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The national Strategic Petroleum Reserve: an anachronism or a springboard?

Abstract

The U.S. Strategic Petroleum Reserve has existed since the mid-1970s, but has never figured prominently in public debate. The authors discuss the arguments for creating it and arguments that would have enriched the debate about creating it. The Reserve never reached its one billion barrel target amount but holds over 700 million barrels. The paper suggests that it should be reviewed in light of the new information about U.S. crude oil production. In hopes of beginning a new discussion, the authors suggest that the Reserve be increased, to transform it from a buffer against supply shocks to a proactive regulator of the world oil market.

Keywords: petroleum, embargo, reserve, national security, protectionism.
JEL Classifications: F13, N50, Q38.

Intoduction

The United States has now had an official Strategic Petroleum Reserve for almost four decades. It was created in response to the disruptions caused by the first OPEC crisis of 1973-74[1]. This Reserve has attracted very little attention since then, so it is suitable to examine it, both in retrospect and as a government program that is relevant to current energy policy and fiscal issues in the U.S. The way the Strategic Petroleum Reserve was proposed, enacted and implemented is a revealing example of the U.S. government reacting to an unexpected disruption, and also a glimpse of the way the U.S. sets energy policy. The Congressional debate on the Reserve was cursory and incomplete; other credible ways of creating a Reserve were dismissed quickly, and several alternative ways of creating the Reserve did not appear to be considered at all. Despite its improvised origins, the Strategic Petroleum Reserve has been a success in financial terms. It has contributed revenue to the Treasury, and has also built up an eye-popping paper profit on its holdings of crude oil. The positive contribution to the Treasury might have been expected to draw attention to the Reserve, but its role as a bulwark against supply interruptions appears to have overshadowed its munificent financial worth[2].

This paper raises two broad sets of questions, putting forward issues that should have been taken into account when it was created, and inquiring what should be done with the Reserve now. Both sets of questions are relevant to the current debate about U.S. energy policy, and also give ideas about a partial solution to the U.S. fiscal deficit. The first set of questions gives a necessarily incomplete summary of how the U.S. government made energy policy at a time of economic stress. The decisions were made hastily, to arrive at a quick, workable defense against future supply interruptions. For that reason the debate was incomplete, but then the legislative process still took over a year, because the Reserve was included in an omnibus energy bill that was not signed into law until almost a year and a half after the OPEC embargo. And the proposed schedule for filling up the Reserve's storage facilities was to take six years.

The second set of questions is about what changes should be made to the Reserve now, or whether the whole conceptual design of the Reserve should be reexamined in light of the new composition of supply sources and new technologies. The Reserve has not been mentioned prominently in today's fiscal or energy debates. That is surprising, because the Reserve is worth over $60 billion, and there may be cheaper ways of providing security against disruptions in crude oil supply. There may also be economically powerful ways of using it, if Congress looks beyond the Reserve's stated purpose.

Both of these sets of questions reveal that there were, and still are, shortcomings in the decision-making process. The debate over these major policy issues lacked a full and careful analytic survey of all the alternatives. For the current debate, the huge paper profit that the U.S. government has in the Strategic Reserve should justify a review to put dollar amounts on alternative uses of the resources tied up in the Reserve, and to compute an actuarial value of the Reserve at its current size. That review would provide answers about what should be done with the Reserve now. The computations done in that review would, of course, have to take into account the Reserve's value for national security, in addition to its value for economic security. The computations should also include whether it would be advantageous to make the Reserve larger, and to hold refined liquids in the Reserve, not only crude

[1] http://www.fossil.energy.gov/programs/reserves/#SPR.
[2] http://fossil.energy.gov/programs/reserves/spr/spr-drawdown.html#non-emergency.

oil. If the computations are extended to include profit-making alternatives, the U.S. Treasury might benefit much more richly than it has until now. Indeed, if the computations cover the widest range, there might be a scenario in which the Strategic Petroleum Reserve becomes the core asset in an initiative to dispute the power of OPEC in the world oil market.

The many idiosyncratic facts about the Reserve and its history are relevant to today's energy policy issues. As intense as energy policy debates are today, they were at least as intense in the time frame when the Strategic Petroleum Reserve was created. So people interested in how energy policy is made will find useful parallels. Today's controversies will not be resolved in exactly the same way as the one described here, but it is our hope that the events and impacts we describe will illuminate similar issues and policy decisions in the current era.

1. Historical background

On December 22, 1975 President Ford signed into law an omnibus energy bill, titled the Energy Policy and Conservation Act (PL 94-163)[1]. This Act amalgamated several energy bills which had been pending during the year. The individual energy bills were blocked from passage while the President and Congress sparred over the issue of decontrol of domestic oil and gas prices. One part of the bill, Title II B, calls for the establishment of a National Civilian Strategic Petroleum Reserve. This Reserve was scheduled to reach 150 million bbl. of crude oil and petroleum products by the end of 1978, and as many as 1 billion bbl. by the end of 1982. While the Reserve was being built up, the FEA was allowed to require oil importers and refiners to maintain inventories up to 3% of their imports for the preceding year, or as much inventory as they had the corresponding month of the previous year. The purpose of the Reserve was to buffer the U.S. economy from fluctuations in the supply of imports of oil.

The potential efficacy of the Reserve can best be understood if it is viewed in conjunction with two policies which were implemented more or less concurrently. These were first, the standby energy conservation measures which were enacted as part of the same omnibus energy bill; and second, the International Energy Program which was set up in November, 1974.

The standby energy conservation measures authorize the President to (a) restrict exports of coal and other fossil fuels, as well as exports of capital goods which he determines could be used to increase domestic energy production; (b) require temporary emergency production rates from domestic oil and gas wells; c) impose gasoline rationing and other allocation schemes; and (d) authorize the Federal Energy Administrator to require any gas or oil-fired electric utility to switch to coal. These measures together were said to be sufficient to deal with reductions in imports of up to 2 million b/d[2].

The International Energy Program (IEP), which encompassed the industrialized oil importing nations, would provide a mechanism for joint action by the signatories in the event of an interruption of imports to any or all of the signatories. According to the agreement, each country must establish a petroleum reserve equal to 60 days' oil needs assuming no imports. Also, each country must establish a plan for restraining petroleum demand. Thus the Energy Policy and Conservation Act brought the U.S. into compliance with the conditions of the IEP agreement. The Program would come into operation in the event of an interruption in imports which exceeds 7% of normal consumption. Member countries would share petroleum products, thereby easing the burden. The IEP implies that the industrialized oil importing countries would have a collective reserve of oil. The IEP provides each member country with formal protection against a selective embargo.

The Strategic Petroleum Reserve went beyond bringing the U.S. into compliance with the IEP. Normal industry practice in the U.S. was to maintain 40-50 day inventories; amounts that were in the range to deal with seasonal changes in demand and the operating requirements of refinery and transport networks. Consequently only a small increase in inventories would be sufficient to bring them to the 60-day level. The Reserve, when fully established, would have brought U.S. oil inventories well above the 60-day level. In the years since the Reserve was created, there have been occasional differences about how many days' protection the amount in the Reserve would provide. The figure stating how large the Reserve is, in terms of days' imports, has been quoted at as low as 34 days, but when computing the size of the Reserve more carefully we find that the Reserve has always been in excess of 60 days, at least since 1982. As of 1975, an early report about the Reserve predicted that by 1982 the Reserve was to contain 90 days' imports at the 1975 rate. The Reserve, in conjunction with the standby energy conservation measures, has had the stated purpose of protecting the U.S. against a reduction in imports in excess of 2 million b/d[3].

[1] For a summary of the law, see http://www.fossil.energy.gov/programs/reserves/spr/spr-facts.html.

[2] H.R. 7014 (94th): Energy Conservation and Oil Policy Act.

[3] http://www.fossil.energy.gov/programs/reserves/spr/index.html.

2. Rationale for setting up the Strategic Petroleum Reserve

There was no disagreement about the need for a Reserve. The debate was on the wisdom of setting up the Reserve the way it was done, and also to analyze the cost effectiveness of the method chosen. The arguments presented during the debate on the Energy Policy and Conservation Act in support of establishing the Reserve did not need to be very thorough or convincing, because the Reserve was included in an omnibus bill and the votes were already lined up to pass the bill. The estimates of the cost of creating the Reserve seemed low. The debate was brief, perhaps because Christmas was approaching, and perhaps because earlier debates had resolved many issues before the final round, so a number of questions were never raised. No satisfactory answers emerged to the following questions:

- How dire is the U.S. position without this Reserve?
- Is there any cheaper way of using existing domestic resources and equipment to provide the country with similar or greater protection from an interruption in imports?
- If this Reserve is set up, exactly what international events or disasters does it protect the U.S. against?
- If U.S. oil imports keep growing, won't a buffer of 1 billion bbl. eventually become inadequate?
- What storage method is contemplated? Won't it be expensive and disruptive to the environment to store a billion barrels of oil?

3. The case for a Reserve

Advocates of the Strategic Petroleum Reserve based their case for creating in on domestic economic arguments. The tremendous economic cost of an insufficiency of energy, measured in terms of lost production and employment, is the principal reason for stockpiling energy resources. The debate about the Reserve did not include military security arguments because there were other petroleum reserves held and managed by the armed forces. The proposed Reserve would have buttressed the reserves that the armed forces had. The debate sometimes mentioned the Naval Petroleum Reserve but did not impute any military value to the proposed Strategic Petroleum Reserve. Instead the analytic argument in favor of the Reserve framed the value in terms of output of goods and services and jobs that would continue instead of being lost in the event of an interruption in the supply. Project Independence estimated that by 1985, the cost of a completely effective one-year embargo on U.S. oil imports from "susceptible" producing nations would be between $30 billion and $205 billion[1]. The U.S. would be in a vulnerable position indeed if it lacked energy reserves.

A stockpiling scheme would insure the country against such a cost to the economy. Clearly, the U.S. must insure itself against such massive economic disruption, especially if an embargo is probable, and if the insurance is cheap enough. Also, it is obvious that public action will be required to buy the insurance, because private companies cannot tie up their capital in a stockpile and hope for an embargo which might never come. For private companies as a group, stockpiling would be a poor investment, because the existence of the stockpile would deter exporters from attempting an embargo. They would also be put into the perverse position of hoping than an economic blow would be struck against the U.S.

4. Alternate ways of creating a Reserve

The mainstream academic disciplines of operations management, industrial and petroleum engineering, petroleum geology, and economics provide accepted methodologies for identifying and evaluating alternative ways of creating a Reserve. These disciplines, in aggregate, would present a wide array of possible ways of creating a Reserve. Some of these ways would not have been politically feasible, but even the ones that were feasible did not receive a full discussion. At this time, almost four decades later, it is useful to consider those alternatives, because similar alternatives exist today, and can perhaps be profitably adopted.

Before the Strategic Reserve was created, the U.S. had domestic stockpiles, but those had obviously been inadequate, as the 1973 OPEC embargo revealed. The OPEC embargo was so damaging to the U.S. economy partly because the U.S. found itself with surprisingly inadequate reserves of crude oil. The damage was particularly painful because the U.S. has adequate endowments of hydrocarbons to be able easily to protect itself, and had allowed itself to be lulled into an embarrassingly vulnerable position. Other countries, particularly Japan, suffered bigger declines in GDP and higher spikes of inflation, but Japan has almost no domestic endowments, and so could blame itself only for not having a large enough buffer of imported supplies. But the U.S. had to blame itself for allowing its domestic production capability to be so depressed that it was unable to ramp up production to cover the shortfall.

To consider the issue in the context of the time and the other measures that were being taken when it was created, we should limit the discussion to crude oil, and also accept that in the short run U.S. energy

[1] http://reason.com/archives/2004/07/21/energy-independence-the-ever-r.

supplies must come from a fairly rigid composition of sources. At that time, about 75% of U.S. energy supplies came from oil and gas. Also, at that time the U.S. oil industry had only its normal 40-50 day inventory. Also, U.S. oil wells were already working at maximum efficient capacity when the embargo occurred. The Texas Railroad Commission, a regulatory body that outgrew its original mandate, ordered oil wells to produce at the maximum rate for the 50th consecutive month. Ten years earlier, when imported oil was cheaper than domestic oil, and was imported under a quota, domestic oil producers had to operate their wells below capacity. The potential to pump 30 days per month instead of 5 days or 15 days a month constituted a reserve against any interruption in imports. That reserve capacity had existed at least since 1959, when the Eisenhower administration and the U.S. Congress approved an import quota on foreign crude oil to protect domestic production capability from foreign competition. Demand gradually outgrew the amount of imports the quota allowed, so by 1973 U.S. oil wells were producing at capacity. This is why when the embargo began, U.S. producers could not simply increase production to make up for the imports that were suddenly not coming in. Oil wells can be "choked" so that they produce less than the maximum amount than their geologic attributes allow, but cannot be made to produce more than the high end of their rated capacity doing so would damage them and diminish their total recoverable reserves. This is why the proven and probable reserves of crude oil in the lower 48 states were no help when the U.S. economy needed it. Importantly, the experts who worried that the U.S. was allowing its domestic crude oil production to atrophy were vindicated.

Despite this unlucky set of circumstances, the United States had several potential reserves of oil, besides current inventories of crude and refined product, and several ways of creating a buffer against future embargos. These are considered in order of how much they figured in the debate.

1. One of these was the Naval Petroleum Reserve. There were four oil fields in the Naval Petroleum Reserve. One of these was in Alaska, a long way from domestic refineries, so did not provide any standby production capacity that would have been useful against the embargo. That oil field would have been developed and on stream before the Strategic Petroleum Reserve would have been completed. The other three fields are in the lower 48 states, and had reserves in excess of 1 billion barrels, but could not produce at a rate greater than 350,000 b/d and consequently did not adequately serve as standby capacity. US imports were reduced 2.2 million b/d during the 1973-74 embargo.
2. A second alternative source of reserve crude oil would have been for the U.S. government to buy producing domestic wells, located close to refineries, sufficient to bring the Naval capacity up to 2 million b/d, and then hold this capacity in reserve. That alternative sounds reasonable but oil wells have an optimal range of production. They can be shut in, but that sometimes damages their long-term total recoverable reserves. Alternatively, the U.S. government could have drilled more wells in the Naval Petroleum Reserve fields sufficient to bring Naval capacity up to 2 million b/d. That plan, which was proposed at the time, might have been criticized by those who would like the country to have one reserve for military security and another for economic security. Proponents of the Strategic Petroleum Reserve argued that such a plan would be costly, but presented no figures to verify that it would be more costly than the plan which was adopted. Also, they argued that holding domestic production capacity in reserve would cause the country to import more oil, cet. par., and importing more oil would presumably hurt the balance of payments. The advocates of the Strategic Petroleum Reserve argued that instead of setting aside standby production capacity, it would be cheaper to store 1 billion bbl. of oil, and then go on using our lower-cost domestic oil to the maximum extent possible.
3. Secondary recovery. Another potential alternate source of domestic reserve capacity was our depleted oil fields. Primary recovery leaves a lot of oil behind. In some fields as much as half the oil remains in the ground after primary recovery ends. At that point the field is considered depleted. As of 1975, there were 40-50 billion bbl. of oil in depleted fields in the U.S. Secondary recovery is more costly than primary recovery because the oil does not come out of the well under its own pressure. Until the 1973-74 embargo there was little interest in secondary recovery, because in the U.S., even primary-recovery-produced oil was more expensive than imports. After the embargo, and for many time periods since, the relative prices were, and are, quite different. Secondary recovery from some U.S. fields was competitive even when domestic crude prices were low.

There does not appear to have been any discussion of the possibility of buying depleted wells, injecting water or steam into them so that the recoverable crude oil would be available to be pumped quickly, and classifying the available amounts of crude oil as a reserve. That is surprising, because secondary recovery was a well-known technique at that time, and would have been a credible alternative way creating a reserve.

During the debate on the omnibus energy bill, an advocate of the Strategic Petroleum Reserve gave the cost of setting up the Reserve and maintaining it through 1982 as $6.3 billion. He did not say whether this figure includes the cost of the oil to be stored in the Reserve. If it did not, $16.3 billion might have been a more correct figure. That larger figure uses $10 as the price to be paid for a barrel of crude oil in the U.S. at that time.

Whichever figure is closer, either $6.3 billion or $16.3 billion would have bought a lot of depleted oil fields and a lot of secondary recovery equipment. At the time when the Reserve was being debated, the U.S. Government could have bought depleted oil fields containing several billion barrels of crude, giving priority to depleted fields close to refineries. Then engineers could pump water into the wells, install pumps, and have a lot of crude ready to be pumped up in the event of an interruption in imports. This plan would probably have cost considerably less, and might have yielded a much larger reserve of crude oil, than the Strategic Petroleum Reserve scheme as it was adopted.

That same method of creating a reserve can be considered today, with the difference that the wells would be in shale oil, fracked and ready to be pumped.

5. Overall defects of the debate

After considering the few other ways of creating a buffer that were considered, it is appropriate to point out overarching defects in the debate. The debate about how to acquire a reserve confuses several issues. First, it was not necessary for the U.S. government to develop or buy any standby capacity, or incur any new exploration and drilling expense, if the U.S. government could simply have found a way to go back to the policy that had been in effect a decade earlier. If the U.S. had increased the amount of imported crude oil that could have been brought in each month, the effect would have been to reduce domestic production from existing wells. If, in the year or years before the embargo, the country could have throttled back domestic crude oil production considerably, as it did during the sixties when the oil import quota was in effect, to a rate of production 2 million barrels a day less than the maximum efficient rate, then the (artificially created) excess capacity in the domestic oil industry would have become our reserve or buffer. Such excess capacity would perform the same function as the Strategic Petroleum Reserve. One way of cutting domestic production would be to reduce (instead of raise or decontrol) the price of domestic crude, until the price would be below the cost of production of some wells. This would cause some domestic producers to shut down temporarily, just as some copper mining companies do in periods of low copper prices. If enough domestic producers shut down, the U.S. would retain considerable petroleum reserves in the ground, ready to be pumped on short notice.

The policy of cutting domestic production, if it had been adopted at the same time the import quota was being increased, would have resulted in some readjustments in the U.S. market, but could probably have been achieved without triggering increases in retail prices of petroleum products. Increasing the import quota would have been disconcerting to domestic crude oil producers. Hindsight shows, however, that intentionally throttling back domestic production would have been a good defense against the embargo as it played out. There would have been political costs, and if retail prices of petroleum products had risen in the U.S., consumers would have complained. But if retail price increases did occur, the U.S. government could have used some of the $6.3 billion (which was what the Strategic Petroleum Reserve was projected to cost) to subsidize some refined products for a transition period, and to compensate those domestic producers who would be forced to produce less or shut in their wells. The $6.3 billion cost estimate was accepted as the consensus price tag of the Strategic Petroleum Reserve when the debate was going on[1,2].

Another issue that the debate fumbled is the distinction between money cost and opportunity cost. The argument that the Strategic Petroleum Reserve is cheaper than maintaining standby production capacity confuses money cost with opportunity cost. Measured in money cost, it was most economical for the United States to use as much domestic oil as possible and to import as little as possible. Measured in money cost, this is true even if the country must establish a Strategic Petroleum Reserve before it can feel safe using 100% of domestic production capacity. Measured in opportunity cost, however, it is obviously more economical for the United States to use none of its own oil, but instead use only imported oil, which it obtains in return for money or exports of renewable goods such as grain or manufactures. Why not trade money or renewable resources in which the U.S. has a comparative advantage, such as grain or lumber, for a depletable resource in which the U.S. had, as of 1975, a comparative disadvantage, such as oil?

Perhaps this criticism overstates the case for using more imported crude oil, and holding U.S. produc-

[1] Beaubouef, Bruce A. The Strategic Petroleum Reserve: U.S. Energy Security and Oil Politics, 1975-2005. Texas A&M University Press 2007.
[2] http://books.google.com/books/about/The_Strategic_Petroleum_Reserve.html?id=G34GAFprQQYC.

tion in reserve, and too glibly attributes coldly calculating economic rationality to everyone involved in the debate. This criticism also sets aside the temper of the time. The realities of American politics at that time, and since still preclude, putting domestic oil wells in mothballs. The specter of balance of payments weakness was also a deterrent at the time, not only because importing more oil would weaken the dollar, but because there was then, as occasionally there has been since, a concern that the OPEC countries might not be content with pricing oil in dollars for very long.

The balance of payments calculations would have been worthwhile to consider in light of the floating exchange rate regime which, by that time, was in effect. There were automatic market mechanisms that would correct a deficit in the U.S. trade deficit. Questions of international finance are never simple and should not be answered by reflexively giving rein to a visceral preference for trade surpluses. Two points weaken the balance of payments argument against high oil imports. First, in a system of floating exchange rates, which the major trading nations had reluctantly adopted just four years earlier, no country can enjoy a persistent balance of payments deficit unless other countries are willing to hold its currency, or invest in the country with the trade deficit. Applying this to the present matter, if OPEC countries sell their dollars for other currencies, the exchange rate of dollars to other currencies will fall. After this rate falls enough, the U.S. balance of trade deficit would correct itself. Second, if OPEC countries use their dollars to import goods from the U.S., American exports would rise to offset imports and again the balance of payments deficit would tend to correct itself.

During the Congressional debate, one speaker presented more pointed argument against this high-import strategy, namely that high imports increase U.S. dependence on foreign oil. He conflated the level of imports with vulnerability to an interruption in imports. A high level of imports need not imply dependence on imported oil. Classical trade theory frames import and export surplus differently. To illustrate the difference, consider that a high level of steel imports does not imply dependence on imported steel. Instead it implies that the U.S. has (or had, until recently) a comparative disadvantage in steel. To know whether the U.S. is dependent on imports of a particular commodity, we must ask if the U.S. can be self-sufficient in this commodity for a reasonable length of time; and that comes down to whether the U.S. has the production capacity and can ramp it up quickly. The U.S. has, and had in 1973, sufficient domestic capacity, but the time needed to activate that domestic capacity was too great. Classical trade theory indicates that the issue is not how much oil the U.S. imports, but rather how much unused domestic production capacity the U.S. has to buffer against a curtailment of imports. So the true issue was how to have crude oil production capacity that could be switched on quickly.

6. The degree of protection the Strategic Petroleum Reserve would provide

By the end of 1982, the Reserve was to contain perhaps as many as 1 billion barrels of oil. That sounds like a comforting level but it would not have helped much if there had been an embargo soon after the U.S. began accumulating the Reserve. By 1983, if it had reached 1 billion barrels, the Reserve would protect against a decrease of imports, but would not provide a full cushion against an international disruption more serious than a coordinated restriction of supply. In the case of a disastrous cutoff of supply, as would occur if the Strait of Hormuz were permanently blocked, the Reserve, even at a level that it has never reached, would provide no more than an incidental palliative.

The Reserve, as it was implemented, would protect the United States from an embargo roughly of the magnitude and duration of the 1973-74 embargo. Even this statement assumes a lot. For example, it assumes that the portion of U.S. imports coming from countries "susceptible to disruption" will be no worse than the scenario in Project Independence[1]. (In this context, it is worth mentioning how quickly events overtook the Project Independence scenario: within months of its publication, Canada decided to phase out exports of petroleum to the U.S. by 1980[2]. That decision alone could potentially have increased the portion of U.S. imports coming from countries "susceptible to disruption").

In the subsequent years, the Reserve reached 765 million barrels, but never 1 billion. During the almost four decades since the Reserve was approved by Congress, the amount of U.S. imports rose, and the margin of safety the Reserve provided became less comforting. It is appropriate to ask whether the attention of Congress drifted to other matters, as years went by with no embargo of the sort the Reserve could protect against.

The Reserve, even when fully set up, offered the U.S. scant protection against several events which

[1] Project Independence was announced in November 1973, with extensive press coverage. It became a rallying cry, but soon was denounced as just another slogan with little implementation to reach its targets.

[2] http://thecanadianencyclopedia.com/articles/energy-policy, http://www.indexmundi.com/canada/oil_exports.html, http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca.energy/files/pdf/eneene/pdf/refstrarafsur-eng.pdf.

may be as likely as a repeat of the 1973-74 experience. These are:

- a severe or protracted Midle East war, with closing of the Suez and the Strait of Hormuz;
- a takeover of one or more major Midle East countries by a power hostile to the United States;
- organized sabotage of 20-30 supertankers by a terrorist group.

Such events are more calamitous than would be required to demonstrate the inadequacy of the Reserve. A lesser event, such as a decline in OPEC shipments such as occurred in 1979-80 because of the Iranian revolution, a curtailment arguably of the magnitude and duration of the 1973-74 experience, sufficed to raise the price of crude oil to $40 a barrel, sixteen times higher than the pre-1973 price. It is also worth noting that because the U.S. is a member of the International Energy Program, the protection that the Reserve would offer may be less than domestic calculations would indicate. The advocates of the Reserve appear to assume that other IEP signatories are building sizeable reserves, commensurate with their increasing imports. If they were not doing this, but were instead increasing storage capacity only enough to stay within the letter of the IEP agreement, the U.S. Strategic Petroleum Reserve would have to serve for all the signatories after the first few months. An unstated assumption might have been, that in a real oil supply emergency, the Congress would repudiate the IEP. This would have been procedurally possible. According to the text of the Energy Policy and Conservation Act, the President shall recommend a rule for international energy allocation; either house of Congress can then veto the rule.

In any case, whether Congress honored the IEP or not, the Reserve would not amount to more than 650 million bbl. by the end of 1980, and it was easy to imagine scenarios in which that amount of oil would not provide sufficient protection. To be really secure, it was clear in 1975, and is clear today, that the U.S. either needs a reserve of oil considerably larger than 1 billion bbl., or needs to turn toward other sources of energy, such as coal, natural gas, wind, or solar energy, over which it has more control.

7. Storing the Reserve

So far we have not discussed exactly which petroleum products are to be stored, and how they to be stored, and in which regions they are to be stored. The question of storage, including methods and regional deployment, attracted great interest and attention during the Congressional debate on the Strategic Petroleum Reserve. The legislators seemed to take it as given that there was to be some sort of Reserve. After that, they seemed concerned primarily with corralling as much of it as they could for their districts, states, or regions. The final text of the bill pays homage to the Northeast's need for residual heating oil; but at the same time the $6.3 billion cost estimate depended on storing the oil in salt dome caves, which are mostly in the South. Such a storage configuration would make it impossible to supply the Northeast rapidly with heating oil. Scientists and engineers wanted to store crude oil, rather than try to anticipate the composition of refined product which might be needed. Politicians, in contrast, wanted assured supplies of whichever refined product their districts chronically lacked.

The cost of different kinds of storage facilities aggravated the regional conflict. Steel tanks would be most convenient, because they would permit storing an appropriate portion of the Reserve in each region, and would permit storing both crude and refined product in varying portions in each region. Steel tanks, unfortunately, cost $3-$5bbl to build, and $l/bbl/yr to maintain (price estimates from 1975)[1]. A more recent source indicates that it costs $3.50 to store a barrel of oil in salt dome caves, and $18 a barrel to store it in above-ground steel tanks[2]. Caves, both then and now, have the disadvantage of being less flexible. Storing the oil in caves does not permit the Reserve to be spread evenly around the United States nor does it permit much latitude in the composition of products to be stored. Cave storage's overwhelming cost advantage was a point in its favor. Cave storage costs $l/bbl to create and $0.10/bbl/yr to maintain (also 1975 estimates). These storage cost figures make it clear that the estimate of $6.3 billion as the cost of the Reserve from 1975-82 assumed that it was to be stored in caves, so the mode of storage was decided early in the discussions.

A third alternative way of storing the Reserve, if crude is what is to be stored, is to pump it into depleted oil wells. This would be the cheapest and the most ecologically harmonious mode of storage. Capital cost and maintenance would be well below those of the other alternatives. Unfortunately, adopting this mode of storage would leave the Government exposed to some embarrassing questions:

1. Why put any more oil in those wells, when there is so much in them already?
2. What if the oil will not come back out?
3. If the oil will come back out, how would pumping it back out be different from standard secondary recovery procedure?

[1] "Design and performance of hot-oil storage tanks", *Applied Energy*, 1975, Vol. 1, Issue 4, pp. 247-278.

[2] http://www.lifeslittlemysteries.com/286-what-is-the-strategic-petroleum-reservewhat-is-the-strategic-petroleum-reserve.html.

These questions may sound naive to a petroleum engineer, but the average taxpayer might ask them. The Government would look foolish buying 1 billion barrels of expensive oil, pumping it back into the earth, and then, in the event of a shortage, pumping it out by using secondary recovery techniques, when the country already has 40-50 billion bbl. of reserves exploitable through secondary recovery techniques. When there are reasons such as these for not using the lowest cost mode of storage, our lawmakers should be led to ask the larger question: Are we also finding reasons for not using the lowest cost mode of creating a Strategic Petroleum Reserve?

After the Reserve was created and stored in salt dome caves, the result was that the caves worked as planned. Engineers were able to extract 98% of the crude oil in the caves, on the few occasions when the Reserve was tapped[1]. That rate of recovery settled the issue of cost of storing the Reserve, because over the four decade life of the Reserve other methods of storing crude oil would have been more expensive or riskier. It also settled the issue, at least in terms of which states would host the Reserve storage facilities, and also gave a strong preference for storing crude oil instead of refined products. In that way choosing cave storage also finessed the delicate question of storing products that the northern consuming states routinely needed.

8. What should we do with the Reserve now?

The current upturn in U.S. crude oil production has attracted attention and controversy. Forecasts are being revised upwards, and the U.S. is projected to become a net exporter of crude oil in five years or less. This new information would appear to justify a reevaluation of the Reserve.

If the U.S. will be a net exporter of crude oil, the original reason for the Reserve would disappear. Instead other countries would need to develop Reserves of their own to guard against the possibility that the U.S. would stop shipping crude oil to them.

The simplest answer would be for the U.S. government to sell the crude oil in the Reserve and apply the proceeds from the sale to government revenue during the fiscal years when the Reserve would be sold. In view of the current fiscal dilemma, that might be the decision Congress would make. The average cost of the crude oil in the Reserve is $28 per barrel, so the gain from selling the crude oil at the current $88-$98 price of West Texas Intermediate crude would be approximately $45 billion, an amount large enough to be relevant to the trillion dollar magnitudes of the U.S. fiscal budget[2]. Of course, there would be costs associated with decommissioning the storage facilities, and the private companies that have set up facilities to transport and process the crude oil in the Reserve would have to be compensated, so part of the gain would need to be spent to terminate the Reserve.

The simplest answer, however, is not the only one that should be considered. The Reserve has worked as a deterrent, and as U.S. crude oil production rises, it continues to deter embargos. For that reason it has a value that can be calculated. The calculation of the Reserve's value as a deterrent would have to take into account that its value as a deterrent declines as the U.S. approaches self-sufficiency in production of crude oil. The calculation would also need to consider that the price of crude oil in the United States has declined since the all-time high of $147 a barrel in 2007[3]. The paper profit of $45 billion that now exists can disappear as U.S. crude oil production rises, and could disappear even faster if rising amounts of Canadian crude oil can enter the U.S. market.

The most advantageous alternative might not be to sell the Reserve. The policy that would best serve U.S. interests might be to *increase* the amount of crude oil in the Reserve.

9. Leveraging the new production capacity for economic gain

The U.S. has been in a weak position since 1973 with regard to crude oil. OPEC became a feared cartel that showed it could move markets and disconcert its former masters. Ordinary Americans, who had been taught that they were the overlords of the world economy, had the humbling experience of the steep recession of 1974-75. Americans had to acknowledge the power of a unified group of commodity producers. The recession of 1974-75 was the most severe that the U.S. had suffered since the end of World War II[4]. The response was to alter the geopolitical framework of the Cold War to make room for OPEC. Previously the struggle for control of the Persian Gulf had been framed as capitalism versus communism. After the two oil crises of the Seventies the new realpolitik had to include the delicate dance between the rich oil-importing countries with poor oil-exporting countries.

[1] Not all the reports about the performance of the salt dome caves was favorable. Flow rates, crucial to the usefulness of the Reserve, have been strongly questioned throughout the life of the Reserve. For a technical assessment, see "Improving the performance of brine wells at Gulf Coast strategic petroleum reserve sites", edited by L.B. Owen and R. Quong, Lawrence Livermore Laboratories, November 5, 1979.

[2] The calculation is 730 million barrels times ($93-$28) gives $45 billion.

[3] http://www.fedprimerate.com/crude-oil-price-history.htm.

[4] Recessions are officially calibrated by the National Bureau of Economic Research. For a discussion of the severity of the 1974-5 recession compared to the 1982-3 recession, see http://www.urban.org/UploadedPDF/411807_unemployment_and_income.pdf.

Since that watershed decade, two generations of U.S. policymakers have been fearful of oil supply interruptions, and have focused intense attention on the Middle East. They acknowledge that oil producers have the capability of causing another severe recession in the U.S., and concede that they have few ways of protecting the country against external shocks originating in commodity markets. The new information about domestic crude oil supply should soon provoke a reassessment of the importance of foreign oil producers. It is too early to announce a rebalancing of power relationships. But the panorama has changed now that the U.S. has alternatives that, in the near future, could reestablish its economic preeminence as the arbiter of the world price of crude oil.

An interruption in Persian Gulf oil production would still be a serious economic event, even after the U.S. becomes a net exporter of crude oil. The mechanism that would transmit economic hardship to the U.S. is less direct but would be equally injurious. That fact is taken into account in the proposal that is set forth below.

We propose that, instead of liquidating the Reserve, the U.S. should increase its size. Congress would have to give the Reserve a broader purpose, and would also need to approve the increase in the target amount, and make other provisions to implement an increase.

For purposes of discussion we propose that the Strategic Petroleum Reserve be increased in size to 6 billion barrels. That is six times the highest amount of 1 billion stipulated in the law authorizing creation of the Reserve. The 6 billion barrel figure is chosen because that is approximately 60 days' consumption of crude oil for the entire world. It greatly exceeds routine storage amounts held by oil companies and governments. Calculations can reveal whether a smaller reserve, for example 4 billion barrels, would be sufficient for the purpose.

The 6 billion barrel reserve would be used to lower and then stabilize the world price of crude oil. An amount of a commodity, in ready form, that is needed to control the price of the commodity depends on several factors that economists have studied extensively. A team of petroleum engineers, statisticians, economists, and production experts should be able to do computations to guide sales and purchases for the 6 billion barrel reserve, to bring the U.S. into the position of swing supplier of crude oil.

If the U.S. chose to be aggressive in its policy of controlling the world price of oil, it could dump an amount of oil sufficient to overfill the storage capacity of oil companies. That would drop the price and cause widespread shocks throughout the industry. Producing countries would immediately have to scale back their expenditures. They would be well advised to cut back expansion of their own production, and would have to be wary of provoking a sudden plunge in the spot price of crude.

If the U.S. can successfully implement the stabilization of the world price of oil, and relegate King Crude back to a less important role in world affairs, the world economy would return to a growth path in accord with a trend toward stable, or gently declining, oil prices. The U.S. would also gain a "self-sufficiency dividend" because it would be less vulnerable to supply shocks, and more able to defend itself against them.

It is utopian and triumphalist to speculate further about an era, possibly several generations in duration that has not begun. It is sufficient to point out that the U.S. has a powerful lever at its disposal, if it chooses to use it.

Conclusion

This paper gave brief views of how the Strategic Petroleum Reserve came into existence, and made reference to some of the controversies about it during its lengthy, unobtrusive life. The reasons for setting up the Strategic Petroleum Reserve were not as compelling as its advocates claimed, and it might have been possible for the United States to achieve the same result (i.e., protection from a temporary shortage of imported oil) at a lower cost, and with less disruption to the environment.

The Reserve was almost never in the spotlight, and is not being discussed prominently in the media now. Its idiosyncratic history is worthy of study, both as an example of how the U.S. government makes decisions, and also as an example of a program that worked as a deterrent, and built up a large paper profit. It is especially worthy of study because it can become the founding entity if the U.S. decides to become the swing producer in the world oil market and the disciplinarian that dictates the price.

The history of the Reserve sets the stage for discussing what should be done with it now. The Reserve is a large national asset that is rarely mentioned. The possibility of selling the Reserve has not been widely suggested but should be rejected if it is seriously considered. We reject that in favor of a different policy.

For purposes of provoking a discussion, we propose that the Reserve should be increased in size. We propose building up the Reserve to the point where it contains 6 billion barrels of crude oil stored and

readily available to be released if needed, and also ready to be dumped on the world market if the price of crude oil spikes, or if the U.S. decides to reestablish its eminence as the controlling force in the world oil market.

The Strategic Petroleum Reserve, which started with a narrow mandate, and which has sometimes been criticized as a conduit for political favors, could become the springboard to resurgent U.S. dominance over the world oil market.

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