



Center for Strategic & International Studies
Washington, DC

July 2007

The Energy Situation in the Western Hemisphere*

Sidney Weintraub

Introduction

Countries in the Western Hemisphere produced 25 percent of the world's oil and consumed 36 percent in 2005. The three countries of North America (the United States, Canada, and Mexico) produced about twice as much oil and consumed about five times as much as the rest of the hemisphere combined.

For natural gas, production and consumption in the Western Hemisphere in 2005 were roughly the same, 32 percent for production and 33 percent for consumption. Here, the production and consumption in the rest of the hemisphere was between 16 and 17 percent that of North America. Most natural gas in the hemisphere moves by pipeline, and thus little can be imported from extra-hemispheric countries. If, as expected, trade increases in liquefied natural gas (LNG), this would make natural gas a global commodity that could be imported from outside the hemisphere.

Energy cooperation is extensive between the three North American countries. Experts from the three countries meet periodically under the aegis of the North American Energy Working Group to assess their individual and collective future prospects and needs. Canada is the largest exporter of oil, natural gas, and electricity to the United States. Mexico, in recent years, has ranked second to Canada in the export of oil to the United States. Mexico, however, is an importer of natural gas and its electricity grid is much less integrated with that of the United States than is Canada's. Most of Canada's oil exports now come from the country's oil sands and there is confidence that future supplies will be forthcoming from this vast resource. By contrast, Mexico's proven oil reserves at current levels of

* This paper is used with permission from the Spanish version in *Foreign Affairs en Español*, vol. 7, No. 3, July-September 2007.

production will last only about 10 years, and exploration and new production are limited by Pemex's lack of discretionary funds and the constitutional prohibition on private equity participation in oil and most gas ventures.

In contrast to North America, energy cooperation is limited between countries in the rest of the hemisphere largely because of political animosities; the most notable case is between Bolivia and Chile dating from Bolivia's loss of its access to the sea after its defeat in the War of the Pacific, some 125 years ago. The inability to generate sustained cooperation on energy issues in Latin America mirrors long-standing failures to generate durable trade and economic integration arrangements. The most recent example of disappointment in intra-Latin American trade is Mercosur, the common market of the south (comprised of Argentina, Brazil, Paraguay, Uruguay, and now Venezuela), which has only partially carried out its economic commitments, so much so that Uruguay is prepared to sign a trade agreement with the United States.

Another difference between North America and the rest of the hemisphere is that neither the United States nor Canada has a national oil company, whereas NOCs are ubiquitous elsewhere. NOCs are by no means alike. Pemex and Petrobras (Brazil's NOC) have different structures and Petrobras has many joint ventures with independent oil companies and other NOCs, whereas Pemex does not. Venezuela's NOC, Petroleos de Venezuela, S.A. (PdVSA), operates quite differently today from the way it did before Hugo Chávez became president of the country.

The energy situation in each hemispheric country is unique. Some countries rely heavily on water power to generate electricity, others on coal, and others on oil and natural gas. Nuclear power is not extensively developed in the hemisphere. Ethanol plays a more important role as a transportation fuel in Brazil than in any other hemispheric country.

The discussion in the next section will summarize the energy situation in each of the 11 hemispheric countries that produce and generally export meaningful amounts of oil and natural gas. The final section draws some conclusions from the energy situation in the hemisphere.

Country Situations

1. United States. U.S. oil production was 6.8 million barrels a day (bbl/d) in 2005, more than any other country in the hemisphere, but oil consumption was 20.6 million bbl/d;

the difference was filled by imports of 13.5 million bbl/d. (The import figure also includes oil products.) U.S. oil consumption in 2005 was 25 percent of world consumption. About half of U.S. imports of crude oil and oil products now come from countries in the Western Hemisphere.

U.S. natural gas production in 2005 was 525.7 billion cubic meters (bcm) and consumption that year was 633.5 bcm, more than any other country in the world. U.S. natural gas consumption in 2005 was 23 percent of world consumption. About 85 percent of U.S. gas imports that year came from Canada. LNG imports were about 15 percent of what is delivered by pipeline, and 75 percent of U.S. LNG imports come from Trinidad and Tobago. The North American Energy Working Group has concluded that the United States, and North America as a whole, will have to rely more in the future than it does now on imports of LNG.

The dominant position of the United States in oil and gas trade makes it the focus of hemispheric energy analysis, even as its growing dependence on oil and oil product imports has become a source of increasing internal concern. This uneasiness gets translated in domestic political rhetoric as the need to achieve energy “independence,” something that is not achievable in the foreseeable future, and perhaps never unless there are major technological innovations. Neither is hemispheric energy independence feasible under current circumstances. The United States generates about 50 percent of its electricity from coal, and this creates considerable greenhouse gases, particularly carbon dioxide. Another 20 percent of U.S. electricity is generated by nuclear power.

Most oil imports are used for transportation, and this explains the current emphasis on the production of biofuels, especially ethanol to supplement gasoline. The raw material for U.S. production of ethanol is corn, and this is about 30 percent less efficient than using sugar cane, the raw material used in Brazil. Even if ethanol production were wildly successful over the next 20 years, whether the raw material is corn or other cellulosic material, this is unlikely to provide enough ethanol to provide even 10 to 15 percent of the power to fuel motor engines. Much research is taking place on improving automobile batteries to reduce gasoline consumption. The federal government, in recent years, has been unwilling to upgrade mandatory fleet fuel efficiency standards, largely because of opposition from domestic producers; this failure is inconsistent with the stated objective of achieving energy independence.

2. Canada. Canada's proven oil reserves are 179 billion barrels, the second largest after Saudi Arabia, but there is a caveat: the bulk of Canada's reserves are unconventional oil that can be extracted from the oil sands of the Western Canada Sedimentary Basin (WCSB). This production is now about 1 million bbl/d and is projected to rise to 3.5 million bbl/d by 2025. It is this resource that makes Canada the most important supplier of oil to the United States and also the most secure supplier in the hemisphere—and perhaps in the world because of the friendship and substantial cooperation between the two countries. More than 99 percent of Canada's crude oil exports are sent to the United States. Production of oil from the oil sands comes at a high environmental cost in polluting enormous amounts of water on which bitumen extraction relies plus releasing large quantities of greenhouse gas emissions. Canada has 1.59 trillion cubic meters of proven natural gas reserves (56 trillion cubic feet), concentrated in the WCSB.

U.S. trade with Canada is substantial across-the-board. Overall two-way U.S.-Canada trade in 2006 (\$533 billion) was almost as much as two-way U.S. trade with the rest of the hemisphere (\$551 billion), despite Canada's population of 33 million and Latin American and Caribbean population of 566 million.

3. Mexico. Mexico's proven oil reserves are about 14 billion barrels, most of these heavy crudes located offshore in the Gulf of Campeche in the southern part of the country. Cantarell, the second largest oil field in the world in terms of output, provided 63 percent of Mexico's oil production in 2004, but its output has been declining—by more than 20 percent between January 2006 to early 2007; output in early 2007 was 1.6 million bbl/d compared with 2 million bbl/d in 2005. A great effort is being made to moderate the decline by injecting large amounts of nitrogen into the field and drilling horizontally to extract oil from a larger area.

Mexico produced an average of 3.8 million bbl/d of oil in 2005, but at this rate of production, coupled with the output decline at Cantarell, proven reserves will last perhaps 10 years, unless new finds are made—and there have been few important finds in recent years. The government imposes a heavy tax on Pemex's gross revenue to fund about 35 percent of the federal budget. This has been necessary because other tax collections are only about 11 percent of GDP for a budget amounting to some 18 percent of GDP. Because of the heavy taxes it must pay, Pemex has operated at a net loss in recent years; Pemex made a modest profit in 2006 because of high world oil prices. Pemex is unable to finance exploration in the

deep waters of the Gulf of Mexico, where prospects for new finds are high; indeed, due to these fund shortages, Pemex lacks experience in deepwater drilling—in contrast with Petrobras, which has great expertise in this activity. Much of the funding for Pemex exploration in recent years has come from borrowing and not from its own resources.

Compounding this problem, Mexico's constitution gives Pemex a monopoly on exploration and production of oil and does not permit private equity financing for these activities. The large IOCs have shown little interest in service contracts with Pemex; they are prepared to take the risks of exploration and then share in the rewards of production. Unless there are changes in tax collections or in allowing private investment, Mexico could be headed for an energy crisis in not too many years. Cantarell was a lucky find in shallow waters; another lucky strike of this type has low probability.

Mexico's proven reserves of natural gas are 0.41 tcm and while production in 2005 was significant at 39.5 bcm, Mexico must import natural gas to meet growing consumption. Pemex is Mexico's largest consumer of natural gas.

4. Venezuela. Venezuela's proven reserves of oil at the end of 2005 were 79.7 billion barrels, the largest in the hemisphere. The reserves would be higher (as much as 270 billion barrels more) if Venezuela were able to count the recoverable bitumen in the Orinoco oil belt in the same fashion that Canada includes its unconventional oil from its oil sands. However, Venezuela has not gone as far as Canada in exploiting this resource, although these vast deposits will almost certainly be important in the future. Statistics on oil production vary depending on the source, somewhere between 2.6 million (oil industry estimate) and 3.1 million bbl/d (the PdVSA figure) in 2005. In 2005, Venezuela provided 1.3 million bbl/d of crude oil to the United States, making it the fourth most important supplier (after Canada, Mexico, and Saudi Arabia). Despite the political friction between the two countries, close to 70 percent of Venezuela's oil exports are sent to the United States. There are two reasons for this: the ability of U.S. refineries to handle the heavy crude from Venezuela, and the relatively low shipping cost, certainly as compared with shipments to China.

High world oil prices provide substantial revenue for Hugo Chávez, Venezuela's president, to play a large role in Latin America and on the world scene. Venezuela provides concessionary oil prices to countries in the Caribbean, including Cuba, and has bought bonds to help Ecuador and Argentina. Chávez is a role model for President Evo Morales of

Bolivia, and perhaps for President Rafael Correa of Ecuador. Chávez has proposed the building of a mega-pipeline to ship natural gas to Argentina, via Brazil, at a cost that probably would exceed US\$25 billion; the future of this proposal is uncertain because of the economics, and also because Venezuela does not now produce enough gas to send through such a pipeline. Venezuela's proven gas reserves are high at 4.32 tcm, but production in 2005 was relatively modest at 28.9 bcm. Venezuela in 2006 moved to secure majority ownership of six projects in the Orinoco Basin that were previously majority owned by six private companies. While doing all this, Venezuela is not making provision for the contingency of a sharp drop in oil prices.

5. Brazil. Brazil, at the end of 2005, had 11.8 billion barrels of proven oil reserves. Production and consumption in 2005 were roughly the same: production was 1.7 million bbl/d and consumption was 1.8 million bbl/d. It is only in the last several years that Brazil ceased to be an oil importer, in part because of increased oil production and in part because of the large use of ethanol as a motor vehicle fuel.

Ethanol can now provide about 40 percent of Brazil's motor vehicle fuel. Most vehicles are flex-fuel and able to run on any mixture of gasoline and ethanol; the current mixture in automobile use is 23 percent ethanol. Ethanol in Brazil is made from sugar cane. The U.S. government directly subsidizes ethanol production, as was true in Brazil for many years but is no longer the case. The United States has a 54 percent a gallon duty plus a 2.5 percent ad valorem import tax on ethanol from Brazil, despite which Brazil is the most important ethanol supplier to the United States. Brazil is also engaged in research on biodiesel made from oil seeds that can be found in the economically backward northeastern part of the country.

Brazil at the end of 2005 had 0.31 tcm of natural gas reserves. Its gas production that year was 11.4 bcm and its consumption was 20.2 bcm. The difference was largely accounted for by imports from Bolivia. Bolivia in 2006 nationalized foreign gas producers, including the facilities owned by Petrobras, and also raised natural gas prices. There have been discoveries of what are apparently large gas deposits in the Campos, Santos, and Espirito Santo Basins. The drilling in the Santos Basin was deep, as much as 3,500 meters. The ability of Petrobras to engage in deep water drilling deserves emphasis because this is precisely a skill not yet developed by Pemex. Brazil hopes to have the infrastructure complete to be able to bring the gas from the Santos Basin to the province of São Paulo in about five years, thus

reducing the need for imports from Bolivia. In addition, Brazil is building two plants for the regasification of LNG.

Petrobras is an NOC that issues shares sold on many stock markets, but the government owns the majority of voting shares. Unlike Pemex, Petrobras must satisfy both private shareholders and the Brazilian government.

Some 80 percent of Brazil's electricity is produced by hydropower. This requires a backup of thermo-electric power generation plants that rely on imports of natural gas and diesel fuel during dry spells.

6. Argentina. Argentina's proven oil reserves are 2.3 billion barrels (end 2005). Oil production was modest in 2005, 725 thousand bbl/d, and oil consumption that year was 421 thousand bbl/d. Natural gas reserves at the end of 2005 were 0.50 tcm. Production was 45.6 bcm and consumption during 2005 was 40.6 bcm, more or less enough for domestic use, but little for export. Indeed, Argentina, in 2004, canceled a contract to ship natural gas to Chile, although some gas continued to be sent for about another year. Natural gas provided the energy for about 55 percent of Argentina's electricity production and oil for 30 percent in 2005. In 1997, Argentina was the third largest user of natural gas in the world, after the United States and Russia. Argentina has now concluded a contract that calls for large quantities of natural gas imports from Bolivia once the infrastructure is in place.

Argentina had a severe economic-financial crisis at the end of 2001-2002 during which there was a large decline in GDP and a cessation of paying foreign debts until they were rescheduled—the largest sovereign rescheduling ever. The Argentine peso, which had been valued at one-to-one with the U.S. dollar, was sharply devalued and user rates for natural gas were frozen at 2001 levels, but in terms of the devalued pesos. Consequently, there was little new investment in natural gas production. Prices to consumers were also frozen at artificially low rates, indeed, at a price lower than Argentina was paying Bolivia for imports of natural gas. These actions were taken by the new president, Néstor Kirchner, who used these controls to keep consumer prices from rising. The price freeze for residential consumers was altered only on April 9, 2007, with an increase of 14 percent.

Argentina's NOC, Yacimientos Petroliferos Fiscales (YPF) was privatized in 1993, during the presidency of Carlos Menem, and the private company is now named Repsol-YPF. A new NOC, Energia Argentina, S.A. (Enarsa) was launched in 2004 with no operating

capital, but with the authority to sell new offshore concession contracts to private sector oil and gas firms and to collaborate in joint ventures.

7. Bolivia. Bolivia's importance in the energy field derives from its relatively recent discoveries of natural gas. Proven gas reserves at the end of 2005 were 0.74 tcm, the second highest in South America after Venezuela. Gas production in 2005 was 10.4 bcm and most of this is available for export. Most of the discoveries took place in the 1990s during the administration of President Gonzalo Sánchez de Lozada and these discoveries were followed by foreign contracts concluded with Bolivia's NOC, Yacimientos Petroliferos Fiscales Bolivianos (YPFB) and the installation of pipelines for export, especially Gasbol, from Rio Grande, south of Santa Cruz, in Bolivia, to São Paulo and Porto Alegre in Brazil. Brazil, mostly through Petrobras, has played a large role in Bolivia, generating about 18 percent of Bolivia's GDP in 2005.

Political nationalism grew after 2000 and this was outwardly focused on the role of natural gas, but more basically on the division of national power. There were street demonstrations under the slogan "*No al gas*", and two presidents, Sánchez de Lozada and then his vice president who succeeded him, Carlos Mesa were forced to resign. Evo Morales was elected president in December 2005 and in May 2006 foreign oil companies were nationalized. Taxes and royalties were raised and the companies were given 180 days to comply or leave the country. There were delays in meeting these demands because it became apparent that YPFB did not have the capacity to run the gas operations, but also because there were lawsuits, especially by Petrobras. In 2007, however, Brazil agreed to pay higher prices for Bolivian gas—and also decided to move full speed ahead on the infrastructure to transport natural gas from the Santos Basin to São Paulo and to construct two facilities to regasify LNG. The long-term future of Bolivian gas shipments to Brazil is thus uncertain. Little foreign investment is going to Bolivia because of the uncertainty of its policies.

A word about Chile is appropriate here because Chile epitomizes the problems of cooperation on energy matters in South America. Before Morales was elected, an evaluation carried out by foreign energy companies proposed transporting Bolivian gas to a seaport in Chile where it would be transformed into LNG for shipment to the west coasts of Mexico and the United States. This was rejected because the port was in Chile. Bolivia will not sell natural gas to Chile and warns other countries not to transship Bolivian gas to Chile. Argentina, as noted above, broke a contract to ship natural gas to Chile. Peru, as will be

noted below, has most of its gas committed to domestic use and for LNG shipments to Mexico and the United States. Chile is surrounded by countries with natural gas, but is now constructing a regasification facility to buy LNG from Asia.

8. Peru. The current emphasis in Peru is also on natural gas rather than oil. Peru, at the end of 2005, had 1.1 billion barrels of proven oil reserves. Oil production in 2005 was 111 thousand bbl/d and consumption was 139 thousand bbl/d. Proven natural gas reserves at the end of 2005 were 0.55 tcm, but production at Camisea, the country's largest gas find, is still gearing up. The expectation is that Peru will be an exporter of hydrocarbons in 2007. Peru has had a success rate of 75 percent in recent gas explorations, and future prospects are therefore promising.

Camisea is located in the sensitive southern jungle area of Peru and there was considerable pressure, both inside Peru and from non-Peruvian organizations, for the imposition of stringent environmental controls. The Inter-American Development Bank also insisted on social provisions to benefit the population in the region and conditioned its financial support on social and environmental measures; the IDB's position was reinforced by other financial backers, including the World Bank, the Corporación Andina de Fomento, and Brazil's national development bank. The social provisions call for about 40 percent of royalties and taxes paid by Camisea operators to go directly to municipalities in the area of the project, and this breaks new ground in natural gas contracts. The Peruvian government itself did not have to borrow money for the investment in Camisea.

The first priority for the use of the gas extracted from Camisea will be to meet Peru's domestic needs. There is also a government contract with a consortium of foreign energy companies to produce LNG for shipment to the west coasts of Mexico and the United States. The workings of two key variables—over and above successful extraction of the gas—will be crucial to the perception of Camisea in the future: will the environmental safeguards be effective in light of some early failures; and will the designated funds actually be distributed directly to the nearby municipalities?

9. Ecuador: Ecuador's proven oil reserves at the end of 2005 were 5.1 billion barrels, the third highest in South America (after Venezuela and Brazil). Production in 2005 was 541 thousand bbl/d and consumption was 148 thousand bbl/d. Ecuador, as can be seen from the figures, exports a large proportion of its production. Ecuador has low natural gas reserves and it is not a significant producer of natural gas.

Ecuador is a politically turbulent country. It has had at least seven presidents during the last 10 years (this does not count a triumvirate that lasted only hours and a president deposed after one day). A contract with Occidental Petroleum was nullified in 2006 and there is still no resolution of the compensation that will be forthcoming. ExxonMobil abandoned Ecuador as a bad place to do business because of frequent contract and royalty changes, and in 2005 EnCana, a large Canadian energy company, sold its assets to a Chinese company. The president elected at the end of 2006, Rafael Correa, is setting up a constituent assembly to write a new constitution, similar to the procedure carried out in Venezuela after Hugo Chávez was elected president and in Bolivia after Evo Morales was elected president there. President Correa easily won the vote on April 16, 2007 to establish a constituent assembly.

10. Colombia. Colombia's proven oil reserves at the end of 2005 were 1.5 billion barrels. Its production that year was 549 thousand bbl/d and consumption was 230 thousand bbl/d. Natural gas reserves at the end of 2005 were 0.11 tcm, production was 6.8 bcm, and consumption the same, 6.8 bcm. Colombia had 6.6 billion short tons of proven coal reserves at the end of 2005.

Colombia, in the 1920s, was an oil exporter, became an importer in the 1970s, but is now able to meet domestic needs from its own production, leaving a modest residue for export. Colombia is in a promising region for oil finds because of its geography next door to Venezuela and Ecuador, but has been less successful than its two neighbors in oil finds. There is concern in Colombia that it may once again become an oil importer and, consequently, favorable terms are given to investors. About 80 percent of Colombia's sedimentary basins have yet to be explored. Colombia's NOC, Empresa Colombiana de Petroleos (Ecopetrol) was established in 1951 and has a good reputation for efficiency. Twenty percent of Ecopetrol was privatized in 2006.

Colombia has long had a serious problem in oil and gas production because of guerrilla destruction of pipelines and violence and kidnappings often directed at foreigners working in the energy sector.

11. Trinidad and Tobago. T&T's proven oil reserves at the end of 2005 were 0.8 billion barrels. Oil production in 2005 was 171 thousand bbl/d. T&T casts a longer shadow in the hemisphere for its production of natural gas and its exports of LNG. T&T had proven natural gas reserves of 0.55 tcm at the end of 2005 and production of 29 bcm in that year. Its

gas reserves are less than 1 percent of global gas reserves, but T&T has nevertheless become a major player in supplying LNG to the United States; T&T, as noted earlier, provides about 75 percent of the LNG imported by the United States. This situation holds much promise for T&T if the energy experts from the three North American countries are accurate, namely, that all of them will probably have to rely on increased imports of LNG in the future.

T&T is a small country with a population of 1.3 million. It has made the most of its oil and gas resources. They generate about 40 percent of the country's GDP and 50 percent of government revenue; and they have spawned such domestic energy-using industries as ammonia, methanol, and smelting aluminum. These activities have led to considerable environmental damage, a problem that must be confronted.

Conclusions

Cooperation on energy issues is much greater in North America than in South America. The best contrasts are the cooperative Canada-U.S. relationship and the antagonistic Bolivia-Chile standoff. Many of the most intractable problems within hemispheric countries are brought on by defensive nationalism, such as Ecuador's turbulent relations with foreign oil companies and Mexico's unwillingness to allow private equity investment in oil exploration and production. Bolivia was willing to antagonize Brazil by forcibly seizing Petrobras operations for the purpose of nationalizing them. Energy policy also suffers from political strife within countries, such as the ouster of two presidents in Bolivia over natural gas sales to foreigners, and congressional disagreement over taxes on foreign energy companies in Ecuador. Venezuela's president states regularly that he seeks to reduce oil sales to the United States, but does not carry this out to the extent he declaims because there are no current alternative markets that can handle the country's heavy crude. There is no mystery about the origins of these discordances, but they all have economic costs to the countries involved.

Only two countries of the 11 discussed above do not have NOCs—the United States and Canada. NOCs are by no means alike. Petrobras has developed an enviable record, while Pemex has been unable act as a typical oil company because the central government deprives the company of the funds necessary for normal exploration and production. The other NOCs vary considerably; PdVSA is much more under political control than is Ecopetrol in

Colombia. In many countries, government ministers direct or sit on the boards of NOCs, and this sets up a conflict between optimizing operating efficiencies or maximizing revenue for the government. Regulatory frameworks could benefit from hard-nosed evaluations of the institutions involved.

Finally, there is often a sharp difference between rhetorical objectives and concrete actions to reach these objectives. Several U.S. presidents have proclaimed the goal of energy independence, but refuse to mandate high fuel efficiency standards. President Chávez announces a project to build a mega-pipeline from Venezuela to Argentina, and the announcement may well be the real objective because no action has been taken to carry it out. Mexican authorities now agree they must explore in the promising deep waters of the Gulf of Mexico, but so far have done next to nothing to make this a reality. The hemisphere has no more been able to integrate energy policy than it has trade policy—and each of these failures comes at a high cost.

Sidney Weintraub holds the William E. Simon Chair in Political Economy at the Center for Strategic and International Studies. Much of the material in this paper is based on the recent book he edited, Energy Cooperation in the Western Hemisphere: Benefits and Impediments (CSIS Press, 2007).