

DR# 2145-8

DOE/PE/70106-T8  
(DE84004723)

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ALTERNATIVE MECHANISMS FOR DRAWING DOWN THE  
STRATEGIC PETROLEUM RESERVE: FORWARD-BASED  
MARKETS COMPARED WITH AUCTION-ONLY MECHANISMS

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Work Performed Under Contract No. AM01-79PE70106

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TECHNICAL INFORMATION CENTER  
U. S. DEPARTMENT OF ENERGY



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ALTERNATIVE MECHANISMS FOR  
DRAWING DOWN THE  
STRATEGIC PETROLEUM RESERVE:  
FORWARD-BASED MARKETS  
COMPARED WITH AUCTION-ONLY MECHANISMS

A DISCUSSION PAPER PREPARED FOR  
THE DEPARTMENT OF ENERGY  
CONTRACT DE-AM01-79PE70106

HARVARD ENERGY SECURITY PROGRAM

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## INTRODUCTION:

In discussing strategies for the drawdown of the Strategic Petroleum Reserve (SPR) during a supply disruption, most of the attention has gone to proposals to auction off SPR oil during an emergency. In this discussion paper, the authors present and discuss alternatives to supplement auctions through additional strategies that use forward-based markets. We will discuss strategies that are intended to be established prior to any crisis--in particular, a proposal for ongoing sales by DOE of options on SPR oil. And we will discuss strategies that are intended to be used during a crisis itself--in particular, proposals to sell futures on SPR oil or to conduct auctions for future delivery. Our goals are twofold: 1) to present these proposals and to outline how they would work, and 2) to compare the proposals to reliance on an auctions-only strategy. In addition, we will to a limited extent compare the proposals to each other.

The proposal to sell options on an ongoing basis prior to an emergency has two principal goals: to provide insurance and to increase certainty. To those who buy options on SPR oil, the price that they will pay for the options, will be conceptually identical to an insurance premium. Refiners, particularly independents, who are worried about access to reasonably priced crude oil during disruptions, could buy options on SPR oil, ensuring themselves of some supply of crude oil. If disruptions did not occur, the options would expire worthless.

A second reason to favor pre-crisis sale of options is that the existence of the options guarantees some minimum release of

SPR oil. Many people are concerned that during a disruption, the pressures on the President would make it difficult to make a decision to release SPR oil. Pre-crisis sale of options, while allowing for additional sales in the event of a crisis, ensures that at least some response will be made.

The basic argument in favor of futures sales of SPR oil during an emergency is that such sales can reduce speculative inventory-building by refiners. When prices are rising, and refiners anticipate that they will continue to do so, refiners have rational economic incentives to buy oil and stockpile it in anticipation of higher profits to be reaped by selling it at the higher price in the future. Such behavior makes sense as long as the costs of storing the oil are less than the expected higher profits. Forward sales of SPR oil would attack the speculative inventory problem because, by shifting out the supply curve for the future, they would lower future prices. The lower future prices would cause refiners to cut back on their current stockpiling, because they would no longer be able to reap as high profits by hoarding oil.

We should note that the plans to sell options before disruptions occur and to implement forward sales during crises are not that different from one another. The differences are more a matter of emphasis--the options plan emphasizing certainty and insurance, the forward sales plan emphasizing price trajectory.

## Chapter I: THE FUNCTIONING OF OPTIONS AND FUTURES MARKETS

It is desirable to start with a common understanding of what is meant in discussing options and futures. This chapter will describe the workings and terminology of futures and options markets in general, as well as the development of energy futures markets (no commodity options markets exist yet, although it is fairly straightforward to envision how they would work).

### Options Markets

To say that somebody has an option to do something is to say that they have a choice whether or not to do it. Option provisions in contracts are common. They generally give one party the opportunity to demand some performance from the other party, in exchange for some consideration. In recent years, a market for option contracts for shares of publicly traded corporations has grown rapidly. Stock options are currently traded on four exchanges, including the American Stock Exchange. There are also currently options on financial instruments such as various stock exchange indices and treasury-bill rates. Options on futures contracts for physical commodities have recently begun and trading in options on physical commodities may come soon.

In securities markets, options work as follows: the seller of the options agrees to sell the buyer a given number of shares of a given security at a given price on or before a given date, if the buyer wishes. There is no requirement that the buyer actually exercise his option by buying the shares. The buyer gets an option to buy; he is not required to buy. In exchange for this commitment by the seller of the option, the buyer of the

option pays the seller a sum of money, the amount set by market forces. The price at which the seller agrees to sell the shares to the buyer is called the "strike price." The date up until which the option may be exercised is the "exercise date." The money the buyer pays the seller is called the "option price."

The general principle of options contracts is that if shares of the security in question are selling at or above the strike price by the date the option expires, it is worthwhile for the purchaser of the option to exercise it (or sell it to somebody else) because one could then obtain the securities more cheaply by exercising the option than by purchasing them in the open market. Thus, if one owns an option to buy 100 shares of IBM at \$130 a share anytime before January 21, 1984, and IBM closes on that date at \$138, one would save \$800 by exercising the option to buy the 100 shares at \$130 a share rather than buying the 100 shares on the open market at \$138 a share. If, however, IBM closes on January 21, 1984, at below \$130 a share (say at \$127), the option expires worthless, because there would be no reason to exercise an option to buy IBM at \$130 a share if one could get it on the open market at \$127. Thus, the options purchaser who has paid some amount of money in exchange for the option to buy IBM at \$130 anytime before January 21, 1984, will lose the entire sum he paid as an option price if the stock closes on that date below \$130, and he had held the option up to the exercise date. He will make money if it closes above \$130 plus the original option price he paid. Note that in principle options contracts could be negotiated for any possible strike prices, exercise dates, and number of shares. In practice, the markets where options are

traded standardize all three features of options contracts. (Standardization does not mean there is only one kind of option available for any share for which options are traded: options contracts for IBM might be able to be traded, for example, at strike prices of \$100, 110, 120, 130, 140, 150, and 160, and with exercise dates in January, April, July, and October.)

The strategy we recommend here involves the government selling "covered out-of-the-money calls" on SPR oil. With securities options, this strategy means that, for example, I own 100 shares of IBM stock, against which I write an option to sell those 100 shares anytime between now and October 1984 at \$150 a share. The idea here is that the options are covered by actual securities held and that the strike price is set higher than the current stock price. By contrast, a seller of uncovered options does not own the underlying securities against which he has sold the options. If I sell an uncovered call option on IBM and the option purchaser exercised the option, I would need to go into the open market to obtain the shares of IBM. This is not the strategy we recommend for the SPR.

#### Futures Markets

A futures contract is defined as a standard agreement to buy and receive, or to sell and deliver, a stated quality and quantity of a commodity at a definite future date at a specific price. In this way a futures contract is different from an options contract. The person purchasing an options contract is paying money for the opportunity to choose to purchase something of value at a certain price. He need not exercise his option, and if the object of

value does not reach the strike price specified in the options contract, the option will not be exercised. By contrast, someone purchasing a futures contract commits himself to purchase the object of value in question at a certain time in the future. The price at which the purchase will occur is specified as the price of the futures contract.

Under the Commodity Futures Trading Commission Act of 1974, all trading of such contracts is prohibited except on licensed and supervised exchanges, which draw up standard contracts. Although trading is done entirely in these standard contracts, obviously it is possible for the parties to reach agreement on modifications to the price specified if one or more characteristics of the commodity are at variance with the terms specified in the contract. (For oil, this might be delivery location, or sulfur content). However, about 98 percent of all contracts traded do not result in delivery of the product. Instead, they are liquidated in one way or another prior to the stated delivery month.

Important concepts in futures trading include the distinctions between "long" and "short" positions in the market, and the term "open interest." A contract to buy makes a trader long, since he has the standard contract amount of that commodity due to him. Conversely, a contract to sell makes the trader short, since the specified amount is owed to him. Clearly, for every buyer or long position there must be a seller or short position. A long position plus a short position equals one open contract, so the open interest is the sum total of matched short and long contracts active on the exchange.

Although the popular image of futures markets is substan-

tially one of a speculators' market, a substantial portion of many futures markets, and especially energy futures, consists of people in affected industries who are trying to hedge against major shifts in one of their costs of doing business. Hedging is the process of taking a position in the futures market to offset the risk of price changes on a commodity one holds. The New York Mercantile Exchange (NYMEX) has estimated that at least 50 percent of their business derives from firms with a day-to-day interest in the oil industry, whether it be as producer, distributor, or major purchaser.

#### History of Energy Futures

The New York Mercantile Exchange (NYMEX) initiated energy futures trading in November 1978, with markets in No. 2 heating oil and No. 6 Industrial Fuel Oil. Trading was initially very slow, with contracts for No. 2 oil averaging less than four per trading day and contracts for No. 6 averaging less than one per day for the remainder of 1978. However, during 1979, the market for No. 2 futures grew, at first slowly and then (with the disturbance in the crude oil market) by leaps and bounds, reaching a maximum daily trading volume for the year of more than 900 contracts in early November. The market for No. 6 futures did not really grow in popularity during this time, and in October 1979 NYMEX dropped this type of contract. Open interest in the No. 2 contracts was in the 2000-2300 range by the end of 1979. Maximum daily trading volume climbed to over 5000 during 1980, with open interest in the 11,000-13,000 range by the end of the year. During 1981 new daily trading records were set several times, culminating

in a volume of 12,570 contracts on October 22, while the open interest in the market grew enormously to the 30,000-34,000 range. 1982 was more a year of consolidation than of growth, as few new records were set, but trading volume became somewhat more consistent and open interest settled in the range of 20,000-25,000.

In early 1981, the London International Petroleum Exchange (IPE) commenced operations, offering gas/oil contracts. Daily contract volume climbed to highs above 5,000 contracts in early 1982 before settling down in the 2000-3000 range later in the year. NYMEX introduced leaded gasoline contracts in late 1981 in two forms -- New York Harbor and Gulf Coast (Houston) -- and added a Gulf Coast option for its No. 2 contracts. It appears that the added delivery point was not really all that useful for attracting additional trading. By late 1982, the gasoline contracts were running a daily volume of 500 to 600, with the open interest in the range of 4000-4500. The Chicago Board of Trade (CBT) now offers trading in unleaded gasoline and heating oil contracts, but does a very small volume.

Analysts have noted that the price movements in the energy markets during late 1982 were not favorable to futures market activity, since the motivation for hedging in futures contracts presumably comes almost entirely from the desire for protection against adverse price movements, which have been upward.

### Crude Futures

On March 30, 1983, both NYMEX and CBT introduced trading in futures on crude oil. These futures attracted considerably more attention than the earlier introduction of product futures had,

despite the general oil market conditions, which were thought to be unfavorable for futures trading. Opening day volumes were 1184 contracts for NYMEX and 3573 contracts for the CBT, and although trading volumes have been quite variable on both exchanges, there has been a steady and healthy growth in the open interest on both exchanges. The larger the open position, and the larger the amount of trading and the number of market participants, the more liquid the market is and the more the prices in the market reflect the views of a large number of market participants. The liquid market is advantageous, because it allows those desiring to do so to enter or leave the market more easily. Market participants are also more likely to wish to participate in a market the prices in which are regarded as being an accurate reflection of the informed opinion of many people in the marketplace.

The current trade in energy futures, while apparently healthy and likely to grow in the future, is still quite small compared to the relevant physical products. Since a contract equals 1000 barrels or 42,000 gallons, it is easy to calculate that the current average daily trading in No. 2 oil amounts to about 6 million barrels, while the open interest is in the range of 20 million to 25 million barrels. Given that only two percent of contracts traded actually result in products being delivered, the physical product transactions connected to the futures markets represent only 120,000 barrels per day for heating oil. The combined volume of the two crude markets amounts to only one million to three million barrels per day, and assuming that the same kind of percentage actually delivered applies, the physical

volume is only 20,000 to 60,000 barrels per day. For comparison, the December 1982 average domestic crude oil production was 8.6 million barrels per day, and imports of crude and products combined were running at about 4.5 million barrels per day.

This lower figure is, however, misleading, since a participant who enters the marketplace to assure himself future availability of product at a price pre-determined by the futures contract need not actually take physical delivery in order to have successfully undertaken that hedging strategy. He might liquidate the contract for cash in the futures market and purchase oil in the spot market. In such a case, the futures market would have fulfilled the function of assuring product availability at a certain price, even though physical delivery on the contracts was never taken.

#### Market Participants

NYMEX suggests that a significant portion of their business comes from producer hedging and trade by independent distributors, although the identities of individual customers are not released by the exchange. Publicly (self-)announced market participants include American Refining (hedging a large diesel contract), NGL Supply, Inc. (a trading company in petroleum products headquartered in Tulsa), and the Southern California Rapid Transit District. According to NYMEX:

"In September 1981, the State of California enacted legislation permitting SCRTD and the San Diego Transit Corporation to invest in No. 2 heating oil futures on the New York Mercantile Exchange. Because of diesel fuel and heating oil price similarities, the agency is able to hedge fuel oil requirements on the futures market."

In general, it appears that the present market is too small

feasibly to accommodate many of the larger participants in the oil industry. The consensus is that as the market grows larger and more liquid, more of the larger companies will enter it as their individual interests require.

## CHAPTER II: PRE-CRISIS STRATEGIES

In this chapter we outline a new proposal for managing the SPR prior to a crisis. This proposal involves ongoing sales by DOE of options to buy SPR oil. After outlining this new proposal, we will compare it, according to DOE criteria, to a strategy that relies exclusively on sales by auction of SPR oil during a crisis itself. We will also briefly discuss an alternative proposal that has already been presented by the Industrial Oil Consumers Group for a pre-crisis strategy for SPR management, and we will compare this proposal to the options idea.

### THE OPTIONS PROPOSAL

The proposal here is that the U.S. government sell covered, out-of-the-money call options on designated quantities of SPR oil. They would function analogously to the securities options described in Chapter 1. The seller, the U.S. government, would commit itself to sell specified quantities of SPR oil at specified prices that are above the current world market price. If the current price of oil is \$30/barrel, options to sell given quantities of SPR oil at, say, \$39, \$45, and \$60 a barrel on or before a given date might be written. These would be premiums of 30, 50, and 100 percent above the spot price at the time the options were written. These strike prices are illustrative only; the decision about what percentage over the current spot price of oil to set the strike price for an SPR option is a policy decision. For purposes of comparison, it may be noted that the world price of oil increased by about 200 percent between 1973 and 1974, and by about 50 percent each year in 1978-1979 and

1979-1980.

Those who bought the options would have the right to buy at the specified strike price the quantity of oil represented by the options they had purchased. If the price of oil remained below the strike price through the exercise date, as one would expect it would unless there were a supply disruption, the options would expire worthless. If there were a disruption and the price of oil went to \$50 a barrel, those who owned SPR oil options at \$39 and \$45 strike prices would exercise these options, and the quantity of SPR oil represented by those options would be released by the government to those options holders. The \$60 options, however, would expire worthless.

#### ARGUMENTS FOR SELLING PRE-CRISIS OPTIONS OVER AN AUCTIONS-ONLY STRATEGY

The basic arguments for the superiority of an options-only strategy are: 1) it would increase the price dampening effects of release of a given quantity of SPR oil, 2) it would increase the certainty of some base response to a supply disruption, and 3) it would provide those worried about crude access during an emergency an inexpensive way to insure themselves.

#### Price Trajectory During an Emergency

Any forward sales of SPR oil -- either pre-crisis options or during-crisis futures -- seek to reduce speculative inventory building by refiners compared with a situation where SPR oil is sold at current auction only. Basically, if prices are rising, and refiners anticipate that they will continue to rise in the future, then it makes sense for those refiners to buy oil now and store it in anticipation of being able to sell it later at the

new, higher price. Such stockpiling behavior will make sense as long as the costs of storing the crude oil are less than the increased profits to be made by taking advantage of the increased prices.

When refiners act in this way during a crisis, they put more pressure on current prices, because they are buying oil today. If such stockpiling, which results from individually rational economic behavior on the part of refiners, could be reduced, then prices both now and in the future would decrease. By selling SPR oil for immediate release, the supply curve is shifted out, making more oil available at a lower price now.

These supply effects of release of a given quantity of SPR oil on the spot price, will be by hypothesis the same, whether the oil is released through auctions for immediate release or forward sales, since the government commits itself to release a given quantity of SPR oil, whether now or in the future. Selling SPR oil in this way achieves thereby some price reduction now, but does not greatly affect behavior down the road, because most of the oil sold will be consumed immediately, with only some of it remaining in inventory at a later date. Forward sales of SPR oil have a more favorable impact than auctions on the price trajectory on oil during an emergency through their effect on the demand for oil. (With forward sales, the expectation of the supply available in the future will be higher than with auction sales for immediate release, since some of that oil auctioned for immediate release will be used now and not available in the future.) The expectation of relatively greater supplies available in

the future reduces incentives to demand oil now for speculative inventory building for the future, since the supplies to be available in the future act as an overhang on the market. These decreased incentives for speculative inventory building in turn reduce demand for oil in the present, since speculative inventory building is one source of present demand for oil.

With the demand curve shifted downward for forward sales versus auction and the supply curve constant for the two forms of sale, one can state that forward sales of a given quantity of SPR oil will likely have more of a price-dampening effect during a crisis than a sale of the same amount of oil for current sale by auction. The fact that refiners demand less oil does not mean that less gasoline will be at the pumps. The whole argument is that the demand being reduced is demand for hoarded oil, not oil to be refined and sold in the immediate future.

There are two arguments that suggest that either pre-crisis sales of SPR options or forward sales of SPR oil during an emergency would actually increase prices during an emergency. One such argument is that forward sales which involve selling SPR oil at prices above current prices tell foreign oil producers that we are willing to pay higher prices, thus encouraging them to raise prices on their own. The other argument is that the higher prices attached to forward sales will themselves "drive" the spot price higher. We will respond to each.

Simply put, the first argument suggests that if the price of oil is \$30/barrel, it would be wrong to sell options for the right to buy oil at \$40/barrel, or to sell futures at \$40/barrel (or any price above the current price), because it tells oil

producers that Americans are willing to pay \$40/barrel. Arabs would learn that they could raise the price to \$40/barrel and still find buyers.

The problem with this argument is that the demand for oil, as for other goods, is downward-sloping. That is, demand for oil increases as the price decreases. If the price of oil is \$30/barrel, all market participants, producers included, know that there are some people who would pay \$35 or \$40 per barrel for oil -- and, depending upon the shape of the demand curve, that there probably are even some people willing to pay \$100 or \$200 per barrel for oil. There would just be many fewer buyers than at \$30. The price of oil is determined not by these "infra-marginal" oil buyers, but by those on the margin. Because forward sales at prices above current prices would tell producers nothing that they did not already know -- namely that there are some people willing to purchase oil at prices above the current price -- they would not have the effect suggested by the argument.

If forward sales told oil producers how large demand would be at prices above current market prices, then the argument would have some substance. If oil producers could act as monopolists, they could use the information to determine whether total net revenue would be greater at the higher price than at the lower price. However, this should not be a real concern in this instance, because the SPR is not large enough to suggest what total demand would be at the higher price levels.

The second argument is that selling options can, during an

emergency, encourage inventory accumulation and hence drive up the spot prices as the increased price of the options tells market participants that it is believed that the future price of oil will be higher.

This argument holds that any sort of contract for future purchase -- be it an options contract or a futures contract -- can itself lead or drive the spot price. If, during an emergency, options contracts (or futures contracts) start trading at increased prices, these increased prices will drive the spot price up as well, because these increased prices signal that market participants believe that the price of oil is headed upwards. Thus, the argument goes, the very existence of traded options (or futures) in an emergency can have the undesirable effect of moving the spot price upwards.

Evidence can be adduced that appears to support this argument. With the maturation of a private futures market in home heating oil over the last few years, spot trades have come more and more to be based on futures prices, with the appropriate discount for the cost of capital and storage costs. An article in The Wall Street Journal (February 22, 1983) reported that an oil analyst had noted that "it is becoming difficult to get cash-market price quotes on heating oil before daily trading (in futures) starts on the NYMEX. 'That indicates the oil market is waiting to see what happens on the futures market.'"

However, the existence of an options (or futures) market will not itself drive up the spot price of oil. Such a market communicates a message. It does not change the message. Let us see why by comparing what happens in the spot market

without an options (or futures) market. People's expectations about the futures differ. Expectations about the future course of oil prices play a significant role in decisions to buy oil for speculative or precautionary inventory. And the level of inventory demand influences prices, even without an options (or futures) market.

What the presence of options or futures markets do is to communicate to individual market participants information about the average expectations of market participants as a group. As a general matter, one would expect that those willing to sell oil on the spot market during an emergency would be those who believed that the price of oil was going to rise less than is believed by those buying oil under such circumstances. Absent an options (or a futures) market, a spot price gets set that, among other things, reflects the equilibrium of the diverse expectations of different market participants about the price of oil.

Imagine a marketplace with only two participants, a buyer and a seller. The buyer buys on the spot market because he thinks the price of oil will be \$50 in six months. The seller sells because he thinks the price will be \$40 in six months. A spot price gets established.

Now imagine that a futures market exists. Given those expectations, the futures price for delivery in six months will be \$45. The existence of that futures price doesn't change the average of expectations, and it is the average of expectations that influences the spot price. It only signals both market participants that their expectations might be respectively too

pessimistic and too optimistic, and hence impel individual expectations towards the average for all market participants. In this case, the tendency would now be for both market participants to move towards a shared view that \$45 was the expected price of oil in six months.

This explains why market participants wish to see the futures price before undertaking spot market transactions. The futures price provides additional information about average expectations regarding the future. The degree of variance in expectations is decreased by the presence of a futures market, but the mean expectation remains unchanged.

#### Insurance of Crude Access

A crucial advantage of ongoing sales of options in advance of an emergency over an auction only strategy is that it would give market participants who worry about access in the event of a supply disruption the opportunity to insure themselves regarding both price and availability. They would be guaranteed access to a certain quantity of oil at a certain price, even if the spot market price turned out to be much higher.

If, for example, an independent refiner wished to insure availability of 10,000 barrels/day for a three-month period, he could buy options for 900,000 barrels of oil at, say, a strike price of \$45/barrel. The price he paid for the options -- which in non-emergency times would likely be quite low -- would be his insurance premium. In exchange for paying that premium, the refiner would be assured access to those 900,000 barrels at \$45 a barrel, even if the spot price were to go to \$60 or \$70. This gives an independent a relatively inexpensive way to protect

himself against a supply disruption.

Auctions alone cannot possibly help those worried about the prices they would need to pay for oil during an emergency. Beyond the general impact on the spot market price of a decision to auction SPR oil, there will be no further beneficial impact of an SPR auction on market participants with access problems, because the price at which the SPR oil would be auctioned off would be equivalent to the then-applicable spot price. Even if an auction were restricted to independent refiners, or others with access problems, the auction price of SPR oil would approximate the spot price, because, as long as the bid was below the spot price, auction participants would have an irresistible economic incentive to raise the bid, since they could always resell (arbitrage) oil into the spot market to obtain the spot price.

If the spot price, even after SPR oil release, remains above the prices integrated refiners charge contract customers, then non-integrated refiners with access problems would continue to suffer the effects of the disruption. The ability to purchase insurance that the options proposal provides can therefore be an important benefit to refiners concerned about access.

The recent organization of futures markets for crude oil on the New York Mercantile Exchange (NYMEX) and the Chicago Board of Trade (CBT) could provide a similar kind of insurance for refiners concerned about access that options would provide. Once the markets are fully "up-to-speed" refiners could purchase crude oil futures contracts at then-current futures prices, ensuring

themselves of some level of supply for periods of up to one year in advance, at pre-crisis prices. Refiners might prefer SPR options to standard futures if they were concerned that, during an emergency, the commodity exchanges would not be able to provide "wet barrels" to those holders of long interest who wished to take delivery. (Presumably, the government would not have problems making delivery.) Otherwise, to a refiner interested in supply insurance, government options will not be much different than futures bought on commodities exchanges. They will, however, perform the beneficial function of "thickening" these hedging markets.

#### Increased Certainty About Government Response

A significant feature of pre-crisis options sales is the certainty that it provides. By signing an options contract, the government commits itself to selling a certain quantity of oil at a certain price. If, during a disruption, the spot price reaches the strike price, then the government must release the oil upon demand of the option holder. In contrast to an auction-only strategy, the government achieves at least some minimum response, without having to make any affirmative decision at the time of the disruption. There is necessarily some uncertainty under the current drawdown plan as to whether SPR oil will be released during a disruption, since any discretionary decision necessitates uncertainty.

The certainty of some basic, in-place strategy being implemented during a crisis has several advantages. First, it assures that the SPR will not be a "paper tiger," that ends up not being used to the benefit of our country during an emergency

because of indecision or of threatened blackmail. This increases the price-dampening effects of the existence of an SPR. If, at the beginning of a crisis, market participants know that some SPR oil will be released should the price hit a certain amount, this will have more of a dampening effect on the spot market price than merely the probability that a given amount of oil will be released.

Because the entire world, including oil producers, would know that a disruption would necessarily precipitate a U.S. response that would mitigate the effects of the disruptions, the SPR becomes a stronger deterrent to blackmail by oil producers against the United States. Deterrent effect is a function of the size and probability of response; creating a guaranteed response, as the options strategy would, therefore unambiguously increases our deterrent against blackmail, by increasing the probability of response.

Observers disagree as to whether the weight of pressure on the President will be to release or not to release SPR oil during a disruption. On one hand, there will be public pressure to do something concrete to shorten gas lines, or lower prices, or solve whatever particular problems are caused by a given disruption. On the other hand, there will be significant pressures on the President to hold onto the SPR. First, there could be long term foreign policy problems associated with a decision to draw down the SPR, particularly with oil-producing countries. Second, and most important, uncertainty regarding length and severity of a crisis will increase the temptation to

wait until things get "really bad." If the President were to release SPR oil during a crisis, it is quite possible that he could later be seen as having wasted the SPR regardless of whether or not the crisis proved worse than expected or less severe than expected.

Finally, certainty would also give the President an argument to use against those pressing for delay of SPR release. His hands would be tied; he would have no choice. This argument would be particularly useful in dealing with foreign policy issues.

The problems caused by uncertainty will be especially severe during the initial stages of a disruption. No prudent President would make a decision immediately to release SPR oil during the early stages of an interruption, before much about its length and severity is known. Yet it is during the early stages of an interruption that panic buying and speculative inventory accumulation can set in motion dramatic developments on the spot oil market that can turn out to have fateful effects, even if a disruption turns out to be relatively mild. A crucial advantage of an options strategy is that it puts something in place as a response to an early-stage disruption. Knowledge that there exist options outstanding for release of SPR oil should the spot price reach a certain figure will calm the spot markets during the early stages of a disruption. And if the disruption then turns out to be relatively short or mild, it is likely that oil from the SPR will never even need to be released, because the options will not be exercised.

The decision to put this strategy in place, obviously, would

not be automatic. It is an important political and policy decision that would not be taken lightly. Putting a strategy such as this in place in advance of an emergency does not therefore take the decision out of politics or remove the decision from the President, since the basic decision to set up the policy would require Presidential approval. A subsequent President, who might believe that the SPR should never be drawn down at all during the early stages of an emergency, or that all responses should be left to the time of an emergency, could of course seek to have the policy of selling options on an ongoing basis changed. Furthermore, under the proposed policy the President would still have the flexibility to undertake supplementary measures in addition to the basic options strategy.

#### SPECIFIC FEATURES OF AN OPTIONS SYSTEM

Several points should be noted about how the system might be organized:

1) The government would begin offering SPR options, on a continuing basis, in advance of any emergency. Such options sales could begin as soon as a decision was made to proceed with the strategy.

2) Options would be sold for specified numbers of barrels of SPR oil at specified strike prices and with specified expiration dates. Options might be valid for one year after they were sold (insurance policies typically run for one year). The government might sell options every third month. This would mean that, after the system had been in operation for a year, options would, in the event no disruption had taken place, expire every third

month. Whenever one set of options expired, the government would roll these options over by writing another set with a one-year life. In this way, at all times one year's worth of SPR options would be outstanding. This will assure that, if there is a disruption, options expiring relatively soon -- and thus likely to be exercised relatively quickly, releasing SPR oil -- will always be available.

3) The initial options prices on a given options contract could be set by sealed bid. Decisions would need to be made about who could participate in the bidding (individuals? foreigners?) and about whether to reserve some number of options for certain classes of bidders (such as independent refiners). There might or might not be a secondary market in these options contracts, once issued. These issues are discussed below.

4) The government would need to decide what quantities of oil it was willing to release from the SPR if the price of oil hit various levels. These decisions would need to be made with the realization that the total number of options outstanding at any given time (that is, one year's worth) at different strike prices would represent a commitment to draw down that number of barrels of SPR oil over a one-year period, if the price of oil hit the various strike prices. Thus, if the government sold options to buy 2.5 million barrels of SPR oil at \$39 a barrel, 5 million at \$45 a barrel, and 5 million at \$60 a barrel, in three-month cycles, then a total of 50 million options would be outstanding for a one-year period. (They would not all be exercised unless the price reached \$60 a barrel.) In thinking about the

number of options to make available, policymakers will wish to think about what minimum proportion of the SPR they are willing to have drawn down in a given year at various levels of emergency. Selling options on 50 million barrels of SPR oil during a year would imply a commitment to be willing to draw down about one-seventh of the current SPR if the price of oil hit the highest strike price specified and it would result in the release of the equivalent of about 140,000 barrels a day of oil.

5) The government would also need to decide, in order to implement an options strategy, the strike price or strike prices at which it would be willing to draw down oil. The strike prices should be set at some levels comfortably above the market price of oil at the time the options were written, so that relatively small fluctuations in the market price would not produce a drawdown of SPR oil. The strike prices could either be set at various dollar amounts above the current market price (say, in \$10 a barrel increments over the current price) or at various percentage amounts (say, in increments of 30, 50, and 100 percent over the current price). It should be noted that these strike prices are fixed only for the options contracts written at any given point. When expired options contracts are rolled over, the new ones should be written based on the oil price current at the time. Suppose that the market price of oil was \$30 a barrel when a set of options were written one year previously and had since risen to \$35 a barrel. When the options written a year previously have expired, the new options would be written at increments from the \$35 price current at the time, not the \$30 price current a year earlier.

6) The government will receive revenues, although likely rather small revenues, from selling these options. In the event the options are exercised during an emergency, the government will be paid the agreed-upon strike price for the oil released. It should be noted, however, that this price will necessarily be at most equivalent to and probably lower than the then-current spot price for oil. The government would thus in an emergency be releasing SPR oil at below-spot prices. It is in fact this feature that allows the options strategy to function as an insurance method for those worried about crude oil access during a supply disruption. However, the release price will be considerably higher than the price paid by the government to purchase the SPR oil.

The fact that an options strategy requires decisions in advance of an emergency about the number of options to be sold and the strike prices for those options may invite some anxiety about the whole idea. It is difficult to know exactly how much oil one will wish to draw down or to predict the price effects of the drawdown of a given amount of SPR oil. This uncertainty is no reason, however, to reject an options strategy, as long as the possibility of supplemental SPR drawdown actions by the government remains. Such a possibility should definitely be kept open, both because of the flexibility it allows regarding an overall SPR drawdown strategy and because of its reinforcing effects (for reasons to be outlined below) on the favorable price impact during an emergency of SPR drawdown.

Seeing the options strategy as a basic, minimum-level

strategy that can be supplemented by other measures at the time of a crisis eliminates the need to be overly concerned about the exact number of barrels of SPR oil for which it is appropriate to sell options or the exact strike prices. All one needs to do is to estimate the minimum SPR drawdown one would wish to undertake should the price reach certain designated levels. The estimate should be a low-side one, because, while one would be able to undertake actions in addition to releasing the oil for which options had been written, one would not be able to do less than to draw down the SPR by the amount for which options contracts have been sold, assuming the world price reached the strike price on the options.

As for the uncertainty about the price impact of releasing, say 10 million barrels of oil at \$40 a barrel, our knowledge during a disruption itself is not likely to be any better. If we decide in the midst of a disruption to auction 10 million barrels of SPR oil, we cannot know the price impact of releasing that oil until it is released. Since the options strategy allows supplemental drawdown of SPR oil in the event that the government concludes that the price impact of an earlier drawdown has been insufficient, there is really no difference between an options strategy and an auctions-only strategy on this point.

### Organizing A Market

The big question in terms of the ability to organize a market for ongoing sales of SPR options is how much demand there will be for such options during non-crisis periods, particularly during an "oil glut" such as presently exists. Obviously, the less market participants are worried about dramatic

increases in the price of oil, the less interested they are likely to be in buying options -- just as any insurance policy becomes less attractive, the less worried one is about the risks one would insure against. In addition, in times of economic hardship for oil firms, they may feel that they are less able to afford insurance (although, from a theoretical point of view, since insurance is not a consumption good, insurance purchases should be based on attitudes towards risk rather than one's wealth position).

One might argue that a slack oil market would not affect the total demand for the options, but only the price people were willing to pay for them -- in other words, in a slack market the options would be sold at a lower price. Certainly, for example, were the government simply to give out the options for free, there would be no problem getting people to take them, no matter how low people might regard the probability of a large price increase. However, the expected bid on the options during a slack market might be less than the within-firm decisionmaking costs of choosing to participate in the market and determining what one's bid would be. If that were the case, companies might fail to bid on options, even though they had some value greater than zero.

The major decisionmaking cost for companies is, in fact, probably the cost of deciding to participate in the market in the first place. Once that decision is made, it would probably be fairly easy to determine one's bid. Given that, a very slack oil market may not be the best time to begin offering SPR options,

since the lower value of the options under these circumstances would be more likely to be less than companies' decisionmaking costs for participation in the market.

Options offer independent refiners, who, since they do not control their own crude have particular reason to be worried about crude access during an emergency, a particularly attractive opportunity to insure themselves. One would therefore expect that independent refiners would be an important source of demand for options.

Major integrated refiners might, however, also have reason to be worried about access during an emergency, particularly to the extent they rely on foreign supplies from politically troubled areas. However, since they are larger, major integrated refiners are in a better position to diversify their risks and thus to self-insure. Furthermore, political fears may inhibit the majors from purchasing options. As has been noted, an option purchaser will, in the event of a disruption, be able to purchase SPR oil at below then-current market prices. Indeed, this is an attractive aspect to the proposal from the point of view of independent refiners. And it would, of course, be economically attractive for the majors as well. But it might well be politically unattractive, because it is easy to see a calculation of the number of SPR barrels a major oil company option holder has purchased during a disruption at below-market prices and a newspaper story about the amount of money the government was "cheated" from or "outsmarted" on by the company. Journalistic scrutiny of this sort is less likely in the case of independents, and is far easier to explain as well.

## The Pricing of Options for SPR Oil

Purchase of SPR options, particularly by small independent refiners, may be contingent upon the price of the options. Thus, the question arises: Can the option price be predicted prior to their issuance, given the current spot price of oil and the option strike price? Four methods exist to evaluate this question: 1) general observations concerning options price movement, 2) application of a rigorous stock option pricing model, and 3) comparison with a similar stock option. While these methods do indicate that the price of SPR options would be rather low, it is not possible with certainty to predict the options price before their issuance.

(1) General observations on options price movements: As the length of time until the expiration date increases, the price of an option increases, if all else is held constant. This is because the expected return on the option rises as there is more time available for the market price to exceed the strike price. Furthermore, as the strike price increases, the option price decreases. If we assume that the strike price is set so that the options are not expected to be exercised unless a dramatic event occurs, i.e., a large (perhaps 30 percent) rise in oil prices, then the options should be relatively inexpensive.

SPR options will be issued far "out-of-the-money." The intrinsic value of the options at their issuance will be zero, because the strike price will be far greater than the current spot price. The hedge ratio of the options--the change in the option price due to a dollar change in the market price--will

also approximate zero. Small changes in the spot oil prices should not be expected to have a large effect on options price because the options are so far "out-of-the-money."

However, as the spot price of oil approaches the strike price, the options price will become more sensitive to increases due to its leveraged nature. Thus, changes in the prices of outstanding options could be considerable if the spot price were suddenly to approach the strike price.

(2) Stock options pricing model: We examined the technical literature on options pricing. Current stock pricing theory contends that the determinants of the price of stock options are the market's expectations of the future price of the underlying stock including a speculative time value of the option. This time value reflects the possibility that the future stock price may actually exceed the stated exercise or strike price of the option during the exercise period. The current stock price reflects similar expectations on the underlying stock, defined as the present value of the expected return on the stock over its life. Consequently, it is believed that a stock option's price is primarily determined by the current stock price.

Several option pricing models have been developed in recent years. The most widely accepted model is that advanced by Fischer Black and Myron Scholes in 1973. It values call options on securities based on five parameters: 1) the current stock price per share; 2) the strike price of the option per share; 3) the time remaining to expiration; 4) the level of interest rates over the exercise period, and; 5) the volatility of the underlying stock measured as the variance per year of the natural

logarithm of the stock price.

Black and Scholes developed a formula for calculating the option price, given this data, all of which are relatively observable, except for the volatility of the price movement for the underlying securities (or, in this case, physical commodity). We made a calculation, using the Black and Scholes formula, for the likely price of an option on a barrel of SPR oil, given the following conditions: 1) a current spot price of \$30, 2) a strike price for the option of \$40, and 3) a one-year length of the option contract. Using these assumptions, and calculating the volatility of the price of oil based on the history of oil price movements since 1968, we calculated that the expected price of such an option would be 15¢ per barrel.

3) Comparison with a similar stock option: As of early November 1983, the market price of one share of Exxon common stock was about \$39. The then-current price of an Exxon stock option expiring in July 1984 with a strike price of \$45 (i.e. about 15 percent out-of-the-money) was 63 cents. This should not be construed as implying that an SPR option that was a similar percentage out-of-the-money and had a similar expiration period would necessarily be similarly priced. The option price of Exxon stock takes into account market expectations of Exxon's overall profitability, return on investment, future acquisitions and divestitures, and other factors as well as the future price of oil. However, it also suggests that the price of an option to buy SPR would be low. Note that the Exxon option is only 15% out-of-the-money (none is offered that is further out of the

money than that), while options on SPR oil would likely be more out-of-the-money than that.

#### Impact of a Secondary Market for SPR Options

The government must decide whether people should be allowed to trade SPR options in a secondary market. (Such a market might be organized by one of the mercantile or options exchanges.) One can imagine a whole range of possibilities: 1) not allowing a secondary market at all; 2) allowing a secondary market only in options that the government had written; or 3) allowing a full-fledged secondary market, like other options or futures markets, where private parties would be allowed to write uncovered options on SPR oil ("go naked") and sell them to anyone who might want to buy. If a secondary market were allowed, initial option prices could still be established by sealed bid, but once the options contracts had been sold to the highest bidder, options holders could sell them to others at prices established in the marketplace. This is the system currently used for Treasury bills, initial coupons for which are set by sealed bid, but which then trade in a secondary market.

It would not be unprecedented for there to be no secondary market in SPR options contracts. Secondary markets do not exist for most insurance policies. Nevertheless, existence of secondary markets would improve the options proposal in at least two ways. First, a secondary market would allow people to come into the market at any time. This feature would be particularly important during the early stages of an emergency, when some who had not purchased insurance earlier might like to do so. Without a secondary market, the only alternative they would have would be

to buy options the next time the government issued them. The problem would be that these options would run for a whole year. It is, of course, possible to exercise an option at any time up to the expiration date, but buying an option that was going to run for an entire year would be an expensive alternative for a firm that needed access to crude quickly, because the longer-term options have larger premiums attached to them and would therefore cost the purchasers more than buying a closer-in option on the secondary market.

Second, not having a secondary market makes the initial purchase of options somewhat less attractive. Some potential buyers may like the freedom re-saleability gives them to get out of their option position before a year is up. Furthermore, a secondary market increases the speculative gains that options buyers could make in the event of an emergency, because until the options contract reaches its expiration date, it will have a speculative premium associated with it. Say an options buyer buys a \$45 per barrel option prior to an emergency, when the spot price is \$30 per barrel, and pays 25 cents per barrel for the option, which will expire one year later. Six months later there is a supply disruption, and the spot price goes up to \$40 per barrel. Although the option is still "out of the money," it might well, with six months left to go before it expires, have a price in the secondary market of something like \$2 an option. The option purchaser who had bought the option prior to an emergency could, if he wished, now sell the contract at a profit of \$1.75 an option to somebody else. If these attractive

features arising from the presence of a secondary market are not present, presumably some potential options buyers at the margin will choose not to purchase options. The equilibrium price of the options (and hence the revenues that accrue to the government) will be somewhat lower than it otherwise would have been.

There are, however, disadvantages to secondary markets that policymakers will also wish to take into consideration. The most important disadvantage may involve public perception of the nature of government policy. Options and futures markets are widely associated with speculation, which many people regard as non-productive and suspect. A secondary market, as noted, increases the potential for and visibility of speculative profits. The air of speculation is much increased if private parties are allowed to sell naked options contracts for oil they don't have.

In normal options or futures markets, the presence of speculators who buy or sell naked positions is valued for the additional players it brings into the marketplace, because the extra players increase the liquidity of these contracts and ensure that the equilibrium price better reflects the varying judgments of a large number of market participants. If the decision is made, however, not to allow private individuals to own options, that would leave only private short sellers in the secondary market. That one-sidedness might distort the options price rather than make it a better reflection of supply and demand.

Another problem with allowing naked sellers into the market

is the problems this creates if there is an emergency. Many speculative short sellers in futures markets are individuals, and a wild increase in the price of oil during an emergency would produce huge financial losses for these people. Many oil companies, particularly the majors whose political situation is more sensitive, might be hesitant to purchase options altogether if they knew they were participating in a market where, during an emergency, individuals who had been naked short sellers might suffer large financial losses or even bankruptcy. A speculative short seller who went bankrupt couldn't make physical delivery of the oil. The private exchanges have rules that require exchange members to make sure that contract holders are paid cash if a short seller goes bankrupt, and options holders could use their cash profits to buy oil in the spot market if they wished. But a large buyer might be afraid that his entry into the spot market might itself increase spot prices. From society's point of view, options purchases from naked short sellers have a negative effect on pre-crisis inventory accumulation (to be discussed further below), but do not bring additional oil into the market during a crisis.

Finally, from a foreign policy point of view, part of the special deterrent value of an options strategy for SPR drawdown is that once the government has, before an emergency, sold the options contract, it is bound by its contractual commitment should a disruption occur and the price of oil rise. If options contracts are traded in a secondary market, foreign governments might try to pressure the U.S. government to buy its own options

back in the secondary market and close out its position. If a decision were made to allow a secondary market, one might wish special statutory provisions, adopted in advance, stating that it would be contrary to the goal of the SPR to have the government re-purchase its own options, and prohibiting the practice.

The presence or absence of a secondary market, finally, has substantive implications for the exact timing of SPR release during a disruption. If the spot price has, in an emergency, gone over the strike price for the option, the option price will, if there is a secondary market in options, still remain greater than the difference between the spot price and the strike price up until the option's expiration date. For example, if the spot price is \$49/barrel in March and there is a June option at \$45/barrel, that option would trade in the secondary market for some amount greater than \$4, because of the option's leveraged nature and the possibility of speculative profits. What this means is that options are not likely to be exercised, if there is a secondary market, until their expiration date, because any options holder who wanted oil in March would do better selling the option and buying oil on the spot market than exercising the option prematurely. If, by contrast, there is no secondary market, there are no speculative profits to be made by trading in the options, and an options holder who wants oil before the option's expiration date will exercise the option as soon as the spot price goes above the strike price. The disadvantage of a secondary market is thus that it puts far greater strain on the capacity of the SPR physically to deliver oil in an emergency, since deliveries would be less spaced out--most options holders

would wait to take delivery until right before the options expired. The more one is worried about the deliverability problem, the greater the argument for having no secondary market in SPR options.

There is, however, an important advantage during an emergency to just this result of having a secondary market, which is the flip side of the disadvantage just noted. If there is no secondary market and therefore no ability to re-sell options contracts prior to their expiration date at a premium over the difference between the strike price and the spot price, then many options holders may well exercise their options any time the spot price goes above the strike price on the option, even if it does so only briefly. One of the criticisms sometimes made of the use of price triggers for drawing down SPR oil is that a temporary blip in the volatile spot price could trigger drawdown of SPR oil, even in a non-serious disruption. If options can be traded in a secondary market, a temporary blip will not lead to any drawdown, because the options will trade at a premium over the difference between the strike price and the spot price right up to the expiration date.

Given all this, it is a policy judgment whether to allow a secondary market and, if so, what kind of market to allow. The optimum course might be to allow a secondary market in the original options only and not allow private parties to write naked options on SPR oil they do not control. (It should be noted that the Anti-Assignment Act prohibits trading in governmental contractual obligations, so a statutory change might be

required to allow a secondary market in SPR options.)

The issues involved in ownership limitations or set-asides for option purchases are identical to those involved in such limitations or set-asides for SPR oil released by other methods, such as auctions. They are the subject of separate work being done as part of this project, and they will therefore not be discussed here. It may be noted, however, that should decisions be made to limit the right to own SPR options or the number of options one might own, these could be implemented in an options system, including a system with a secondary market, simply through provisions in the options contract. The contract might, for example, have a provision that the government will sell a barrel of oil to the options holder, but only if, say, the holder is a U.S. entity. Foreign firms or individuals would then be unable to exercise such options.

#### THE DOE EVALUATION CRITERIA

Determining the desirability of a drawdown plan requires formulation of criteria for evaluating exactly what it means to have a good drawdown plan. DOE has asked us to address a number of criteria and evaluate these proposals against them. Many of the criteria have been addressed in our discussion above. The others we discuss below. They are:

1. What impact will the drawdown plan have on refiners' inventory behavior?
2. How flexible is the drawdown plan?
3. Would statutory changes be required?
4. What impact will the plan have on SPR financing?

### Effects on Inventory Behavior

The nature of worries about private inventory behavior in normal times is exactly the opposite from the worry about inventory behavior during disruptions. In normal times, the view is that some level of private inventory stocks is desirable to cushion against supply disruptions, and the worry is that the existence of an SPR might reduce the incentives for private firms to hold stocks, leaving the entire burden on the taxpayer through the SPR. In emergency times, the worry is that precautionary and speculative inventory accumulation by private firms is a main contributor to price rises, and the hope is that SPR drawdown can dampen such inventory accumulation and hence price rises.

There is a relatively straightforward answer regarding the impact of an options strategy on inventory accumulation during an emergency. Any use of the SPR is designed to reduce inventory accumulation during an emergency. For the reasons outlined above, a strategy involving forward sales, such as this options proposal, will have a more positive impact on reducing inventory accumulation than one involving auctions for immediate release.

The impact on desirable inventory accumulation prior to an emergency is somewhat more complex. In terms of the effects of various SPR drawdown policies on private stockpiling behavior in advance of an emergency, the very existence of an SPR tends to reduce private stockpiling behavior. An SPR is intended to dampen price increases in the event of an emergency. Anything that dampens the expected trajectory of oil prices will reduce speculative inventory accumulation that is designed to profit from such price increases. Any policy, including pre-crisis sale

of options, which increases the expectation that SPR oil will actually be drawn down in the event of an emergency, will sharpen any negative effect of the existence of an SPR on private inventory behavior prior to an emergency. Furthermore, any drawdown plan -- whether pre-crisis sales of options, a pre-crisis allocation plan, or whatever -- which increases certainty about access during an emergency will reduce private precautionary inventory accumulation among those refiners who become more assured of access as a result of such a plan.

The direction of the effects noted above is clear, but their magnitude is not. Holding inventories for long periods of time is expensive, and one may question the extent to which firms are likely to hold significant inventories at all, as they balance the private cost to them of holding such inventories against the expected private gains. So, in fact, the magnitude of negative effects on private inventory behavior may be quite small. The justification for holding a public SPR in the first place is that the social costs -- in terms of both our national security and the performance of our macroeconomy -- of an oil disruption are far greater than the private costs to oil firms of such a disruption. Private inventories will be kept at a very inadequate level, since private firms can only be expected to weigh private costs against private benefits. This justifies having an SPR despite any negative effects on private inventory accumulation.

For many firms worried about crude access during an emergency, the alternative to purchasing insurance through buying options is likely not to be private inventory accumulation, but

rather no insurance at all. At an interest rate of 10 percent and a cost of oil of \$30 a barrel, the capital costs of holding a barrel of oil in inventory are \$3 a year, assuming no new storage capacity is constructed. The annual cost assuming the need to construct new storage capacity are estimated at \$7-11 a year, depending on the amount of additional capacity constructed. These are very significant costs. The evidence from above on the likely price of SPR options suggests that options purchases would almost certainly be a dramatically cheaper way to buy the same insurance protection.

The cheaper the protection, the more likely a firm is to purchase it. But without options, given the carrying costs of inventory, one is likely to have the worst of both worlds. Oil users, particularly independent refiners, are unlikely to keep any significant private inventories prior to an emergency, and during an emergency they will experience the sorts of access problems that create both individual hardships and macroeconomic chaos. Some decreased amount of private inventorying is a small price to pay for avoiding those problems.

### Flexibility

Flexibility is an important aspect of SPR drawdown strategies for several reasons noted earlier. First, one doesn't know at the beginning of a disruption what its duration and magnitude are likely to be. Second, one doesn't know until after one has released a certain amount of SPR oil into the marketplace what the price impact of that drawdown will be. Auctions, with decisions about timing and extent to be made only once a crisis has come, appear to be superior on this dimension to any plan,

including an options strategy, that involves a forward commitment by government, i.e. commitment at one time to taking certain actions at a future time. Auction decisions may be tailored to specific circumstances at the specified time an auction is organized.

In fact, however, an options strategy can be as flexible as a strategy where decisions are made at the time of a crisis as long as the possibility remains open to supplement drawdown through options sales with other drawdown actions if need be. If the options strategy is in place as a minimum response only, no flexibility is lost in terms of taking additional steps should they be desired. The specific tailoring at the time of the crisis can thus take the form of other measures decided on at the time, over and above the basic measures the options strategy involves.

There is a sense, nevertheless, in which an options strategy is less flexible than any strategy that leaves all decisions to the time of an emergency. An options strategy specifies a minimum response, and there are certainly participants in policy debates surrounding the SPR who believe that the government's response in terms of the SPR should, except in the most severe emergencies, be zero -- that no SPR oil be drawn down except in the most direful of emergencies, so that all the oil can be saved for, say, national security uses.

It would certainly be inappropriate to have an SPR drawdown plan involving options sales, adopted at one time, be binding on all future decision-makers, when issues involving SPR drawdown

are controversial and where, for example, a new President might wish to change the basic policy. But the options strategy does not bind future Presidents or Congresses in such ways. Since only a year of options would be outstanding at any one time, and since some portion of those options would be rolled over every three months, a change in basic policy could be reflected quite quickly simply by changing the strike prices at which options are sold (say, from a minimum of 25 percent over the then-current oil price to a minimum of 200 percent over the then-current price) or by ending new sales of options entirely. Within one year of a decision to change policy, all the "remains" of a previous policy would be gone. And, if a decision to change strike prices could be made by executive order, such a policy change could be adopted quickly by a new president.

Finally, there is one other way an options strategy could limit flexibility. Those who had already purchased options, especially any whose primary motivation was speculative gain rather than insurance, might be expected during a crisis to oppose politically additional SPR drawdown beyond the quantities for which the government had sold options, because the price-dampening effect of such supplementary drawdown would reduce their speculative gains. One may debate just how heavily such considerations would weigh, given the vital national interests involved in the debate about drawdown during a crisis. Furthermore, the fact that it had been announced in advance that the government reserved the right to undertake additional responses beyond the original options sales would close to existing option owners the argument that they were being unfairly surprised by

such a decision.

#### Administrative Feasibility

As long as the government did not itself need to run a secondary market in SPR options, the organization of the system for ongoing sales of SPR options would not present major difficulties. A sealed bid system similar to that used regularly by the U.S. Treasury for the sale of Treasury obligations could be applied. An options system would not require the government to return to the marketplace to close out contracts. Either the contracts would expire worthless or they would be exercised.

There are issues involving specification of the quality of SPR oil and regarding possible bottlenecks in pipeline delivery capability that would be similar for an options and an auction system. The quality of SPR oil to be delivered would need to be specified in options contracts, just as it would need to be specified in an auction. If there is no secondary market for SPR options and, therefore, for reasons noted earlier, all the options would be likely during an emergency to be exercised in a short period of time, the physical drawdown capability would likely be insufficient to supply all the oil immediately to those exercising the options. The existing futures exchanges have provisions in futures contracts calling for delivery on a pro-rata basis to those taking physical delivery, until the delivery is completed, in the event of such bottlenecks. One could adopt a similar system for delivery of oil to those exercising SPR options. These provisions would need to be stated clearly in the options contracts. This would allow market participants, who

would know the physical drawdown capability for SPR oil as well as the number of options contracts outstanding, to plan accordingly.

#### Would Statutory Changes Be Required?

The Energy Policy and Conservation Act of 1975 (EPCA) allows drawdown of SPR oil only after a finding by the President that an energy emergency exists. Presumably, an auction would be triggered by such a Presidential declaration during an emergency. A strategy such as the one outlined here that would involve the government signing a contract prior to an emergency committing itself to sell SPR oil may well create problems under the existing statute.

One possibility might be for the President to make a declaration at the time options sales were to begin to the effect that an energy emergency for the purposes of EPCA will be deemed to exist whenever the spot price of oil hits a level 50 percent above the price prevailing at the time when any options were sold (assuming that option strike prices were set starting at 50 percent above the spot price at the time of their sale). This general finding might be acceptable under EPCA. If it were not, a statutory change to allow the government to sell options on an ongoing basis prior to an emergency would be required.

It would also be possible to modify the proposal presented here into a proposal to sell what one may call "contingent options," without creating any statutory problems. A contingent options contract would be exactly like the options contract discussed here, except that it could not be exercised by the option holder absent a Presidential declaration of an energy

emergency pursuant to EPCA. Selling this kind of contingent option would eliminate some of the important advantages of the proposal presented here. Since a separate Presidential declaration would still be required at the time of an emergency, the price-dampening and deterrent advantages of automaticity would be lost. However, some of the advantages in terms of the ability of those firms worried about crude access during an emergency to insure themselves would be retained. To the extent that these firms believed that whenever a situation arose where they were having access problems, the President would likely declare an emergency, thus allowing them to receive the oil they had purchased options to buy, they could use such options purchases to insure themselves. They would be saying, in effect, that whenever the insurance turned out to be needed, it would be there. However, the more they doubt this, the poorer the insurance policy would be. A given contingent options contract of this sort would have a lower premium attached to it than a non-contingent options contract that could be executed whenever the price hit a pre-specified level.

#### Impact on SPR Financing

Selling options would generate a very modest, by steady, stream of income to the government during non-emergency times. If options were sold for 50 million barrels of oil a year and they sold at an average price of 10 cents an option, \$5 million a year would be generated. Were they to sell for an average of 50 cents an option, \$25 million would be generated. During an emergency, however, the government would realize less money for

SPR oil being released than it would through auctioning it off, since the auction price will equal the spot price, while the option strike price will necessarily be lower than (or at the most equal to) the spot price, or else the options will not be exercised. Such a result is a necessary correlate of the ability of an options system to provide those worried about crude access with a way to insure themselves against this problem. However, it should be noted that the price the government would realize for the SPR oil it released, while it would likely be lower than the then-current spot price, would nevertheless likely be considerably higher than the price the government originally paid for the oil, since the strike prices are set at a considerable premium over the spot price current when the options are written.

One cannot predict in advance the likely sales price of any SPR oil distributed by set-asides or other non-market allocations, and it is therefore impossible to know whether the price obtained for oil released that way would be greater or less than the price obtained for oil released to those who had purchased insurance in advance of a crisis by purchasing options.

#### THE IOCG PROPOSAL

The Industrial Oil Consumers Group (IOCG) has developed a drawdown plan, which, because it is a form of ongoing pre-crisis strategy, deserves mention here. The IOCG proposal envisions DOE holding ongoing contingent auctions for SPR oil. That is, like the options proposal, the government holds "regular" actions for sale of rights to a limited amount of SPR oil, to be released during an emergency. The auctions would be contingent auctions, because the right to buy the SPR oil that would be achieved by

submitting a winning bid would only become valid if the president were to declare an energy emergency.

All bidders to the auction would have to agree to documents that would establish the terms of the sale if an emergency were to take place. Rights to SPR oil won through competitive auctions would last only until the next auction. There is no way to force the President to declare an emergency under certain circumstances, but IOCG does emphasize the need for an emergency declaration to be made soon after a disruption begins. The IOCG proposal requires no changes in statutory language. The IOCG proposal is similar in many ways to the options proposal outlined here. Differences include:

(1) The IOCG proposal lacks the advantages of automaticity that are one key to the plan presented here. As long as uncertainty exists concerning whether the President will actually declare an emergency, the price-deampening effects of certainty would be lost, and independent refiners can no longer guarantee themselves supply insurance by participating in the auction. On the other hand, however, the IOCG proposal can be implemented under current legislation, where as the options proposal may require new legislation.

(2) Possible participants in the IOCG auction would have something of an unclear idea of what exactly it was they were bidding on. They would in fact be asked to say what they would be willing to pay for a barrel of oil if there were "an emergency." Since "an emergency," as declared by a

President, might be of varying levels of severity, one would expect that their willingness to pay would vary depending on the severity. Thus, people would be bidding for something-- "oil in an emergency"--whose characteristics they are uncertain about. This would discourage participation and lower the average winning bid. By contrast, under the options proposal, people would know what they were bidding for, namely the option to buy oil at a specified price, rather than the chance to buy oil in an "emergency" whose specific features are uncertain.

(3) The IOCG plan does not allow for secondary marketing in rights to buy SPR oil during the period between the holding of an auction and the declaration of an emergency. As noted earlier, it is unclear whether the government would wish to allow a secondary market in options. But at least the options proposal provides that possibility, and the IOCG plan does not.

### Chapter III: STRATEGIES DURING A CRISIS

In this chapter, we discuss proposals that DOE sell futures contracts on SPR oil during a crisis or that auctions be held at a given point during a crisis for delivery at a later date (forward sales). We will compare these proposals, according to DOE criteria, to a strategy relying exclusively on auctions for immediate delivery during a crisis and to each other.

#### THE FUTURES PROPOSAL

As discussed in Chapter I, a futures contract is a standard agreement to buy and receive (or sell and deliver) a stated quantity and quality of a commodity at a definite future date at a specific price. The proposal here is that DOE sell specified quantities of SPR oil for future delivery. The essential argument for doing so has already been presented, namely that this will bring about a greater price-dampening effect per barrel of SPR oil released than would simply auctioning the oil for immediate release. A strategy to release SPR oil through the sale of futures contracts raises several issues concerning implementation. These include:

1. Should the government sell futures on its own, or would it use existing futures markets? If it uses existing markets, would it hire a broker or act as its own broker?
2. Is the standardization inherent in futures contracts a problem?
3. Would the government act as a regular trader in the market? In particular, would DOE ever go long in the futures markets to avoid release of SPR oil?
4. How would the price be set?

### Using Existing Markets

DOE could sell futures through existing futures markets, or it could create its own futures market. Both possibilities have problems and opportunities associated with them. Selling futures outside existing markets might make it easier for DOE to impose restrictions on possible buyers or to grant preferential treatment to some classes of buyers. However, selling futures independently of existing markets would be a problem in and of itself. Such sales would appear to place the government in competition with those existing markets. In addition, the government would be forced to create a bureaucracy to oversee operation of the market.

Because this competition with existing markets is a significant institutional obstacle, and the bureaucratic problems are also non-trivial, if the government is to sell SPR futures it seems to make sense to do so through existing markets. DOE can simply enter existing markets, acting as its own broker, and sell as much oil as it desires (or for which there are buyers).

### Standardization

One issue relating to the sale of futures in existing markets is how the magnitude of such sales will affect the markets. Presumably, out of fairness, DOE would sell futures in all exchanges trading in crude oil futures. Nonetheless, SPR sales might well still swamp the markets, especially when one realizes that daily trading in heating oil futures averages 5,000-7,000 contracts.

Use of existing markets raises certain technical issues that

would be of lesser importance were the government to sell crude oil futures outside existing markets. The cornerstone of futures markets is the standard contract. All the qualities of the oil (density, sulphur content, delivery location) are specified. The government must take account of the fact that the oil contained in the SPR may not (and probably will not) match all the characteristics required by the standard contract. This should not be too difficult to accommodate since it is a common practice to have agreed-upon terms for delivery of a product that varies somewhat from that specified in the futures contract. However, if potential buyers of SPR futures are concerned about DOE ability to make delivery on oil with agreed-upon characteristics, then we still have something of a problem, regardless of any actual capability we may have to make delivery.

#### Should the Government Trade in the Futures Markets

One of the elegant features of the plan to sell futures is that it allows the government to change its mind about releasing oil by going long in the futures market, in effect cancelling its earlier short position which would have led to a drawdown. However, balanced against this added flexibility is the fact that it is the action of returning to the market which would leave the government most open to the charge of gambling on SPR oil. The gain in flexibility is really only a reduction in transaction costs. This cost decrease is not as important as the need to minimize the appearance of government gambling. The government should not re-enter the market.

#### Pricing

The price of government oil sold in futures markets would be set by the futures markets. There is no reason that the Secretary, at the time of a decision to release oil, could not establish a minimum price. Traders in futures markets often operate that way, giving instructions to their brokers to sell or buy only if a commodity reaches a certain price.

#### Forward Contracts

An idea that is very similar to the idea of using futures during an emergency is for DOE to hold auctions at one point during the emergency, for delivery at some specified point later in the emergency. What would be sold at such auctions is a forward contract to buy barrels of SPR oil at a specified future date.

#### COMPARISON WITH AUCTION SALES

##### DOE Criteria

As noted earlier, DOE will evaluate any drawdown plan on the basis of the following five criteria:

1. Price effects;
2. Inventory effects;
3. Flexibility;
4. Impact on SPR financing;
5. Ease of implementation.

As discussed in Chapter 2, futures, forward contracts, and options should have similar effects on the price of crude oil. They all cause the price of crude to fall for two reasons. The first is that any sale of SPR oil shifts out the supply curve for crude oil, lowering the price. The second reason for lower

prices, and the one which motivates this paper, is that forward sales, such as futures, forward contracts, and options, shift out the supply curve for future deliveries of crude oil, thus reducing refiners' incentives to build speculative inventories, thus reducing immediate pressure on the demand for crude oil, thus lowering the price beyond what simple auctions could accomplish.

The impact which futures or forward contracts would have on refiners' inventory behavior is less clear. As noted, either plan would reduce speculative inventory building once a disruption occurred. However, the impact of the drawdown plan on pre-crisis inventory behavior depends upon the mechanism chosen to trigger a drawdown. Any plan, such as the options proposal, which guarantees the release of some SPR oil, will reduce refiners' incentives to self-insure. Now, as noted, this may not be a problem. To the extent that we do believe that a drawdown plan will affect refiners' pre-crisis inventory behavior, a plan which leaves refiners uncertain as to whether (and under what circumstances) there will be a drawdown will be most effective in preserving self-insurance incentives. The plan to sell forward contracts under existing authority obviously does so, because a drawdown is a discretionary presidential decision. The plan to sell futures would require new legislation, so one cannot predict its effects on pre-crisis inventory behavior.

Both futures and forward contracts would provide a great amount of flexibility to DOE in dealing with a disruption. DOE would have the authority to decide how much SPR oil to release through futures or forward contracts. It could also easily control when sales and releases would take place. Finally,

either plan could be authorized in combination with the simple auctions envisioned by the current drawdown plan. Here again, a plan which would not require a drawdown, such as forward contracts, would be somewhat more flexible than one that would, such as options, but the fact that either plan can be combined with auctions means that all the forward sales strategies would provide more than adequate flexibility.

It is almost impossible to predict what the impact of futures or forward contracts will be on SPR financing. Both plans rely on competitive sales, which would realize the maximum amount of revenue at the time of the sales. However, because prices will be particularly volatile during disruptions, DOE could either "make" or "lose" money from the sales. If, during the initial stages of a crisis, DOE were to sell six month futures at \$60/barrel, and the price six months later turned out to be \$80/barrel, DOE would have lost money to the extent that DOE could have waited the six months and sold the oil at \$80/barrel. If the price turned out to be only \$40/barrel, then DOE would have made money.

A plan to sell futures on SPR oil would be almost unquestionably more difficult to implement than a plan to sell forward contracts. Futures sales outside existing exchanges would appear to be government competition for the exchanges. A plan to sell futures within the exchanges would have to respond to the possibly significant technical problems discussed earlier. Probably the most important advantage that forward contracts have over futures in ease of implementation is that the forward

contracts strategy can be implemented under current legislative authority, whereas the plan to sell SPR futures might require new legislation. Such legislation may be difficult to pass, given the aura of government "gambling" which might surround the plan. The plan to sell forward contracts would be extremely easy to implement, precisely because it would dovetail so well with the existing drawdown plan. No legislation would be needed, and the changes to be made in the drawdown plan would not be complex.