

June 2006

# ENERGY SECURITY

## Issues Related to Potential Reductions in Venezuelan Oil Production





Highlights of [GAO-06-668](#), a report to the Chairman, Committee on Foreign Relations, U.S. Senate

## Why GAO Did This Study

Venezuela is the world's eighth-largest oil exporter and among the top 10 countries in total proven oil reserves. Venezuela also supplies about 11 percent of current U.S. imports of crude oil and petroleum products and wholly owns five refineries in the U.S. Consequently, Venezuela is a key player in the future energy security of the United States and the world.

The current global oil market is tight and may be more susceptible to short-term supply disruptions and higher and more volatile prices. Recently, tension between Venezuela and the United States has caused concern about the stability of Venezuelan oil supplies. On several occasions, Venezuela's President has threatened to stop exporting oil to the U.S. or to close Venezuela's U.S.-based refineries.

In this context, GAO analyzed: (1) how Venezuela's crude oil production and exports of crude oil to the U.S. has changed in recent years, (2) the potential impacts of a reduction in Venezuelan oil exports to the U.S., and (3) the status of U.S. government programs and activities to ensure a reliable supply of oil from Venezuela. Commenting on a draft of the report, the State and Commerce Departments generally agreed with the report, but DOE contended that the report presents an "alarmist view" of U.S. energy security. We disagree and believe the report presents a contextually balanced treatment of the issue.

[www.gao.gov/cgi-bin/getrpt?GAO-06-668](http://www.gao.gov/cgi-bin/getrpt?GAO-06-668).

To view the full product, including the scope and methodology, click on the link above. For more information, contact Jim Wells at (202) 512-3841 or [wellsj@gao.gov](mailto:wellsj@gao.gov).

## ENERGY SECURITY

# Issues Related to Potential Reductions in Venezuelan Oil Production

## What GAO Found

Venezuelan oil production has fallen since 2001, but exports of crude oil and petroleum products to the United States have been relatively stable—except during a 2-month strike in the winter of 2002–2003, during which the oil sector was virtually shut down and exports to the United States fell by about 1.2 million barrels. Energy Information Administration data show that total Venezuelan oil production in 2001 averaged about 3.1 million barrels per day, but by 2005 had fallen to about 2.6 million barrels per day. Following the strike, Venezuela's President ordered the firing of up to 40 percent of Venezuela's national oil company employees. U.S. and international oil industry experts told us that the resulting loss of expertise contributed to the decline in oil production. In 2005, the Venezuelan government announced plans to expand its oil production significantly by 2012, but oil industry experts doubt the plan can be implemented because Venezuela has not negotiated needed deals with foreign oil companies as called for in the plan.

A model developed for the Department of Energy estimates that a 6-month disruption of crude oil with a temporary loss of up to 2.2 million barrels per day—about the size of the loss during the Venezuelan strike—would, all else remaining equal, result in a significant increase in crude oil prices and lead to a reduction of up to \$23 billion in U.S. gross domestic product. A Venezuelan oil embargo against the United States would increase consumer prices for petroleum products in the short-term because U.S. oil refiners would experience higher costs getting replacement supplies. A shutdown of Venezuela's wholly-owned U.S. refineries would increase petroleum product prices until closed refineries were reopened or new sources were brought on line. These disruptions would also seriously hurt the heavily oil-dependent Venezuelan economy.

U.S. government programs and activities to ensure a reliable supply of oil from Venezuela have been discontinued, but the U.S. government has options to mitigate short-term oil disruptions. For example, activities under a U.S.–Venezuela oil technology and information exchange agreement were stopped in 2003, in part, as a result of diplomatic decisions. In recent years, U.S. oil companies have not sought assistance from the U.S. government with issues in Venezuela because the companies do not believe that federal agency intervention would be helpful at this time. To mitigate short-term oil supply disruptions, the U.S. government could attempt to get oil-producing nations to increase their production to the extent possible, or could release oil from the U.S. Strategic Petroleum Reserve. While these options can mitigate short-term oil supply disruptions, long-term reductions in Venezuela's oil production and exports are a concern for U.S. energy security, especially in light of current tight supply and demand conditions in the world oil market. If Venezuela fails to maintain or expand its current level of production, the world oil market may become even tighter than it is now, putting further pressure on both the level and volatility of energy prices.

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### Abbreviations

DOE	Department of Energy
EIA	Energy Information Administration
GDP	gross domestic product
OPEC	Organization of the Petroleum Exporting Countries
PDVSA	Petroleos de Venezuela S.A.

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United States Government Accountability Office  
Washington, DC 20548

June 27, 2006

The Honorable Richard G. Lugar  
Chairman, Committee on Foreign Relations  
United States Senate

Dear Mr. Chairman:

The United States imports about 13 million barrels of crude oil and refined petroleum products each day, or about 65 percent of its total daily consumption. Venezuela is the world's eighth largest crude oil exporter and supplies about 1.5 million barrels per day of crude oil and refined petroleum products, such as gasoline and fuel oil, to the U.S. market, comprising about 11 percent of current U.S. imports. In addition, Venezuela ranks among the top 10 countries in the world in the size of its proven oil reserves—oil that has been proven to exist in the ground and could be produced. Venezuela is also one of the founders and an influential member of the Organization of the Petroleum Exporting Countries (OPEC), whose 11 members control over three-quarters of the world's total oil reserves and can greatly affect world oil prices. Consequently, Venezuela is a key player in the future energy security of the United States and the world.

Most of Venezuela's crude oil that is not consumed domestically in Venezuela is exported to the United States. The United States is a natural market for Venezuelan oil because it is so close—about 5 days by tanker to the U.S. Gulf Coast compared to about 30 to 40 days for supplies coming from the Middle East. Moreover, Venezuela's national oil company, Petroleos de Venezuela S.A. (PDVSA), wholly owns five refineries in the United States and partly owns four other refineries in the United States and U.S. Virgin Islands, either through partnerships with U.S. companies or through PDVSA's U.S. subsidiary, CITGO, Inc. These refineries are unusual in their capacity to refine large volumes of the heavy, sour (high-sulfur) crude oil that constitute a large part of Venezuela's oil exports.

Political strife within Venezuela and political tension between Venezuela and the United States have caused concern about the stability of Venezuelan oil production and exports to the United States. The election of Hugo Chavez as President of Venezuela in 1998 signaled a major change in how the Venezuelan government views the country's oil industry. For example, the government took steps to shift managerial authority for

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Venezuela's oil resources from PDVSA to the Venezuelan Ministry of Energy and Petroleum. The government also changed the way it deals with foreign companies—it raised the maximum royalty rates paid by foreign oil companies from 16-2/3 to 30 percent, established a new “extraction tax,” raised income taxes for those companies, and instituted provisions requiring joint ownership structures with majority shares for PDVSA. Opposition to the new government culminated in a general strike that lasted from December 2, 2002, until February 2, 2003, and virtually shut down the oil sector of the economy. This strike temporarily decreased world oil supplies by about 2.3 million barrels per day, or about 3.0 percent of total world daily oil supply, and reduced oil exports to the United States by about 1.2 million barrels per day—equivalent to about 11 percent of total U.S. oil imports at the time. More recently, in April 2006, Venezuela seized two oil fields operated by two foreign oil companies because the companies did not comply with new rules unilaterally imposed by the Venezuelan government.

Instability in Venezuela's oil sector exists in a broader context of a tightening global oil supply and demand balance. Surplus global oil production capacity—the amount by which oil production could be increased immediately without additional investment—was as high as 5.6 million barrels per day in 2002, but has since decreased to only about 1 million barrels a day; Saudi Arabia provides most of this surplus capacity. Meanwhile, demand for crude oil is growing rapidly in China and other countries. Market tightness, along with the fact that much of the world's supply of oil is in relatively unstable regions, may make the global oil market increasingly susceptible to short-term disruptions and lead to higher and more volatile oil prices. In this context, instability of oil supply from any significant individual oil-producing country can create oil price volatility, which can cause an economic slowdown. Studies of past oil supply disruptions indicate that sudden increases in oil prices can contribute to inflationary pressure and economic slowdowns. In extreme cases, such as the large oil price increases associated with the Arab oil embargo and Iranian revolution in the 1970s, these high prices were associated with severe economic recessions.

Four U.S. government agencies have significant involvement in implementing U.S. energy security policy regarding Venezuela.

- The Department of Energy's (DOE) Office of Policy and International Affairs establishes and implements U.S. international energy policy, and is responsible for monitoring and analyzing world energy market developments and the international political, economic, and strategic

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factors that influence these developments; managing relevant bilateral energy relationships; and ensuring protection of U.S. interests in bilateral and multilateral treaties and obligations that affect energy services, commodities, and technology. Also, according to DOE officials, the office holds dialogues with energy producers, monitors national and global energy security, and serves as the U.S. lead in coordinating oil supply disruption-response issues and measures with the International Energy Agency. The Office of Fossil Energy works with various countries through bilateral agreements to identify areas of mutually beneficial collaboration in promoting and developing fossil energy technologies. These agreements also facilitate relationships that may lead to commercial development. The Office of Fossil Energy also manages the U.S. Strategic Petroleum Reserve, which is a U.S. stockpile of about 700 million barrels of light crude oil maintained by the federal government for use in the case of a major disruption of oil supplies to the United States. DOE is also responsible for collecting and analyzing data and information through its Energy Information Administration (EIA).

- The Department of State's Office of International Energy and Commodity Policy is responsible for coordinating U.S. international energy policy, participating in dialogue with energy producers, and monitoring national and global energy security. The Department of State and DOE, in conjunction with other stakeholders, advise the National Security Council on energy security issues, including the potential impacts of oil supply disruptions on the U.S. economy and on possible actions that could mitigate these impacts.
- The Department of Commerce's Office of International Trade Administration plays a role in advising U.S. business interests seeking to invest in Venezuela's oil sector.
- The Office of the U.S. Trade Representative and Department of State co-lead the negotiations of bilateral and multilateral treaties, which may contain specific aspects that affect energy security, trade, and investment.

Until the strike in the winter of 2002–2003, the United States and Venezuela had steady diplomatic contacts with respect to oil. Since then, the relationship between the two countries has become strained. On several recent occasions, Venezuela's President has threatened to stop exporting Venezuelan oil and refined petroleum products to the United States. He also has made statements regarding the possible sale or closure of Venezuela's refinery interests in the United States. Furthermore, Venezuelan officials have repeatedly made statements that they are trying to develop new markets for their crude oil.

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In the context of effects on U.S. oil supplies, we addressed the following questions: (1) How has Venezuela's production of crude oil and exports of crude oil and refined petroleum products to the United States changed in recent years, and what are the future prospects? (2) What are the potential impacts of a reduction in Venezuelan oil exports, a Venezuelan embargo on oil exports to the United States, or sudden closure of Venezuela's refineries in the United States? (3) What is the status of U.S. government programs and activities to ensure a reliable supply of oil from Venezuela and to mitigate the impacts of a supply disruption?

We used a number of methodological techniques to address these questions. To address the first objective, we reviewed studies and analyses of the Venezuelan oil sector and its history and met with officials of numerous U.S. oil companies and other oil companies, industry experts, and federal agency officials. In addition, we visited Venezuela and met with the U.S. Ambassador and embassy staff; Venezuela's Minister of Energy and Petroleum; PDVSA officials, including the president of the company and a number of board members and senior managers; the Venezuelan Auditor General; members of the financial community; and other individuals with expertise in the Venezuelan oil sector. Both in the United States and in Venezuela, we spoke with numerous former PDVSA employees, executives, and directors, and oil company officials. We also collected, evaluated the reliability of, and analyzed data on Venezuelan production, consumption, and exports of oil and petroleum products. The sources of our data include U.S. government agencies, especially the EIA; the Venezuelan government and PDVSA; and other international and private sources. We deemed these data to be reliable for the purposes of addressing our objectives. Finally, we reviewed PDVSA's plan to expand oil production, and collected oil industry officials' and experts' views on the likely implementation of that plan.

Regarding the second objective, we reviewed studies of oil disruptions, including studies of the impacts of the Venezuelan strike. We also analyzed current conditions in the world oil market to evaluate what might occur if a similar disruption occurred today. Further, we evaluated the potential impacts of several different scenarios involving reductions in Venezuela's oil production or exports to the United States—(1) a sudden and severe drop in Venezuelan oil exports from the world market, (2) a sudden diversion of oil from the United States to other markets through an embargo, and (3) the closure by Venezuela of its wholly-owned U.S.-based refineries. Regarding the first scenario, we asked a DOE contractor at the Oak Ridge National Laboratory to use an economic oil-disruption model to analyze the impacts of a hypothetical Venezuelan oil disruption on world



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oil prices and on the U.S. gross domestic product (GDP).<sup>1</sup> For this analysis we constructed a hypothetical disruption scenario similar to the one that actually occurred during the Venezuelan oil strike in the winter of 2002–2003, but using assumptions regarding market and economic conditions closer to those that prevailed at the time of the analysis (late 2005). We also analyzed data from private entities and met with numerous industry experts in Venezuela and the United States; officials in the Departments of State and Commerce; DOE officials; and officials in the International Energy Agency to determine the impact of potential oil supply disruptions.

To address the third objective—identifying the status of programs and activities to ensure a continued supply of oil and to mitigate a disruption of imports of crude oil and refined petroleum products from Venezuela—we met with officials at the Departments of State and Commerce, DOE, and the Office of the U.S. Trade Representative. We also talked to oil company officials. In addition, we spoke with Venezuelan officials and U.S. embassy staff in Venezuela. This report focuses on federal programs and activities related to U.S. energy security. Diplomatic and political actions that may impact U.S. energy security may be undertaken for a multitude of foreign policy goals that are beyond the scope of this report. Therefore, our assessment of programs and activities related to energy security is not an evaluation of the U.S. government’s approach to these broader goals.

To obtain the official Venezuelan government position on questions relating to all three objectives, we made arrangements with the Venezuelan Embassy in Washington, D.C., for an official spokesperson.

A more detailed description of the scope and methodology of our review is presented in appendix I. We performed our work between March 2005 and May 2006, in accordance with generally accepted government auditing standards.

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## Results in Brief

Venezuelan oil production has fallen since 2001, but exports of crude oil and refined petroleum products to the United States have been relatively

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<sup>1</sup>GDP is a quantifiable measure of a country’s total income for a given year. A sudden loss of crude oil would, all else remaining equal, harm the economy by increasing petroleum product prices, resulting in higher costs and lower employment. However, as will be discussed later in this report, the United States and other oil-consuming countries may take steps to mitigate the impact of a disruption, including using strategic petroleum reserves.

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stable except during the strike. EIA data show that total Venezuelan crude oil production in 2001 (the last full year before the Venezuelan strike) averaged about 3.1 million barrels per day, but by 2005 had fallen to about 2.6 million barrels per day—a 16 percent reduction. Venezuelan government officials dispute these figures, and provided data that indicates production has almost fully recovered to prestrike levels, but most available data indicate that the Venezuelan government data are overstated. Following the 63-day strike, Venezuela’s President ordered the firing of up to 40 percent of PDVSA’s employees, including many of the company’s management and technical staff. Experts told us that this loss of managerial and technical expertise, along with Venezuela’s underinvestment in oil field maintenance since the early 1990s, contributed to the decline in PDVSA’s oil production. While overall production has fallen, shortly after the strike Venezuela’s exports of crude oil and refined petroleum products to the United States returned (and have remained) close to prestrike levels of about 1.5 million barrels per day. Most of these exports go to CITGO or other refineries on the U.S. Gulf Coast that are owned wholly or partly by PDVSA. In 2005, PDVSA announced plans to expand its oil production significantly by 2012, but oil company officials and industry experts expressed doubt about PDVSA’s ability to implement the plan, in part because, to date, the company has not negotiated any of the numerous deals with foreign oil companies that are called for in the plan. The absence of such deals increases the likelihood that Venezuelan oil production will continue to fall because, given that PDVSA’s own production is in decline, Venezuela needs willing foreign oil company partners to maintain the country’s current level of oil production.

A sudden and severe reduction in Venezuelan oil exports would have worldwide impacts, while the impacts of a Venezuelan oil embargo against the United States or closure of Venezuela’s U.S. refineries would be primarily concentrated in the United States and Venezuela.

- A sudden loss of all or most Venezuelan oil from the world market under the current tight global supply and demand balance would raise world oil prices. For example, a model developed for DOE estimates that a disruption of crude oil with a temporary loss of up to 2.2 million barrels per day—about the size of the loss during the Venezuelan strike—would, all else remaining equal, result in a crude oil price spike of up to \$11 per barrel in the early stages of the disruption. Such an increase would raise the price of petroleum products and, because petroleum products are important to the functioning of the economy, would likely slow the rate of economic growth in the United States and other countries until

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replacement oil could be obtained. The model also predicted that U.S. GDP would decrease by about \$23 billion. Because a severe drop in oil production would also cause large losses for Venezuela in export revenues and jobs, Venezuela would likely try to restore oil production as quickly as possible.

- A Venezuelan oil embargo against the United States would increase consumer prices for gasoline and other petroleum products in the short term because U.S. oil refiners would experience higher costs getting oil supplies from sources farther away than Venezuela. Also, some U.S. refineries that are designed to handle Venezuelan heavy sour crude oil would lose some of their effective capacity if they had to use the lighter replacement crude oil that most likely would be available. In this scenario, because Venezuelan oil would not be taken off the market entirely, the impact on world oil prices would be minimal in the long term. The impact of a U.S.-specific embargo would also be smaller on Venezuela than if its total oil production fell.
- If Venezuela shut down its wholly-owned U.S. refineries there would be a reduction in the supply of gasoline and other petroleum products—and a corresponding increase in prices of these products—until the closed refineries were reopened or new sources of refined petroleum products were brought on line. The impacts would be obviously most severe in the United States and Venezuela, although greater demand by U.S. oil companies to buy petroleum products from other countries could cause price increases in those countries. Venezuela would suffer direct losses of revenues from its U.S. refineries and, if closing the refineries was deemed a threat to U.S. national security, Venezuela could potentially face sanctions by the U.S. government.

The U.S. government's programs and activities to ensure a reliable long-term supply of oil from Venezuela have been discontinued, but the U.S. government has options to mitigate short-term oil supply disruptions. DOE has had a bilateral technology and information exchange agreement with Venezuela since 1980 to enhance oil production in—and secure reliable and affordable sources of oil from—that country, but these activities ceased in 2003. According to DOE officials, the activities stopped in part as a result of diplomatic decisions and in part because Venezuela no longer had counterparts to DOE technical staff who could continue the cooperative exchanges. In addition, the United States, co-led by the Department of State and the Office of the U.S. Trade Representative, attempted to negotiate a bilateral investment treaty that would have provided rules on investment protection, binding international arbitration of investment disputes, and repatriation of profits, and assisted U.S. oil

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and other companies doing business in Venezuela, but negotiations broke down in 1999 because of significant differences between the two countries. Officials in many oil companies told us that poor relations between the United States and Venezuela had made it difficult to compete on new investment opportunities in Venezuela and that a bilateral investment treaty would have helped protect their investments in Venezuela when the Venezuelan government unilaterally changed the way it deals with foreign companies. The U.S. government has options to mitigate short-term supply disruptions. It has relied on diplomacy in the past to persuade oil-producing countries to increase production, and it could use oil from the U.S. Strategic Petroleum Reserve. During the Venezuela strike, for example, the U.S. government used diplomacy to persuade oil-producing countries in the Middle East and other areas to bring spare oil production capacity online and make up for the lost oil. However, such diplomacy may be less effective today because there is currently very little spare production capacity. In addition, during the strike, DOE allowed oil companies that were to deliver oil to the U.S. Strategic Petroleum Reserve to delay those deliveries, which increased the available oil supply in the United States. Officials in the Departments of State and Commerce, DOE, and the Office of the U.S. Trade Representative told us that they do not have Venezuelan-specific contingency plans for a potential loss of oil; rather, they believe diplomacy to persuade oil-producing countries to increase production and using oil in the U.S. Strategic Petroleum Reserve are adequate actions to deal with an oil-supply disruption. Although the U.S. government has options to mitigate impacts of short-term oil disruptions on crude oil and petroleum products prices, these mitigating actions are not designed to address a long-term loss of Venezuelan oil from the world market. If Venezuela fails to maintain or expand its current level of production, the world oil market may become even tighter than it is now, putting further pressure on both the level and volatility of energy prices. In this context, the United States faces challenges in the coming years that may require hard choices regarding energy sources, foreign relations and energy-related diplomacy, and the amount of energy Americans use.

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## Background

As the United States has become more dependent on foreign sources for crude oil, our energy security has become increasingly intertwined with that of other countries. Crude oil is a global commodity and, as such, any world event that increases instability in crude oil prices reduces energy security for all oil-buying countries in similar ways. Numerous empirical studies have shown a correlation between oil price shocks and economic downturns. When crude oil prices rise, this pushes up prices of petroleum

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products. Consumers spend more of their income on energy and less on other goods, which can cause an economic slowdown. In addition, since much of the oil is imported, there is a greater flow of funds overseas rather than increased domestic spending. World oil prices have more than doubled since 2003 and are currently higher, when adjusted for inflation, than in any time since the early 1980s. World demand for oil is projected to increase by about 43 percent over the next 25 years—from about 82 million barrels per day in 2004 to about 118 million barrels per day in 2030—with much of the increased demand coming from China and other countries. Some experts believe oil prices will remain high for the foreseeable future as suppliers struggle to increase production to keep up with demand. In this tight demand and supply environment, even small supply disruptions can create large increases in prices. In this way, our energy security is tied to events in all oil-producing countries.

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## Venezuela Has Been a Key Player for Almost a Century

Oil was first produced commercially in Venezuela in the early 1900s, and by the late 1920s Venezuela was the world's second largest producer, after the United States. Today, Venezuela's 78 billion barrels of proven reserves—crude oil in the ground that geological and engineering data have demonstrated with reasonable certainty is able to be produced using existing technology—are the seventh or eighth largest in the world. Outside of the Persian Gulf, only Canada's proven reserves are considered greater than Venezuela's.<sup>2</sup>

In 2005, Venezuela was the world's eighth largest exporter of crude oil. Most of Venezuela's crude oil that is not consumed domestically in Venezuela is exported to the United States because of its close proximity; additionally, Venezuela owns significant refining assets in the United States and the U.S. Virgin Islands that can refine its heavy sour oil. In the 1980s and 1990s, PDVSA bought CITGO, Inc. and acquired interests in several other U.S. refineries that had the ability or could be reconfigured to refine such crude oil. Today, the refining capacity of PDVSA's share of the nine U.S. refineries in which it has an interest is about 1.3 million barrels per day. For example, CITGO's five wholly-owned refineries have a

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<sup>2</sup>While Canada's proven reserves include oil sands, which are a low-quality source of oil, Venezuela's extra heavy oil reserves are only partly included in its proven reserves. Many industry sources believe that Venezuela probably has extensive reserves of extra heavy oil. The Venezuelan government estimates the country has an additional 235 billion barrels of such crude oil that ultimately will be recoverable. If this estimate is proven, Venezuela's reserves would exceed over 310 billion barrels—the largest of any country in the world.

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refining capacity of about 750,000 barrels per day and market their refined petroleum products in the United States through about 14,000 independently owned service stations using the CITGO name. In addition, PDVSA partners directly, or through CITGO, with ExxonMobil, Lyondell, ConocoPhillips, and Amerada Hess in the U.S. Virgin Islands. These nine refineries buy most of the crude oil and refined petroleum products exported by Venezuela. While the United States is unique in its capacity to refine large volumes of the heavy crude oil that constitutes a majority of Venezuela's oil exports,<sup>3</sup> China and other countries, such as Brazil, have plans to build refineries that can process heavy crude oil, which, if built, may create other attractive markets for Venezuela's oil.<sup>4</sup> In addition, the Venezuelan government has launched several regional initiatives to increase its export base, including (1) PetroCaribe, through which Venezuela offers oil and some refined petroleum products to 14 Caribbean countries with favorable financing, and (2) PetroAndina and PetroSur, which offer oil under similar terms to, respectively, the Andean countries of Colombia, Ecuador, and Bolivia and the South American countries of Brazil, Uruguay, and Argentina.

The oil sector in Venezuela consists of a network of oil fields and wells that produce crude oil, refineries to process the crude oil, and an infrastructure to transport the crude and refined products. The bulk of Venezuela's production comes from the Lake Maracaibo area in the country's western region and from the Faja area in the Orinoco Belt in the country's eastern region. The crude oil is processed by PDVSA's six refineries in Venezuela or is exported to the United States or other countries. Crude oil is shipped by way of 39 oil terminals from Venezuela's major oil ports, located in the western and eastern regions of the country.

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## U.S. and Other Foreign Companies Have Long Been Involved in the Venezuelan Oil Sector

Foreign oil companies began producing crude oil in Venezuela in the early 1900s. In 1976, Venezuela nationalized its hydrocarbon industry, bringing control of oil—which is the main source of the country's wealth—under the control of the national oil company. However, beginning in 1992, the

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<sup>3</sup>The oil industry uses a "gravity scale" to characterize grades of crude oil. Crude that has a higher numerical value is considered light; crude that has a lower numerical value is considered heavy; crude that is less than 10 degrees gravity, such as that contained in the Faja area of Venezuela's eastern region, is considered extra heavy. Faja oil is upgraded to a lighter synthetic oil.

<sup>4</sup>DOE told us that these plans are conceptual and have not been finalized.

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Venezuelan government reopened its petroleum industry to foreign and private Venezuelan oil companies in what was known as the “Apertura.” Between 1992 and 1997, Venezuela signed 32 operating service agreements to allow 22 private Venezuelan, U.S., and other foreign companies to produce oil in fields that were considered, at the time, economically marginal or high risk. The purpose of these 32 operating service agreements was to allow foreign companies to assist PDVSA in producing oil, and the contracts were structured so foreign-company operators did not have any rights over the volumes, reserves, or prices of crude oil but were reimbursed for their costs plus a service fee for production. The Venezuelan government granted the foreign company operators an indefinite “royalty holiday” whereby the companies paid no more than 1 percent royalty on the extracted crude, instead of the maximum of 16-2/3 percent at the time.

Also during this period, PDVSA entered into four joint ventures with foreign companies, including ExxonMobil, ConocoPhillips, and ChevronTexaco from the United States, to produce crude oil in the Faja. These joint ventures, whose majority shares were owned by the foreign oil companies, were considered high risk at the time, in part due to the challenges of producing “extra-heavy” sour oil from the Faja, which is among the lowest quality oil commercially produced anywhere in the world. Venezuela’s extra-heavy Faja oil has higher density (is “heavier”) and has a higher sulfur content than most commercially produced crude oil. Commercial production of extra-heavy oil is relatively expensive—pumping it from the ground requires the use of techniques to improve its flow characteristics and readying it for market requires “upgrading” to prepare it for final refining. During upgrading, the extra-heavy crude oil is processed to make it lighter and remove much of its sulfur content. In 1997, foreign companies began to produce extra-heavy sour crude oil in Venezuela’s Faja region, and, by 2005, the four joint ventures were producing about 600,000 barrels per day of Faja crude. The projects in the Faja also paid only 1 percent royalty instead of 16-2/3 percent. Extra-heavy crude from the Faja region is also used to produce Orimulsion, a boiler fuel that is a mixture of bitumen and water. Orimulsion is marketed internationally, especially to China.

Effective January 2002, a new law governing Venezuela’s hydrocarbon industry went into effect. The new law increased maximum royalties from 16-2/3 percent to 30 percent, and increased the percentage of ownership by PDVSA in all operating arrangements with foreign and domestic companies to at least 51 percent. In 2005, the Venezuelan government took steps to make foreign and domestic companies migrate from the terms of

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the existing 32 operating service agreements to the terms of the new law. Essentially, beginning in 2006, the companies that had been paying no more than 1 percent in royalty fees under the operating service agreements had to pay as much as 30 percent. Also, instead of paying 34 percent in income taxes as service providers, the foreign companies had to pay 50 percent as part owners in the joint ventures. If the foreign companies did not comply with the new rules, the Venezuelan government took control of the operations. While the new rules had not been applied to the four joint ventures in the Faja, in March 2005 the Faja projects began paying 16-2/3 percent royalties. Also, in May 2006, the Venezuelan government established a new extraction tax in addition to the 50 percent income tax. According to a Venezuelan spokesperson, the extraction tax is 33.33 percent applied to well production, but royalty fees are deducted from this tax. The Venezuelan tax authority also issued bills for millions of dollars in back taxes to foreign companies conducting production activities under the 32 operating service agreements after the effective date of the law.

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## Political Situation in Venezuela

The oil industry is capital-intensive and heavily dependent on continuous investment to maintain existing wells, establish new wells for crude oil production, and develop and maintain the infrastructure supporting the production network. According to the EIA, PDVSA is Venezuela's largest employer and accounts for about one-third of the country's GDP, about 50 percent of the government's revenue, and 80 percent of Venezuela's export earnings. PDVSA stated in 2005 that it plans to invest \$26 billion to expand its oil production to 5.8 million barrels per day by 2012.

After Hugo Chavez was elected president of Venezuela in 1998, responsibility for the oil industry changed. Managerial authority for the petroleum industry was shifted from PDVSA to the Venezuelan Ministry of Energy and Petroleum; the way Venezuela does business with foreign companies also changed, as discussed previously. Domestic resistance to the Chavez administration and the changes in hydrocarbon sector oversight resulted in a 63-day strike by nearly half of PDVSA workers in the winter of 2002–2003. Oil production almost completely stopped, as oil wells stopped pumping, refineries closed, oil tankers stopped running, and storage facilities reached full capacity. The strike caused a temporary decrease in world oil supplies of about 2.3 million barrels per day, an amount equivalent to about 3.0 percent of total world daily oil supply.



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## Involvement of International Organizations

Venezuela is a founding member of OPEC, which controls about 40 percent of the world's estimated 84 million barrels of production. Venezuela is the third largest producer within OPEC, according to EIA data. OPEC can wield great power in the international oil market, particularly by setting production quotas for its member countries to raise and lower the supply of oil, thereby influencing world oil prices. During the mid-1990s, Venezuela was suspected of weakening oil prices by producing above the country's quota. Since Hugo Chavez became President of Venezuela, the Venezuelan government has favored stricter adherence to OPEC quotas, and currently Venezuela is considered a price hawk in the ranks of OPEC, generally favoring production restraint to keep oil prices relatively high.

Energy security is a national priority for the United States, and the United States has long had programs and activities designed to foster energy security. The United States government also strives to enhance cooperation with energy consuming and producing governments to mitigate the impact of supply disruptions and to support U.S. and world economic growth. The United States is a member of the International Energy Agency, an organization comprised of Organization of Economic Cooperation and Development countries that was established to cope with oil supply disruptions and coordinate an international response in case of a disruption to the global oil supply market. International Energy Agency member countries hold about 4.1 billion barrels of oil stocks, and for a limited period can release an amount equivalent to 10 percent of global demand each day in case of a disruption.

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## Venezuelan Government Actions Have Decreased Crude Oil Production, but Exports to the United States Have Changed Little

Venezuelan oil production has fallen since 2001, largely as a result of actions by the Venezuelan government. Since that time the production of Venezuelan crude oil decreased in oil fields operated by PDVSA and increased in fields operated by foreign companies, but, as of 2005, increased production by foreign companies was not enough to bring total Venezuelan oil production back to the prestrike level. Despite production declines, exports of crude oil and refined petroleum products to the United States since shortly after the strike have remained close to prestrike levels of about 1.5 million barrels per day. The Venezuelan government announced plans in 2005 to expand its oil production and exports significantly by 2012, but most experts with whom we spoke doubted Venezuela's ability to implement the expansion plan in the near term.

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## Venezuela's Total Crude Oil Production Has Fallen since 2001, Largely as a Result of Venezuelan Government Actions

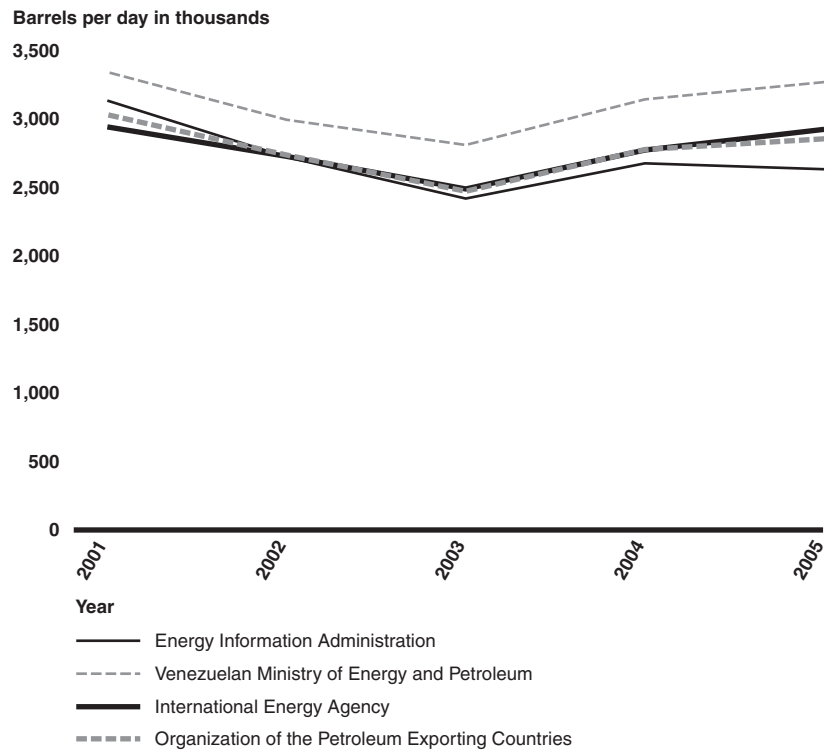
Data from EIA, the International Energy Agency, OPEC, and the Venezuelan government all indicate that Venezuelan crude oil production decreased between 2001 and 2005. For example, EIA data show that production decreased from 3.1 million barrels per day to 2.6 million barrels per day, reflecting a decrease of about .5 million barrels per day, or 16 percent. OPEC, International Energy Agency, and Venezuelan government data all indicate varying but higher levels of production in 2005.<sup>5</sup> While Venezuelan production figures should be the most accurate because they have access to all the production data, many oil industry officials and experts told us that Venezuelan government figures have been overstated.<sup>6</sup> Figure 1 shows production levels for 2001 through 2005 from four sources and illustrates the drop in production as a result of the strike and the recovery following the strike.

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<sup>5</sup>To make the data comparable, we made adjustments to the sources, as necessary, to include crude oil, condensates, and extra-heavy oil, but exclude natural gas liquids. Venezuelan government data for 2004 and 2005 are preliminary.

<sup>6</sup>During our review, the Venezuelan government provided many different production numbers. Some of these numbers changed and some were incomplete or inconsistent. We used the numbers we believe are most accurate.

**Figure 1: Venezuelan Oil Production (2001–2005)**



Source: GAO analysis of EIA, OPEC, International Energy Agency, and Venezuelan government data.

While there are differences of opinion and uncertainty about the accuracy of available production data, other data also support a significant decline in production. For example, international financial data show that foreign investment in Venezuela declined between 2001 and 2004. Specifically, net foreign direct investment in Venezuela was about \$3.5 billion in 2001, declined to almost zero in 2002, and recovered to about \$1.9 billion in 2004, the last year for which investment data are available. Because we were unable to obtain reliable, independent data on specific investment in Venezuela's oil and gas sector, we analyzed total foreign investment in Venezuela as a proxy for the condition of the oil sector. Our analysis indicates a high correlation between Venezuelan oil production and net foreign investments in Venezuela.<sup>7</sup> In addition, experts told us that there is

<sup>7</sup>We estimated a correlation coefficient of 83 percent between Venezuelan oil production and net foreign direct investment for 1995–2004, which indicates a similarity in the trends in oil production and net foreign investment in the country.

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a high correlation between the number of active oil drilling rigs and oil production.<sup>8</sup> However, the number of active rigs fell sharply during and after the strike and, as of 2005, had not returned to their 2001 levels. Specifically, there was an average of 66 active drilling rigs in Venezuela in 2001; the number of rigs fell to as low as 12 during the height of the strike in January 2003; and the average increased to 60 in 2005. This provides further evidence that Venezuela's oil production has decreased.

The Venezuelan government's firing of thousands of PDVSA employees following the strike contributed to the decline in production. The government dismissed about 40 percent of PDVSA's approximately 40,000 employees, including many management and technical staff. Experts told us that the loss of managerial and technical expertise caused a rapid decline in the company's oil production from existing fields. In fact, some said that the loss of expertise was so critical that after the strike, PDVSA was unable to issue invoices for contractor services.

Venezuelan officials told us that strikers did deliberate damage to the company and that this sabotage accounts for some of their difficulties since the strike. PDVSA employees with whom we spoke, some of whom were fired and others who resigned, disputed the claims of sabotage and said that strikers had originally planned only a two- or three-day strike, but that the government shut them out before they could return to work. Venezuelan officials acknowledged that the loss of expertise initially hampered operations and said that they have been replacing and training lost workers as quickly as possible. However, many industry experts told us that a black list of former PDVSA managerial and technical staff that the Venezuelan government will not rehire is limiting Venezuela's ability to acquire the necessary staff to meet its production goals. In addition, officials from foreign oil companies with operations in Venezuela told us that since the strike, PDVSA has become highly politicized and that PDVSA officials are often slow to make key decisions, which have complicated foreign companies' decisions to invest in the Venezuelan oil sector. Many oil industry officials told us that PDVSA's lack of managerial and technical expertise still remains one of the biggest challenges in continuing operations in Venezuela with PDVSA as a partner. In addition, experts told us that Venezuela had underinvested in oil field maintenance since the

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<sup>8</sup>We calculated a correlation coefficient of 73 percent between Venezuelan production and the number of active drilling rigs for 1995–2005, which indicates a similarity in the trends in oil production and the number of active drilling rigs.

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early 1990s, and that this had contributed to PDVSA's declining production.

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**Declines in Production by PDVSA Have Been Partly Offset by Increases in Foreign Oil Companies' Production, but Not by Enough to Reach the PreStrike Production Level**

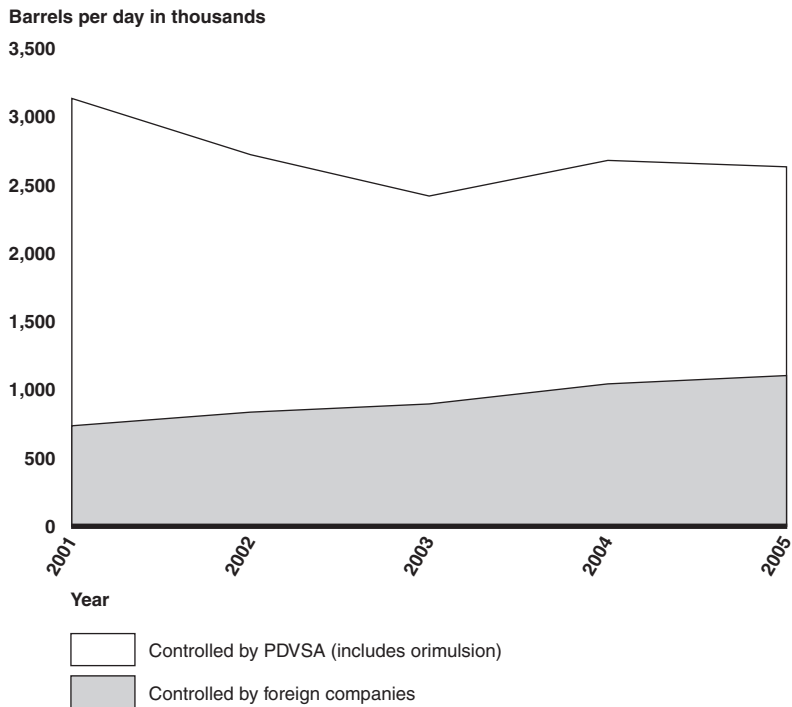
Data from EIA, the International Energy Agency, OPEC, and the Venezuelan government indicate that, from 2001 through 2005, Venezuelan crude oil production controlled by PDVSA decreased, while production controlled by foreign companies increased.<sup>9</sup> For example, using EIA data as the base for total Venezuelan crude oil production, of 3.1 million barrels of crude oil produced per day in 2001, PDVSA produced about 2.4 million barrels per day (or 77 percent), and foreign companies produced about .7 million barrels per day (or 23 percent). By 2005, these data indicated that of 2.6 million barrels produced per day, PDVSA produced about 1.5 million barrels per day (or about 58 percent), and foreign companies produced about 1.1 million barrels per day (or 42 percent). International Energy Agency, OPEC, and Venezuelan government data show similar trends, but the relative proportion of PDVSA's production differs because each of these data sources reflects a different total volume of Venezuelan crude oil production. All of the data sources indicate that increases in production by foreign companies were not enough to totally offset decreases in PDVSA's production, resulting in a net crude oil production loss. Figure 2 shows the increase in foreign companies' production and decrease in PDVSA's production for 2001–2005 using EIA's figures as the base for total production.<sup>10</sup>

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<sup>9</sup>Production controlled by foreign companies includes extra-heavy oil produced under joint ventures in the Faja and oil produced under operating service agreements throughout the country.

<sup>10</sup>We used EIA data to illustrate the reduction in PDVSA's share of production. All other sources show a similar pattern, but the reduction in PDVSA's share would be somewhat less because these sources have varying but higher 2005 production figures than does EIA.

**Figure 2: Foreign Company and PDVSA Production of Venezuelan Crude Oil, 2001–2005**



Source: GAO analysis of data provided by Venezuelan government and EIA.

Note: Foreign companies' production is based on Venezuelan government data, and PDVSA's production is based on EIA data for total production minus the Venezuelan government's data for foreign companies' production.

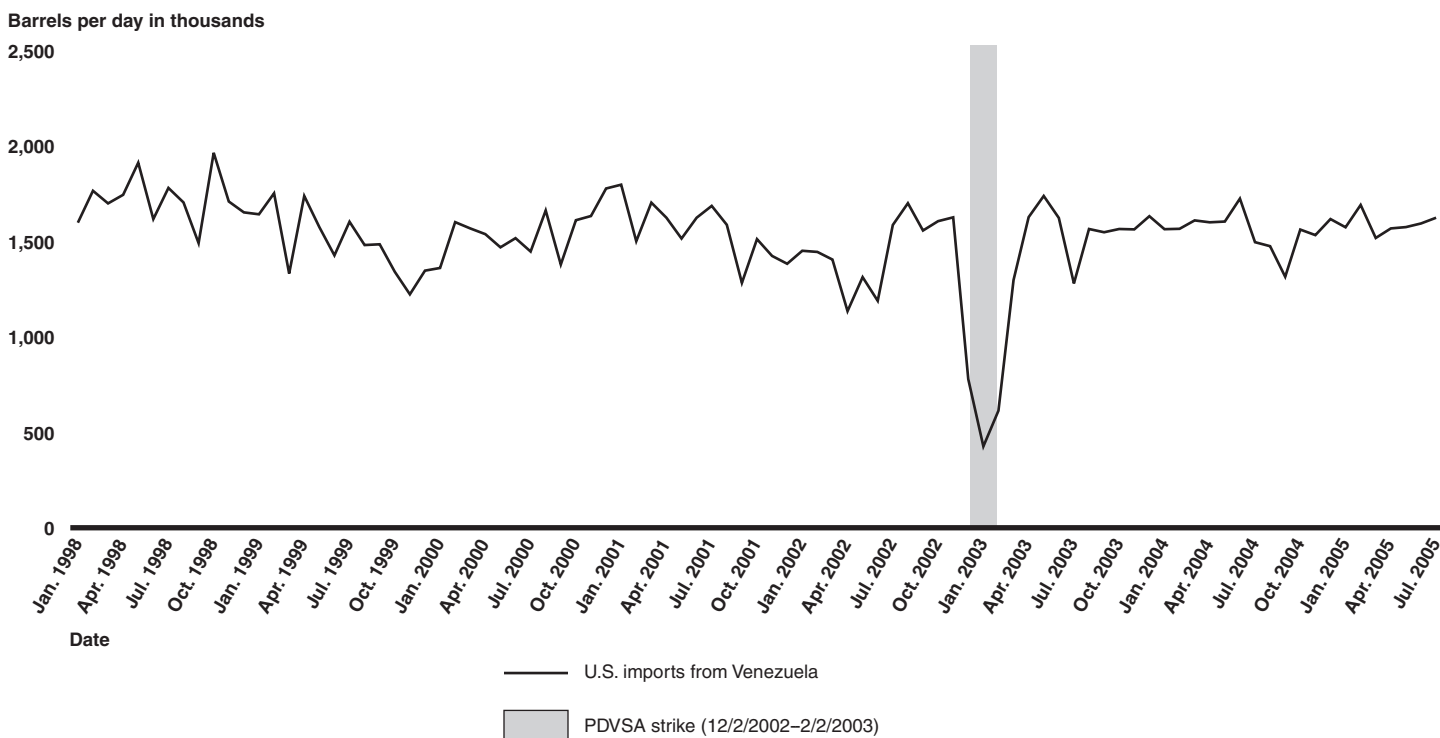
### Venezuela's Exports of Crude Oil and Refined Petroleum Products to the United States Have Remained Relatively Stable in Recent Years

Since shortly after the Venezuelan strike ended, Venezuela's exports of crude oil and refined petroleum products to the United States have remained close to the prestrike levels. EIA data show that Venezuelan exports of crude oil and refined petroleum products to the United States (excluding the Virgin Islands) have fluctuated month-to-month, but prior to the strike had averaged about 1.5 million barrels per day. These exports reached a low of about .4 million barrels per day during the strike,<sup>11</sup> but by April 2003 had returned to approximately the average prestrike level. Specifically, EIA data show that such Venezuelan exports averaged between 1.5 million and 1.6 million barrels per day between April 2003 and

<sup>11</sup>Exports to the United States decreased from about 1.6 million barrels per day in November 2002 to about .4 million barrels per day in January 2003—a decline of about 1.2 million barrels per day.

August 2005, as shown in figure 3. The EIA data also show that Venezuela exports most of its crude oil to the United States. For example, the data show that exports to the United States accounted for about 66 percent of Venezuela’s total exports of crude oil in 2004. Most of Venezuela’s exported crude oil goes to refineries on the U.S. Gulf Coast that are owned wholly or partially by the Venezuelan government.

**Figure 3: Venezuelan Exports of Crude Oil and Refined Petroleum Products to the United States, Excluding the U.S. Virgin Islands, 2001–2005**



Source: GAO analysis of EIA data.

Venezuelan government data show that, like exports to the United States, Venezuelan domestic consumption has remained close to the prestrike level—about .5 million barrels per day. Given that Venezuelan crude oil production has decreased and Venezuelan domestic consumption and exports to the United States have remained relatively constant since shortly after the strike, most of the loss of Venezuelan crude oil must have been absorbed by decreased Venezuelan exports to countries other than the United States. Some oil company officials also told us that in recent years there have been smaller amounts of Venezuelan oil available for

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purchase on world spot markets, which would also indicate that less Venezuelan oil is going to non-U.S. markets. Venezuelan officials gave us data that showed exports to non-U.S. markets were greater than EIA's numbers, but we were unable to verify the Venezuelan data.

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## Future Venezuelan Production Is Uncertain

The Venezuelan government announced plans in 2005 to expand its oil production to 5.8 million barrels per day by 2012, which is more than double the figure reported by EIA for 2005. Some industry experts told us that the expansion plan is technically feasible and that Venezuela's oil revenue in recent years has been sufficient to fund the plan. However, many oil industry officials and experts expressed doubt about the government's ability to implement the expansion plan in the near term for several reasons.

- According to Venezuelan officials, as of late 2005, no agreements had been signed or investments made to start implementing the major oil production expansions detailed in the plan; experts told us that, without agreements, the plan will face significant delays, at best. The absence of such deals increases the likelihood that Venezuelan oil production will continue to fall because, given that PDVSA's own production is in decline, Venezuela needs willing foreign oil company partnership to maintain its current level of oil production.
- PDVSA has not been able to maintain its own level of oil production in recent years. U.S. and international oil industry officials and experts, as well as Venezuelan government officials, told us that PDVSA faces significant challenges in overcoming the 20 to 25 percent per year rate of production decline in its mature oil fields. Venezuelan officials and other experts told us that Venezuela faces a challenge in overcoming the normal decline in productivity of its older fields, especially in the Maracaibo area where oil production dates back to the 1920s.
- Future foreign investment is uncertain given the Venezuelan government's recent decision to unilaterally change its business dealings with foreign companies. Beginning in 2005, the Venezuelan administration took steps to make private Venezuelan and foreign companies producing crude oil under the 32 operating service agreements renegotiate those agreements. Essentially, the new agreements increase the maximum royalty from 16-2/3 percent to 30 percent, increase income taxes from 34 percent to 50 percent, and give PDVSA at least a 51 percent share of the operations covered by the agreement. Oil industry officials and experts have generally reacted negatively to the changes in the agreements. Most company officials we contacted told us that Venezuela's move to unilaterally impose



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new agreements increased their risk and eroded the investment climate in Venezuela, likely leading to future production declines. Many oil industry officials and experts told us that the changes in the foreign company participation structure, such as mandating a majority share of the operation for PDVSA, pose investment risks and uncertainty for foreign companies because the Venezuelan government has ultimate control in decisionmaking. When France's Total and Italy's Eni oil companies failed to sign new agreements, the Venezuelan government seized control of their operations in April 2006; five other fields were turned over to PDVSA after negotiations, according to the Venezuelan spokesperson. Also, ExxonMobil and Norway's Statoil chose to sell their minority stakes in smaller fields rather than accept Venezuela's required changes. Furthermore, in May 2006, the Venezuelan Congress approved a new oil extraction tax. According to the Venezuelan spokesperson, the extraction tax is 33.33 percent applied to well production, with royalty fees deducted from this tax.

- Venezuela's decision to spend a significant part of its oil revenues on social programs such as education and health care, instead of reinvesting it in the oil industry, could slow further development of the country's oil sector. Venezuela's new hydrocarbon law imposes significant social commitments on PDVSA. Venezuelan government officials told us that they directly spent about \$3.7 billion of oil revenues on social programs in 2004 and about \$5 billion on social programs in 2005. This spending was in addition to money companies paid to the Venezuelan government as royalties and income taxes, and therefore reduces the amount of funds available for investing in oil production.
- Future production could be impaired by the Venezuelan government's preference to use national oil companies from developing countries (such as China) and other geopolitically strategic countries (such as Brazil) as partners to explore and develop new fields in Venezuela, instead of relying on experienced international oil companies. Several oil industry officials and experts told us that national oil companies generally do not have the expertise of the international oil companies to develop heavy oil fields.

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## A Drop in Venezuelan Oil Exports Would Have Worldwide Impacts, while Impacts of a Venezuelan Embargo against the United States or Closure of Its U.S. Refineries Would Be Felt Primarily in the United States and Venezuela

The potential impacts of a disruption of production and exports of Venezuelan crude oil and petroleum products on world oil prices and on the U.S. economy would depend on the characteristics of the disruption. The greatest impacts would occur if all or most Venezuelan oil were suddenly removed from the world market due to a Venezuelan oil industry shutdown. A Venezuelan oil embargo against the United States would have smaller impacts that would primarily affect the United States. Similarly, if Venezuela shut down its U.S. refineries, the impacts would be felt primarily in the United States. Venezuela would suffer severe economic losses from all three types of disruption, especially a shutdown of its oil production.

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## A Sudden Drop in Venezuelan Oil Production Would Have Significant Worldwide and U.S. Impacts

Given the current tight global supply and demand conditions, a sudden loss of all or most Venezuelan oil from the world market, for example due to a strike, would, all else remaining equal, result in a marked spike in world oil prices and a decrease in the growth rate of the U.S. economy as measured by GDP. Because Venezuela's economy is so dependent on its oil sector, Venezuela would likely try to restore oil production as quickly as possible following a strike or similar disruption to avoid large losses of export revenues.

A model developed for DOE by a contractor, using a hypothetical oil disruption scenario that we developed to resemble the disruption caused by the Venezuelan strike during the winter of 2002–2003, predicted that, by the second month of a disruption, worldwide crude oil prices would temporarily increase by about \$11 per barrel—from an assumed pre-disruption price of \$55 per barrel to almost \$66 per barrel.<sup>12</sup> The increase

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<sup>12</sup>This analysis was done in fall 2005. In consultation with the contractor, we chose a starting price for oil of \$55 per barrel—lower than the actual price of light oil at the time—to reflect a composite of light and heavy oil and the fact that future oil price forecasts were falling in the medium term. In the event that an actual oil supply disruption occurs, the predictive power of the model estimate will depend in part on how close the actual starting price of oil is to the assumed price in the model.

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in world crude oil prices would, in turn, drive up prices of refined petroleum products. Later, as the lost oil was replaced with oil from other sources or production resumed, the price of crude oil would return to the previous level. The model further predicted that the temporary increase in world oil prices caused by a disruption would lower the U.S. GDP by about \$23 billion relative to what it would have been otherwise—about \$13 trillion. A loss of this magnitude for a given year is likely to cause a small decline in the growth rate of the U.S. economy, but is unlikely to result in a recession. In this analysis, the rate of GDP growth would be about 0.18 percent less than what it would have otherwise been for the year.

Our hypothetical disruption scenario lasts only a few months because Venezuela, like any other country that is heavily dependent on oil revenue, is likely to exert a great effort to end any severe disruption of crude oil production. The country's economy in general, and government revenues in particular, depend heavily on the revenues that the country obtains from petroleum production and exports. For example, oil revenues accounted for between 45 and 50 percent of Venezuelan government revenues in recent years. A severe drop in oil revenues for more than a few months would cripple the economy, resulting in lower economic growth and lost jobs; Venezuelan authorities would consider a prolonged oil industry shut down as a very grave threat to the government and to the country as a whole. Indeed, PDVSA officials told us that they restored most of their lost production during the first few months after the strike.

It should be noted that the model somewhat understates the impacts on the United States of a sudden and severe loss of oil from Venezuela because it treats any disruption of oil supplies as equal, regardless of the location or the characteristics of the lost oil. In other words, the model does not differentiate between heavy sour crude oil (such as that produced in Venezuela) and any other type of crude oil—for example, "Arab Medium" (which is Saudi Arabia's medium-quality crude oil). Thus, the model does not consider the economic cost of replacing, for example, 100,000 barrels of heavy sour oil with the same amount of lighter, sweeter oil.<sup>13</sup> In fact, Arab Medium may cost more than some Venezuelan crude oils because of its higher quality, and because the transportation cost of a barrel of oil from Saudi Arabia is higher than that of a barrel of oil from

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<sup>13</sup> Arab Medium was used to help replace lost oil during the Venezuelan strike. However, in any disruption, any quality oil may be used to replace lost oil. According to DOE officials, "Arab Heavy," which has qualities closer to much of Venezuela's crude oil, constitutes the bulk of spare capacity in 2006.

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Venezuela. In addition, there may be an economic penalty associated with some U.S. refineries' switching from their normal significant reliance on Venezuelan oil to replacement oil from alternative sources. For example, one U.S. oil company that refines Venezuelan crude oil ran its refinery optimization model for us to illustrate the impact of switching crude oil types on its refining costs. Its model showed that replacing a large quantity of the Venezuelan oil that it uses on a regular basis with oil from Mexico and the Middle East would cause a 7 percent drop in the capacity utilization of one of its refineries. This would reduce supplies of petroleum products, putting upward pressure on consumer prices.

The DOE contractor who developed the model acknowledged that the model does not account for the effects of higher transportation costs or changes in refinery capacity utilization caused by switching from one type of crude oil to another. He said that higher transportation costs and switching crude oil types could result in larger impacts than the model predicts, but that the price impact of switching crude oil types is not understood well enough to be accurately modeled and is likely to be small.

We also did an analysis of the impact of the same hypothetical Venezuelan disruption scenario on world oil price and on U.S. GDP using parameters developed by EIA to evaluate oil price disruptions. EIA has also done similar analyses, including (1) a slightly larger oil supply disruption and (2) an analysis of the impacts of the actual Venezuelan strike. The impacts on the price of oil are quite close in all the analyses. However, the impacts on U.S. GDP vary significantly as a result of differing assumptions about how sensitive the economy is to increases in oil prices. DOE officials told us that the impact of such a disruption on the U.S. economy would likely fall somewhere between the estimates derived in the model and our analysis. The results of the analyses and studies are shown in table 1.

**Table 1: Results of Analyses and Studies of Impacts of a Sudden Disruption of Crude Oil Production and Exports**

Analyses or studies	Disruption description	Temporary impact on world crude oil prices (U.S. dollars per barrel)	Impact on U.S. GDP (billions of U.S. dollars) <sup>a</sup>
DOE contractor model using our hypothetical scenario (January 2006)	Disruption of a maximum of 2.2 million barrels per day for 6 months	11	(\$23)
Our analysis using EIA disruption parameters (January 2006)	Disruption of a maximum of 2.2 million barrels per day for 6 months	9–13	(2.6–7.5)
EIA analysis using EIA's own hypothetical scenario (March 2005)	Disruption of 2.4 million barrels per day for 6 months	10–18	<sup>b</sup>
EIA study of actual Venezuelan disruption in winter of 2002–2003	Actual disruption of a maximum of 2.8 million barrels per day	<10 <sup>c</sup>	<sup>b</sup>

Source: GAO based on Leiby, Paul N. and David W. Bowman, "Disruption Scenarios and the Avoided Costs Due to SPR Use," Oak Ridge National Laboratory Working Paper, January 19, 2005; GAO analysis conducted in January 2006; EIA, Impacts of Hypothetical Oil Supply Disruptions—Venezuela, Mar. 5, 2005 (unpublished); and EIA, Impacts of the Venezuelan Crude Oil Production Loss, by Joanne Shore and John Hackworth, Sept. 25, 2003.

<sup>a</sup>Numbers in parentheses reflect reductions in the U.S. GDP from what it would be without a disruption.

<sup>b</sup>This analysis did not include impacts on the U.S. GDP.

<sup>c</sup>EIA attributed the \$10 per barrel increase to the Venezuelan oil strike and low petroleum inventories.

## A Venezuelan Oil Embargo against the United States Would Have Smaller Impacts, Primarily in the United States

An EIA analysis shows (and several industry experts told us) that a Venezuelan oil embargo against the United States would have a smaller impact on oil prices than a sudden and severe drop in production. The impact of an embargo would be smaller because the Venezuelan oil would go to other destinations instead of being taken off of the world market. However, since most replacement supplies are farther away than Venezuela, U.S. oil refiners would experience higher costs and delays in getting oil supplies; such an embargo would therefore increase U.S. consumer prices for gasoline and other petroleum products in the short term. Also, as discussed previously, some U.S. refineries that are designed to handle large amounts of Venezuelan heavy sour crude oil would operate less efficiently if they had to switch to different types of crude oil.

EIA's March 2005 analysis estimated that a Venezuelan oil embargo against the United States would cause the price of West Texas Intermediate crude oil (a commonly used benchmark oil) to increase in the short term by \$4 to \$6 per barrel from the then-current price of \$53 per barrel—an increase of between 8 to 11 percent, as opposed to the 19 to 34 percent increase associated with a sudden and severe loss of oil. The price would rise because the embargo would cause (1) higher transportation costs resulting from longer distances to transport oil from locations farther away than

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Venezuela; (2) refinery inefficiencies resulting from switching crude oil types; and (3) a market psychology premium reflecting fears of further escalation.

The EIA analysis did not quantify the impact of an oil embargo on U.S. prices of gasoline and other refined petroleum products. However, an increase in U.S. crude oil prices by 8 to 11 percent per barrel would raise costs of refined petroleum products to the extent that the increase would be passed on to the consumer. All else being equal, such an increase would add 11 to 15 cents to the price of a gallon of gasoline, assuming the conditions in March 2005.<sup>14</sup>

DOE officials told us that their analysis assumes the \$4 to \$6 per barrel increase would last as long as the disruption. However, adjustments would reduce this price impact over time. Refineries, for example, could reconfigure some of their processes and make other adjustments over time to improve their ability to efficiently handle replacement crude oil types. Transportation costs could also adjust over time. For example, Venezuela likely could switch from the relatively small tankers used for the short haul to the United States to very large tankers to move its oil to more distant locations, thereby helping offset Venezuela's increased transportation costs for shipping the oil longer distances.

A Venezuelan oil embargo against the United States would also affect the Venezuelan economy, but the impact would not be as great as the impact of a sudden loss of oil. According to a U.S. company that produces oil in Venezuela, such an embargo would reduce PDVSA's oil revenues from between \$3–4 billion dollars per year due to the following factors:

- Refinery operations that Venezuela wholly and partly owns in the United States, which take about 70 percent of Venezuela's oil exports to the United States, would be adversely affected by the embargo because they would have to obtain crude oil from locations farther away than Venezuela and the replacement crude oil would likely be of a different quality.
- Venezuela's crude oil revenues would be adversely affected by the higher cost of transporting oil to locations farther away than the United States market.

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<sup>14</sup>The impact on the price of gasoline at the pump could be higher or lower depending on many factors, such as whether the refiner passed all crude oil cost increase on to the consumer and whether the gasoline retailer passed all the increases on to the customer.

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In addition, oil company officials and industry experts told us that few countries have significant refining capacity that is designed to efficiently process the heavy sour oil from Venezuela. Therefore, it would be difficult for Venezuela to find markets for all the oil it currently exports to the United States.

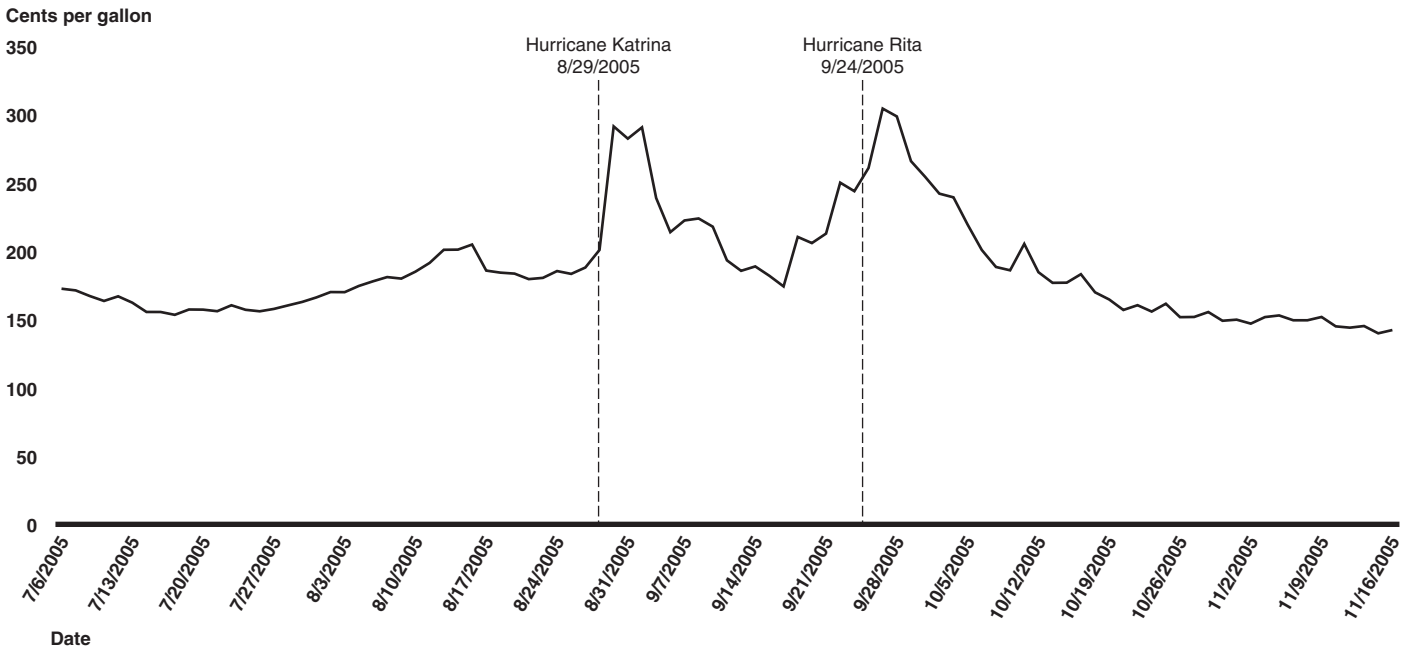
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### Closure of Venezuela's U.S. Refineries would Increase U.S. Petroleum Product Prices and Reduce Venezuelan Revenue

If Venezuela shut down its wholly-owned U.S. refineries, the supply of gasoline and other refined petroleum products made from crude oil would decrease and, correspondingly, the prices of these refined petroleum products in the United States would increase. Venezuela wholly owns five refineries in the United States through its PDVSA subsidiary, CITGO, and these account for about 750,000 barrels per day of refining capacity—4 percent of total U.S. refining capacity. The impacts of shutting down CITGO refineries would continue until the closed refineries were reopened or new sources of refined petroleum products were brought on line. The impacts would be obviously most severe in the United States, although increased demand by U.S. oil companies to buy petroleum products from other countries could cause prices to rise in those countries as well. Venezuela would also lose the profits of these refineries for as long as they were shut down, and could face sanctions by the U.S. government—including freezing Venezuelan assets in the United States—if the closure of the refineries were deemed a threat to U.S. security.

We identified no studies of the impacts of oil refinery shutdowns on the prices of refined petroleum products, but a shutdown of several large U.S. refineries as a result of hurricanes Katrina and Rita in 2005 clearly contributed to sharp increases in U.S. fuel prices. For example, Hurricane Katrina caused a shutdown of 879,000 barrels per day, or 5.2 percent of U.S. refining capacity. Figure 4 shows that following hurricanes Katrina and Rita in late August and late September 2005, gasoline prices increased by over \$1 per gallon on the U.S. Gulf Coast Wholesale Market. While these price spikes are indicative of what can happen in the event of refinery shutdowns, it must be noted that there were other very important disruption factors that affected these prices—such as major pipeline shutdowns and damage—which make it difficult to isolate the impact of the refinery shutdowns.

**Figure 4: Changes in Wholesale Conventional Regular Gasoline Prices in the U.S. Gulf Coast following Hurricanes Katrina and Rita**



Source: Energy Information Administration.

## U.S. Government Programs and Activities to Ensure a Reliable Long-Term Supply of Crude Oil from Venezuela Have Been Discontinued, but the Government Has Options to Mitigate Supply Disruptions in the Short Term

The U.S. government has programs and activities intended, in part, to ensure a reliable long-term supply of oil from Venezuela and other oil-producing countries to U.S. and world markets; these programs include bilateral technology and information exchange agreements, bilateral investment treaties, and multilateral energy initiatives. However, these programs and activities have not been pursued with regard to Venezuela in recent years. The U.S. government has options to mitigate the impacts of short-term oil disruptions to global oil supplies, such as the disruption caused by the Venezuelan strike. These options include diplomacy to persuade oil-producing countries to increase production and using oil in the U.S. Strategic Petroleum Reserve, with or without the release of oil from other International Energy Agency countries' strategic reserves. However, none of the U.S. government agencies, and few of the U.S. oil companies that we contacted, have contingency plans specifically to mitigate a Venezuelan oil disruption, although DOE conducts analyses of the effects on the market of potential supply disruptions.



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## U.S. Programs and Activities to Ensure a Long-Term Supply of Venezuelan Crude Oil for the United States Were Discontinued

The United States has had a bilateral technology and information exchange agreement with Venezuela since 1980, and this agreement was expanded in 1997 to include policy dialogue on topics such as energy data exchange, natural gas policy, and energy efficiency. Also, in the 1990s, the two countries entered negotiations for a bilateral investment treaty and worked together under the multilateral energy initiative to organize hemisphere-wide meetings on energy security. By 2004, however, these programs and activities had been discontinued as the result of strained relations between the two countries and diminished technical capacity in Venezuela.

## Oil Production Technology and Information Exchanges between the United States and Venezuela Occurred until 2003

According to DOE, it maintains bilateral technology and information exchange agreements with Venezuela and 21 other oil-producing countries: Angola, Argentina, Australia, Azerbaijan, Brazil, Canada, China, Equatorial Guinea, Kazakhstan, India, Italy, Iraq, Mexico, Norway, Pakistan, Peru, Russia, Saudi Arabia, the United Kingdom, Ukraine, and West Africa/Nigeria. DOE officials told us that bilateral technology and information exchange agreements are generally designed to offer avenues to leverage publicly funded domestic research, accelerate scientific achievement through technical cooperation, and support U.S. economic competitiveness by providing U.S. scientists with opportunities to gain access to (and build upon) other countries' research. They also said that the agreements with four countries—Venezuela, China, Canada, and Mexico—include provisions for cooperation on oil and natural gas recovery technology that DOE requires be based on joint research of mutual benefit. In the case of Venezuela, the specific purpose of the bilateral technology exchange agreement was to cooperate on oil and gas technology and, after 1997, incorporate policy dialogue on such issues as the exchange of information regarding the design and implementation of energy regulatory systems, the development and evaluation of energy resources and production, and the application of alternative energy sources. DOE headquarters and field staff told us that the technical exchanges between the United States and Venezuela under the agreement were robust. For example, meetings were held about twice annually where technical staff from both countries exchanged information.

Since November 21, 2003, however, no formal meetings of the countries' technical staff have occurred. DOE headquarters and field officials told us they were directed in 2003 by DOE headquarters to stop activities under the agreement to accommodate diplomatic decisions. In addition, DOE officials also told us that the last few technical meetings involved very little exchange of technology information. Specifically, they said that after the Venezuelan government fired a significant number of technical

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employees following the Venezuelan strike, DOE technical staff had difficulty identifying technical counterparts in Venezuela to maintain activities under the agreement.

Venezuelan officials told us that attempts to encourage DOE to continue activities under the technology exchange agreement were unsuccessful. For example, Venezuela sent two letters to DOE in 2005 to arrange meetings between Venezuela's Minister of Energy and Petroleum and the Secretary of DOE, but DOE's response to one letter stated that the Secretary of DOE was unable to meet, and, according to the Venezuelan spokesperson, DOE did not respond to the other letter. Also, the Venezuelan spokesperson told us that in November 2003, Venezuela presented DOE with a plan to reactivate projects under the agreement but DOE demonstrated no interest. The spokesperson also said that in March 2006, DOE officials told PDVSA's vice president of production that DOE would not resume activities under the agreement until the political relationship between Venezuela and the United States improved. DOE officials confirmed this, but said DOE also told PDVSA's vice president of production that part of the reason activities could not be resumed was because DOE research on technology to extract extra-heavy oil and gas was not a high priority, as it had been at one time, because high energy prices removed the need to subsidize such research.

#### Negotiations for a Bilateral Investment Treaty Ceased in 1999

According to Department of State and the Office of the U.S. Trade Representative officials, informal bilateral investment treaty discussions with Venezuela began in 1992 and formal negotiations began in October 1997. The United States has bilateral investment treaties in force with 39 countries, including many oil- and gas-producing countries such as Bolivia, Kazakhstan, Trinidad and Tobago, and the Ukraine. These treaties provide rules on investment protection, binding international arbitration of investment disputes, and repatriation of profits, and assist U.S. companies doing business in foreign countries. In our 1991 report on Venezuelan production and conditions affecting potential future U.S. investment there, we observed that most of the 22 oil companies with whom we spoke during that effort told us that a bilateral investment treaty would help increase their investment protection. In that report, we also noted that an official in the Office of the U.S. Trade Representative said that, in order for negotiations to be successful, Venezuela would have to meet standards set forth in the model U.S. treaty—including provisions prohibiting nationalization of property, providing for repatriation of profits, and providing for international arbitration to resolve disputes.

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U.S. and Venezuelan government officials said that bilateral investment treaty negotiations broke down in 1999 because of significant policy differences between the two countries. A Venezuelan spokesperson and U.S. officials identified three major differences, including the model treaty provisions relating to performance requirements, such as rules stipulating minimum content requirements and obligations to compensate investors for damage done by internal strife.

In May 2001, the U.S. National Energy Policy Development Group recommended that the United States conclude bilateral investment treaty negotiations with Venezuela. Department of State officials told us that later in 2001, when they revisited the issue in response to this recommendation, they made an effort to reengage Venezuela, but the effort proved unsuccessful because of continued major differences between the two countries. Department of State officials said they decided that the probability of negotiating a treaty that contained the high standards the United States expects was very unlikely, and they pursued the treaty no further. Department of State officials told us that in bilateral investment treaty negotiations generally, it is overall policy to insist on the high standards contained in the U.S. model treaty to avoid a dilution of standards across agreements.

Many oil company officials and experts said that a bilateral investment treaty could have helped protect oil companies' investments in Venezuela when the Venezuelan government unilaterally required them to change their existing operating service agreements to comply with the new hydrocarbon law. For example, officials from one U.S. oil company said new agreements that companies were required to sign did not contain provisions allowing international arbitration to settle disputes. The officials said their company was concerned about the fairness of having Venezuelan arbitrators settle disputes between U.S. companies and PDVSA or the Venezuelan government. International arbitration was required under the company's old agreements, and the current U.S. model bilateral investment treaty provides for it. Some U.S. oil company officials also told us that some companies are considering incorporation in other countries that have bilateral investment treaties with Venezuela, such as the United Kingdom and the Netherlands, because the treaties would help protect their investments. Similarly, some oil experts also told us companies from countries with bilateral investment treaties have assurances that they can repatriate profits if Venezuela seizes control of their operations.

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## The United States and Venezuela Participated in the Multilateral Hemispheric Energy Initiative until 2004

In 1994, DOE and the Venezuelan Ministry of Energy and Petroleum became the principal coordinators of what was known as the Hemispheric Energy Initiative. The goal of this activity was to stimulate dialogue and cooperation on energy issues among countries in the Western Hemisphere and identify and promote actions to foster regional interconnections through the development of energy sector projects in the hemisphere. As the coordinators, DOE and Venezuela's Ministry of Energy and Petroleum organized a series of hemispheric-wide summit meetings to discuss energy cooperation beginning in 1995. For example, at the third hemispheric meeting in Caracas, Venezuela, in January 1998, officials from the 26 countries in attendance agreed to promote policies that facilitated trade in the energy sector and facilitate the development of the energy infrastructure, develop regulatory frameworks that are transparent and predictable, and promote foreign private investment in the sector throughout the hemisphere. DOE officials told us that this initiative ended with the meeting in Mexico in 2002, but that, in 2004, Trinidad offered to host a meeting of hemispheric energy ministers in a less formal setting to discuss energy security. The meeting, which was held in Trinidad and Tobago in April 2004, was organized by DOE and Trinidad, without Venezuela playing a significant role organizationally. The meeting focused on hemispheric energy security and included high-ranking energy officials from 35 countries, including the United States, Canada, Mexico, and Venezuela, as well as other key energy-producing countries from Central and South America. DOE officials told us that, during the meeting, Venezuela's Minister of Energy and Petroleum met with DOE's Secretary and agreed that it was very important not to politicize the oil trade between the United States and Venezuela and that both countries recognized the importance of that trade. According to DOE officials, no action has taken place since the meeting in Trinidad and Tobago.

## Relations between the United States and Venezuela Have Become Strained

According to Department of State and other U.S. government officials, the United States has had historically strong ties to Venezuela with respect to oil issues, and the dialogue between the two countries in the past was robust. But the relationship between the two countries with respect to energy issues has changed in recent years—some energy related activities previously used to foster energy security have been discontinued. For example, DOE officials told us that 3 years have elapsed since the last formal discussion between DOE and the Venezuelan Ministry of Energy and Petroleum regarding energy security. Also, officials in the Commerce Department and in the Office of the U.S. Trade Representative reported there is no current engagement between them and their counterparts in Venezuela regarding energy security. Officials in Department of State headquarters said that they have worked hard for years to build a

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productive energy relationship with Venezuela by participating in frequent consultations with Venezuelan energy officials, meeting most recently in March 2006. DOE officials also said they have maintained open dialogue with Venezuelan energy officials.

Most U.S. oil companies have not relied on assistance from the U.S. government to help with issues in Venezuela in recent years although, according to DOE officials, DOE stays in contact with companies regarding the situation in Venezuela, and senior DOE officials frequently report on the status of U.S. energy investment and overall energy production in Venezuela at senior-level meetings of the U.S. government. The U.S. Ambassador to Venezuela told us he does not have good access to Venezuelan government officials and, correspondingly, it is difficult to help U.S. companies doing business in Venezuela obtain access to Venezuelan officials. Officials in the Departments of Commerce and State, and in the Office of the U.S. Trade Representative, told us companies that might otherwise seek their assistance in negotiating with foreign governments do not do so in Venezuela because the companies do not believe that federal agency intervention would be helpful. For example, an official from the Department of Commerce said that U.S. government involvement would be extremely harmful to the relationship between U.S. companies and their business interests in Venezuela. Officials in several U.S. oil companies told us that the poor bilateral relationship between the United States and Venezuela makes it difficult for them to operate and compete for new investment contracts in Venezuela.

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### The U.S. Government Has Options to Mitigate the Impacts of Short-Term Venezuelan Oil Supply Disruptions

Key activities and programs that the U.S. government has used to mitigate the impacts of short-term oil supply disruptions include diplomacy, whereby U.S. government officials negotiate with senior officials in oil-producing countries to increase their supply of crude oil in case of a disruption; using oil in the U.S. Strategic Petroleum Reserve; and coordinating with the International Energy Agency, whose members hold stocks equal to 90 days or more of its net imports to address supply disruptions.<sup>15</sup> Officials in the Department of State and DOE, as the lead agencies in crafting U.S. energy security policy, consult with each other, with other U.S. government agencies (as appropriate), and with U.S.

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<sup>15</sup>DOE officials also told us that they encourage energy efficiency and conservation during oil disruptions.

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companies doing business in foreign countries to identify potential oil disruptions and craft responses to the disruptions, if necessary.

U.S. government agencies used diplomacy to mitigate the impact of the oil disruption resulting from the Venezuelan strike. Anticipating a potential oil supply problem in Venezuela, representatives from key DOE offices began coordinating with the Department of State months before the strike to produce a plan to bring together data and information about possible supply problems and to produce an appropriate response to the potential disruption. The overall effort was headed by the National Security Council and top U.S. government administration officials, with Department of State and DOE officials acting as subject experts. After the strike began, the Department of State and DOE used diplomacy to encourage increases in OPEC member and other countries' crude oil production by 1.3 million barrels per day. Also, according to DOE officials, DOE officials responsible for coordinating oil supply disruptions responses with the International Energy Agency upgraded their day-to-day contact with emergency response officials at the agency, focusing on the strike's potential impacts and assessing possible mitigation measures. According to an EIA study, most of the replacement oil came from Mexico and the Middle East, especially Iraq.

Notwithstanding this success, most oil industry officials and experts, as well as U.S. government officials, said that using diplomacy to obtain additional oil likely would be less effective today because there is less surplus oil production capacity now than there was during the Venezuelan strike. During the Venezuelan strike, as much as 5.6 million barrels per day of spare oil production capacity was available from several regions, including Mexico, West Africa, and the Middle East. Now, experts say that the total world spare production capacity is only about 1 million barrels per day, and most of it is in Saudi Arabia. If the oil balance continues to tighten and surplus production capacity shrinks, increasing production in response to disruptions will be more difficult, if not impossible.

Aside from using diplomacy, another tool for mitigating supply disruptions is the use of oil reserves. The U.S. government can use the U.S. Strategic Petroleum Reserve to increase the supply of crude oil available to U.S. refineries in three ways: selling oil from the reserve, exchanging oil from the reserve whereby Reserve oil is replaced at a specified date in the future, and allowing oil companies to delay delivering oil to the reserve. Federal law requires that the drawdown and sale of oil from the Strategic Petroleum Reserve be authorized by the President. However, DOE can authorize an exchange of oil from or a delay in delivery of oil to the

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Reserve.<sup>16</sup> While no set criteria exist for triggering the release of oil from the reserve in the case of a supply disruption, U.S. agency officials told us that, during any disruption, the Department of State and DOE provide analytical and technical advice through the National Security Council to help the President evaluate his options. U.S. policy makers believe that providing oil during a supply disruption is the most efficient mechanism to counteract the impacts of the disruption.

The United States currently maintains about 700 million barrels of crude oil in the U.S. Strategic Petroleum Reserve. If 1.5 million barrels a day were released—the amount of crude oil exported by Venezuela to the United States—the reserve is enough to replace over 450 days of lost Venezuelan oil. During the Venezuelan oil strike, oil was not withdrawn from the U.S. Strategic Petroleum Reserve, mostly because other oil-producing countries increased production by 1.3 million barrels a day. However, the U.S. government allowed U.S. oil companies to delay delivering oil that they were committed to deliver to the U.S. Strategic Petroleum Reserve, which added about 18 million barrels to the U.S. oil supply available to refineries—an amount equivalent to almost 1 day of U.S. oil consumption, or almost 2 weeks of Venezuelan oil exports to the United States.

In addition to using the U.S. Strategic Petroleum Reserve to mitigate the impact of a supply disruption, the United States could also benefit if the strategic reserves of International Energy Agency member countries were released. Each International Energy Agency member country is required to hold stocks equal to 90 days or more of its net imports. Presently, International Energy Agency countries hold about 4.1 billion barrels of oil stocks. According to a DOE official, the three countries with the largest government controlled reserves—the United States, Germany, and Japan—are able to release about 8 million barrels a day at the onset of a disruption. This quantity is equal to about 10 percent of total world oil demand. The International Energy Agency also requires member countries to release stocks, restrain demand, and share available oil, if necessary, in the event of a major oil supply disruption. While there are no criteria for triggering the release of oil from the member countries' reserves, the International Energy Agency has specified arrangements for the coordinated use of a drawdown, the restraint of demand, and other

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<sup>16</sup>Energy Policy and Conservation Act § 161(d) as amended, 42 U.S.C. § 1641(d) et seq. The Secretary is also authorized to carry out test drawdowns and sales not to exceed 5,000,000 barrels of petroleum products. 42 U.S.C. § 6241(g).

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measures that member countries could implement in case of a disruption. Also, International Energy Agency officials say that a disruption of 7 percent or more of world supply is a de facto trigger.

During the Venezuelan strike, the Department of State and DOE maintained steady diplomatic contact with members of the International Energy Agency to discuss the evolving situation and to share concerns in case a drawdown of member reserves was deemed necessary. A later International Energy Agency analysis of the Venezuelan disruption concluded that, although International Energy Agency member-country stocks were not used during the Venezuelan disruption, the presence of the International Energy Agency stocks played an important role in reassuring the market. Furthermore, the availability of government stocks muted speculation on the markets, according to an International Energy Agency analysis of the disruption.

Although the U.S. government has options to mitigate impacts of short-term oil disruptions on crude oil and petroleum products prices, these mitigating actions are not designed to address a long-term loss of Venezuelan oil from the world market. If Venezuela fails to maintain or expand its current level of production, the world oil market may become even tighter than it is now, putting further pressure on both the level and volatility of energy prices. In this context, the United States faces challenges in the coming years that may require hard choices regarding energy sources, foreign relations and energy-related diplomacy, and the amount of energy Americans use.

Officials in the four U.S. government agencies we contacted said they do not have contingency plans to deal with oil losses specifically from Venezuela or any other single country. Officials at the lead agencies for energy security, the Department of State and DOE, said they do not have specific plans because the available mechanisms to mitigate the impacts of an oil disruption—diplomacy to persuade oil-producing countries to increase production and using oil from the U.S. Strategic Petroleum Reserve—are adequate to deal with disruptions from any source. According to DOE officials, it conducts scenario analyses of the vulnerabilities of disruptions from certain countries and relies on these options to deal with disruptions. They said that these options have been proven to be adequate.

Officials in most oil companies we contacted also said they do not have plans to deal specifically with a disruption of Venezuelan oil because, as with any oil disruption, if a Venezuelan oil disruption were to occur they



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would replace the lost oil with oil from other sources. The officials said that oil is a fungible commodity and typically available on the spot market. During the Venezuelan strike, for example, U.S. refiners replaced Venezuelan crude oil with crude oil from other sources, including Mexico, Brazil, Russia, Ecuador, and the Middle East.

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## Agency Comments and Our Evaluation

We provided the Departments of State and Commerce, DOE, and the Office of the U.S. Trade Representative with a draft of this report for their review and comment. The Department of State and the Office of the U.S. Trade Representative told us that they generally agreed with the findings of the report but did not provide written comments. DOE and the Department of Commerce provided written comments. The Department of Commerce agreed with the report's overall findings; Commerce's letter is reproduced in appendix II. DOE neither agreed nor disagreed with the report's overall findings, noting that the United States has had a long and mutually beneficial relationship with Venezuela and that our report makes valuable points regarding the challenges facing Venezuelan crude oil production. However, DOE raised two issues that it contends provide an "alarmist view" of U.S. energy security. DOE's concerns and our response to them are summarized below; DOE's letter is reproduced in appendix III. All four agencies also provided technical comments, which we incorporated as appropriate.

DOE's first concern is that a \$23 billion loss to U.S. GDP, which we reported and attributed to a model developed for DOE by a contractor, is misleading and will be taken out of context because the prediction does not take into account mitigating factors that could influence the impact of an oil disruption on U.S. GDP. Specifically, DOE said that the prediction does not take into account worldwide response to an oil supply disruption, the availability of Arab Heavy oil to replace lost Venezuelan heavy oil, and the ability to use the U.S. Strategic Petroleum Reserve and worldwide stocks to mitigate the impact of a disruption. We disagree that our reporting of the model results is misleading or out of context and believe all the mitigating factors raised by DOE have been addressed in our report. Contrary to DOE's assertion, the model that predicted the \$23 billion loss incorporates the worldwide response and availability of replacement oil from surplus production capacity, such as Arab Heavy oil. However, as our report notes, because there is much less surplus capacity available today than there was in winter 2002-2003 when a similar disruption occurred as a result of the Venezuelan strike, relying on surplus capacity would not be as effective as it was at that time. Also, our report discusses in detail the options the U.S. government has to mitigate the impacts of an

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oil disruption, including using strategic petroleum reserves, either unilaterally or in concert with other countries. DOE also states that the report does not contain an analysis of the impact of a Venezuelan oil supply disruption on that country's economy. We disagree with this assertion. Our report discusses the severe impact a Venezuelan oil disruption would have on that country's economy—the Venezuelan national oil company is the country's largest employer, and accounts for a third of Venezuela's GDP, four fifths of its export revenue, and half of government revenue—and notes that Venezuela would likely take steps to correct any such disruption as soon as possible to avoid that impact.

DOE's second concern is that by focusing on the discontinuation of bilateral programs with Venezuela our report leads the reader to believe that such programs could guarantee U.S. energy security. We disagree; nowhere in the report do we imply that such programs with Venezuela could guarantee the United States' energy security. On the contrary, we point out that instability in Venezuela's oil sector exists in a broader context of tightening global oil supply and demand balance and that instability of any significant individual oil-producing country can have a significant impact on U.S. and world energy security. Further we report that a number of factors create energy security concerns, including a reduction in global surplus oil production capacity in recent years, the fact that much of the world's supply of oil is in relatively unstable regions, and rapid growth in world oil demand that has led to a tight balance between demand and supply. DOE also states that our report does not address the comprehensive actions the U.S. is taking domestically and internationally to ensure energy security. While a comprehensive assessment of U.S. energy security was beyond the scope of this report, our report nonetheless notes that the United States has long had a number of programs and activities designed to ensure energy security. For example, for those initiatives identified as within the scope of our report, we listed the 21 other countries with which the U.S. government has negotiated bilateral technology and information exchange agreements.

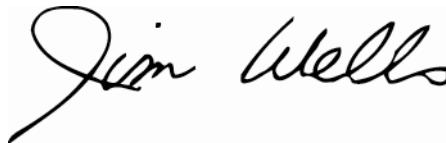
Overall, we disagree that our report, as written, presents an "alarmist view" of U.S. energy security. We point out that oil supply disruptions can have adverse economic impacts but that the U.S. government has options to mitigate such impacts. However, we also point out that these mitigating options are only designed for short-term disruptions and there remain potential long-term concerns with regard to Venezuelan oil supply in the event that Venezuelan oil production continues to fall.

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We are sending copies of this report to interested congressional committees, the Secretary of Energy, the Secretary of State, the United States Trade Representative, and the Secretary of Commerce. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions, please contact me at (202) 512-3841 or at [wellsj@gao.gov](mailto:wellsj@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix IV.

Sincerely yours,

A handwritten signature in black ink that reads "Jim Wells". The signature is written in a cursive, flowing style.

Jim Wells  
Director, Natural Resources  
and Environment

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# Appendix I: Objectives, Scope, and Methodology

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The Chairman of the Senate Committee on Foreign Relations asked us to answer the following questions: (1) How have Venezuela's production of crude oil and exports of crude oil and refined petroleum products to the United States changed in recent years, and what are the future prospects? (2) What are the potential impacts of a reduction in Venezuelan oil exports, a Venezuelan embargo on oil exports to the United States, or sudden closure of Venezuela's refineries in the United States? (3) What is the status of U.S. government programs and activities to ensure a reliable supply of oil from Venezuela and to mitigate the impacts of a supply disruption? We used a number of methodological techniques to address these issues.

To address the first objective, we reviewed studies and analyses of the Venezuelan oil sector and its history. We met with officials from 10 U.S. and multinational oil companies, eight refiners, and two service companies; industry experts from the International Energy Agency, the Center for Strategic and International Studies, the National Petrochemical and Refiners Association, an international energy consulting firm, and other institutions; and officials from the Department of Energy (DOE), Department of State, Department of Commerce, the Office of the United States Trade Representative, the U.S. Geological Survey, and various other U.S. government agencies. In addition, we visited Caracas, Venezuela, and met with the U.S. Ambassador and embassy staff; Venezuela's Minister of Energy and Petroleum; Petroleos de Venezuela S.A. (PDVSA) officials, including the president, the vice president of production, and a number of PDVSA board members and senior managers; the Venezuelan Auditor General; members of the financial community; and other individuals with expertise in the oil sector of Venezuela. We met with operations officials at various oil exploration, production, and refining centers in the Maracaibo and Faja regions of Venezuela. Both in the United States and in Venezuela, we spoke with numerous former PDVSA employees, executives, and directors, and oil company officials. We also collected, evaluated the reliability of, and analyzed data on Venezuelan production, consumption, and exports of oil and petroleum products. The sources of our data include U.S. government agencies, especially the Energy Information Administration (EIA); the International Energy Agency; the Venezuelan government and PDVSA; and other governmental and private sources. We deemed these data to be reliable for the purposes of addressing our objectives. Regarding Venezuela's plans for future production, we analyzed plans and data provided by the Ministry of Energy and Petroleum and PDVSA officials. We also discussed the feasibility of Venezuela implementing its plans with Department of State and DOE officials, as well as with numerous oil company officials and industry experts.

To address the second objective, we reviewed several studies of the impacts of oil disruptions, including the impact of the Venezuelan strike in the winter of 2002–2003. We also analyzed current conditions in the world oil market to evaluate what might occur if a similar disruption occurred today. We also evaluated the potential impacts of—(1) a sudden and severe drop in Venezuelan oil exports from the world market, (2) a sudden diversion of oil from the United States to other markets through an embargo, and (3) the closure by Venezuela of its wholly-owned U.S.-based refineries. Specifically, we asked a DOE contractor at the Oak Ridge National Laboratory to use an economic oil-disruption model to analyze the impacts of a hypothetical Venezuelan oil disruption on world oil prices and on the U.S. gross domestic product (GDP). For this analysis we constructed a hypothetical disruption scenario similar to the one that actually occurred during the Venezuelan oil strike in the winter of 2002–2003, but using assumptions regarding market and economic conditions closer to those that prevailed at the time of the analysis (late 2005). We also conducted our own analysis of the same scenario using EIA’s oil disruption rules of thumb that predict how oil prices and the U.S. GDP respond to disruptions in world oil supplies. For the analyses of the potential impacts of a Venezuelan embargo against the United States, we relied largely on EIA analyses. For the impacts of Venezuela’s sale or closure of its CITGO refineries in the United States, we analyzed the response of gasoline prices to the major loss of refinery capacity that accompanied hurricanes Katrina and Rita in 2005. In addition, we discussed the impact of potential Venezuelan oil disruptions with numerous industry experts in Venezuela and in the United States; officials in the Departments of State and Commerce, and DOE; and International Energy Agency officials.

To address the third objective, we met with officials at various U.S. government agencies, including the Departments of State and Commerce, DOE, and the Office of the U.S. Trade Representative, to identify the status of programs and activities to ensure a continued supply of oil and to mitigate a disruption of imports of crude oil and refined petroleum products from Venezuela, as well as to determine whether the agencies have Venezuelan-specific contingency plans. We also met with officials of 10 U.S. and multinational oil companies, eight refiners, and two service companies; industry experts from the International Energy Agency, the Center for Strategic and International Studies, the National Petrochemical and Refiners Association; Purvin and Gertz; and other institutions. In addition, we obtained information on Venezuelan decrees and legislation governing foreign investment in the petroleum industry. We reviewed our previous work on U.S. energy security, especially our 1991 study,

**“Venezuelan Energy: Oil Production and Conditions Affecting Potential Future U.S. Investment.”**

Because the Department of State advised us that visiting port facilities may be considered too sensitive to the Venezuelan government given that government’s apprehension about the U.S. government, we did not assess port or other facilities for vulnerability to sabotage or attack. However, the Coast Guard, as part of its port security responsibilities, identifies countries that are not maintaining effective antiterrorism measures. According to Coast Guard officials, Venezuela has not been identified as such a country.

This report focuses on federal programs and activities related to U.S. energy security. Diplomatic and political actions that may impact U.S. energy security may be undertaken for a multitude of foreign policy goals that are beyond the scope of this report. Therefore, our evaluation of programs and activities related to energy security is in no way intended to evaluate the U.S. government’s approach to these broader goals. Department of State officials reviewed a draft of our report to ensure we did not include information in our report that could influence diplomatic relations.

To obtain the official Venezuelan government position on questions relating to all three objectives, we made arrangements with the Venezuelan Embassy in Washington, D.C., for an official spokesperson. Generally, we submitted questions to the spokesperson who then asked for answers and explanations from the appropriate officials in Venezuela and provided the answers to us, usually in writing. In addition, the spokesperson made several presentations to provide information on Venezuela’s oil sector. We did not verify the information provided by the spokesperson. In addition, we did not independently review Venezuelan laws and decrees, and relied on secondary sources such as interviews.

We performed our work from March 2005 through May 2006 in accordance with generally accepted government auditing standards.

# Appendix II: Comments from the Department of Commerce



**THE DEPUTY SECRETARY OF COMMERCE**  
Washington, D.C. 20230

June 15, 2006

Mr. Jim Wells  
Director  
Natural Resources and Environment Division  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Mr. Wells:

Thank you for the opportunity to comment on the draft report entitled, *Energy Security: Issues Related to Potential Reductions in Venezuelan Oil Production*. Venezuelan oil exports to the United States and Venezuelan-owned refining and distribution operations within our borders remain major components in meeting our Nation's energy demands.

The Department of Commerce, along with our colleagues at other federal agencies, has worked hard to obtain bilateral and multilateral commitments from our trading partners that will help ensure our Nation's ability to obtain hydrocarbon resources from foreign sources in the future. We will continue these efforts.

Though the Department cannot comment on the specific remarks made in the report regarding the Departments of Energy and State and the Office of the U.S. Trade Representative, we agree with the report's overall findings. The International Trade Administration (ITA) continues to caution American companies seeking to do business in Venezuela's increasingly difficult investment environment. We intend to remain in frequent contact with U.S. energy companies regarding their investments in Venezuela. Of note, in May 2006, ITA's Commercial Service's office in Caracas, Venezuela, organized and brought a delegation of Venezuelan private sector energy companies to the Offshore Technology Conference in Houston, Texas. This effort helped to further encourage these companies' business linkages to American products, goods, and services in the energy sector.

Thank you again for the opportunity to review and comment on this overview.

Sincerely,

A handwritten signature in black ink, appearing to read "David A. Sampson", written over a horizontal line.

David A. Sampson

# Appendix III: Comments from the Department of Energy



## Department of Energy

Washington, DC 20585

June 23, 2006

Mr. Jim Wells  
Director  
Natural Resources and Environment  
United States Government Accountability Office

Dear Mr. Wells:

On behalf of the Department of Energy I am pleased to respond to your email of June 6, 2006, transmitting a copy of the GAO's proposed report entitled "Energy Security: Issues Related to Potential Reductions in Venezuelan Oil Production, (GAO-06-668)." We appreciate the opportunity to review the report before it is issued in its final form.

The U.S. has a long and mutually beneficial relationship with Venezuela. The report makes many valuable points regarding the demonstrated and potential challenges facing Venezuelan crude oil production. We commend the GAO for its efforts to outline the significant issues facing Venezuela's petroleum sector. However, DOE has two major issues with the GAO's report:

1. GAO asserts that an interruption of Venezuela oil would result in a \$23 billion loss to U.S. gross domestic product. This is attributed to a model developed by a DOE contractor, Oak Ridge National Labs. That model result is an estimate of what would happen in the absence of any mitigating response. Given the likelihood of action to mitigate such a disruption, attributing a specific dollar amount is inappropriate and misleading. DOE is very concerned it will be taken out of context. The prediction does not take into account the immediate worldwide response that would occur as was demonstrated during Hurricane Katrina, the availability of Arab heavy oil to replace lost Venezuelan supply, the ability of the U.S. to tap its Strategic Petroleum Reserve, nor the existence of significant worldwide stocks held by International Energy Agency members. The report also does not make any analysis of the impact such actions would have on the Venezuelan economy.
2. The report asserts that DOE has discontinued bilateral programs with Venezuela designed to ensure energy security. No program with Venezuela or any other country could guarantee reliable supply or our energy security, as the report now leads the reader to believe. The federal government does not enter into agreements that compel production. However, the U.S. is undertaking tremendous efforts to enhance our energy security. The report does not address the comprehensive actions the U.S. is taking at home and with producing and consuming countries around the world to increase supply, to increase refinery capacity, to improve energy infrastructure, to assure the most efficient use of



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energy resources and to improve the share of alternative fuels in our energy base. These actions ensure U.S. energy security.

The attached comments include further discussion of these and other DOE concerns with the report. While it adds to the debate on energy and energy security, a reading of the report necessitates the addition of these comments to provide an accurate, rather than an alarmist, view of United States energy security, which I know we are all committed to ensuring for the benefit of our citizens and our economic prosperity.

Sincerely,



Karen A. Harbert  
Assistant Secretary  
Office of Policy and International Affairs

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# Appendix IV: GAO Contact and Staff Acknowledgments

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## GAO Contact

Jim Wells (202) 512-3841

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## Staff Acknowledgments

In addition to the individual named above, Philip Farah, Byron S. Galloway, Carol Kolarik, Michelle Munn, Cynthia Norris, Melissa Arzaga Roye, Frank Rusco, and Barbara Timmerman made key contributions to this report.

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