepreneur as first mover is the prime mover in economic development. He or she pursues (actively) opportunities (Stevenson and Jarillo, 1990) in the face of uncertainty (Mises, 1949) and changes the landscape of competition. Since the innovators are the prime catalyst for the “opening” of new markets, which we suggest for many of the firms from the global south, their participation with climate change emissions reduction mechanisms will be the opening of new market opportunities. If the rest of the globe is searching for opportunities to invest in emissions reduction, firms in the southern region have an opportunity to

innovate and provide avenues for those investments and potentially reap the benefits. These benefits include newer technologies, new and improved capabilities, emission credit payments, global recognition, local environmental improvements and so forth.

Because the climate change issue is an environmental initiative, we believe that it is falsely portrayed as an investment that is not supported by governing institutions and as competitively disadvantageous. However, at the rate that organizations and their respective countries continue to address the climate change issue, and activities continue to unfold, opportunities for firms of the global south will be certain to arise. Innovators—organizations that are able to reconcile environmental initiatives as potential opportunities—will be the ones that seize first mover status and enjoy the advantage.

NOTES

1. The Framework Convention on Climate Change (FCCC) emerged in Rio and led to the introduction of the Kyoto protocol, signed in 1997. The Kyoto protocol invited developed nations to reduce their greenhouse gas (GHG) emissions to approximately 5% below 1990 levels over a five-year period (from 2008 to 2012). The Kyoto protocol would come into effect if 55 countries ratified it.

2. Royal Dutch Shell and BP are reducing emissions and have participated in emissions trading. In Canada, regional projects such as PERT (pilot emissions reduction trading) and GERT (greenhouse gas emissions reduction trading) have been piloted to gain experience with emissions constraints. Trading floors have been established in many countries such as the US's Cantor Fitzgerald and Australia's Price Waterhouse Coopers.

3. The Greenhouse Emissions Management Consortium (GEMCO) is a group of Canadian electricity producers in Canada. The mandate of the consortium is to voice the concerns of their members to ensure that policy makers understand such concerns. Some members are: BC Hydro; Enbridge Ltd. EPCOR Utilities Inc.; PanCanadian Pipelines Ltd. (applied); TransAlta Corporation; TransCanada Pipelines Limited.

4. Defined by Shrivastava (1995) as production equipment, methods and procedures, product designs, and product delivery mechanisms that conserve energy and natural resources, minimize the environmental load of human activities, and protect the natural environment. Both pollution prevention and/or pollution control strategies can be considered as environmental technologies. The former seeks to change the process or raw materials used to reduce emissions (e.g., energy efficiency). The latter implies the implementation of what is known as end-of-the-pipe technologies which capture the emissions by preventing their release into the environment [Shrivastava, 1995].

5. Some firms from the Oil and Gas industry may be an exception. Companies such as Petrobras from Brazil, Pemex from Mexico and PDVSA from Venezuela have developed centers of excellence for outstanding technology development [Thorp, 1998 #57].

6. A total of 960,000 GWh were generated in 2000 in LAC, with hydroelectricity making up 63%, and thermoelectricity representing 34%.

7. The UNFCCC sees the CDM as promoting “sustainable development” by encouraging the investment of private firms and governments in projects in developing countries that reduce or avoid emissions. Developed countries will receive credit against their targets, as outlined by Kyoto, for emissions reduced by these projects. In addition, a levy on the CDM will fund projects that will help the most vulnerable countries adapt to future climate change impacts.

8. The Marrakesh Accord, agreed upon by the Conference of the Parties, can be found at the UNFCCC website: http://unfccc.int/cop7/documents/accords_draft.pdf

9. We are assuming that both fuels (coal and natural gas) are available for such a plant.

10. The calculations were done using U.S. average (CO₂) output rate from different energy sources (See: DOE/EPA “CO₂ emissions from the generation of electric power in the US,” July 2000)

11. The gas/coal price differentials are estimated between \$0.72 and \$ 1.18 per million of Btu (MBtu).

12. A similar analysis could be done, considering switching oil derivatives to gas.

13. Certified Emission Reductions.

14. The CERUPT 2001 (Certified Emission Reduction Unit Procurement Tender) was a bidding process promoted by the government of the Netherlands to buy CERs under Clean Development Mechanism (CDM). It was the first program under such a mechanism promoted by the Netherlands.

15. TransAlta Utilities of Canada has been involved in the investment and purchase of emissions credits since 1999. Their hallmark investment was in 2000. The firm partnered with Washington-based Global Livestock Group and provided a feed supplement to owners of Ugandan cows. The supplement helped the cows digest their food better, and as a result they produced less flatulence. Thirty million tons of methane credits were earned from the investment.

16. R. Lemoine and J. Allard’s paper “Brazil Market Study: Clean Development Mechanism” for the Ministry of Foreign Affairs on behalf of SNC Lavalin, July 2001, assesses the country of Brazil for such investment opportunities.

17. A. Curbelo, Director of Ministry of Science, Technology and Environment has compiled a list of opportunities in Cuba entitled “Climate Change Projects, Opportunities in Cuba.” The report was prepared for the government of Canada.

18. The State of Development of National CDM Offices in Central and South America. An institutional evaluation by the Andean Center for Economics in the Environment for The Department of Foreign Affairs and International Trade, Climate Change and Energy Division, Canada.

REFERENCES

- Barney, J. (1991). “Firm Resources and Sustained Competitive Advantage,” *Journal of Management*, Vol. 17, No. 1, pp. 99-120.
- Baron, R. (2000). “Leading up to COP 6 Where are we and Where are we Going?” Paper presented at the *Emissions marketing Association’s Annual Conference*, Toronto, Canada, Oct 1-2, 2000. R. Baron from the International Energy Agency, Paris France.

- Barrera-Hernandez, L., A. Lucas, E. McCoy, and J. McCready (2000). *Energy and Environmental Law in Latin America & the Caribbean: Legislative Inventory & Analysis*. Quito: OLADE, University of Calgary, CIDA.
- Carbon Dioxide Information Analysis Center (2001). Current Greenhouse Gas Concentrations. <http://www.cdiac.esd.ornl.gov>.
- Carvalho, G., P. Moutinho, D. Nepstad, L. Mattos, and M. Santilli (2004). "An Amazon Perspective on The Forest-Climate Connection: Opportunity for Climate Mitigation, Conservation and Development," *Environment, Development, and Sustainability*, Vol. 6, pp. 163-174.
- Coyne, K. (1986). "Sustainable Competitive Advantage: What it is, What it isn't," *Business Horizons*, Vol. 33, No. 6, pp. 54-61.
- Dasgupta, S., H. Hettige and D. Wheeler (1997). What Improves Environmental Performance? Evidence from Mexican Industry. Development Research group, World Bank.
- Dierickx, I., and K. Cool (1989). "Asset Stock Accumulation and Sustainability of Competitive Advantage," *Management Science*, Vol. 35, No. 12, pp. 1504-1514.
- Donnelly, A. (2000). "Case Studies—Innovative Financing of GHG Deals." Paper presented at the *Emissions marketing Association's annual conference*, Toronto, Canada, Oct 1-3, 2000, A. Donnelly from the Greenhouse Emissions Management Consortium.
- Hall, R. (1992). "The Strategic Analysis of Intangible Resources," *Strategic Management Journal*, Vol. 13, No. 2, pp. 135-144.
- Hart, S. L. (1997). "Beyond Greening: Strategies for a Sustainable World," *Harvard Business Review*, Vol. 75, No. 1, pp. 66-76.
- Henriques, I., and P. Sadorsky (1996). "The Determinants of an Environmentally Responsive Firm: an Empirical Approach," *Journal of Environmental Economics and Management*, Vol. 30, No. 3, pp. 381-395.
- Hoffman, A. J. (2005). "Climate Change Strategy: the Business Logic Behind Voluntary Greenhouse Gas Reductions," *California Management Review*, Vol. 47, No. 3, pp. 21-46.
- Hunt, S. (2000). *A General Theory of Competition*. London. Sage Publications.
- IFAC (1998). International Federation of Accountants. Environment Management in Organizations. IFAC Financial and Management Accounting Committee, March.
- INECEL (1993). *Plan Maestro de Electrificación 1993-2002*. Quito, Ecuador.
- Interlaboratory Working Group (1997). Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy-Efficient and Low-Carbon Technologies by 2010 and Beyond. Oak Ridge, TN and Berkeley, CA, September. (www.enduse.lbl.gov).
- International Energy Agency-IEA (2000). Prospects for up Grading Coal-Fired Power Plants, Profiles, December.
- Kanter, R. M. (1999). "From Spare Change to Real Change," *Harvard Business Review*, Vol. 77, No. 3, pp.122-132.
- Kinkead, G. (1999). "In the Future, People Like me Will go to Jail," *Fortune*, Vol. 139, No.10, pp. 190-195.
- Klassen, R. D., and P. McLaughlin (1996). "The Impact of Environmental Management on Firm Performance," *Management Science*, Vol. 42, No.8, pp. 190-195.

- Kolk, A., and J. Pinkse (2005). "Business Responses Top Climate Change: Identifying Emergent Strategies," *California Management Review*, Vol.47, No. 3, pp. 6-20.
- Kondra, A., and C. Hinings (1998). "Organizational Diversity and Change in Institutional Theory," *Organization Studies*, Vol. 19, No. 5, pp. 743-767.
- Levy, D. (1997). "Business and International Environmental Treaties: Ozone Depletion and Climate Change," *California Management Review*, Vol. 39, No. 3, pp. 54-71.
- Lieberman, M., and D. Montgomery (1988). "First-mover Advantages," *Strategic Management Journal*, Vol.9, Summer Special Issue, pp. 41-58
- Leiss, W. (2000). *Risk Issue Management*. Montreal. McGill-Queen's University Press.
- Marziliano, N. (1998). "Managing the Corporate Image and Identity: A Borderline Between Fiction and Reality," *International Studies of Management & Organization*, Vol. 28, No. 3, pp. 3-11.
- Meyer, J., and B. Rowan (1977). "Institutionalized Organizations: Formal Structure as Myth and Ceremony," *American Journal of Sociology*, Vol. 83, No. 2, pp. 340-363.
- Michaelowa, A. (2005). "Leaving the Kyoto Oasis—The Climate Caravan Moves on," *Intereconomics*, Vol. 40, No.1, pp. 2-3.
- Mises, L. (1949). *Human Action: A treatise on Economics*. New Haven, CT: Yale University Press.
- OLADE (2002). SIEE www.olade.org.ec
- OLADE and the University of Calgary (2000). *Energy and Environmental Law in Latin America and the Caribbean: Legislative inventory and Analysis*. OLADE, Quito, Ecuador.
- OLADE, CEPAL and GTZ (2000). *Energy and Sustainable Development in Latin America and the Caribbean: Guide for energy policymaking*. Latin American Energy Organization, Quito, Ecuador.
- Painuly, J. P. (2001). "The Kyoto Protocol , Emissions Trading And The CDM: An Analysis From Developing countries perspective," *The Energy Journal*, Vol. 22. No. 3, pp. 147-169.
- Pistonesi, H., V. Rodriguez Padilla, and C. Chávez (2000). *Energy and Sustainable Development in Latin America and the Caribbean: Guide for Energy Policymaking*. Quito: OLADE, CEPAL and GTZ.
- Porter, M. E. (1979). "How Competitive Forces Shape Strategy," *Harvard Business Review*, Vol. 57, No. 2 , pp. 81-92.
- Porter, M.E., and S. Stern (2001). "Innovation: Location Matters," *MIT Sloan Management Review*, Vol. 42, No. 4, pp. 28-36, Summer 2001.
- Porter, M., and Van der Linde, C. (1995a). "Green and Competitive: Ending the Stalemate," *Harvard Business Review*, Vol. 73 , No. 5 . pp. 120-134.
- Porter, M., and Van der Linde, C. (1995b). "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives*, Vol. 9, No. 4. pp. 97-118.
- Reinsch, A., and R. Tissot (1995). *Models of Oil and Gas development: Latin America's Spectrum*, Petroleum Industry in Latin America, Vol. I: Canadian Energy Research Institute—CERI.
- Russo, M., and P. A. Fouts (1997). "A Resource-Based Perspective on Corporate Environmental Performance," *Academy of Management Journal*, Vol. 40, No. 3, pp. 534-559.

- Scherer, A.G., and M. Smid (2000). "The Downward Spiral and the US Model Business Principles—Why MNEs Should Take Responsibility for the Improvement of World Wide Social and Environmental Conditions," *Management International Review*, Vol. 40, No. 4, pp. 351-371.
- Schumpeter, J. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
- Sharma, S., and H. Vredenburg (1998). 'Proactive Corporate Environmental Strategy and the Development of Competitively Valuable Organizational Capabilities,' *Strategic Management Journal*, Vol. 19, No. 8, pp. 729-753.
- Shrivastava, P. (1995). "Environmental Technologies and Competitive Advantage," *Strategic Management Journal*, Vol. 16, Summer Special Issue, pp.183-200.
- SIEE - OLADE (1999). Sistema de Informacion Economico Energetica—Organizacion Latinoamericana y del Caribe de Energia.
- Stevenson, H., and J. Jarillo (1990). "A Paradigm of Entrepreneurship: Entrepreneurial Management," *Strategic Management Journal*, Vol. 11, Special Issue, pp.17-27.
- Victor, D.F., and J.C. House (2004). "A new currency: climate change and carbon credits," *Harvard International Review*, Vol. 26, No. 2, pp. 56-59.
- Zittel, W., and M. Treber (2000). Analysis of BP statistical review of world Energy with respect to CO₂-emissions. Bonn: Germanwatch.

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