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# National Policies for Energy Emergencies: An Overview

**A**fter the Arab oil embargo of 1973 and 1974, the U.S. government concentrated on developing energy policies that would protect the U.S. economy from the adverse effects of future disruptions of world oil supplies. Many of those policies focused on providing incentives for raising domestic oil production and for lowering oil use by consumers and businesses, thereby reducing the nation's vulnerability to disruptions before they happen. A different set of emergency policies evolved for cushioning the impact of supply disruptions once they had occurred.

Since the mid-1970s, energy emergency policy has relied on the Strategic Petroleum Reserve (SPR) --a government-owned stock of crude oil--and the multilateral programs of the International Energy Agency (IEA). The Energy Policy and Conservation Act of 1975 (EPCA) provided authorization for both. The EPCA and policy statements of the U.S. Department of Energy list general emergency circumstances in which the U.S. government could release oil from the SPR and describe how the government would respond to a supply disruption.

The current policy for responding to severe disruptions of oil supplies is to rely on market forces to allocate supply, as well as to supplement that supply (if needed) with an early drawdown of the SPR in large volumes and in coordination with the members of the International Energy Agency. In a sense, the SPR and the IEA are very much products of their times: they represent a particular view of how energy policies could be useful in blunting the worst effects of any disruptions in the oil supply.

However, changes in energy markets and in the broader economy since 1973, plus the recent experience of the Persian Gulf crisis, have underscored a number of problems with current policies. This study specifically addresses those problems. In so doing, it examines issues and options relating to government decisions about when and how to make use of the Strategic Petroleum Reserve to best protect the economy from losses.

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## Understanding the Strategic Petroleum Reserve and International Programs

The Department of Energy (DOE) describes its strategic stocks of crude oil and its participation in international programs that restrain oil demand and increase indigenous production of oil and alternative fuels as the nation's most important emergency programs for dealing with a major loss of world oil supplies.<sup>1</sup> Despite many changes in other government policies affecting energy and in the basic structure of energy markets, those emergency programs and the policies guiding their use have changed little since their inception in the 1970s.

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1. Department of Energy, *Energy Security: A Report to the President* (March 1987), p. 215.

## What Is the Strategic Petroleum Reserve?

The Strategic Petroleum Reserve, established by the Energy Policy and Conservation Act of 1975, was a response to the 1973 Arab oil embargo.<sup>2</sup> The Congress intended the SPR primarily to promote economic security. More directly, the creation of the SPR satisfied the nation's commitments under the Agreement on an International Energy Program, signed by the United States and other industrialized countries in November 1974.

However, additional arguments existed for developing the Strategic Petroleum Reserve as a national security asset. For example, the government is a major oil consumer, and the SPR can serve as an inventory for government use. Moreover, to the extent that the United States is in a position to affect the world supply and demand for oil through its military and geopolitical activities, it could have greater freedom to do so if it can use the SPR to help offset those effects on oil markets. Outside the energy arena, the United States contracted to buy additional volumes of crude oil for the SPR from Mexico in the 1980s to help support that country in a financially difficult period.

**SPR Size and Drawdown Capability.** As amended in 1990, the Energy Policy and Conservation Act authorizes the Department of Energy to store up to 1 billion barrels of crude oil for emergency use in a Strategic Petroleum Reserve. DOE has constructed storage capacity for up to 750 million barrels and plans to develop a drawdown capability of 4.5 million barrels per day (bbl/day). However, the reserve only holds about 590 million barrels today, and current maximum capability for drawdown is 4 million bbl/day. That oil is located in five underground storage facilities along the gulf coasts of Texas and Louisiana. If the Strategic Petroleum Reserve was ever filled to the 750-million-barrel mark, a drawdown capability of 4.5 million bbl/day would be sufficient

to replace about 55 percent of the current level of net petroleum imports for nearly six months.

The SPR's effective capability for distribution today is only about 2 million bbl/day--about 25 percent of net petroleum imports--and is sustainable for merely 90 days. That level is far below the maximum drawdown capability because of problems with excessive heat and with natural gas seepage into some of the storage caverns.<sup>3</sup> Excessive gas content makes the crude oil too volatile for transportation. And excessive heat raises the vapor pressure of the crude oil and increases air emissions during drawdown. Problems with excessive heat and gas content mean that about 200 million barrels of SPR oil cannot be safely removed. A third problem that may reduce the availability of SPR oil even further involves water leakage at the Weeks Island storage site, which holds a total of 73 million barrels of oil.<sup>4</sup> Nevertheless, current plans to correct the natural gas and heat problems would not restore the SPR to its designed drawdown capacity until 1998.

**Budgetary History: Government Expenditures on SPR Facilities and Oil.** To date, the United States has spent about \$21 billion on the Strategic Petroleum Reserve (see Table 1). That figure includes about \$4 billion to construct and maintain storage and transportation facilities and about \$17 billion for crude oil, which has a current market value of about \$10 billion. In addition, the government is spending more than \$200 million annually to operate and maintain the reserve. In the next couple years, about half of those funds will go to correct the heat, gas, and water problems just mentioned.

In the 1995 Department of Interior Appropriations Act (H.R. 4602), the Congress appropriated \$244 million to continue operating and maintaining existing SPR storage facilities. No new funds were appropriated to acquire crude oil or to transport, in-

2. The Congressional Research Service has summarized the legislative history of the Strategic Petroleum Reserve and the debates on financing and drawdown capability in Robert Bamberger, *The Strategic Petroleum Reserve*, CRS Issue Brief IB87050 (September 10, 1993).

3. See testimony by Jack S. Siegel, Assistant Secretary for Fossil Energy, before the Subcommittee on Interior and Related Agencies of the House Committee on Appropriations, March 23, 1994. The General Accounting Office analyzed the impact of these problems on SPR drawdown capacity in the report *Energy Policy: Ranking Options to Improve the Readiness of and Expand the Strategic Petroleum Reserve*, GAO/RCED-94-259 (August 1994).

4. "DOE Is Likely to Reach a Decision Within Next Two Weeks," *Inside Energy* (September 5, 1994), p. 5.

ject, draw down, and distribute oil. Indeed, the Administration has not asked for new funds to acquire crude oil since 1990 (for spending in fiscal year 1991), and the Congress last provided new funds to acquire oil in the Department of Interior Appropria-

tions Act for fiscal year 1992. In the 1995 appropriation, the Congress even transferred \$91 million (included in the \$244 million figure) from unspent acquisitions funds to pay for facilities and for operating costs.

**Table 1.**  
**Strategic Petroleum Reserve Appropriations, 1976-1995 (In billions of dollars)**

Fiscal Year	Petroleum Acquisition and Transportation	Storage Facilities Development and Operations	Management	Total
1976	0	0.30	0.01	0.31
1977	0.44	0	0.01	0.45
1978	2.70	0.46	0.02	3.01
1979 <sup>a</sup>	2.36	0.63	0.02	3.01
1980 <sup>a</sup>	-2.02	0	0.02	-2.00
1981 <sup>a</sup>	3.21	0.11	0.02	3.33
1982 <sup>a</sup>	3.68	0.18	0.02	3.88
1983	2.07	0.22	0.02	2.32
1984	0.65	0.14	0.02	0.81
1985	2.05	0.44	0.02	2.51
1986 <sup>a</sup>	-0.01	0.11	0.01	0.11
1987	0	0.13	0.01	0.15
1988	0.44	0.15	0.01	0.60
1989	0.24	0.16	0.01	0.42
1990 <sup>b</sup>	0.37	0.18	0.01	0.56
1991 <sup>c</sup>	0.57	0.19	0.01	0.77
1992	0.09	0.17	0.01	0.27
1993 <sup>d</sup>	-0.01	0.16	0.01	0.18
1994	0	0.19	0.02	0.21
1995 <sup>a</sup>	-0.09	0.23	0.02	0.15
Total	16.59	4.16	0.31	21.06

SOURCE: Congressional Budget Office based on Department of Energy data.

- a. Figures reflect reprogramming from petroleum acquisition to other Strategic Petroleum Reserve activities (mainly development of storage facilities).
- b. Includes \$122.7 million from the test sale in the fall of 1990.
- c. Includes \$315.4 million from the Strategic Petroleum Reserve sale in the winter of 1991.
- d. Includes a \$126 million Department of Defense appropriation for acquiring oil for the Strategic Petroleum Reserve.

Using unspent past funds and revenues from SPR sales, the Department of Energy acquired oil for the SPR at an average rate of about 40,000 bbl/day in fiscal year 1993 (see Table 2). The fill rate fell to about 16,000 bbl/day in fiscal year 1994 and will be near zero in 1995.

Despite the lack of new appropriations, by the end of 1994, the Department of Energy will still have about \$200 million in unspent funds for purchasing oil for the SPR. Those funds would support an acquisition rate of about 10,000 bbl/day for about three years. However, Congressional reports filed in association with the 1995 Department of Interior Appro-

priations Act anticipate that SPR oil acquisition funds will continue to be transferred to help pay for annual maintenance and upgrading costs of the SPR facilities. Hence, the Strategic Petroleum Reserve is unlikely to reach a level of even 600 million barrels without new appropriations for oil acquisition.

**Legal Restrictions on the Use of the SPR: Responding to Physical Shortages, Supporting the IEA.** The Energy Policy and Conservation Act authorizes and restricts the use of the Strategic Petroleum Reserve. Specifically, a distribution of SPR oil would require a Presidential finding of a shortfall in supply or could be authorized by the President to

**Table 2.**  
**Levels of Strategic Petroleum Reserve Oil Fills, 1976-1994**

	Fiscal Year		Calendar Year	
	Year-End Inventory (Millions of barrels)	Average Fill Rate (Thousands of barrels per day)	Year-End Inventory (Millions of barrels)	Average Fill Rate (Thousands of barrels per day)
1976	0	0	0	0
1977	1.1	3	7.2	20
1978	49.1	131	68.5	168
1979	91.2	115	91.7	64
1980	92.8	4	107.8	44
1981	199.2	292	230.3	336
1982	277.9	215	293.8	174
1983	361.0	228	379.1	234
1984	431.1	191	450.5	195
1985 <sup>a</sup>	489.3	159	493.3	119
1986 <sup>a</sup>	506.4	47	511.6	51
1987	533.9	75	540.6	80
1988	554.7	57	559.5	52
1989	577.1	62	579.9	56
1990 <sup>a</sup>	589.6	34	585.7	27
1991 <sup>b</sup>	568.5	0	568.5	0
1992	571.4	8	574.7	17
1993	585.7	39	587.1	34
1994	591.7	16	591.7	13

SOURCE: Congressional Budget Office based on Department of Energy data.

a. Reflects drawdown of some SPR oil during test sales.

b. Reflects moratorium on acquisitions during the Persian Gulf crisis.

meet U.S. obligations under the International Energy Program. The EPCA provides no guidance on the size of the loss needed to trigger a SPR release. Nor does the EPCA indicate the degree of adverse economic impact or the size of a price increase that would justify a release. Indeed, the government has in the past rejected the idea of releasing SPR oil based on any specific trigger formula.<sup>5</sup>

No major changes in the purposes to which the SPR is put or in the way the SPR is financed or sold can take place without some change to the Energy Policy and Conservation Act. However, some changes have occurred. For example, the concept of the supply shortfall needed for SPR drawdown has changed in the past couple years. The original definition promulgated in 1975 was a loss in the national supply caused by interruptions in the supply of imported petroleum that could adversely affect the national economy. The 1990 amendments to the EPCA broadened that concept to include shortages brought about by interruptions in the supply of domestic petroleum products. Regional interests had pressured the Congress for many years to expand use of the SPR to help with local supply imbalances. The Exxon Valdez oil spill in 1989 (and subsequent increases in West Coast gasoline prices) and the severe cold that winter in the Northeast (and subsequent increases in Northeast heating oil prices) probably contributed to passage of the 1990 amendments.

Moreover, in the 1992 amendments to the Energy Policy and Conservation Act, the Congress made the requirements for drawdown more specific by directing the President to consider severe increases in petroleum prices as an indicator of shortfalls in supplies. That revision recognized that government regulation of oil markets had eased greatly since the 1970s and that physical shortfalls, as evidenced by gasoline lines, would not be likely as long as prices could rise to clear the market.

Within the restrictions of the EPCA, the stated policy of the United States on the use of the Strategic Petroleum Reserve is to draw down the stocks early and in large volumes in response to a supply disrup-

tion.<sup>6</sup> Under the auspices of the International Energy Agency, the United States participates in a cooperative process to draw down those stocks in a coordinated manner. The intent of this coordination is to maximize the value of the stocks and avoid counterproductive measures (such as decisions by other countries to increase their own stocks).

**The Current Sales Process: Competitive Bidding for a Set Volume.** To release oil from the Strategic Petroleum Reserve, the Department of Energy decides on and announces the level of supply it would like to sell; the actual release of oil takes place a month or two in the future.<sup>7</sup> The department also decides on a minimum price it will accept for that oil. Private companies then submit sealed, competitive bids for particular crude oils at particular SPR sites, including a price they would pay for prompt delivery of that volume and a range of dates when they would like delivery. (Delay in delivery is a necessary consequence of logistical problems, such as the need for private companies to arrange for transportation of the oil and the limited rate at which oil can flow from the SPR.)

The Department of Energy ranks all the bids it receives by price, starting with the highest price and working down until the total volume of oil offered is accounted for. DOE rejects bids out of hand that are below 90 percent of the minimum price. For the successful bids, the price ultimately paid on delivery will not be the initial bid price but rather the bid price plus an adjustment for any changes in market prices between the bid date and the delivery date. That process of setting volumes and minimum prices and accepting bids is conducted separately for SPR crude oils of different qualities and from different storage locations.

**The Economic Rationale for Releasing a Set Volume of SPR Oil.** The current objective of setting the volume to be released may reflect the Department of Energy's early concern with lost oil supplies being the principal cause of economic losses during a dis-

6. Department of Energy, *United States Policy for Responding to Oil Supply Disruptions* (February 1994).

7. Department of Energy, *Strategic Petroleum Reserve Distribution Plan* (December 1982), Amendment Number 4.

5. Department of Energy, *SPR Drawdown Plan* (1982).

ruption. That approach may also have been a tailored response to the major threat of the day: politically motivated disruptions in oil supply that would be of a known volume for a known period of time.

In DOE's original view, a release of SPR oil could achieve economic benefits by replacing lost oil imports and causing the world oil price to fall. Specifically, DOE assumed that U.S. oil imports and world demand for newly produced oil would fall by the full amount of the SPR release. Obtaining that result required a further assumption that domestic oil production, oil consumption, and private oil stocks would not change in response to the release or to the subsequent change in the oil price.

Analyses by the Department of Energy of the benefits of releasing the Strategic Petroleum Reserve continue to focus on the economic costs of this type of disruption--with full information about the size and duration of supply loss. Moreover, DOE makes those analyses without assuming any significant response in demand or domestic production to changing oil prices; nor does it assume any response in private stocks to changes in expected price levels or to uncertainty over the course of the disruption. As a result, private demand and oil stocks are assumed to have no incentive to change in response to an SPR release, and a simple release of any given amount of SPR oil would always have the same magnitude of effect on total imports and prices. That is, total oil imports change only by the amount of the SPR release. In this view, the only government decision relevant for lowering oil imports and oil prices appears to be how much SPR oil to sell.

## What Is the International Energy Agency?

The International Energy Agency was created to carry out the goals of the Agreement on an International Energy Program, signed by 21 industrialized nations in November 1974 (24 countries are now members).<sup>8</sup> In the International Energy Program, the

IEA members agreed to maintain sufficient reserves to sustain domestic oil consumption for at least 90 days with no net oil imports. Crude oil and petroleum products in private storage, alternative fuel supplies available for substituting for oil, and standby capability for oil production all count toward the nation's emergency reserve commitment under the International Energy Program. Under the auspices of the IEA, the United States and other members confer on drawing down emergency stocks and activating other emergency measures in a coordinated manner.

**Emergency Programs of the IEA.** The members also agreed to develop capabilities to respond to an emergency if a significant disruption of the world oil supply system occurred, including a formula for sharing the available supply of oil. In addition to stock drawdown and oil sharing, capabilities for responding to emergencies are to include restraints on demand, switching away from oil products for the short term, and increasing oil production by members. As evidenced by the response to the Persian Gulf crisis, the International Energy Agency relies on emergency stocks to replace most of the lost supplies, with most of those stocks coming from the Strategic Petroleum Reserve.

**Legal Restrictions on IEA Actions: Responding to Supply Shortfalls.** The charter of the International Energy Agency is more specific than is the Energy Policy and Conservation Act concerning the size of the supply shortfall needed to activate the IEA's emergency programs. It makes no mention at all, however, concerning the ultimate economic goals of those programs--for example, how much economic loss would warrant action. The IEA Secretariat makes the finding of disruption, subject to review by the agency's Governing Board, and directs the member nations to activate programs for restraining demand, drawing down reserves, and sharing oil among members--most likely in that order. As originally envisioned, some use of emergency reserves could be considered a restraint on demand, but a total commitment of emergency reserves would be viewed as a last resort. The agency now appears to view sharing

8. The 24 member countries of the IEA today are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New

Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

among member nations as the last line of defense after a drawdown of stocks.

The International Energy Agency follows either one of two processes for carrying out its emergency programs, depending on the size of the disruption. Both mechanisms take the volume of lost oil as the criterion for activation. That loss is a net figure, however, calculated after world supply has had a chance to respond to higher prices.

For disruptions of less than 7 percent, individual members of the IEA would participate in a cooperative process, outlined by the IEA Governing Board in 1984, that may result in the release of emergency reserves to increase available supply.<sup>9</sup> Each country would follow domestic conservation policies that it believes are appropriate. Policies may include letting the free-market system work, urging voluntary conservation, or switching from oil to other fuels. To help identify disruptions that merit an emergency response, the Governing Board only identifies circumstances it considers relevant--with price change notably absent.<sup>10</sup> That procedure provided the framework for the U.S. decision to release oil from the SPR in January 1991.

For disruptions that are greater than 7 percent, the International Energy Agency would supposedly activate its Emergency Sharing System and calculate a restraint on demand or an emergency reserve drawdown for each member. The conditions for invoking these emergency programs have not changed since the International Energy Program was first signed. The International Energy Program defines a disruption that would activate the agency's programs as a reduction in supply from predisruption levels for the IEA group as a whole or for any single member. The program also defines a complex set of data requirements and procedures for sharing the remaining oil supplies among IEA members.

The Emergency Sharing System formula establishes an allotment for each country's total oil use during the disruption. Countries currently consuming

an amount that is above their permissible level are obligated to share that oil with those currently consuming below their permissible level.<sup>11</sup> The formula establishes those rights to oil in two parts. The first part is the restraint on demand, a percentage adjustment from each member's oil consumption in a base period (the past year). The size of this restraint on demand would itself depend on the size of the disruption. If the supply loss was between 7 percent and 12 percent, that part of a country's permissible level of oil use would be 7 percent below its consumption in the base period. If the loss was more than 12 percent, that part of the permissible level would be 10 percent below its consumption during the base period.

The second part of the formula is the obligation to draw down emergency reserves. If the restraints on demand do not fully allocate the loss of supply, that part of the formula specifies further reductions in permissible oil use proportionate with each member's net imports of oil in the base period (again, the past year). A country with emergency reserves of oil, however, such as the United States with its Strategic Petroleum Reserve, would meet that requirement by drawing down those reserves. Countries with larger net imports, calculated after a drawdown of emergency reserves, would incur a larger reduction in permissible supplies. Largely because of the Strategic Petroleum Reserve, the United States would probably have received oil during the Persian Gulf crisis under the International Energy Program formula.<sup>12</sup> Any country that was experiencing low oil use relative to its base year--because of poor economic performance, weather, or other circumstances--would have been more likely to receive oil than otherwise under the oil-sharing formula.

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9. International Energy Agency, *I.E.A. Governing Board Decision on Stocks and Supply Disruptions* (Paris: IEA, July 1984).

10. *Ibid.*, Appendix I.

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11. For a discussion of the sharing formula and potential gains to the United States, see David R. Henderson, "The IEA Oil-Sharing Plan: Who Shares with Whom?" *The Energy Journal*, vol. 8, no. 4 (October 1987).

12. For example, the General Accounting Office concluded the United States would have received 1.5 million barrels per day during the Persian Gulf crisis had the oil sharing taken place. See General Accounting Office, *International Energy Agency: Response to the Oil Disruption Caused by the Persian Gulf Crisis*, GAO/NSIAD-92-93 (1992).

## How the Government Currently Views the Benefits of Intervening in Oil Markets

The Energy Policy and Conservation Act identifies the objective of releasing the Strategic Petroleum Reserve as avoiding economic losses from supply shortfalls and severe price increases. However, neither the Department of Energy nor the International Energy Agency maintains any specific formula for evaluating the likely effects of government intervention in oil markets on the economy. The clearest insight into the thinking of those agencies comes from investigating the methodology that DOE uses to evaluate the economic benefits from building up the SPR in the first place.

Given the prevailing government views of the 1970s and 1980s, releasing SPR oil during a temporary disruption of world oil supplies would have yielded several benefits by avoiding economic costs. For example, DOE studies have identified two components of the costs of disruption: lower gross domestic product (GDP) attributable directly to higher oil prices, and lower GDP attributable to the costs of adjusting to higher prices (including the consequences of slow adjustment in labor markets and of less favorable terms of trade). The Department of Energy measures those adjustment costs as the loss of consumer surplus by oil users, an economic concept representing the change in the difference between the amount those consumers would be willing to pay for oil imports and the amount they actually pay.<sup>13</sup> Higher oil prices lead to lower oil imports and lower consumer surplus (and higher adjustment costs). But the smaller the response of oil imports to higher prices, the greater the loss of surplus and the smaller the costs of adjustment.

Thus, the benefits of releasing SPR oil come from the contribution of that release to lowering oil prices and to lowering imports of oil. Accordingly,

the government's first step in measuring the benefits of releasing SPR oil is to calculate the drop in oil prices from the associated addition to world supply and the addition to GDP from that price drop. The second step is to calculate the reduction in adjustment costs as a result of the price drop, measured as the net rebound in oil consumer surplus. (DOE also includes consumer payments to the government for SPR oil among the benefits of release, even though that payment actually represents a transfer among sectors of the economy.)

Presumably, the government should release SPR oil whenever DOE's calculations indicate positive economic benefits. The problem is that such a formula would be likely to yield positive benefits at almost any time and, as such, is of little value for decisionmaking.

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## Deciding When and How to Use Strategic Stocks

Setting aside the current views of the Department of Energy and the International Energy Agency on emergency policy, which may no longer be completely relevant, some basic economic considerations should underlie decisions about when and how best to use the nation's strategic reserves of crude oil. For example, in deciding when to release SPR oil, it is important to compare the benefits from releasing stocks in the face of a crisis with the expected benefits from maintaining the reserve instead for future use.<sup>14</sup> Moreover, in calculating the benefits from release--whether current or expected--it is important to acknowledge the impact of that release on domestic oil consumption and production (as a result of lower oil prices) and on private oil stocks (as a result of changes in the expected price paths of oil and subsequent market uncertainty).

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13. Department of Energy, *Strategic Petroleum Reserve: Analysis of Size Options*, DOE/IE-0016 (February 1990). The Interagency Working Group on SPR Size, chaired by the Department of Energy with representation by 12 other agencies, assumes domestic supply of oil does not rise with higher oil prices, so oil producer surplus (the difference between the market price and the cost of supplying goods) does not increase to offset any decrease in oil consumer surplus.

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14. Alternative views on simple rules to guide decisions to release the Strategic Petroleum Reserve are reviewed in a report by Robert L. Bamberger and Lawrence C. Kumins, *The Strategic Petroleum Reserve and the Drawdown Dilemma*, Report 90-492 ENR (Congressional Research Service, October 12, 1990).

How the government goes about releasing SPR oil can also determine the benefits of release if the sales process itself affects the expected price path and market uncertainty. Hence, the decision about when to release oil may depend closely on how the government sells that oil.

### **When to Use the Strategic Petroleum Reserve: Now Versus Later**

Releasing crude oil from the Strategic Petroleum Reserve may help to protect the nation from economic losses attributable to a temporary disruption of world oil supplies. But the government could achieve some level of economic stimulus from selling SPR oil at almost any time--regardless of any turmoil in oil markets. A key consideration in deciding if a current release is indeed appropriate should be whether the current economic benefits from the release in question are greater than the expected benefits from releasing oil later. That strategy would ensure the greatest total benefits from release over any period of time.

The current economic benefits of an SPR sale would stem from its ability to lower world oil prices and the nation's total oil imports. The expected benefits from holding onto SPR oil for later release would also reflect the expected size of the supply disruption at that later date and the likelihood of that future disruption occurring. In short, the benefits of release at any particular time would closely mirror the economic costs of an oil supply disruption at that time.

**Oil Supply Disruptions and Economic Losses.** A disruption of world oil supplies and the ensuing shock to oil prices could have several adverse effects on the economy. In particular, a sudden rise in prices might contribute to losses in economic output by lowering real incomes and consumer demand, causing businesses to lay off workers and to idle machinery in oil-intensive activities. It could also cause the economy to expend resources as it adjusts to changing relative prices. Total real consumer expenditures for all goods and services--a broad measure of economic welfare--would decline along with economic output. Consumer expenditures could also slip as more of the nation's output is directed to exports to

satisfy an increased demand for U.S. goods and services by oil-exporting nations.

Some of those losses attributable to higher prices would be offset if the nation was able to reduce its use of oil and its total oil imports in response to higher oil prices without having to reduce total consumer expenditures. However, the net impact of a supply disruption on the overall economy would be negative. In some circumstances, the net impact of a disruption might also reflect the state of the economy. For example, a supply disruption would pose more of a threat to an economy at the turning point between recession and recovery--with weak consumer confidence and no strong investment.

**Economic Benefits from SPR Release.** The economy can benefit from a release of SPR oil in two ways. First, a release could help the economy avoid some of the initial adverse effects of a supply disruption by lowering oil prices. Second, a release could enable the economy to reduce its total oil imports further without the necessity of reducing oil use or incurring the costs of switching to other fuels or increasing domestic oil production.

Estimating current and expected benefits from releasing SPR oil, however, is more difficult than just identifying the volume of release and its impact on current oil prices. For example, the benefits of release would presumably be greater in the face of larger price shocks--whether now or later. Otherwise, a release would yield no greater benefits than in noncrisis times. And just as a price shock may pose a greater threat to the economy at certain points in the business cycle, the benefits from government action to reduce oil prices may be greater at different times.

Similarly, the effect of SPR release on total oil imports may be greater or less than the direct amount of the release. Indeed, the effect of releasing SPR oil on total oil imports would be threefold.

The first is the volume of SPR release itself. A greater release means a greater reduction in total imports--all else being constant.

The second is any subsequent increase in private oil use and decrease in domestic oil production in

response to the lowering of oil prices. Greater domestic oil use and lower domestic oil production mean higher oil imports--all else being constant.

The third is any subsequent change in the rate of addition to private oil stocks in response to any change in expectations about future market conditions. A lower rate of addition to private stocks means lower oil imports--all else being constant. Numerous studies on the interaction between public and private stocks exist. But the conclusions of those studies vary widely, depending on specific assumptions about how private businesses make inventory decisions.<sup>15</sup> For example, in its analyses of the optimal size for the Strategic Petroleum Reserve, the Department of Energy assumes that private inventories would not change because of an SPR release.<sup>16</sup> Even those studies that do assume some change in private inventories provide little recognition of how price expectations and market uncertainty can vary among different types of disruptions or how a release of SPR oil can affect expectations, uncertainty, and, hence, the incentives to hold private stocks.

In relying on basic economic theory concerning storage decisions and uncertainty, however, two observations are especially useful. First, individual consumers and businesses will add to their private stocks of oil and oil products at a lower rate (or draw from those stocks at a higher rate) whenever expected future prices drop relative to current prices or uncertainty surrounding current oil prices drops relative to that surrounding future prices. Second, from that perspective, a release of SPR oil may help reduce economic losses simply by reducing current market uncertainty. (Note that this view diverges from a common assumption in economic theory related to the factors determining inventory demand--namely, that all uncertainty is in the future. Acknowledging the uncertainty surrounding today's de-

cision is the critical first step in recognizing how changes in uncertainty affect inventory decisions.)

In contrast to the simplicity of these three examples, all else is not constant. A release of SPR oil can simultaneously affect current and future prices and market uncertainty in ways that make the net effect of a release on total oil imports difficult to predict. For example, if the government announces its intention to release SPR oil in the near future, it could lower expected future prices (which lowers imports for private stocks); at the same time, however, it could add to current market uncertainty about when and how much prices will drop, which merely adds to imports.

The nature of the supply disruption itself can also complicate the decision to release oil when a current loss of supply and the prospect of continued or additional losses are connected. In that context, it is useful to distinguish temporary supply disruptions (as in an embargo) from longer-lasting restrictions on oil production (as in a competitive restraint on output).

**Temporary Supply Disruptions: Actual or Threatened.** Changes in current and expected economic losses--and in current and expected benefits from an SPR release--may be closely linked. For example, a supply disruption may be accompanied by both an immediate loss of oil supplies and a threat of further loss. In that event, an immediate release of SPR oil would not be appropriate if current events simultaneously point to an increased likelihood of additional disruptions in the near future and higher expected benefits.

**Longer-Lasting Supply Disruptions.** The relative benefits from holding onto SPR oil for later use may rise by even more if the disruption is long lasting. Expected benefits would rise for two reasons. First, the longer the period of curtailed supplies, the greater the likelihood of some additional, unrelated disruption occurring--just as a matter of statistical chance. Second, any subsequent disruptions and price hikes that take place from a higher base price will be even more costly to the economy since it will have already made its easiest and least costly adjustments in response to the first price increment. That logic supports the conclusion that using strategic stocks would not be appropriate to counter permanent price

15. A useful review of studies on the interaction of public and private stocks appears in Frederic Murphy, Michael Toman, and Mark Goldstein, *Strategic Oil Stocks and Public-Private Interactions: A Dynamic Game Analysis* (Washington, D.C.: Resources for the Future, April 1984).

16. For a description of the Department of Energy's model and its assumptions, see Paul Leiby and Russell Lee, *Preliminary Results of the SPR Size Cost-Benefit Study* (Oak Ridge, Tenn.: Oak Ridge National Laboratory, November 17, 1988).

changes, perhaps because of rising costs of oil production or the successful exercise of market power by the Organization of Petroleum Exporting Countries (OPEC).

The economy's long-term response to sustained higher prices would also be likely to develop ways of using oil products more efficiently, switching to other fuels, and increasing domestic oil production. If such changes enhance the economy's ability to import less oil in response to further price hikes without having to cut consumer expenditures, the economic cost of subsequent disruptions in oil supply may be lower, not higher. Thus, over a sufficiently long period of high oil prices, the benefits from an SPR release in response to any particular size of disruption could decline, not rise. However, those changes in the economy's responsiveness would reduce the benefits from an immediate release in the face of future disruptions as well as expected benefits from subsequent release.

### **How to Use the SPR: Paying Attention to Changes in Domestic Use and Private Stocks**

The economic benefits from releasing SPR oil would result from lowering oil imports and oil prices. But the precise contribution from selling a given volume of oil would depend on the state of the economy, the nature of the supply crisis, and how the government goes about the sale. The sales process can influence the level of economic benefits and the decision of whether to release oil in at least three ways.

First, the process can influence the outlook for oil prices by influencing how quickly that release actually adds to the world supply and how quickly oil prices fall. Second, it can lessen the day-to-day volatility of oil prices by making more or less oil available to buyers in response to increasing prices. Third, the sales process can also influence the level of market uncertainty by affecting the market's perception about how much SPR oil the government wants to release and when.

**SPR Sales and Change in Current Prices.** How quickly a decision to release SPR oil will affect oil

prices will depend on how quickly the government can complete the sale of oil and on how much uncertainty the market attaches to the government's willingness to make good on its stated intention to release oil.

With any sales process, some lag between the signing of sales contracts and the physical delivery of oil will occur as a necessary consequence of logistical problems. For example, private companies need time to arrange to transport the oil they purchase. Moreover, ultimately, the existing capacity of pumping units and distribution systems at SPR storage sites will limit the rate of flow.

However, the government has more control over the lag between the decision to release oil and the signing of sales contracts. If the lifting of oil was at the buyer's initiative, only minimal delay would accompany this type of off-the-shelf sale. A sales process wherein the government sets the release price and sells oil to all who are interested--first come, first served--would release oil at the buyer's initiative.

If the sale was at the government's initiative, perhaps as it attempts to sell a predetermined volume of oil by competitive bids, some delay would occur in transferring title to the oil because the government would need to evaluate those bids and perhaps negotiate specific terms of sale. The current sales process, wherein the government sets the release volume and sells oil to the highest bidders, will release oil only at the government's initiative.

That type of sales process can be streamlined to minimize delays--for example, identifying a list of potential buyers by conducting conditional bids in advance of an actual sale or by screening interested bidders for their financial integrity. But at no time can businesses be induced to buy as much oil as the government wants to sell--unless the government is willing to give the oil away at any price.

Announcing a decision to release oil would probably still affect current prices by private-sector arbitrage, even if the sales process causes the final sale to come months after that decision. But the drop in current prices would generally be smaller than the expected drop in the future price. In general, the greater the uncertainty about when and how much oil

the government will ultimately sell, the smaller the impact on current prices.

**SPR Sales and Uncertainty About World Oil Prices.** How the sale of SPR oil affects market uncertainty will depend in part on how that sale alters the relationship between world oil supply (including supply from the SPR) and oil prices. If the world supply is more responsive to changes in price, then oil prices will be less volatile and less uncertain. Different sales processes can have different effects on the price responsiveness of world oil supply. For example, the current volume-setting process effectively increases the amount of oil available at every price. At an opposite extreme, a sales process that established a set price for SPR oil, selling as much as the market wants at that price, would eliminate all uncertainty about prices above the price set by the government--as long as the supply of SPR oil held

out. How the sale of SPR oil affects market uncertainty will also depend on how well the sales process communicates the government's intentions concerning the volume and timing of sales.

The focus should be on reducing uncertainty, not volatility itself. Volatility may merely be evidence of an efficient market, in which changes in supply and demand are reflected quickly in the price level. Constraining price movements in an effort to dampen uncertainty would simply impede the market's operation, creating alternating gluts and shortages. Market uncertainty about prices would give way to consumer uncertainty about supply availability and producer uncertainty about sales. Price uncertainty, however, may be reduced without any sacrifice in market efficiency by policies that make supply or demand more responsive to price changes and that promote full information on future additions to supply.