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WORKING PAPER

Energy Security

A Fresh Approach to US Energy Security and Alternative Fuels: The Western Hemisphere and the Ethanol Option

ANNETTE HESTER

Working Paper No.10
October 2006

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Thank you for your interest,

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Author Biography

Annette Hester is a fellow with the Centre for International Governance Innovation, a senior associate with the William E. Simon Chair in Political Economy at Center for Strategic and International Studies and an economist, writer, and independent scholar. Previously, she was the founding director of the Latin American Research Centre at the University of Calgary. Ms. Hester is the author of numerous articles published in *Oil and Gas Journal*, *Estey Centre Journal*, and the *Journal of Canadian Petroleum Technology*; as well as chapters in edited volumes; and is a frequent contributor to a variety of newspapers including *The Globe and Mail* and the *Calgary Herald*.

Abstract

Spurred by world events, energy security has vaulted to the top of the US political agenda. Concerns about supply interruptions and rising prices sped approval of an energy bill which Congress had in the works for nearly five years. Moreover, the growing prominence of the nation's energy challenges, drew special attention from President Bush in his 2006 State of the Union Address, sparking a renewed search for viable alternative fuels. Of those, ethanol is receiving the lion's share of attention. This paper will argue that the new US focus on energy alternatives will undoubtedly impact the ethanol and agriculture markets. However, this discussion will also advance the notion that a key element of an effective ethanol strategy from both cost and environmental perspectives lies in forging technological and open trading relationships in the Western Hemisphere, particularly with Brazil and Canada.

1. Introduction

Events in early August 2006 vividly demonstrated the energy dilemma of the United States - and the lack of effective policies to cope with it. On August 7, the world's most voracious oil consumer, guzzling 21 million barrels per day (mmb/d),[1] was threatened to lose eight per cent of its domestic production because of one company's neglect of a 25km transit pipeline.[2] The immediate result: a US$2 jump in oil prices to an all time record US$78 a barrel.

Granted, there were several additional aggravating factors. Last summer's war between Israel and Hezbollah and the standoff with Iran over nuclear proliferation made oil markets jittery, as did turmoil in Nigeria, the continuing conflicts in Iraq and Afghanistan, and hints of a change in regime in Cuba. Very tight supply conditions were also made worse by fears of yet another pounding hurricane season[3].

However, none of these factors account for the one-day jump.

The worrying question is why the potential loss of the 400,000 barrels per day (b/d) Prudhoe Bay field in Alaska[4] - representing only a small percentage of US oil consumption, (and not infrequent variation relative to the world's almost 85 mmb/d consumption[5]) should have caused such a significant rise in price. The fact that it did, reflects the market's perception that the US is managing its energy resources poorly.

Oil prices have been spiralling for three years, from an average of US$30 per barrel in 2003, to US$40 per barrel in 2004, to US$50 per barrel in 2005, to over US$60 per barrel already this year. US concerns about energy security and rising prices finally led to passage of the Energy Policy Act of 2005, legislation that had been in the works since 2001. The same concerns served as a backdrop for President George W. Bush's famous declaration in his 2006 State of the Union Address that

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[1] Energy Information Administration (EIA), 2004 Data. Note that all the energy statistics were calculated from various tables. Online: <www.eia.doe.gov>

[2] British Petroleum - the company announced the shut down of 400,000 b/d production from Prudhoe Bay, Alaska, due to corrosion on its transit pipeline (transit pipelines are the smaller lines that gather oil from the field and takes it to the main interstate pipeline). Online: <http://www.bp.com/genericarticle.do? categoryId=2012968&contentId=7020563>

[3] The industry is still trying to recuperate from last year's hurricanes Katrina and Rita. Recovery is still short 300,000 b/d.

"America is addicted to oil."[6] Given that almost half of US oil consumption is dedicated to motor vehicles,[7] it is not surprising that the legislation's principal focus was on promoting alternative motor fuel sources. Of those, biofuels, particularly ethanol, received most attention through increased incentives for domestic production. At the same time, Indiana Senator Richard Lugar led the chorus of ethanol boosters with a proposal to abolish existing import tariffs on ethanol.[8] Support for lifting import tariffs even includes the Governor of Florida, Jeb Bush, who now sees ethanol as the answer to his state's oil dependency woes.[9] There persists differing perspectives on how the US should approach energy issues. On the one hand, barriers are raised to promote an increase in domestic production, while on the other, an appeal is made for barriers to be lowered to increase the more abundant imports. The two approaches underline the inherent contradictions of the current US administration's approach to energy security.

This paper will argue that although the energy bill, as well as Senator Lugar's initiative, will undoubtedly impact the ethanol and agriculture markets, the measurable impact on energy security is not as certain. Insofar as ethanol, the discussion will advance the notion that a key element of an effective ethanol strategy from both cost and environmental perspectives lies in forging technological and open trading relationships in the Western Hemisphere, particularly with Brazil and Canada.

2. All about Oil in the US

Last year US crude oil and oil products consumption reached almost 21 mmb/d, equivalent to 25 per cent of the world's total. Of this amount, 64 per cent came from foreign sources. To put this figure in perspective, the next largest consumers were China and Japan, with 6.5 mmb/d and 5.4 mmb/d respectively. Germany and Russia

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[4] In the end, only half of that production was shut in.
[5] EIA. Online: <www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html>
[6] United States, Press Release, The White House, January 31, 2006. Online: <http://www.white house.gov/news/releases/2006/01/20060131-10.html>
[7] Peter Tertzakian, *A Thousand Barrels a Second: The Coming Oil Break Point and the Challenges Facing an Energy Dependent World* (New York: McGraw- Hill, 2006), 106.
[8] Import tariffs are currently US$0.54 per gallon. This tariff is imposed on all imports with the exception of imports from the Caribbean basin (limited to a maximum 7 per cent of the US total market).
[9] David Adams, "Gov. Bush puts clout behind use of biofuel," *St. Petersburg Times*, August 25, 2006. Online: <http://www.sptimes.com/2006/08/25/State/ Gov_Bush_puts_clout_b.shtml>

followed with 2.6 mmb/d each, and India, in sixth place, consumed 2.3 mmb/d. Importantly, none of these countries were able to meet their own needs. Japan imported almost all of its oil (5.4 mmb/d), while China's and India's imports were 45 and 58 per cent of total consumption, respectively.[10]

The situation is even more troubling when you combine the historical trend with future projections. US consumption has been increasing steadily since the 1980s - from 16 mmb/d to 18 mmb/d in the 1990s, to 20 mmb/d this decade. Domestic production has gone in the opposite direction. US crude oil production declined from an average of 8.5 mmb/d in the 1980s to 6.7 mmb/d in the 1990s, to 5.6 mmb/d this decade. This has left the country increasingly dependent on foreign sources for its energy needs. The expectation of continued declines in domestic production means this dependence will likely continue, if not increase. Meanwhile the rest of the world is experiencing a period of growth, as other nations, especially China, significantly increase consumption. As in the US, China's production is not keeping pace with demand growth. The country went from a production surplus in the 1980s to importing about 9 per cent of its petroleum and products requirements in the 1990s. In this decade, China has experienced a staggering increase in imports to 35 per cent of total consumption.[11]

Additionally, the discovery of new worldwide sources, especially what the industry calls "elephant" fields, is becoming rarer. Significant production increases are now due mostly to unconventional sources such as the oil sands in Alberta, a western Canadian province. This development has a number of implications that impact energy security, among them an increase in the costs of extraction and production, a turn to production in large increments (which may translate into sizeable disruptions), as well as the concentration of production in fewer countries.

Analysts expect these trends in supply and demand to continue. Credible forecasts predict that oil consumption worldwide will increase from 80 mmb/d in 2003 to 98 mmb/d in 2015, and to 118 mmb/d in 2030.[12] Higher oil prices are expected to spur increases in unconventional as well as alternative fuels production. These projections

[10] Statistics calculated from EIA, 2006 data. Online:<http://www.eia.doe.gov>
[11] These are averages for the decades. This current decade is has been calculated including data up to 2005.
[12] EIA, International Energy Outlook to 2030. Online: <http://www.eia.doe.gov/oiaf/ieo/index.html>

are included in the *International Energy Outlook 2006*, of the Energy Information Administration, US Department of Energy. The report goes further in its findings. It states:

> Worldwide, transportation and industry are the major growth sectors for oil demand. On a global basis, the transportation sector-where there are currently no alternative fuels that compete widely with oil-accounts for about one-half of the total projected increase in oil use between 2003 and 2030, with the industrial sector accounting for another 39 percent of the incremental demand.[13]

Unquestionably, the transportation sector is important now and, if this forecast is accurate, it is set to continue its dominant position for the foreseeable future. It is therefore not surprising to find that of the world's ten largest corporations, five are integrated oil companies, four are automotive companies, and only one (Wal-Mart) is in a non-energy-related line of business.[14]

Fossil fuels are the linchpins of transportation technology, but there are alternatives to the dependence on hydrocarbons for overall energy needs. It is a policy choice. For instance, France has opted to power its economy with a mix of nuclear generation, hydropower and fossil fuels. Nuclear energy accounts for 37 per cent; hydro for 6 per cent; and fossil fuels compose the remaining 57 per cent. In contrast, the US relies on oil, natural gas, and coal for 90 per cent of its needs.[15]

Taxation offers another policy tool. Most European countries have chosen to tax gasoline heavily as a way to discourage consumption. But in the US and Canada, tax proposals that appear to restrict the freedom of private vehicle travel have made little headway. American legislators and the White House appear extremely reluctant to confront the American people on the unsustainability of their gas-guzzling lifestyle.

As a result, in the current political climate, American energy policies rarely address the demand side of the problem. Although President Bush did acknowledge the country's "addiction" to oil, the focus of the federal government's rhetoric and action has been, unfortunately, solely on the supply side.

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[13] Ibid.

[14] Fortune 500, 2006 Ranking, World Largest Companies. Online: <http://money.cnn.com/magazines/fortune/global500/2006/>

[15] Peter Tertzakian, *A Thousand Barrels a Second*, 79.

3. The Energy Security Talk

To most energy-savvy observers, President Bush's 2006 State of the Union Address reflected the administration's unwillingness to face the energy dilemma comprehensively by addressing both supply and demand. Moreover, it showed how the supply issue can be distorted to serve a particular geopolitical agenda. Specifically, the President stated:

> . . . Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology. . . . Breakthroughs [technological] . . .will help us reach another great goal: to replace more than 75 percent of our oil imports from the Middle East by 2025. By applying the talent and technology of America, this country can dramatically improve our environment, move beyond a petroleum-based economy, and make our dependence on Middle Eastern oil a thing of the past.[16]

The message was: Americans can continue to consume as much oil as they want because domestic technology will provide seamless substitution from hydrocarbons. Moreover, this strategy will eventually replace Middle East suppliers.

Unfortunately, the evidence suggests both parts of the message are unrealistic. Technological advances have, so far, only made marginal contributions to relieving dependence on foreign petroleum. And hopes of finding large-scale alternative energy sources for transportation are equally unlikely. As the EIA forecast to 2030 cited earlier notes, hydrocarbons will continue to be the main source of fuel for transportation for the foreseeable future.

Moreover, the Middle East dependency argument is misleading. In 2005, when the US imported 13.5 mmb/d,[17] three of the top five providers to the US were in the Western Hemisphere, one was in Africa, and only one was in the Middle East. Together these five accounted for 59 per cent of all imports. Table 1 shows the countries and their weight relative to total imports.

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[16] United States, Press Release, The White House, January 31, 2006. Online: <http://www.whitehouse.gov/news/releases/2006/01/20060131-10.html>

[17] Note that 2005 was used as a base year as it followed the trend of the previous five years.

After those, the next provider was Iraq with a distant 522 thousand b/d (3.9 per cent of the total), followed by Algeria, Angola, Russia, the United Kingdom, and the US Virgin Islands. The Persian Gulf States - Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates - together accounted for 17 per cent of the total - and of that, as shown in Table 1, Saudi Arabia alone is responsible for slightly over 11 per cent.

Table 1: Top Five Oil Providers to the US, 2005

Country	Total Imports (mmb/d)	Percentage of Total Imports
Canada	2.17	16.05
Mexico	1.64	12.16
Saudi Arabia	1.52	11.25
Venezuela	1.50	11.13
Nigeria	1.14	8.40

Source: Energy Information Administration, US Department of Energy, 2006

At best, a case could be made that the US depends excessively on OPEC (Organization of Petroleum Exporting Countries)[18] producers, who were responsible for 40 per cent of total US imports. Saudi Arabia, the only OPEC member with significant spare capacity, has often been singled out for special attention, but this muddles the picture. As a target for American rhetoric, OPEC has proven to be elusive. Although some OPEC members do have common strategies that tie oil production to anti-Americanism, forging a comprehensive foreign policy towards the group on this basis is likely to be just short of impossible. That said, one could argue, along with Frank Verrastro, director of the Energy Program at the Center for Strategic and International Studies in Washington, D.C., that "the farther you look out, the greater the reliance on OPEC sources, and the overwhelming source of both oil and gas proven reserves (and lowest cost) are in the Middle East, so we all may have to rely more on them." Nonetheless, for the time being, the alternative is to deal with other regions, or single countries in a region. And of all the regions, the Western Hemisphere is the most important. It supplies half of the US oil and

[18] Organization of Petroleum Exporting Countries include: Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela.

petroleum product needs, virtually all of its natural gas, and is likely to maintain this position for the next two decades.

Yet, as the distinguished American political economist Dr. Sidney Weintraub pointed out in his testimony to Congress in March 2006, "… with this much energy resources reliance on the hemisphere, it is remarkable that the US government has so thoroughly ignored the hemisphere in its foreign policy."[19] In an attempt to counter this neglect, the next section will present a picture of the key players in the hemisphere.

4. Who is Who in the Hemisphere?

The ability of Venezuela's Hugo Chavez to effect oil supply receives most of the attention from nervous Americans, but the crucial players in the US energy market are America's neighbours, Canada and Mexico.

Canada

Canada's emergence as a twenty-first century oil power is due to a combination of astute energy policies, a stable regulatory framework - and luck. Since Canadian provinces own mineral rights, this has been a story of successful provincial policy-making - most notably in Alberta.

Alberta's skilful shepherding of exploration and development policies - such as a progressive royalty regime and massive investments in technology - has transformed its massive oil sands into an economically viable resource, raising Canada's proven oil reserves (conventional and unconventional) to 178.8 billion barrels,[20] second only to Saudi Arabian reserves. The importance of this development for Canada's oil economy is hard to overstate. In 2002, Canada's total oil reserves amounted to a skimpy 4.9 billion barrels.

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[19] Sidney Weintraub, "The Role of the Western Hemisphere in Fostering US Energy Security," Testimony to the Committee on International Relations, Subcommittee on the Western Hemisphere, House International Relations Committee, United States Congress, March 2, 2006. Online: <http://www.cs is.org/media/csis/congress/ts060302_weintraub.pdf>

[20] As reported by the *Oil and Gas Journal*, January 2006. EIA, Country Analysis Brief, Canada. Online: <http://www.eia.doe.gov/emeu/cabs/Canada/Full.html>

In the decade since 1996, investment in Alberta's energy resource totalled C$30 billion, and another C$75 billion are expected during the next decade.[21] This activity is translating into an unprecedented increase in tar sand or "unconventional" production - from 431,500 b/d in 1996, to 849,000 b/d in 2003, to an estimated 955,000 b/d in 2005.[22] Moreover, official Alberta government estimates are for production to increase by almost 50 per cent during the next three years, and industry forecasts envision production at 3 million b/d by 2020.[23] This incremental production more than offsets the expected declines in Canada's conventional production and has placed that country at the top of oil exporters to the US, a position it has enjoyed since 1999 when it replaced Venezuela as the premier supplier to the US.[24]

However, Canada's ability to increase its unconventional production at the pace it hopes is questionable. Although there are a number of projects in development, manpower shortages, environmental concerns, and a host of other challenges that have raised costs are likely to force a production slowdown in Alberta and require analysts to re-evaluate their forecasts. Also darkening the picture is the state of the industry in Canada's Atlantic provinces, where hopes for a "boom" in conventional (offshore) production have yet to materialized.

Furthermore, the change in Alberta's provincial leadership, with the retirement of Premier Ralph Klein set for early 2007, will undoubtedly lead to a change in provincial energy policy. The new premier will have to respond to the growing concerns expressed by Albertans over the detrimental effects of the booming oil industry.[25]

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[21] Nichols Applied Management, "Oil Sands Industry Update 9," September 2004. Online: <http://www.alberta-canada.com/oandg/>

[22] Oil production statistics were calculated from the National Energy Board's figures from <http://www.neb.gc.ca/Statistics/CrudeOil_PetroleumProducts/ index_e.htm>, using a converting factor of 6.3 to translate M3/d to bbl/d.

[23] Annette Hester and Sidney Weintraub, "Canada," in Sidney Weintraub ed., *Energy Cooperation in the Western Hemisphere: Benefits and Impediments* (Washington: CSIS, 2006), Forthcoming.

[24] EIA, Imports by Country, Historical Series, Online: <http://tonto.eia.doe.gov/dnav/pet/xls/pet_move_impcus_a2_nus_ep00_im0_mbblpd_a.xls>

[25] Several articles have commented on the challenges and discontent brought about by the accelerated growth in oil sands development, including: Eric Reguly, "Boom Gone Berserk," *Globe and Mail*, May 26, 2006, where he comments on former Alberta Premier Peter Lougheed's calling for a moratorium on oil sands development. Another noted that opposition was coming from the Mayor of Fort MacMurray who said her city couldn't possibly keep up with its current rate and scale. "Oilsands boom overwhelming Fort McMurray: Mayor," *Canadian Press*, July 10, 2006. Finally, Premier Klein made headlines on September 1, 2006, when he admitted the opposition was right all along - the boom caught his government "unprepared."

Mexico

Since 9/11, Mexico has edged into the position of second largest energy supplier to the US, managing to increase its exports in the last five years, though only marginally. The reality is that Mexico's energy sector is facing a serious challenge. The constitution gives the state and the state owned company Petróleos Mexicanos (Pemex) monopoly powers to explore and produce oil and gas, and does not allow private equity investment.

That puts the country in a tenuous position. Although Pemex is the fifth largest oil firm in the world, posting a total of 3.78 mmb/d in 2005 - of which 2 mmb/d are consumed internally and the rest exported[26] - with the correspondingly high revenues, it has been unable to make the necessary investments to maintain and increase production. Largely, this is a factor of state involvement, as the government has considered it as a cash cow, directing revenues to other areas. According to Dr. Weintraub in his forthcoming work on Mexico's energy sector, "the government tax take is more than 60 percent of Pemex's gross revenue for overall budgetary purposes and, in recent years, this has amounted to about 110 percent of the company's net income. Pemex has consistently posted losses in recent years, even when global oil prices were high. The recorded net loss was $3.72 billion in 2003, $3.7.2 billion in 2004, and $3.8 billion in 2005."[27]

The situation is so dire that Mexico's proven reserves have been adjusted downwards. Currently, the country can only count on ten more years of production. Moreover, lack of investment has turned Mexico into a net importer of refined petroleum products and natural gas.

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[25] Several articles have commented on the challenges and discontent brought about by the accelerated growth in oil sands development, including: Eric Reguly, "Boom Gone Berserk," *Globe and Mail*, May 26, 2006, where he comments on former Alberta Premier Peter Lougheed's calling for a moratorium on oil sands development. Another noted that opposition was coming from the Mayor of Fort MacMurray who said her city couldn't possibly keep up with its current rate and scale. "Oilsands boom overwhelming Fort McMurray: Mayor," *Canadian Press*, July 10, 2006. Finally, Premier Klein made headlines on September 1, 2006, when he admitted the opposition was right all along - the boom caught his government "unprepared."

[26] EIA, Country Analysis Brief, Mexico. Online: <http://www.eia.doe.gov/emeu/cabs/Mexico/Full.html>

[27] Sidney Weintraub and Rafael Fernandez de Castro, "Mexico," in Sidney Weintraub, ed., *Energy Cooperation in the Western Hemisphere.*

There are only two ways out of this predicament: change the constitution and allow private investment, or change the fiscal regime, increase taxes, and let Pemex keep its revenue to invest as desired. Chances are that by the time Mexicans take action, a long term solution will require a mix of both alternatives. Regrettably, although everyone agrees the country is nearing an energy crisis, there has been no political will so far to bring about a consensus about the need to enact these changes.

In Mexico's case, it seems that high oil prices serve a perverse incentive. It allows the country to postpone decisions it must take if it wants to ensure a healthy future as an energy producer and supplier. This predicament plagued Vicente Fox - who ended his mandate without being able to fulfill his promise to modernize Mexico's energy sector - and might have the same effect on Felipe Calderon, in spite of the new president's best intentions.

Venezuela

Without a doubt, Venezuela is an energy powerhouse. It boasts the hemisphere's largest conventional oil reserves,[28] and if its bitumen sands are deemed viable, could post total reserves of 270 billion barrels.[29] Historically, Venezuela was the premier oil and petroleum products supplier to the US through its state owned oil company, Petroleos de Venezuela S.A. (PdVSA). Although the country was instrumental in the creation of OPEC, it never failed to honour its contracts even during the crisis triggered by the Arab oil embargo of 1973 and the Iranian revolution in 1979.[30]

In the early 1990s, Venezuela became a major shareholder in the US energy sector. With the purchase of Citgo, PdVSA became the America's fifth largest gasoline producer. The company owned eight refineries with a refining capacity of almost a million barrels a day, and was not only the largest gasoline distributor in the mainland US, but the largest asphalt producer on the US East Coast. Although PdVSA was government-owned, its management team made decisions anchored in regular business practices.[31]

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[28] According to the EIA, Venezuela's proven oil reserves (2005E) are 77.2 billion barrels; production (2004E) were 2.855 bb/d; and consumption (2004E) was 544.1 thousand b/d.

[29] EIA, Country Analysis Brief, Venezuela. Online: <http://www.eia.doe.gov/emeu/cabs/Venezuela/Full.html>

[30] To date, in spite of Chavez's rhetoric, Venezuela has honoured all its contracts for oil delivery to the US.

[31] Annette Hester, "Venezuela's risky game," *Calgary Herald*, February 9, 2005.

When President Hugo Chavez was elected in 1998, PdVSA's objectives changed radically to reflect his opposition to the neo- liberal market policies encouraged by Washington across Latin America. Venezuela's model for national and regional development is based on the principles of the Bolivarian Alternative for the Americas (ALBA), and Chavez doesn't miss an opportunity to deploy his economic policies in the service of his anti-US foreign policy. Although Chavez claims ALBA is a proposal for integration that emphasizes the struggle against poverty and for inclusion, the model is short on details of how this will be accomplished.[32]

Yet in spite of Chavez's talk of diversifying Venezuela's customer base, the US is still his country's biggest trading partner. Moreover, according to a recent article in the *New York Times*, "Pulled largely by those rising oil revenues, trade [between Venezuela and the US] climbed 36 percent in 2005, to US$40.4 billion, the fastest growth in cargo value among America's top 20 trading partners." Those record high oil prices have given Chavez much room to manoeuvre. It has allowed him to neglect the health and efficiency of Venezuela's oil sector, and still have plenty of funds to disperse to his much-touted social welfare programs. Although official Venezuelan government sources quote oil production at 3.1 mmb/d, most foreign analysts and the EIA quote crude production at approximately 2.5 mmb/d. This gap between official statistics and outsiders' analysis is likely to continue as little information is forthcoming from PdVSA about actual reinvestments and new projects underway to offset normal production declines. Currently, after taking outsiders' views of production numbers estimates are that Venezuela is exporting 2.2 mmb/d, of which 1.5 mmb/d is destined to the US.[33] The *New York Times* article also notes that American companies are benefiting hugely from the Venezuelan oil bonanza. One example is Haliburton, which has posted double digit growth figures for its Venezuelan operations.[34]

But Chavez is looking for a way to reduce Venezuela's economic profile in the US. After all, Venezuela is estimated to have more than US$10 billion in assets in the US,[35] which makes him vulnerable to political and economic pressure from the US government. The hope of avoiding future arm-twisting from the White House

[32] Alternative Bolivariana, Online: <http://www.alternativabolivariana.org/modules.php?name=Content&pa=showpage&pid=1>

[33] Gathering statistics for Venezuela is extremely cumbersome. EIA, Business Analysts, and Venezuelan official and unofficial sources were consulted.

[34] Simon Romero. "For Venezuela, as Distaste for US Grows, So Does Trade" *New York Times*, August 15, 2006.

[35] Steven Paget, energy analyst at First Energy Capital Corp., offered this estimate in 2005.

likely explains the August 15, 2006 announcement by Venezuelan Energy Minister, Rafael Ramirez that Citgo had agreed to sell its minority share in the 265,000 b/d Lyondell-Citgo refinery in Texas to Lyondell Chemical Co. for about $1.31 billion.[36]

Furthermore, Chavez is actively wooing new trade partners in a variety of sectors around the world, and has offered special deals in oil supplies to Caribbean and Central American nations, including Cuba. Venezuela is also buying Argentine debt and backing the nationalization of Bolivia's gas sector. These and many other steps appear designed to bolster Chavez' hopes of becoming the new leader of the developing world.

The US unwittingly strengthened Chavez's role as a world player and his popularity at home by its antagonistic policies and hostile rhetoric towards Venezuela. Although the US administration now seems to have changed tactics, the polarization between Caracas and Washington has left little room for milder left-leaning leaders, such as Brazilian President Luis Inácio Lula da Silva.

Brazil

Of all countries in the hemisphere, Brazil has most consistently treated energy as synonymous with national security. Unlike its Latin American neighbours, Canada, or the US, it had few accessible reserves on its mainland to draw on, and was forced to employ perseverance and creativity to fuel its economic development with offshore reserves. The national oil company, Petrobras, was created in 1953 in that spirit.

Today, Petrobras is a mixed capital company, with the Brazilian government controlling 51 per cent of its shares and the remainder traded publicly in stock exchanges. Deloitte's 2006 report, "The Energy Intelligence Top 100: Ranking the World's Oil Companies," ranks Petrobras as the world's 15th largest integrated oil company.[37] It has operations in twenty countries, and is a world leader in deep offshore exploration and production technologies. Petrobras is responsible for almost all of Brazil's oil production of 1.85 mmb/d in 2005, and is set to become a leader in bio-diesel production and refining technologies.[38]

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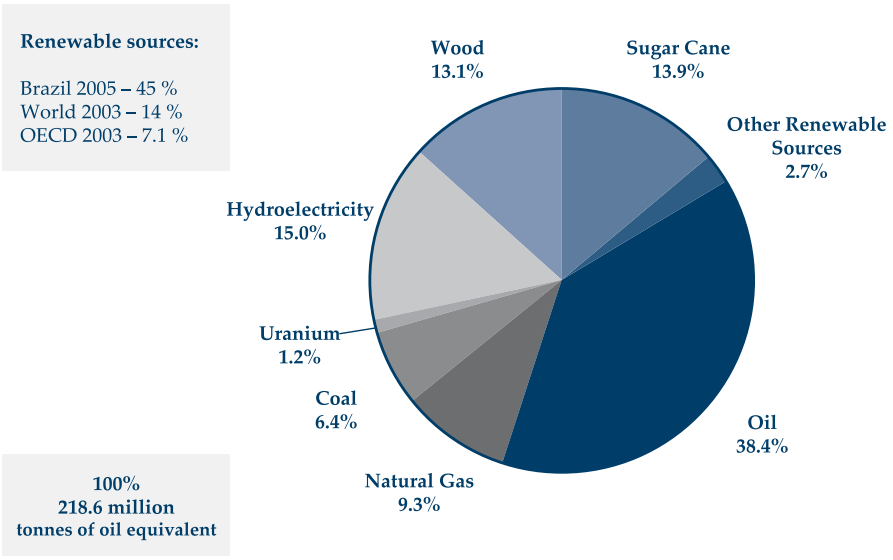
[36] Marianna Parraga, "Citgo Sells Stake in Lyondell Refinery," *El Universal*, Caracas, Venezuela, August 16, 2006. Online: <http://english.eluniversal.com/2006/08/16/en_eco_art_16A767043.shtml>
[37] Deloitte, "The Energy Intelligence Top 100: Ranking the World's Oil Companies," 2006. Online: <http://www.deloitte.com/dtt/cda/doc/content/UK_EIU_EIGRankingBrochure_FINAL_March06.pdf>
[38] Petrobras, Annual Report 2005. Online: <http://www2.petrobras.com.br/ri/ing/pdf/Relatorio_Anual_2005_Ing.pdf>

Brazil's innovative policies were a product of necessity. With no onshore oil reserves, it looked to the high seas. With plentiful water resources, the country's electricity supply is 85 per cent-dependent on hydropower.[39] During the oil crisis of the 1970s, the country developed sugar cane ethanol as an alternative fuel to counter its dependence on foreign supplies. When the rain didn't fall and the reservoirs were low (and there were no transmission lines between the areas with full reservoirs and consuming regions), it turned to natural gas and a new program of thermoelectric generation. When Bolivia (who supplies half of Brazil's natural gas needs) recently nationalized its gas sector, Brazil quietly put in place a plan to build liquefied natural gas terminals and increase exploration and production of natural gas on its own territory.

Most of these policies were developed over decades, and mistakes were made - but much has been learned in this process. Today, Brazil's energy supply is one of the world's most diversified. Figure 1 shows each energy source and its participation in the total.

Figure 1: Brazil's Energy Mix

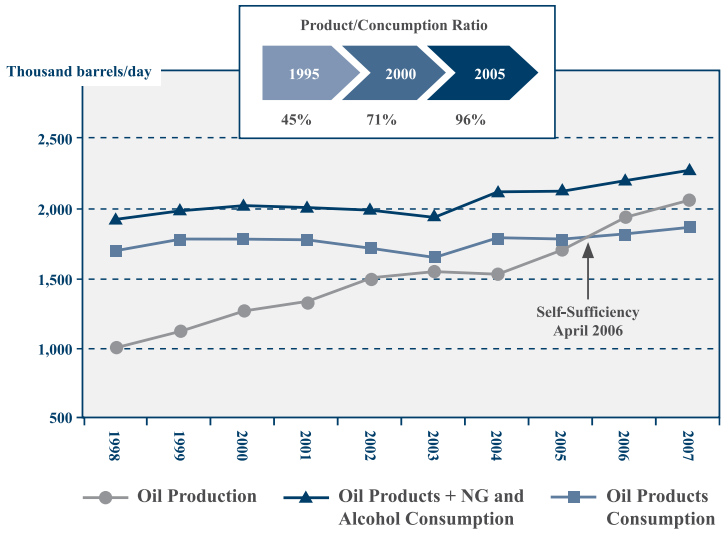


Source: Brazilian Ministry of Mines and Energy, 2005

[39] Brazil, *Balanço Energético Nacional 2005*, Ministério de Minas e Energia, 2005.

By using vehicular natural gas and ethanol to complement gasoline usage, combined with and aggressive oil exploration program, the country managed to achieve self sufficiency in oil consumption this year. Figure 2 traces Brazil's oil production and fuels consumption.[40]

Figure 2: Brazil's Oil Production and Fuel Consumption



Source: Brazilian Ministry of Mines and Energy, 2006

Thus, when it comes to energy security, Brazil has lessons worth noting in other parts of the hemisphere. This is particularly true in the development of ethanol as a complementary and alternative transportation fuel.

[40] Minister Silas Rondeau, Presentation at the Inter-American Development Bank, Washington, D.C., July, 2006. Online: <http://www.iadb.org/news/articledetail.cfm?Language=En&artid=3189&artType=PR>.

5. The Brazil Ethanol Story[41]

Brazil is currently the world's largest producer and consumer of fuel ethanol,[42] with a production of 15.4 billion litres (bbl) in 2004 and 16.03 bbl in 2005, equivalent to 38 per cent of the world's total production. Ethanol, which in Brazil is derived from sugar cane, accounts for 40 per cent of the domestic transportation market, and to further encourage of ethanol use as well as to control oil demand, the government mandates the blending of all gasoline to include between 20 to 25 per cent ethanol.

Brazil's success with ethanol is a product of many policies and of many decades. It actually started as far back as the 1930s. However, as mentioned earlier, it wasn't until the two oil shocks of the 1970s that the government decided to subsidize production and legislate gasoline blending as a way to mitigate the country's foreign oil dependency. As a vibrant industry emerged, however, an increase in sugar exports and the stabilization of oil prices during the later part of the 1980s and 1990s put ethanol production on the backburner. The technology available at the time also made vehicles less efficient, and motorists were happy to go back to their gasoline-burning engines. The government used this window of opportunity to completely deregulate the sector by eliminating production, and distribution controls and all price supports. Aside from the mentioned mandated blending, the only other current government incentives are some tax exemptions.

Meanwhile the industry used the opportunity provided by government policies to increase efficiency and to deal with a host of environmental issues. Brazilian agricultural methods are another spur to efficient ethanol production. The fuel is

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[41] Note that all sections dealing with ethanol follow the same line of reasoning and research as an earlier brief authored for Oxford Analytica. Consequently, if using this material for reference, please include this publication as well as: Oxford Analytica, "Ethanol Key in Fuel Market," North America/Brazil Daily Brief Series, July 20, 2006.

[42] Ethanol, or ethyl alcohol, can be used either as an alternative fuel, or, in blends with gasoline, or as an octane-boosting, pollution reducing additive. Given current technology, converting biomass to ethanol - regardless of the source - involves converting the biomass into some form of fermentable feedstock (generally sugar), from which ethanol is distilled, and finally a last stage of separation and purification. From this process, two types of ethanol are produced: Hydrous, which is 95 per cent pure (the balance is water) and is suitable for automobile fuel, used in Brazil since 2003, and in Flex Fuel vehicles that allow consumers to choose between gasoline or ethanol in any combination; and, Anhydrous, where all the water has been removed and is suitable for blending with gasoline.

produced from over 500 cane varieties without irrigation, using environmentally sound management techniques. The feedstock is used to produce either sugar or ethanol, and in both cases, byproducts are used to generate heat and power in mills that can be re-tooled to manufacture either sugar or ethanol. It is now the cheapest biofuel in the world (equivalent to US$35 to $50 per barrel of oil).[43]

Today 41 new mills are under construction to increase the total number of ethanol factories to 361, thus ensuring that ethanol production will expand considerably over the next few years.

Another extremely important factor in ethanol's success in Brazil has been the development of the *Flex Fuel* vehicle. This leading-edge technology allows vehicles to run on gasoline, ethanol, or any combination of the two fuels in the same tank. As Vicente Lourenço, General Motor Brazil's chief engineer for powertrain operations, states, "you develop something more because you really need it."[44] That philosophy explains the astounding popularity of Flex Fuel cars. In 2003 only 3 per cent of new vehicles sold had this technology. But by 2005, sales skyrocketed to 80 per cent of all new vehicles sold (approximately one million). In addition, Brazil counts on an extensive infrastructure for transporting the fuel - which needs dedicated pipelines since it cannot use the same infrastructure as oil[45] - and for distributing it to costumers. However, its export infrastructure - including roads and ports - is in urgent need of upgrade.

Still, there are other challenges to be faced if Brazil wants to expand ethanol production at the rate and pace that it envisions.[46]

Sugar prices are also increasing. Also, the unprecedented increase in exports of ethanol raises the possibility of product shortages. The consequences of these two

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[43] Masami Kojima and Todd Johnson, "Potential for Biofuels for Transportation in Developing Countries," Energy Sector Management Assistance Programme, *World Bank*, October 2005.
[44] Martha Brannigan, "Taking a Lead in Flex-Fuel Technology," *Miami Herald*, August 14, 2006.
[45] According to Transpetro, the transportation arm of Brazil's Petrobras, ethanol can be transported in conjunction with oil products such as gasoline. However, there are a number of issues that render joint transport of ethanol and crude oil almost impossible, including: oil contains a certain amount of salt water which will be absorbed by ethanol, polluting the product; and ethanol high corrosive properties translate into a much higher need for inspection and pipeline maintenance, which would increase the transportation costs for oil.
[46] Brazil, "Plano Nacional de Agroenergia," Ministerio da Agricultura, October 20, 2005; Brazil, "BioCombustíveis," Cadernos NAE, December 2005.

factors could be significant. Aside from the impact that competition between ethanol and sugar will have on each commodity's price, the perception of ethanol's viability as a fuel might be negatively affected. The reason: shortages might persuade participants in the value chain - from manufacturers to consumers - to postpone conversion to ethanol until supply is stable. In this case, the impact is mitigated by Flex Fuel vehicles, as they offer the option of switching to gasoline use.

Second, sugar cane monoculture was a defining feature of the Brazilian northeast. It created a number of economic and cultural problems, from which the region is only emerging five hundred years later. Although the industry argues that it is using state-of-the-art crop management techniques for ethanol production, and rightly points out that the overall conditions are radically different than in the past, once again 80 per cent of the production comes from one region: the Centre-South,[47] and of that, 60 per cent comes from the State of São Paulo. It is not likely that today's concentrated production in a single area will generate the same drastic effects as it did in the Northeast. Nevertheless, as production expands, there is a need for careful monitoring to make sure that the adverse environmental impact of monoculture is at least mitigated. Furthermore, since the potential income from sugar cane becomes an overwhelming incentive to expand production, attention must be paid to the adverse consequences of dependence on single source of revenue.

Third, Brazilians claim they can expand ethanol production to new areas. However, although production in new areas is possible, before they do that, there needs to be systematic study of the implications of crop substitution. What's also needed is discussion of the appropriate infrastructure, such as dedicated pipelines to get the product to market, and the overall impact of expanded production, particularly if the land and climatic conditions in the new areas are not as suitable as they are in the Centre-South.

Finally, and more importantly, after thirty years of improvements in efficiencies, unless there are significant investments in research and development, future advances in Brazil's ethanol technology are likely to be incremental. In contrast, the new ethanol push in the US, thanks to the Energy Policy Act, could lead to new technologies and state-of-the-art facilities that challenge Brazil's pre-eminence in ethanol production.

[47] Brazil, "Plano Nacional de Agroenergia," Ministerio da Agricultura, October 20, 2005.

6. Ethanol in the US

The US, using corn as a feedstock, produced 7.9 bbl of ethanol in 2002. Production increased to 10.6 bbl and 12.9 bbl. in the two succeeding years, and is expected to post 15.1 bbl for 2005. In a very short time, the country accounted for 33 per cent of the world's total production.

US ethanol production started timidly with the Clean Air Act Amendment of 1990 which mandated the Reformulated Gasoline (RFG) program. This program required the use of oxygenates, of which the most widely used was methyl tertiary butyl ether (MTBE). However, the product was found to be a contaminant and its use banned in several states. By early 2004 ethanol became the oxygenate of choice.[48] Yet it wasn't until May of this year, when the elimination of the oxygenate requirement enacted in the Energy Policy Act of 2005 came into effect, exposing refiners liability to MTBE use,[49] that consumption of ethanol by refiners became widespread. The surge in demand led to an unprecedented spike in prices, posting an increase of 67 per cent between the end of March and the beginning of July 2006.[50]

The Energy Policy Act of 2005 also established the Renewable Fuel Standards regime, that mandated the use of 15.14 bbl (4 billion gallons) of renewable fuels in 2006, with the amount increasing each year to 28.4 bbl (7.5 billion gallons) by 2012.[51] Most of this requirement will likely be met by ethanol. Add to this a host of federal and state level tax incentives - of which a federal tax credit of US$0.52 per gallon for pure ethanol is the largest - loan guarantees, direct payments, grants, an import tariff of US$0.54 per gallon, and the farm subsidy program,[52] and it's easy to see why the US ethanol market is booming.

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[48] MTBE use was banned in January of 2004, in California, New York, and Connecticut. Since then, several states have followed suit.

[49] Bruce Blythe explains: "The policy act also did not include a liability waiver for makers/users of the MTBE additive, leaving refiners open to lawsuits over groundwater pollution and effectively signaling the end of MTBE." Bruce Blythe, "US Ethanol Extends Surge as Demand Outpaces Supply," *Bloomberg News*, July 5, 2006. Online: <http://www.bloomberg.com/apps/news?pid=20601087&sid=a4WvhtwDNN1s&refer=worldwide_news>

[50] Ibid.

[51] United States of America, Energy Policy Act of 2005, Online: <http://www.doi.gov/iepa/EnergyPolicyActof2005.pdf>

[52] Corn producers have received US$37.4 billion between 1995 and 2003. Oxford Analytica, "Ethanol Key in Fuel Market," North America/Brazil Daily Brief Series, July 20, 2006.

An increasing percentage of the US corn harvest is being devoted to ethanol production: 10 per cent in 2004, 14.4 per cent in 2005, and an estimated 22 per cent by 2011.[53] However, although corn yields are expected to increase, analysts predict that US domestic supply will grow less than 1 per cent during the same period.[54] That might have a considerable impact in the world corn market. Currently the US is the world's largest exporter, and although agriculture experts a nticipate an increase in world corn production, China's huge domestic market could swallow much of this increase.[55] There is also the potential risk of supply bottlenecks resulting from a surge in demand caused by ethanol markets in the US. Eventually one would expect markets to adjust as other countries, for instance Argentina, switch production to corn. That of course, will affect the supply and demand of the product that got bumped. This cycle is a good reminder that all markets are connected.

Currently, US ethanol is produced in over 100 plants. Although the exceptional market conditions are providing incentives for many new players to enter the market, traditionally the business has been controlled by few companies. Now, the top five companies are responsible for 37 per cent of production and the top ten for 41 per cent.[56] One company, Archer Daniels Midland (ADM), holds 17 per cent of that capacity. Moreover, ADM serves as an aggregator for commercialization and distribution of ethanol produced by small producers, bringing its market dominance to a much higher level.

Geographic concentration of production - 80 per cent in the Midwest Corn Belt - is another issue of concern, particularly when the major consuming markets are on the east and west coasts. Without a dedicated pipeline system, as mentioned before, ethanol must be shipped by truck or rail. This is extremely costly and adds a negative environmental factor to US ethanol production. It is not clear how the US will deal with this issue. Not much attention has been devoted to this matter, but an informed guess would be that constructing a new pipeline network is not an economically viable proposition at this time. Moreover, there are other environmental negatives, such as large water usage for irrigation, and the diesel needed to operate tractors and farm machinery. On the processing side, several plants use coal for power

[53] Credit Suisse, "US Ethanol Industry," Ethanomics 101, New York, August 4, 2006.
[54] Ibid.
[55] Informa Economics, "International Perspective on the Cereal Market," An Agra Informa Company, Prepared for the Seminar CIARA-CEC 2006, Buenos Aires, Argentina, April 6, 2006.
[56] Credit Suisse, "US Ethanol Industry."

generation. These factors translate into a very low energy output/input ration of 1.3 to 1.18 (compared to sugar cane's 8.3).[57] Moreover, corn ethanol has an extremely high cost per tonne of CO_2 reduction. According to the International Energy Agency's estimates using 2002 technology and costs, corn ethanol costs around US$600 per tonne of CO_2 equivalent greenhouse gas emissions while ethanol from sugar cane costs only US$50.[58]

The costs and inefficiencies of US ethanol production are significant. So much so that even with all the incentives and protection afforded to domestic production, Brazilian producers still manage to export profitably to the US. A recent investment bank report on the US ethanol market calculates that imported Brazilian ethanol is competitive at an oil price of US$67 a barrel.[59] In 2005, the US received 260 million litres directly and 454 million litres via the Caribbean - corresponding to 10 per cent and 17 per cent of Brazil's exports. However, with fuel prices surging, and refiners' increased use of ethanol, from January to May of this year alone almost 60 per cent of Brazil's exports came to the US (280 million litres directly and 130 million litres through the Caribbean). Should import tariffs be eliminated, as Senator Lugar suggested, Brazilian exports might increase to the point where it causes shortages in the domestic market. If such was the case, perhaps a gradual tariff decline would allow markets in both countries to adjust without any adverse impacts.

Still, with only 700 ethanol pumps operating in a national landscape of 170,000 service stations,[60] it is virtually impossible for the product on its own (as opposed to a blend) to win greater consumer acceptance. Currently, ethanol accounts for a skimpy 3 per cent of the market for vehicle fuel. Even with the mandated increases, its use is estimated to increase to 8 or, at most, 10 per cent.[61]

7. And in the Hemisphere

The only other countries in the hemisphere that have ethanol programs are Canada and Colombia. However, although both programs are modest compared to Brazil's or the US', Canada is about to advance its program considerably.

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[57] F.O. Licht, I. Macedo, et al., "Ethanol & Sugar Industy in Brazil: An Overview," 2004; and NREL 2002, in PowerPoint presentation from UNICA, June 2006.
[58] Ibid.
[59] Credit Suisse, "US Ethanol Industry."
[60] Martha Brannigan, "Taking a Lead in Flex-Fuel Technology," *Miami Herald*, August 14, 2006.
[61] Credit Suisse, "US Ethanol Industry."

Canadian ethanol production in 2004 amounted to 250 million litres. That figure is set to increase to 1.4 bbl by 2007 and to 3.1 bbl by 2010. The federal government has signalled its interest in setting a target for ethanol production of 5 per cent of renewable fuels by 2010, but to date there have been no official announcements. Three provinces, including Ontario (the most populous), have already set targets, but so far the incentives are more modest than those used in the US. They include a federal tax exemption of C$0.10 per litres of ethanol blended with gas, and approximately C$118 million in support for construction or expansion of 11 fuel plants.

Canada's ethanol production incurs the same inefficiencies as the US'. In addition, the country's vast size and sparse population density make ethanol usage as substitute fuel even less efficient than in the US. The only provinces with potentially the same costs as the US are Ontario and Quebec, as they can balance the relative small market size by the fact that, unlike the situation across the border, production occurs in close proximity to the major consumption areas. In spite of this, several other provinces are seeking to attract ethanol producers, and are offering incentives which often put them at odds with one another. For instance, both Saskatchewan and Manitoba create economies of scale disincentives, by having ethanol programs that demand local production and consumption.[62] Under these circumstances, it is hard to envision how the industry will be successful without significantly increased government subsidies and incentives. On the positive side, Canada is host to the only existing cellulosic[63] pre-commercial ethanol pilot plant - Iogen, in Ottawa. That means that the country has the potential to be a player in the development of new technologies. However, to make that happen, it will take substantial investments and, more importantly, an understanding of how to leverage the advantage of being the US' most trusted oil supplier into an expanding presence in other areas - including in the technology race of alternative fuels.

[62] Allan M. Walburger, et al, "Policies to Stimulate Biofuel Production in Canada: Lessons from Europe and the United States," BioCap Canada, June 2, 2006.

[63] Given that feedstock for ethanol can be used for food for human consumption, or as an input in the food industry, much effort is being devoted to the development of a new alternative using cellulosic materials (the fibrous part of any plant, wood, etc) as a feedstock.

8. The Cellulosic Race

Without doubt, the answer to a viable ethanol industry in North America[64] lies in technological improvements. The US Renewable Fuel Standards of the Energy Policy Act of 2005 make a special provision for cellulosic ethanol in its mandated usage of alternative fuels: it counts for 2.5 gallons of other renewable fuels.

Also, the legislation allocates US$160 million this fiscal year for financing commercial cellulosic production (of three start up plants). Each recipient is eligible for grants of between US$50 million and US$70 million out of this total, and must have a pilot plant showing that the process can be scaled up. At least 30 companies are competing for the funds, but as mentioned earlier, the Canadian firm Iogen - which has teamed up with Royal Dutch Shell and Goldman Sachs - seems to have the lead as long as it builds in the US. According to the *Wall Street Journal*,[65] the company is already negotiating contracts with southeastern Idaho farmers for delivery of raw materials. Other credible contenders are ADM and Abengoa Bioenergy, a US subsidiary of Abengoa S.A., the leading Spanish ethanol producer. DuPont and partners are also investing heavily into new technologies that would allow the bio-refinery to be fuelled by corn stover. The company's goal is to equalize cellulosic and corn ethanol costs by 2009.

It is worth mentioning that Iogen was also seeking C$160 million in loan guarantees from the Canadian government. Although the company seemed to be suggesting to the public that it would locate the commercial plant in the country that came up with the most generous support package, few analysts believed a plant in Canada was seriously being considered.

9. Still Other Thoughts on Ethanol

Brazil and the US are the undisputed leaders in ethanol production. China, the next largest producer, accounts for only 9 per cent of the world market. Nonetheless, global

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[64] Although Mexico is part of North America, this statement does not necessarily includes the country, as no research on the viability of ethanol production in that country was undertaken for this paper.

[65] John J. Fialka and Scott Kilman, "Big Players Join Race to Put Farm Waste Into Your Gas Tank," *Wall Street Journal*, June 29, 2006.

production has increased from less than 20 bbl in 2000 to over 40 bbl in 2005. Moreover, forecasts are for production to almost double again by 2010. Still, in spite of this significant increase, ethanol's share of the US gasoline market is expected to increase only from the current paltry 3 per cent to approximately 8 per cent by 2012 - a considerable growth in absolute terms, but marginal relative to the total transport fuel sector. On the other hand, given the fact that ethanol is currently produced from sugar cane (Brazil), corn (US), and sugar beet (European Union) - all food crops - this sharp increase in production/demand is sure to impact the agricultural sector and food processing industry.

Moreover, it is extremely troublesome to see the distortions in the global agriculture markets permeate the energy markets. Much like the current situation with the World Trade Organization's failed Doha Round, it has the potential to set developed countries (in this case the US) against developing countries (in this case Brazil). Just as in Doha, the battle would be over subsidies to and protectionism of domestic producers paired against efficient developing producers.

The emergence of agriculture-based renewable fuels, using the current technology, also could present a difficult challenge for countries that either currently have, or are likely to experience, a constraint on domestic availability of arable land, such as Japan and China. While Japan is planning for the future by investing heavily on all aspects of ethanol technology, production, and distribution in Brazil, it is not so clear how China or others in similar situation will deal with this issue. Increase transportation needs combined with population growth and decline in arable land are sure to present policy makers with difficult choices.

These are among the issues that should be on the minds of government and industry leaders as they set the future course for this alternative fuel. Although the Brazilian example suggests there can be worthwhile payoffs from subsidizing a nascent ethanol industry there are valid questions about whether North American feedstock, geography and market conditions will ever allow for a viable and environmentally sound industry without government support. Moreover, the support combined with protectionism creates a constituency that, once formed, becomes almost impossible to dismantle.

The switch to ethanol as a major fuel plays into the hands of a well-organized and extremely articulate agriculture lobby in producing countries such as the US, Brazil and Canada. There is also the question of who benefits from this taxpayer-funded largesse - multinational agri-corporations or a large rural constituency?

Finally, there is the crucial question of the industry's future once new cellulosic technology develops. Will the new government -funded technologies in developed countries which will increase domestic production without consideration to efficiency and sustainability prevent, or at least slow, developing countries' efforts to become viable and efficient suppliers of ethanol?

10. In Conclusion

Putting it all together takes us back to the first point: the US must face its energy dilemma directly. That means dealing with both supply and demand. President Bush is correct when he argues that much can be achieved when America puts its ingenuity and creativity to work. Turning American attention to balancing its increasing consumption of energy resources with sustained growth would be a good first step. Until that time, dealing more realistically with supply and fostering hemispheric energy integration, makes good sense.

That said, logic dictates that cooperation will happen much easier between countries which have common strategic interests than between those who do not.

In that context, the Western Hemisphere is of singular importance, which is why there is a need for the US to develop a comprehensive policy towards the region. The overall thinking must take into consideration the fact that two of the hemisphere's main energy players, Mexico and Venezuela, have strategic interests predicated on high oil prices. The rationale is that there are only two variables, quantity and price. If there are constraints on quantity, as is the case with these two countries, they must turn to price - Mexico is not in a position to influence world prices; Venezuela is. Consequently, in its desire for and ability to affect rising oil prices, Venezuela is provider of energy "insecurity."

In contrast, much like the US, Canada and Brazil are better off when prices are high enough to curb demand growth and provide incentives for the development of

alternative fuels - but not so high as to force hyper activity in their respective energy sectors (unconventional oil for Canada and ethanol for Brazil). High oil prices force the pace of development and costs to unsustainable levels. Unfortunately, complex as markets are, neither Brazil nor Canada is able to set oil or ethanol prices alone, or together make a major contribution to hemispheric energy security. However, they can contribute to setting the right tone and leading by example.

For at least the next two decades, the world is going to consume increasing amounts of alternative renewable fuels in addition to more, readily accessible hydrocarbons. But renewable fuels are not always environmentally friendly or easily produced without additional costs to society. Increases in consumption of such fuels could have negative consequences for other parts of the global economy.

Given the importance of the transportation sector, the focus on alternative fuels makes sense. That is key to energy security. The US is behaving as if protecting its domestic production is synonymous with security. That approach is misguided. It is a contradiction to promote economic integration and free trade, while protecting your own industry with distorting policies. Instead, the US could foster energy security by increasing cooperation with Brazil and Canada.

Between the US and Canada, energy integration is already almost seamless. Yet, in the current development of alternative fuels (ethanol now, but could be extended to biodiesel, etc.) the Iogen example shows that the two countries are competing to finance new technologies and treating their markets as completely isolated. It would make much more sense to join forces and develop an integrated approach to technology development. It would also make sense for the two countries to establish public - private partnerships in the development of commercially viable cellulosic ethanol, where the government has some say on the application of this proprietary technology in developing countries. This way the developed countries (the US and Canada) can actually demonstrate that the advantages of integration are widespread and serve more than their own needs.

Meanwhile, Brazil and the US could coordinate public policy to ensure that growth in the ethanol markets is gradual and sustainable. The US could extend its special allowances for cellulosic ethanol to product produced in Brazil through that technology. Additionally, an agreement between Canada, the US, and Brazil could be reached

on policies that would promote the development of cellulosic ethanol in existing sugar cane-producing areas on an experimental basis. If these policies are successful, the outcome would unquestionably be the production of the most efficient and environmentally friendly alternative fuel ever. These steps would also ensure that the strains that have plagued the agricultural sector are not carried over to the fuels markets.

Moreover, these three countries could join efforts to ensure that ethanol becomes a global commodity, and is produced throughout the world where conditions exist to duplicate the model with the maximum efficiency and ecological sustainability. Brazil would offer its management and production know-how. Canada and the US would contribute development funds and the new technology (on a development assistance basis where appropriate), and both countries would ensure their markets are open and free of tariffs.

These suggestions might appear idealistic, but they are do-able. Confronting the energy dilemma faced by the world will take a lot more effort, but even an incremental change in the hemisphere's energy dynamics would be a big step ahead.

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